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Chapter 2

Supply and Demand: The Basics

After reading this chapter,
you will understand the following:

1. How the price of a good or service affects the quantity demanded by buyers
2. How other market conditions affect demand
3. How the price of a good affects the quantity supplied by sellers
4. How other market conditions affect supply
5. How supply and demand interact to determine the market price of a good or service
6. Why market prices and quantities change in response to changes in market conditions
7. What the unintended consequences are of price floors and price ceilings

Before reading this chapter,
make sure you know the following concepts:

Spontaneous order

Markets

Opportunity cost

Law of unintended consequences

How to work with graphs

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Olive oil is the flavorful centerpiece of the healthful and popular Mediterranean diet. Its price can rise or fall sharply from year to year. Although it may not be featured on the nightly news as often as the price of gasoline, it, along with millions of other prices, affects the way we live—our jobs, our incomes, the things we buy, and the things we sell. What determines prices? The short answer is supply and demand.

Economists use the term **supply** to refer to sellers' willingness and ability to provide goods for sale in a market. **Demand** refers to buyers' willingness and ability to purchase goods. This chapter will show how supply and demand work together to determine prices.

2.1 Demand

According to the **law of demand**, there is an inverse relationship between the quantity of a good that buyers demand and its price. The quantity demanded tends to rise as the price falls and to fall as the price rises. We expect that to happen for two reasons. First, if the price of one good falls while the prices of other goods stay the same, people are likely to substitute the cheaper good. Second, when the price of one good falls while incomes stay the same, people feel a little richer. They use their added buying power to buy a bit more of many things—including, in most cases, a little more of the good whose price went down.

The terms *demand* and *quantity demanded*, as used in economics, are not the same as want or need. For example, someone might think a Porsche is a beautiful car. Sometimes when they see one on the street, they think, "Hey, I want one of those!" Alas, their income is limited. Although in the abstract they might want a Porsche, there are other things they want more. As a result, the quantity of Porsches they demand at the going price is zero, because they are neither willing nor able to buy any Porsches.

On the other hand, someone might say that they *need* dental surgery to avoid losing their teeth. Suppose they are low-income, however. If they cannot pay for the surgery or find someone to pay for it on their behalf, they are out of luck. The quantity of dental surgery demanded, therefore, would be zero, however great the need.

Demand, as economists use the term, requires both a willingness and an ability to buy. It is not desire in the abstract, but desire backed by the means and the intent to buy.

Supply
The willingness and ability of sellers to provide goods for sale in a market

Demand
The willingness and ability of buyers to purchase goods

Law of demand
The principle that an inverse relationship exists between the price of a good and the quantity of that good that buyers demand, other things being equal

Demand curve
A graphical representation of the relationship between the price of a good and the quantity of that good that buyers demand

2.1a The Demand Curve

The law of demand defines a relationship between the quantity of a good that people are willing and able to buy, other things being equal, and the price of that good. Figure 2–1 represents this relationship for a familiar consumer good: chicken. It would be possible to discuss a single consumer's demand for chicken; but, more frequently, we focus on the total demand for the good by all buyers in a market (as in this figure).

The figure shows the demand relationship in two different ways. Start with Panel (a). The first row of the table shows that when the price of chicken is $3.00 a pound, the quantity demanded per year is 1.0 billion pounds. Reading down the table, we see that as the price falls, the quantity demanded rises. At $2.50 per pound, buyers are willing and able to purchase 1.5 billion pounds per year; at $1.50, 2.5 billion pounds; and so on.

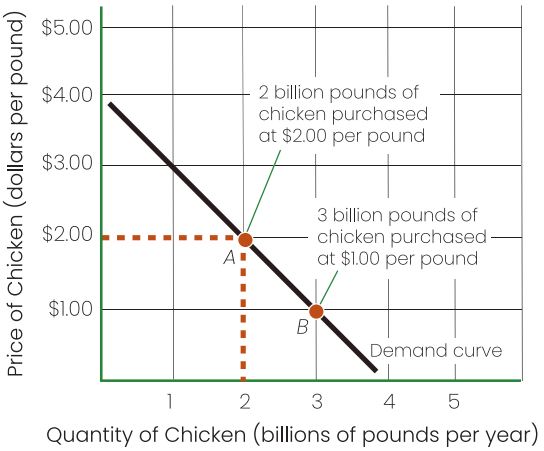
Panel (b) of Figure 2–1 uses a graph, which we call the **demand curve** for chicken, to show the same information in a different way. To use the demand curve to find out what quantity buyers will demand at a price of $2.00 per pound, start at $2.00 on the vertical axis and move across, as shown by the arrow, until you reach the demand curve at point *A*. Then, still following the arrow, drop down to the horizontal axis. Reading from the scale on that axis, you can see that the quantity demanded at a price of $2.00 per pound is 2.0 billion pounds per year. That is the same as the quantity demanded in row A of the table in Panel (a).

Figure 2–1 A Demand Curve for Chicken

(a)

	Price of Chicken (dollars per pound)	Quantity of Chicken Demanded (billions of pounds per year)
	$3.50	0.5
	$3.00	1.0
	$2.50	1.5
A	$2.00	2.0
	$1.50	2.5
B	$1.00	3.0
	$0.50	3.5

(b)



Both the table and the chart show the quantity of chicken demanded at various prices. At a price of $2.00 per pound, buyers are willing and able to purchase 2 billion pounds of chicken per year. Row A in Panel (a) and point *A* in Panel (b) both show this price-quantity combination.

The effect of a change in the price of chicken, other things being equal, takes the form of a movement from one point to another along the demand curve. Suppose that the price drops from $2.00 to $1.00 per pound. In response, the quantity that buyers plan to buy increases. The point corresponding to the quantity demanded at the new, lower price is point *B*, which corresponds to row B of the table. Because there is an inverse relationship between price and quantity demanded, the demand curve has a negative slope.

Economists speak of a movement along a demand curve as a **change in quantity demanded**. Such a movement represents buyers' reactions to a change in the price of the good, other things being equal.

2.1b Shifts in the Demand Curve

The demand curve[1] in Figure 2–1 shows a relationship between two variables: the price of chicken and the quantity of chicken demanded. Changes in other variables can also affect people's buying decisions. For example, the prices of beef and pork also affect the demand for chicken. So do changes in consumer incomes. Changes in expectations about the future and changes in consumer tastes are also factors that affect how much chicken people will buy. We could make a similar list for any good or service—the weather affects the demand for ice, the birth rate affects the demand for diapers, the win-loss record of the home team affects the demand for baseball tickets, and so on.

How do we handle all these other variables graphically? In brief, two rules apply.

1. When we draw a single demand curve for a good, such as the one in Figure 2–1, we treat all conditions other than the price of chicken as constant, following the "other things being equal" clause of the law of demand. As long as that clause is in force, the only two variables at work are quantity demanded (on the horizontal axis) and the price of chicken (on the vertical axis). The effect of a change in price on quantity demanded takes the form of a movement along the demand curve, as we have already seen.

Change in quantity demanded
A change in the quantity of a good that buyers are willing and able to purchase that is caused by a change in the price of a good, other things being equal; shown by a movement from one point to another along a demand curve

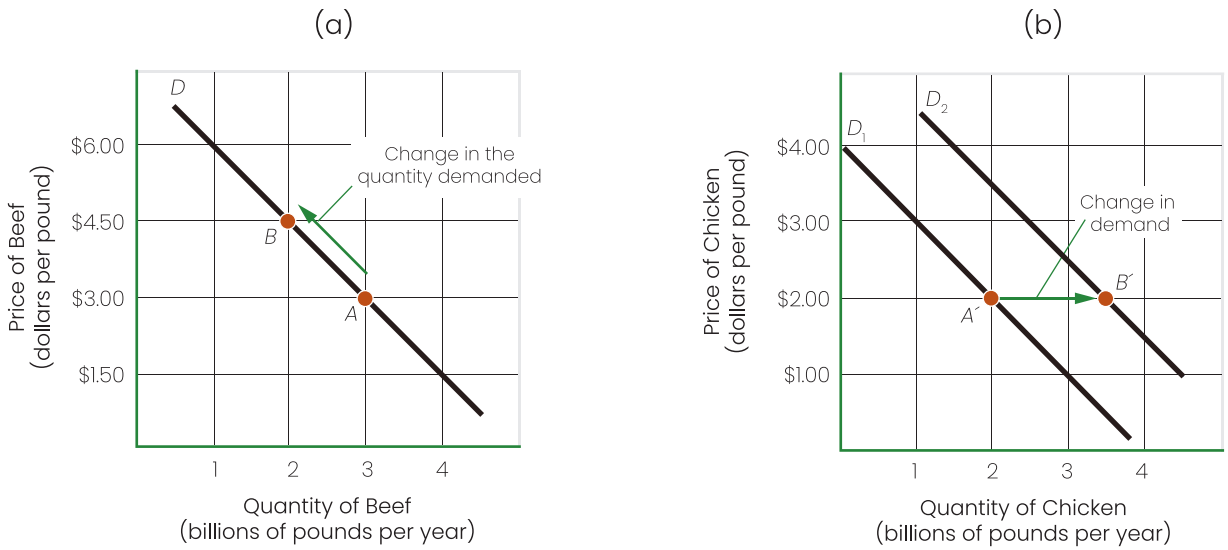
2. When we look beyond the "other things being equal" clause to discuss the effect of a change in any variable that does not appear on one of the axes, the situation changes. We show the effect of any other variable, such as a change in consumer income or the price of another good, as a shift in the demand curve. In its new position, the demand curve still represents a relationship between the price of chicken and the quantity demanded, but it is a slightly different relationship than before because one of the "other things" is no longer equal.

These two rules for demand curves are crucial to understanding the theory of supply and demand. Let's look at some examples.

Changes in the Price of Another Good

We already know that the demand for chicken depends on the price of beef as well as the price of chicken. Figure 2–2, which shows demand curves for both goods, provides a closer look at how the two prices interact.

Figure 2–2 Effects of an Increase in the Price of Beef on the Demand for Chicken



An increase in the price of beef from \$3.00 to \$4.50 per pound, other things being equal, causes a movement from point *A* to point *B* on the beef demand curve—a decrease in the quantity of beef demanded. With the price of chicken unchanged at \$2.00 per pound, consumers will substitute chicken for beef. That will cause an increase in the demand for chicken, which takes the form of a shift in the chicken demand curve from D_1 to D_2.

Suppose that the price of beef starts at \$3.00 per pound and then increases to \$4.50. The effect of this change on the quantity of beef demanded appears in Panel (a) of Figure 2–2 as a movement along the beef demand curve from point *A* to point *B*. Panel (b) shows the effect on the demand for chicken. With the price of beef higher than before, people will tend to buy more chicken *even if the price of chicken does not change.* Suppose the price of chicken is steady at \$2.00 per pound. When beef was selling at \$3.00, consumers bought 2.0 billion pounds of chicken a year (point A' on demand curve D_1). After the price of beef goes up to \$4.50, they will buy 3.5 billion pounds (point B' on demand curve D_2).

An increase in the price of beef will cause consumers to buy more chicken regardless of the price of chicken. If the price of chicken had started at $3.00 and remained there while the price of beef went up, people would have increased their chicken consumption from 1.0 billion pounds a year to 2.5 billion pounds a year. If the price of chicken had been $1.00 a pound, the quantity demanded would have increased from 3.0 billion pounds to 4.5 billion, and so on. An economist would say that a change in the price of beef causes the entire demand curve for chicken to shift. The chicken demand curve shifts because one of the "other things"—this time the price of beef—is no longer equal. For the new demand curve, D_2, the price of beef is $4.50 a pound, rather than the $3.00 we assumed in drawing demand curve D_1.

If we call a movement along a demand curve a "change in quantity demanded," what do we call a shift in the curve? Economists call a shift in a demand curve a **change in demand**. A change in quantity demanded (a movement along the curve) is the result of a change in the price of the good in question—in our example, that means the price of chicken, which is the variable on the vertical axis. In contrast, a change in demand (a shift in the demand curve) is the result of a change in some variable other than the price of the good in question. In the example above, it was the price of beef—a variable that does not appear on either axis.

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A change in the price of gasoline will affect consumer choice between economy cars and SUVs.

In the example in Figure 2–2, people bought more chicken when the price of beef went up, replacing one meat with the other in their meals. Economists call such pairs of goods **substitutes** because an increase in the price of one increases the demand for the other—a rightward shift in the demand curve.

A different situation arises when consumers tend to use two goods together. One example is cars and gasoline. An increase in the price of gasoline affects people's selection of cars. For example, they buy fewer low-mileage, large SUVs—even if the price of SUVs does not change. An increase in the price of gasoline thus causes a movement upward along the gasoline demand curve and a *leftward shift* in the demand curve for SUVs. We call pairs of goods that have this relationship to one another **complements**.

One more point regarding the effects of changes in the prices of other goods: It is the price of a good *relative to the prices of other goods* that counts for demand. During periods of inflation, when the average level of all prices rises, it is especially important to distinguish between changes in *relative prices* and changes in *nominal prices* (the number of dollars actually paid per unit of a good). During a time of inflation, a good can become relatively less expensive, even though its nominal price rises, if the prices of other goods rise even faster.

For example, from the end of 2003 to the middle of 2009, the average retail price of chicken rose by almost 19 percent, from $1.05 per pound to $1.25 per pound. Over the same period, the average price of beef and veal—substitutes for chicken—rose by only 10 percent. Thus, the price of beef and veal *relative to chicken* fell during the period even though the nominal price rose. This decrease in the relative price of beef and veal, all else equal, would cause the demand curve for chicken to shift to the left.

Change in demand
A change in the quantity of a good that the buyers are willing and able to purchase that is caused by a change in some condition other than the price of that good; a shift in the demand curve

Substitute goods
A pair of goods for which an increase in the price of one causes an increase in demand for the other

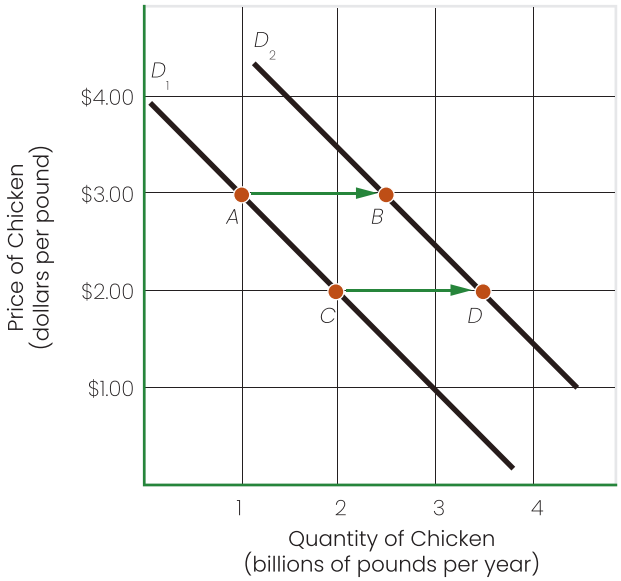
Complementary goods
A pair of goods for which an increase in the price of one causes a decrease in demand for the other

Changes in Consumer Incomes

Changes in consumer incomes also affect demand. People tend to buy larger quantities of many goods when their incomes rise, assuming that prices do not change.

Figure 2–3 shows the effect of an increase in consumer income on the demand for chicken. Demand curve D_1 is the same one shown in Figure 2–1. Suppose, now, that consumer income rises. With higher incomes, people throughout the world tend to eat more meat. For example, increasing income was one factor that made chicken increasingly popular in the decades after World War II.

Figure 2–3 Effects of an Increase in Consumer Income on the Demand for Chicken



Demand curve D_1 assumes a given level of consumer income. If incomes increase, consumers will want to buy more chicken at any given price, other things being equal. That will shift the demand curve rightward to, say, D_2. If the prevailing market price at the time of the demand shift is $3.00 per pound, the quantity demanded increases to 2.5 billion pounds (B) from 1.0 billion (A). If the prevailing price is $2.00 per pound, the quantity demanded will increase to 3.5 billion pounds (D) from 2.0 billion (C), and so on.

Suppose that, after their incomes rise, people want to buy 2.5 billion pounds of chicken instead of 1.0 billion at $3.00 per pound. Figure 2–3 shows the change as an arrow drawn from point A to point B. If the price of chicken were instead $2.00, consumers would buy even more chicken at any level of income. When income was at its original low level, consumers would buy 2.0 billion pounds, as shown by point C. After their incomes went up, buyers would want 3.5 billion pounds, shown by point D. It's important to note that, even though consumers want to buy more chicken at all prices after incomes rise, they still want to buy less chicken at higher prices than at lower prices. In other words, even with a shifting demand curve, the law of demand still holds.

The same reasoning applies for any given price of chicken. As a result, rising income tends to shift the entire demand curve to the right. Later, if consumer incomes stay at the new, higher level but the price changes, the effects would appear as movements along the new demand curve. There is a chicken demand curve for every possible income level. Each represents a one-to-one relationship between price and quantity demanded for that income.

In the example we have just given, an increase in income causes an increase in demand. Because that is what happens for most goods, economists call goods like chicken **normal goods**.

Not all goods are normal, however. People buy less of some goods when their incomes rise, other things being equal. For example, as the economy slipped into a deep recession in 2008, sales of new shoes fell, but demand for shoe repair services increased sharply. Hormel Foods reported a surge in sales of staple products like Spam and Dinty Moore beef stew, even while demand for its upscale, single-serving microwaveable foods fell. We call goods like shoe repair services and Spam, for which demand increases as income falls, **inferior goods**. An increase in income shifts the demand curve for an inferior good to the left instead of to the right.

Changes in Expectations

Changes in buyers' expectations can also shift demand curves. If people expect the price of something to go up, they may hurry to buy more before the increase takes place.

Suppose that in May consumers hear that airline prices will go up after June 1. Some of them may be planning to travel late in the summer and would have waited several weeks before booking a flight, but instead, they will book early. The expectation of higher prices later produces a temporary rightward shift in the demand curve before the increase takes effect.

The same thing can happen if people expect something other than a price increase to raise the opportunity cost of the good. For example, in the spring of 2020 it started to become clear that COVID-19 was spreading rapidly in the US. Many people began to worry that they would not be allowed to go out for routine shopping trips, or at the very least that doing so would put them at risk of contracting COVID-19, which would be a considerable opportunity cost. As a result, there was an early surge in demand for goods like toilet paper, disinfectant wipes, and bottled water.

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As US consumers have become more health conscious, demand for fish, organic vegetables, gym memberships, and at-home fitness equipment has increased. (Shutterstock)

Changes in Tastes

Changes in tastes can also cause an increase or decrease in demand. Sometimes these changes occur rapidly, such as with popular music, clothing styles, and fast foods. In other cases, changes in tastes take longer but are more permanent. For example, over the years, US consumers have become more health conscious. As that has happened, demand has fallen for cigarettes and fatty foods, while demand for fish, organic vegetables, gym memberships, and at-home fitness equipment has risen.

2.2 Supply

Let's turn now to the supply side of the market. Many students who are just beginning to study economics have a harder time making sense of supply than they do demand. The next section gives a few pieces of advice that may help you avoid that fate. After that, we'll continue our earlier example, changing our focus from the quantity that consumers are willing and able to buy under given market conditions to the quantity that producers are willing and able to sell. As in the case of consumers, we will see that the choices made by producers depend both on the price of the good in question and on other relevant conditions.

Normal good
A good for which an increase in consumer income results in an increase in demand

Inferior good
A good for which an increase in consumer incomes results in a decrease in demand

2.2a Some Tips for Learning Supply

There are at least three reasons that learning supply is a little trickier than learning demand. The first is that we often have a harder time relating to suppliers. Even though many of you reading this may be entrepreneurial and even run your own small (or large!) business, everyone spends more time consuming than producing, and everyone consumes considerably more than they produce. This can lead us to subconsciously relate to the demand side of the market, because we think of ourselves primarily as buyers. To relate to the supply side of the market, remember this: If you have a job, then in the market for labor you are a *seller*. Labor markets are modeled this way, viewing employees as *selling their labor*, sometimes one hour at a time, to employers.

The next hurdle has to do with the language that economists use. The word "demand" works well because it does not imply that consumers actually buy anything. "Quantity *demanded*" sounds like a request that may or may not be fulfilled—it's just what consumers demand, regardless of whether anyone is willing to sell. The word "supply" does not have this same quality. When we say "quantity *supplied*" it sounds like a done deal—like the goods are already on the shelves. But what it really means is more like "quantity *offered*." In other words, when it comes to supply, we are still only talking about what sellers would be willing to sell if they could sell all they wanted at a given price; this is still just a hypothetical statement about seller desire.

This leads to the final hurdle. A lot of students, when they start to learn economics, think it sounds strange to ask what quantity a seller would be willing to sell at a given price because, in our minds, sellers are the ones who set the prices. It can be much easier for us to imagine buyers responding to market prices than it is for us to think about sellers doing the same.

It is definitely true that some firms have a greater ability to set their prices higher than other firms. For instance, the local drycleaner's price probably depends a lot on what the competition is charging. This is what we mean about sellers "facing a price." The drycleaner has to decide whether to go into the dry-cleaning business by looking around and seeing what the going prices for dry-cleaning services are. As you read through the sections that follow, keep in mind that even though poultry farmers often sell to a larger market area, they are more like the drycleaner (they face a lot of competition and cannot get away with charging higher prices) than a major firm with a lot of market power, such as Apple. By the way, even Apple can't just charge any price it wants, it has to consider what buyers are will to pay. We will have much more to say about this in Chapters 7 and 8.

2.2b The Supply Curve

Supply curve
A graphical representation of the relationship between the price of a good and the quantity of that good that sellers are willing to supply

Law of supply
The principle that a direct relationship exists between the price of a good and the quantity of that good that sellers are willing to supply, other things being equal

We begin the discussion of the choices made by producers by looking at Figure 2–4, which shows the relationship between the price of chicken and the quantity that suppliers are willing and able to sell. We call the relationship shown in the figure a **supply curve** for chicken. The supply curve has a positive slope because the **law of supply** holds that there is a direct relationship between the price of a good and the quantity that sellers are willing to sell: the quantity supplied increases when the price goes up. Like demand curves, supply curves are based on an "other things being equal" condition. The supply curve shows how sellers respond to a change in the price of chicken, assuming no changes in the prices of other goods, production techniques, input prices, expectations, or other relevant conditions.

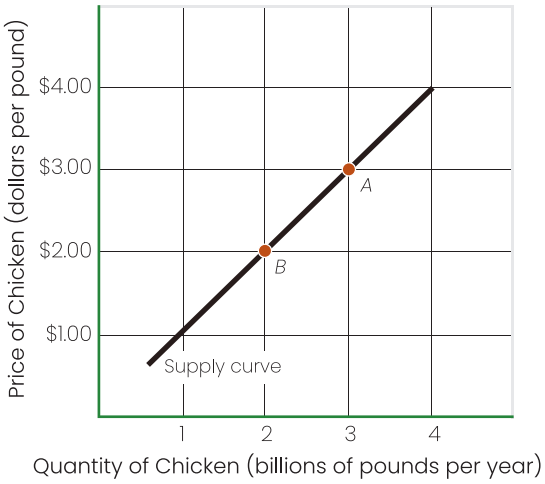
Why do sellers, other things being equal, plan to supply more chicken when the price is higher? Before developing a detailed theory, we can consider some commonsense explanations.

Figure 2–4 A Supply Curve for Chicken

(a)

	Price of Chicken (dollars per pound)	Quantity of Chicken Supplied (billions of pounds per year)
	$4.00	4.0
	$3.50	3.5
A	$3.00	3.0
	$2.50	2.5
B	$2.00	2.0
	$1.50	1.5
	$1.00	1.0

(b)



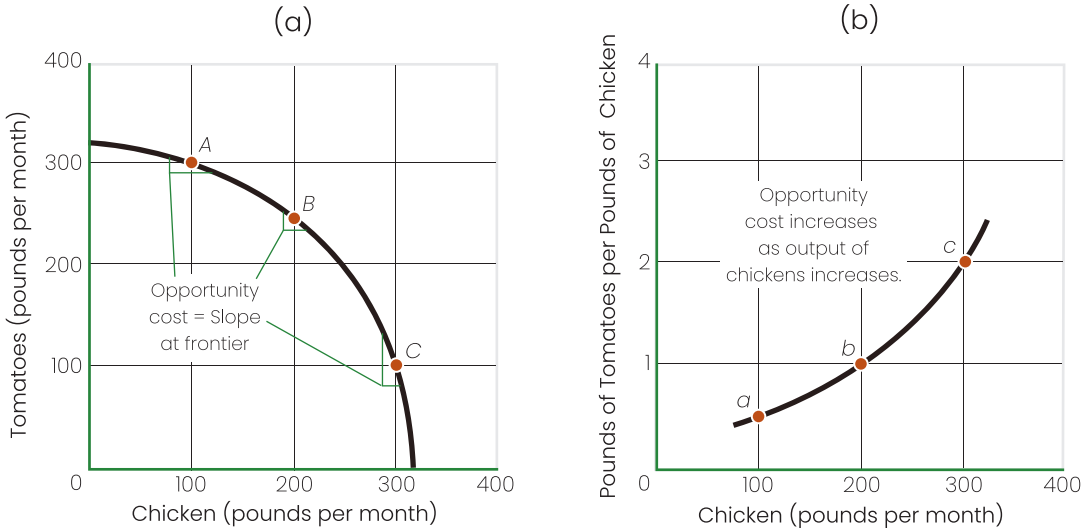
Panels (a) and (b) of this figure show the quantity of chicken supplied at various prices. As the price rises, the quantity supplied increases, other things being equal. The higher price gives farmers an incentive to raise more chickens, but the rising opportunity cost of doing so limits the supply produced in response to any given price increase.

One explanation is that the positive slope of the supply curve represents *producers' responses to market incentives.* When the price of chicken goes up, farmers have a reason to expand their capacity. Some who raise chickens as a sideline may decide to make chickens their main business. Other people may enter the chicken business for the first time. The same reasoning applies in every market. If parents are finding it hard to get babysitters, what do they do? They offer a bigger incentive in the form of a higher hourly rate. If a sawmill cannot buy enough timber, it raises the price it offers to loggers, and so on. Exceptions to the rule that a higher price causes a greater quantity supplied are rare.

Alternatively, we could explain the positive slope of the supply curve in terms of the *rising cost of producing additional output in facilities of a fixed size.* A furniture factory with a fixed amount of machinery might be able to produce more chairs only by adding shifts or paying overtime. A farmer trying to grow more wheat on a fixed amount of land could increase the use of fertilizer; but beyond a point, each added ton of fertilizer would yield less additional output.

Finally, we can explain the positive slope of the supply curve in terms of *comparative advantage and opportunity cost*. Panel (a) of Figure 2–5 shows a production possibility frontier for an economy that produces tomatoes and chicken. Some farmers have a comparative advantage in one product; some, in the other. Suppose we start from a point where farmers produce only tomatoes and then introduce chicken. The first farmers to switch to chicken will be those with the strongest comparative advantage—that is, those able to produce chicken at the lowest opportunity cost relative to tomatoes. They will be willing to switch from tomatoes to chicken even if the price of chicken is low. As farmers add more and more chicken, the point of production moves down and to the right along the frontier. After each adjustment, the price of chicken must rise further to give the needed incentive for farmers with higher opportunity costs to make the switch.

Figure 2–5 The Production Possibility Curve and the Supply Curve



This figure offers an interpretation of the supply curve in terms of the production possibility frontier for an economy that produces two goods: tomatoes and chicken. Panel (a) shows a production possibility frontier. The slope of the frontier, at any point, shows the opportunity cost of producing an additional pound of chicken measured in terms of the quantity of tomatoes that farmers could have produced using the same factors of production. The frontier curves because some farmers have a comparative advantage in producing tomatoes and others have a comparative advantage in producing chicken. As farmers raise more chicken, those with the greatest comparative advantage are the first to stop producing tomatoes. Because the frontier gets steeper as the quantity of chicken increases, the opportunity cost rises, as shown in Panel (b). We can interpret the curve in Panel (b) as a supply curve, in the sense that in order for farmers to be inspired to shift more and more factors from tomatoes to chicken, the price that they are paid for that chicken, relative to tomatoes, needs to rise.

Change in quantity supplied
A change in the quantity of a good that suppliers are willing and able to sell that is caused by a change in the good's price, other things being equal; shown by a movement along a supply curve

Change in supply
A change in the quantity of a good that suppliers are willing and able to sell that is caused by a change in some condition other than the good's price; shown by a shift in the supply curve

The slope of the frontier at any point represents the price of chicken, relative to the price of tomatoes, that will cause one more farmer to switch. Panel (b) of Figure 2–5 uses information on opportunity costs, based on the slope of the frontier at points like *A*, *B*, and *C*, to construct a supply curve for chicken. That curve shows how the price of chicken must rise relative to the price of tomatoes to induce more farmers to switch from one product to the other.

Each of these commonsense explanations fits certain circumstances. Together, they provide an intuitive basis for the positive slope of the supply curve.

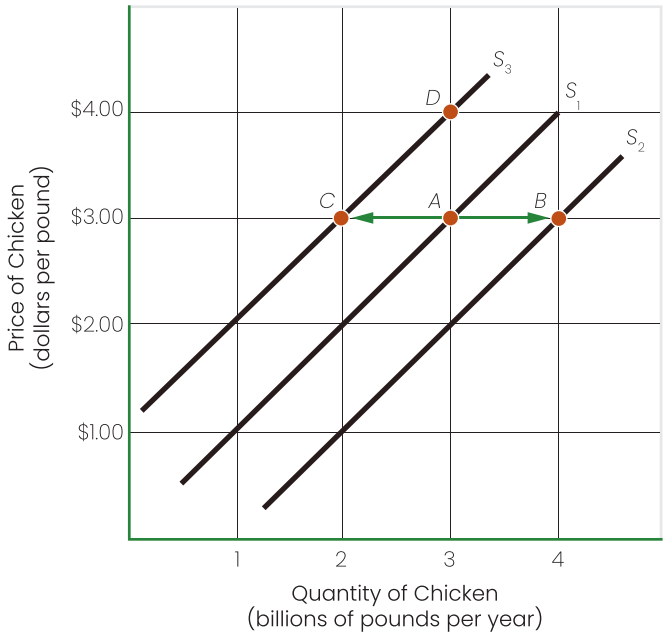
2.2c Shifts in the Supply Curve

We call the effects of a change in the price of chicken, other things being equal, a **change in quantity supplied**, shown as a movement along the supply curve. The effects of a change in a condition other than the price of chicken are known as a **change in supply**, shown as a shift in the supply curve. Four sources of change in supply are worth noting. Each of them reflects a change in the opportunity cost of producing the good or service in question.

Changes in Technology

A given supply curve is based on a given technology. Entrepreneurs are constantly looking for new ways of doing things that lower costs. When production costs fall, it becomes worthwhile to sell more of the good at any given price. Figure 2–6 shows how new technology affects the supply curve for chicken.

Figure 2–6 Shifts in the Supply Curve for Chicken



Several kinds of changes can cause the supply of chicken to increase or decrease. For example, a new production method that lowers costs will shift the curve to the right, from S_1 to S_2, because producers will be willing to supply more at any given price. An increase in the price of inputs, other things being equal, will shift the curve to the left, from S_1 to S_3. Changes in sellers' expectations or in the prices of competing goods can also cause the supply curve to shift.

Supply curve S_1 is the same as the one shown in Figure 2–4. It indicates that farmers will plan to supply 3.0 billion pounds of chicken per year at a price of $3.00 per pound (point A). Now suppose that the development of a faster-growing bird reduces feed requirements. With lower costs per unit, farmers will be willing to supply more chicken at any given price. They may, for example, be willing to supply 4.0 billion pounds of chicken at $3.00 (point B). The move from A to B is part of a shift in the entire supply curve from S_1 to S_2. Once the new methods of production are established, any increase or decrease in the price of chicken, other things being equal, will cause a movement along the new supply curve.

Changes in Input Prices

Changes in input prices are a second item that can cause supply curves to shift. An increase in input prices, other things being equal, increases the cost of producing the good in question and reduces quantity supplied at any given price. Refer again to Figure 2–6. Suppose that, starting from point A on supply curve S_1, the price of chicken feed increases and no offsetting changes occur. Now, instead of supplying 3.0 billion pounds of chicken at $3.00 per pound, farmers will supply just 2.0 billion pounds (point C). The move from A to C is part of a leftward shift in the supply curve, from S_1 to S_3.

If the price of feed remains at the new level, changes in the price of chicken will cause movements along the new supply curve. Even after the reduction in the quantity supplied at all prices, caused by a leftward shift of the supply curve, the law of supply still holds, and farmers would be willing to sell more at higher prices. For example, farmers could be induced to supply the original quantity of chicken—3.0 billion pounds—if the price of chicken were raised enough to cover the increased cost of feed. As you can see in Figure 2–6, that would require a price of $4.00 per pound for chicken (point D).

Changes in the Prices of Other Goods

Changes in the prices of other goods that producers could make using the same factors of production can also shift the supply curve. In our earlier example, farmers could use available resources for either chickens or tomatoes. Suppose that the price of tomatoes rises while the price of chicken stays at $3.00. The higher price of tomatoes gives some farmers who would otherwise have produced chickens an incentive to shift to tomatoes. The result would be a leftward shift in the chicken supply curve and movement up along the supply curve for tomatoes.

Changes in Expectations

Changes in producers' expectations are a fourth factor that can cause supply curves to shift. A farmer's selection of crops depends less on the price at planting time than on the price expected at harvest. Expectations over a time span also matter. Each crop requires special equipment and know-how. We have just seen that an increase in the price of tomatoes gives farmers an incentive to shift from chicken to tomatoes. The incentive will be stronger if they expect the price of tomatoes to remain high for a long time, making it worthwhile to buy special equipment and learn the necessary production techniques.

2.3 The Interaction of Supply and Demand

Markets transmit information, in the form of prices, to people who buy and sell. Buyers and sellers take those prices into account, along with other knowledge they have, when making the plans that shape the supply and demand curves.[2]

Equilibrium
A condition in which buyers' and sellers' plans exactly mesh in the marketplace, so that the quantity supplied exactly equals the quantity demanded at a given price

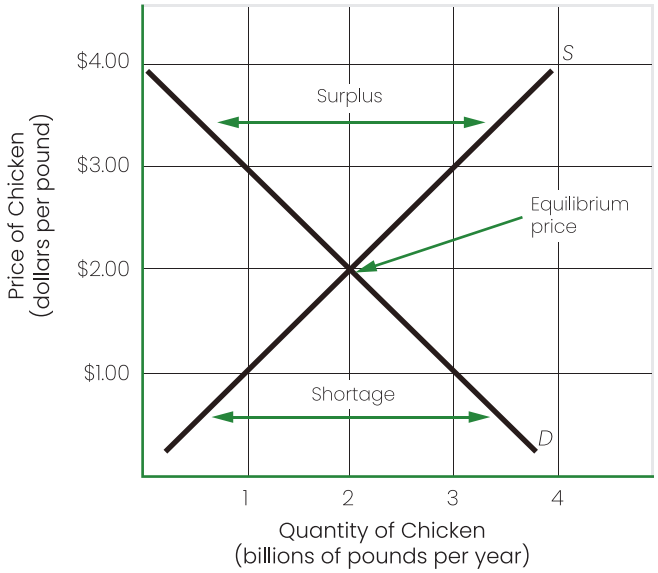
Nothing guarantees that all of the buyers and sellers in a market will be able to carry out their plans, as hoped, when they meet to trade. Perhaps the quantity of a good that buyers want is greater than the quantity suppliers are willing to sell at the prevailing price. In that case, some of the would-be buyers will be disappointed and must change their plans. Perhaps planned sales exceed planned purchases. In that case, some would-be sellers will have to adjust their plans. Sometimes, though, buyers' and sellers' plans will exactly mesh when they meet in the marketplace; no one is disappointed or needs to change plans. In that case, the market is in **equilibrium**.

2.3a Market Equilibrium

We can illustrate a state of market equilibrium by drawing both the supply and demand curves for a good on one diagram. Figure 2–7 does that for the chicken market. If we compare the quantity of planned sales at each price with the quantity of planned purchases, we can see that there is only one price where the two sets of plans mesh. (We can use either the table or the graph to make the comparison.) That price—$2.00 per pound—is the equilibrium price. If all buyers and sellers make their plans with the expectation of a price of $2.00, no one will be surprised and no one will have to change their plans.

Figure 2–7 Equilibrium in the Chicken Market

(a)



(b)

Price (per pound)	Quantity Demanded (billions of pounds)	Quantity Supplied (billions of pounds)	Shortage (billions of pounds)	Surplus (billions of pounds)	Direction of Pressure on Price
$3.50	0.5	3.5	—	3.0	Downward
$3.00	1.0	3.0	—	2.0	Downward
$2.50	1.5	2.5	—	1.0	Downward
$2.00	2.0	2.0	—	—	Equilibrium
$1.50	2.5	1.5	1.0	—	Upward
$1.00	3.0	1.0	2.0	—	Upward
$0.50	3.5	0.5	3.0	—	Upward

This figure shows the supply and demand curves for chicken presented earlier in graphical and numerical form. The demand curve shows how much buyers plan to purchase at a given price. The supply curve shows how much producers plan to sell at a given price. At only one price ($2.00 per pound) do buyers' and sellers' plans exactly match. That is the equilibrium price. A higher price causes a surplus of chicken and puts downward pressure on price. A lower price causes a shortage and puts upward pressure on price.

2.3b Shortages

What would happen if people were to base their plans on a price other than $2.00 a pound?[3] Suppose, for example, that they plan for a price of $1.00. As Figure 2–7 shows, planned purchases at that price are 3.0 billion pounds per year, but farmers plan to supply only 1.0 billion. When the quantity demanded exceeds the quantity supplied, the difference is an **excess quantity demanded** or, more simply, a shortage. In Figure 2–7, the **shortage** at a price of $1.00 is 2.0 billion pounds per year.

In most markets, the first sign of a shortage is a decrease in **inventories**—that is, in previously produced stocks of a good that are ready for sale or use. Sellers normally plan to hold a certain level of inventory to allow for minor changes in demand. When they see inventories dropping below the planned level, they change their plans. Some sellers may try to rebuild their inventories by increasing their output. Others may take advantage of strong demand to raise prices. Many are likely to do a little of both. As sellers adjust their plans, they will move upward and to the right along the supply curve.

(Shutterstock)

A line of people waiting to buy something is a sign of shortage.

As the price begins to change, buyers, too, adjust their plans. They cut back on their planned purchases, moving up and to the left along the demand curve. As both buyers and sellers adjust, the market moves toward equilibrium. When the price reaches $2.00, the shortage disappears, along with the pressure to make further adjustments in plans.

In the markets for services—knee surgery, tax preparation, lawn care, and the like—the adjustment process is a little different because there are no inventories of services produced but not yet sold. The same is true of goods like custom-built houses and custom-designed machine tools, where producers do not begin work until they have a contract with a buyer.

In markets where there are no inventories, the first sign of a shortage is a queue of buyers. The queue may take the form of a line of people waiting for service or a list of names in an order book. The queue is a sign that, at the prevailing price, people would like to buy more of the good than is being supplied. In that case, buyers cannot carry out all of their plans—at least not right away.

Excess quantity demanded (shortage)
A condition in which the quantity of a good demanded at a given price exceeds the quantity supplied

Inventory
A stock of a good awaiting sale or use

Excess quantity supplied (surplus)
A condition in which the quantity of a good supplied at a given price exceeds the quantity demanded

The formation of a queue of buyers has the same effect on the market as a decrease in inventories. Sellers react by increasing output, raising prices, or both. Buyers react by reducing purchases or by agreeing to higher prices. The market moves up and to the right along the supply curve and, at the same time, up and to the left along the demand curve until it reaches equilibrium.

2.3c Surpluses

Suppose, instead, that buyers and sellers expect a price that is above the equilibrium. For example, in Figure 2–7, if the expected price is $2.50 per pound, farmers will plan to supply 2.5 billion pounds of chicken, but their customers will plan to buy only 1.5 billion pounds. When that happens, there is an **excess quantity supplied**, or a **surplus**. Here, the surplus at $2.50 per pound is 1.0 billion pounds per year.

If there is a surplus, suppliers will not be able to sell all they had hoped at the expected price. Inventories will start to grow. Suppliers will react to the inventory buildup by changing their plans. Some will cut back their output. Others will lower their prices in the hope of getting customers to buy more. Still others will do a little of both. Those changes in plans will cause a movement down and to the left along the supply curve.

As unplanned inventory buildup puts downward pressure on the price, buyers change their plans, too. Finding that chicken costs less than they had expected, they buy more of it. Figure 2–7 shows that reaction as a movement down and to the right along the demand curve. Taken together, buyers' and sellers' reactions to the surplus bring the market into equilibrium.

In markets in which there are no inventories, surpluses lead to queues of sellers looking for customers. Taxi queues at airports are a case in point. At some times of the day, the fare for taxi service from the airport to downtown is more than high enough to attract all the taxis needed to meet demand. A queue of cabs waiting for passengers forms. If there are rules against fare cutting, as there are in many traditional taxi services, the queue continues to grow until the next peak period when a surge in demand shortens it. In contrast, nontraditional ride services like Uber adjust prices flexibly as weather, traffic, and other conditions change, so you're unlikely to see a long line of Uber drivers waiting for riders.

2.3d Changes in Market Conditions

Finding the equilibrium price and quantity looks easy enough in our examples, but in real life, it is a moving target. The market conditions that fall under the "other things being equal" clause change frequently. When they do, both buyers and sellers must revise their plans, and the equilibrium price and quantity change.

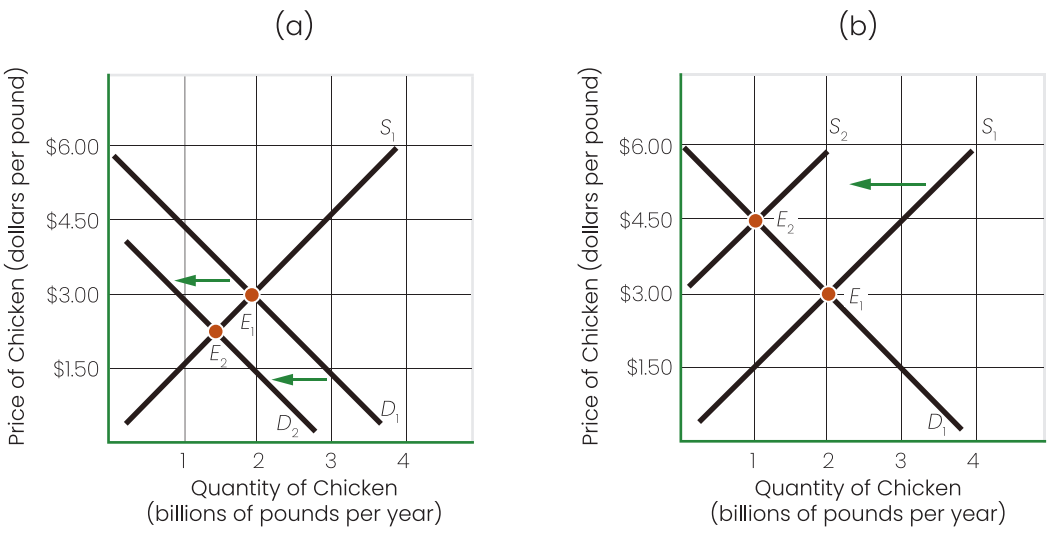
Response to a Shift in Demand

Let's start by looking at how a market responds to a shift in demand. Suppose you hear on Twitter that there has been an outbreak of food poisoning linked to chicken. As the news spreads, the demand for chicken decreases. Panel (a) of Figure 2–8 shows that as a leftward shift of the demand curve.

After the decrease in demand, there will be a surplus at the original price of $3.00. The price will not stay at that level for long, though. As soon as inventories start to rise, producers begin to revise their plans. They cut their prices and reduce quantities supplied. Suppliers' reactions appear as a movement along the supply curve, not as a shift in the curve, because the producers are responding to a change in the price of chicken—the variable shown on the vertical axis. Nothing has happened to change the "other things being equal" conditions for supply, such as technology or input prices, which could cause the supply curve to shift.

Adjustments continue until the plans of suppliers once again mesh with those of consumers. That happens at point E_2 in Panel (a) of Figure 2–8, where the price has fallen to $2.25 and the quantity sold to 1.5 billion pounds. Later, if health officials can track and isolate the source of the bad chicken, the demand curve may shift back to D_1, and the market will return to its original equilibrium.

Figure 2–8 Effects of Changing Conditions in the Chicken Market



Panel (a) of this figure shows the effects of a decrease in demand for chicken caused by reports linking food poisoning to eating chicken. Initially the market is in equilibrium at E_1. The report shifts the demand curve. At the original equilibrium price of $3.00, there is a temporary surplus of chicken. That causes inventories to rise and puts downward pressure on the price. As the price falls, producers move down along the supply curve to a new equilibrium at E_2. There, both the price and quantity of chicken are lower than before the shift in demand. Panel (b) shows the effects of a decrease in supply caused by an increase in the price of chicken feed. The shift in the supply curve causes a shortage at the initial price of $3.00 per pound. The shortage puts upward pressure on price. As the price rises, buyers move up and to the left along the demand curve until they reach a new equilibrium at E_2. In each case, note that only one curve needs to shift to bring about the new equilibrium.

Response to a Shift in Supply

In another case, the market equilibrium might be upset by a change in supply rather than demand. For example, suppose that increased use of corn to make ethanol pushes up the price of chicken feed. That would shift the supply curve for chicken to the left, while the demand curve remains unchanged, as shown in Panel (b) of Figure 2–8.

The shift in the supply curve would cause a shortage if the price of chicken remained unchanged at $3.00 per pound. Inventories would fall, putting upward pressure on the price. Producers would increase the amount they planned to sell, moving upward and to the right along the new supply curve. Buyers would move upward and to the left along the demand curve. A new equilibrium would be established when the price reached $4.50.

A Shift in One Curve or Both?

One of the most common mistakes people make in using supply and demand is to think that *both* curves always must shift in order to restore equilibrium. The examples given in Figure 2–8 show why they do not. As Panel (a) shows, after the demand curve shifts, the market moves along the supply curve to reach the new equilibrium. The supply curve does not need to shift. Similarly, in Panel (b), where the supply curve shifts, the market moves along the demand curve to reach the new equilibrium.

However, in the turmoil of real-world markets, it is easy to find cases where two separate changes occur at the same time, one acting on supply and the other on demand. *Economics in the News 2–1* provides an example.

No central authority has to plan the process of adjustment. Equilibrium is not a compromise negotiated by a committee of consumers and producers. Just as shoppers manage to equalize the length of supermarket checkout lines without the guidance of a central authority, markets like that for microchips move toward equilibrium on their own, even if sometimes very slowly.

Economics in the News 2–1

Hindsight Is 20/20 for Auto Manufacturers

In the spring of 2020, when the COVID-19 pandemic was beginning to change life around the world, many automakers began closing their plants. They did so in part for reasons of public safety guidelines and in part because they saw that a recession was coming that would curb the demand for new cars. US automakers also canceled orders for component parts from their suppliers. In modern cars, those include dozens of microprocessors that help control everything from GPS and entertainment to controlling emissions and tire pressure.

For the microchip makers, a decrease in demand is not good news. A decrease in demand, all else equal, decreases the equilibrium price and quantity. But luckily for chip manufacturers, all else was not equal. At the same time that automotive manufacturers were demanding fewer chips, companies that make and sell smartphones, gaming consoles, and laptops were increasing theirs! Demand for those products was rising as many people suddenly found themselves learning and working from home. The chipmakers took the chips they would have sold to automotive manufacturers and instead sold them to producers of consumer electronics. In the meantime, the car industry found that the recession did not tamp down the demand for new cars as much as predicted. After the initial lockdowns, demand recovered more quickly than anyone could have predicted.

In our textbook model of supply and demand, this may not seem like a big deal. If demand falls and then later rises again, won't the price and quantity just bounce back too? Over time, yes. Automakers will have all of the microchips they need, even if the price is a little higher due to the increased chip demand from other industries. But there is an important element missing from the basic demand and supply model: *time*. When demand unexpectedly decreases, suppliers can move quickly to cancel orders, halt production, and resell chips that can be used elsewhere. Still, the market adjusts more slowly in the other direction. Many chipmakers need about six months' lead time for some of the more specialized chips that auto companies use.

In early 2021, the result of this slow adjustment was what many media outlets called a "shortage." Whether that is the right word here is probably not that important. The end result is that factories were making fewer cars and seeing inventories shrink because they could not get their hands on chips. That certainly *feels* like a shortage, even though we fully expect the microchip market to equilibrate over time.

What are the lessons for students of economics? One is that the market adjustment process is not always simple, quick, or well understood. Some markets, such as stock markets, adjust quickly. Others, such as the market for specialized manufactured goods, take a long time.

Another lesson is that expectations matter. It can be very disruptive to markets when expectations are wrong. The automakers thought the recession that started in 2020 would be like others in the past and that new car demand would take longer to recover. Anyone who claims they knew differently might have 20/20 vision in hindsight only.

Sources: Pierre Lemieux, "The Mysterious Microchip Shortage," EconLib, http://bvtlab.com/8RP77. Camila Domonoske, "Auto Production Disrupted By Chip Shortages: A Dream Car May Be Hard To Find," NPR, January 12, 2021, http://bvtlab.com/8m875.

2.4 Price Floors and Price Ceilings

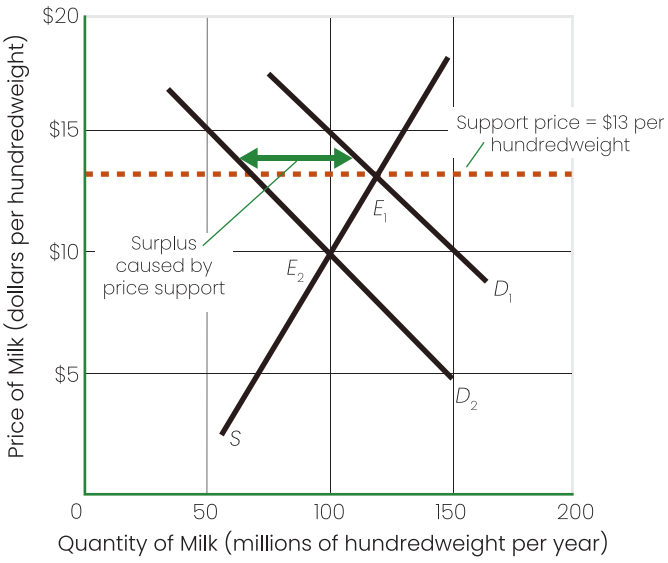
The previous section discussed how temporary surpluses and shortages cause prices and output to change when market conditions change. Sometimes, however, government regulations impose price floors or ceilings that interfere with free adjustment of prices. Surpluses and shortages then become persistent, often resulting in unintended consequences for producers, consumers, and taxpayers. This section uses the supply and demand model to analyze the effects of government-imposed price floors and ceilings and provides some examples.

2.4a Price Supports: The Market for Milk

In our earlier example of the market for chicken, a decrease in demand caused a surplus that, in turn, caused the price to decrease until the surplus disappeared. Markets are not always free to respond by adjusting prices, however. The market for milk is one such market.

Figure 2–9 shows the market for milk. The horizontal axis shows the quantity of milk in hundredweight, the unit used for bulk milk sales, equal to roughly twelve gallons. Suppose that, initially, the market is in equilibrium at point E_1. The wholesale price of milk is $13 per hundredweight, and the output is 110 million hundredweight per year. Then suppose that a trend in taste away from high-cholesterol foods shifts the demand curve for milk to the left. The result would be a surplus of milk at the $13 price, as shown by the arrow in Figure 2–9.

Figure 2–9 Price Supports for Milk



The market for milk is in equilibrium at E_1. A change in tastes away from high-cholesterol foods then shifts the demand curve to D_2. If the price were free to fall, a temporary surplus would push the price down to a new equilibrium at $10 per hundredweight. Instead suppose that the government maintains a support price for milk at a level higher than the equilibrium price, as it did for many years ($13 per hundredweight in this example). The government would then need to buy the surplus milk and store it in the form of powdered milk, butter, and cheese to keep the price from falling.

If the price of milk were free to fall in response to a surplus, the market would quickly reach a new equilibrium at $10 per hundredweight. However, suppose that the government sets a minimum price of $13 and enforces it by agreeing to buy all of the milk that farmers cannot sell at that price. With the demand curve in its original position, D_1, there was no surplus, and the government did not need to buy any milk. However, with the demand curve in position D_2, there is a surplus of forty million hundredweight per year. The result is a persistent surplus.

In effect, the price floor sends conflicting signals to producers and consumers. To consumers, the price of $13 says, "Milk is scarce. Its opportunity cost is high. Hold your consumption down." To producers, it says, "All is well. Incentives are unchanged. Feel free to continue using scarce resources to produce milk." Without the price supports, a drop in the price to $10 would send a different set of messages. Consumers would hear, "Milk is cheaper and more abundant. Although it is not cholesterol free, give in to temptation! Drink more of it!" Producers would hear, "The milk market is not what it once was. Look at your opportunity costs. Is there perhaps some better use for your labor, capital, and natural resources?"

Congress established the original milk price support program in 1949. For most of its first fifty years, the price floor was consistently higher than the equilibrium price. By the 1990s, the program became very expensive—more than $1,000 per US family by some estimates, enough to buy each family its own cow. From time to time, Congress attempted to control program costs without harming dairy interests, but nothing seemed to work for long.

Then, during the early years of the twenty-first century, conditions in the milk market changed. Increasing demand from emerging-market countries and rising feed costs caused shifts in both supply and demand curves. By 2005, the support price had fallen below the market price, and the surplus had disappeared. By 2014, changing market conditions plus renewed political pressure to cut government spending finally led to the end of milk price supports. Dairy interests did not come away entirely empty-handed. Farmers received the opportunity to buy into a program that protects their profit margins against any squeeze from a simultaneous fall in milk prices and rise in feed prices. However, it appears that artificially high prices and persistent surpluses have become a thing of the past.

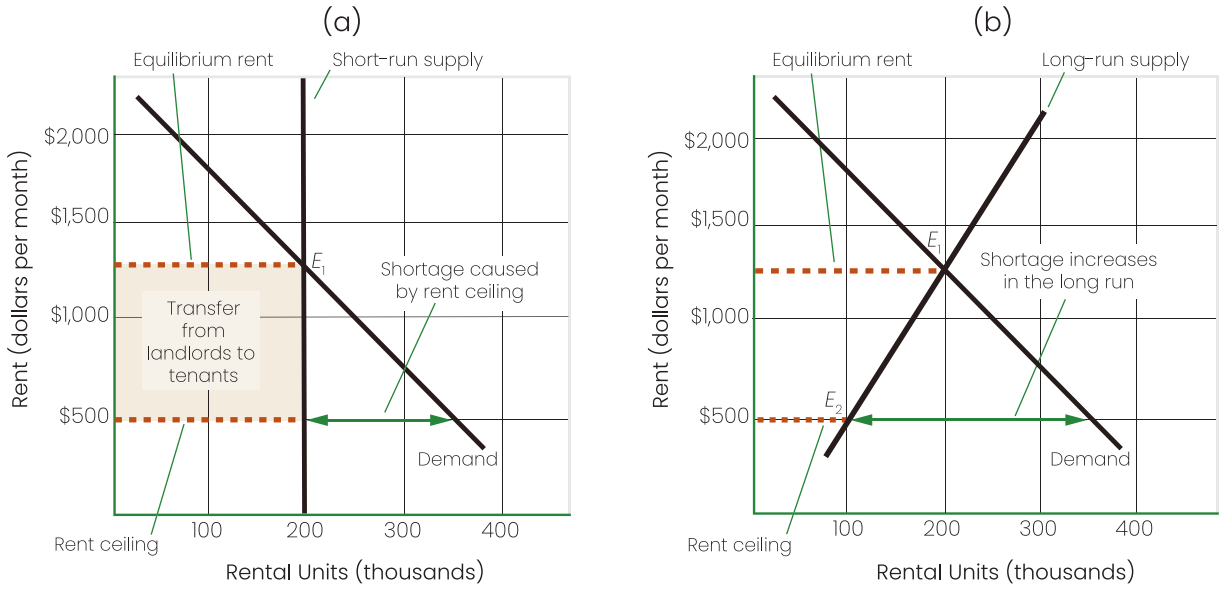
2.4b Price Ceilings: The Case of Rent Control

Milk price controls established a price floor that was higher than the market equilibrium. In other markets policy has, instead, imposed a price ceiling below the equilibrium. Consider the case of rent control in housing markets, such as those in New York, Los Angeles, San Francisco, and Washington, DC. The supposed aim is to aid tenants by preventing landlords from charging "unreasonably high" rents. However, what should be considered unreasonably high is determined by the relative political strength of landlords and tenants rather than by the forces of supply and demand.

Intended Effects

Figure 2–10 interprets the effects of rent control in terms of supply and demand. (For simplicity, we assume that housing units have equal size and rental value.) Panel (a) of the figure shows the effects of rent control in the short run. Here the short run means a period that is too short to permit significant increases or decreases in the supply of rental housing, making the short-run supply curve a vertical line.

Figure 2–10 Effects of Rent Control



Panel (a) shows the short-run effects of rent control. In the short run the supply of rental apartments is fixed. The equilibrium rent is $1,250 per month. Authorities then impose a rent ceiling of $500 per month. One possible outcome is that landlords will charge disguised rent increases, which will bring the true price back to $1,250 per month. If regulations prohibit such disguised increases, there will be a shortage of 150,000 units at the ceiling price. Panel (b) shows the long-run effects, when there is time to adjust the number of units in response to the price. With the ceiling in effect, landlords move down their supply curve to E_2. The shortage then becomes even more severe than in the short run.

Under the conditions shown, the equilibrium rent per standard housing unit is $1,250 per month for each of the two hundred thousand units in the city. Now suppose that authorities impose a rent ceiling of $500. At that price, tenants would save $750 per unit per month. The total sum transferred to tenants in the form of below-market rents is $750 multiplied by two hundred thousand units, or $150 million, equal to the area of the shaded rectangle.

Unintended Effects

Unfortunately for tenants, rent control also produces unintended consequences. In the short run, when the stock of apartments is fixed, the unintended consequences stem from the apartment shortage created because the quantity demanded is greater at the lower ceiling price than at the higher equilibrium price. Quantity demanded increases, in part, because some people who would otherwise own a house or condominium might prefer to seek rent-controlled units in the city instead of living in suburbs without rent control.

The shortage creates a problem for both landlords and tenants: How will the limited supply of apartments be rationed among those who want them? Both landlords and tenants devise a number of creative responses—*entrepreneurial* responses, as an economist would say.

One response on the part of landlords is to seek disguised rent increases—for example requiring large, nonrefundable deposits, selling used furniture or appliances at inflated prices as a condition for renting the apartment, or overcharging for maintenance or security services. Tenants, too, may get into the act. When they decide to move, they

may sublet their apartments to other tenants rather than give up their leases. Now it is the tenant who collects the deposits or sells the old furniture to the subtenant. The original tenant may have moved to a distant city but maintains a bank account and a post office box for use in paying the rent. The subtenant is instructed to play the role of a "guest" if the landlord telephones.

Advocates of rent control view these responses as cheating and often try to outlaw them. But the alternatives to this cheating are not necessarily better. The landlord still has to decide to whom to rent the apartment. Often they rely on discrimination against renters who are from minority groups, who have children, or who have unconventional lifestyles.

In the long run, rent control has other unintended effects. The long run in this case means enough time for the number of rental units to grow through construction of new units or shrink through abandonment of old ones (or their conversion to condominiums). Other things being equal, the higher the rent, the greater the rate of construction; the lower the rent, the greater the rate of abandonment or conversion. Those effects produce the positively sloped long-run supply curve in Panel (b) of Figure 2–10.

If landlords enforce rent controls in such a way that there are no disguised charges, the number of rental units shrinks, and the market moves from E_1 to E_2. At E_2, the unintended effects that appeared in the short run become more pronounced. The intensity of housing discrimination increases relative to the short-run case because the difference between the number of units available and the number sought by renters increases. That difference shows up as a horizontal gap between the supply and demand curves at the ceiling price. In the short run, there is a shortage of 150,000 units; in the long run, the shortage increases to 250,000 units.

Advocates of rent controls often defend them as beneficial to the poor; but when all of the unintended effects of rent control are taken into account, one may question whether that is really true. The most likely beneficiaries of rent control are stable middle-class families who work at the same jobs and live in the same apartments for long periods.

Why does rent control persist as a policy, given its many unintended consequences? Some economists explain the popularity of rent control in terms of the political power of the middle-class tenants, who are most likely to benefit from rent controls and who see "helping the poor" as nothing more than a convenient cover for their own self-interest. Some explain the popularity in terms of the short time horizon of government officials: The adverse effect on tenants of ending rent control would appear very quickly, whereas such benefits as increased construction of new apartments would materialize only long after the next election. Others attribute the popularity of rent control to the simple fact that many voters do not give much thought to the policy's unintended consequences.

Rent controls are making a comeback, with Oregon and New York passing new rent-control laws in 2019. However, most of the recent rent regulation policies attempt to mitigate some of the unintended consequences of rent controls. For example, in some cases landlords can pass along certain maintenance costs to tenants, reducing the incentive for landlords to skimp on maintenance. The trade-off is that these regulations are becoming increasingly complicated, making it easier for landlords to accidentally break the law and for tenants to not understand their rights.

2.4c Equilibrium as Spontaneous Order

The way that markets adjust to change is an example of economic coordination through spontaneous order. Consider, again, the market for microchips. Adjusting to changes in consumer incomes, a public health crisis, political events, and changing demand in other markets involve decisions made by dozens of manufacturers, suppliers, and original equipment manufacturers (OEMs), as well as millions of consumers. Somehow their actions must all be coordinated. But how?

A market economy needs no central planning agency or regulatory bureaucracy. The required changes in the use of scarce resources take place in response to information and incentives transmitted by changing market prices. As prices rise, chip manufacturers expand production capacity where possible. At the same time, dealerships and electronics retailers devise new strategies for managing excess demand; engineers redesign cars to exploit ever-advancing computer technology; and drivers, mechanics, and service shops look for ways to make existing cars last longer.

2.5 Some Closing Thoughts

This chapter has covered the basics of the supply and demand model and described a few of its applications. There are many more applications in both macro- and microeconomics. In macroeconomics, supply and demand apply to financial markets, labor markets, and the problem of determining the rate of inflation and real output for the economy as a whole. In microeconomics, the model applies to product markets, markets for labor and natural resources, and policy issues ranging from pollution to farm policy to international trade. As the great economist Alfred Marshall once put it, nearly all of the major problems of economics have a "kernel" that reflects the workings of supply and demand (see *Who Said It? Who Did It? 2–1*).

When we turn from the general outline presented in this chapter to some of the finer details, we will see that the supply and demand model fits some markets more closely than others. The fit is best for markets in which there are many buyers and many sellers, the goods offered by one seller are much like those sold by others, and all buyers and sellers have good information on market conditions. Markets for farm commodities, such as wheat and corn, and some financial markets, such as the New York Stock Exchange, meet these standards reasonably well.

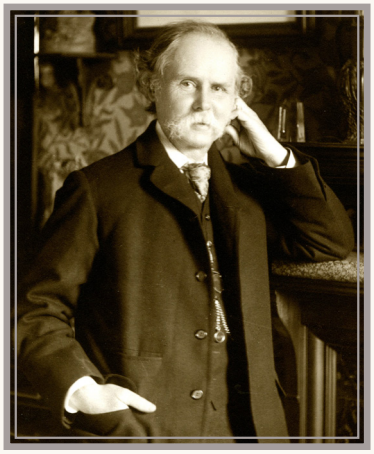
However, not all markets display all of these features. Automobiles are an example. Microchips, as a basic commodity, fit the supply and demand model closely. Markets for high-end luxury automobiles do not. In those markets, the products of different producers are not alike, and just a few specialist firms dominate some segments of the market. Even in markets like those, however, the notions of supply and demand provide a useful framework to which we can add refinements and extensions.

Who Said It? Who Did It? 2–1

Alfred and Mary Paley Marshall on Supply and Demand

Alfred Marshall, who many think was the greatest economist of his day, was born in London in 1842. His father was a Bank of England cashier who hoped the boy would enter the ministry. Young Marshall had other ideas, however. He turned down a theological scholarship at Oxford to study mathematics, receiving his MA from Cambridge in 1865.

While at Cambridge, Marshall joined a philosophical discussion group. There he became interested in promoting the broad development of the human mind. He was soon told that harsh economic realities would prevent the realization of his ideas. Britain's economic potential as a country could, supposedly, never allow the masses enough leisure for education. This disillusioning episode appears to have triggered Marshall's fascination with economics.



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Alfred Marshall

At Cambridge, Marshall also became fascinated by Mary Paley. Mary was a student of economics, but was prevented from receiving a degree, despite passing her final exams, because she was a woman. They married in 1877. Alfred and Mary published only one book together—*The Economics of Industry*—but she continued to contribute to the works he later published under his name only. At the time, the classical school founded by Adam Smith and David Ricardo dominated British economics. Alfred Marshall had great respect for the classical writers, and simply wanted to apply his mathematical training to the classical system. Before long, however, he was breaking new ground and developing a system of his own. By 1890, when he published his famous *Principles of Economics*, he had laid the foundation of what we now call the neoclassical school.

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Mary Paley Marshall

In an attempt to explain the essence of his approach, Marshall included the following passage in the second edition of his *Principles*:

> In spite of a great variety in detail, nearly all the chief problems of economics agree in that they have a kernel of the same kind. This kernel is an inquiry as to the balancing of two opposed classes of motives, the one consisting of desires to acquire certain new goods, and thus satisfy wants; while the other consists of desires to avoid certain efforts or retain certain immediate enjoyment . . . in other words, it is an inquiry into the balancing of the forces of demand and supply.

Unfortunately, we can never be certain about Mary's contributions to *Principles*, but it's not easy to imagine, given the time in which she lived, that she received much less credit than she deserved. Their influence on economics—at least in the English-speaking world—was enormous. *Principles* was the leading economics text for several decades, and modern students can still learn much from it. As professors at Cambridge, the Marshalls taught a great many of the next generation's leading economists. Today their neoclassical school continues to dominate the profession. Many have challenged it, but it lives on.

Summary

1. How does the price of a good or service affect the quantity that buyers demand?

The term *demand* means the willingness and ability of buyers to purchase goods and services. According to the *law of demand*, there is an inverse relationship between the price of a good and the quantity demanded. The *quantity demanded* is the amount buyers will purchase at a given price. We can represent the law of demand with a negatively sloped *demand curve*. A movement along the demand curve shows a change in the quantity demanded.

2. How do other market conditions affect demand?

A change in any of the variables covered by the "other things being equal" clause of the law of demand causes a shift in the demand curve, known as a *change in demand*. Examples include changes in the prices of goods that are *substitutes* or *complements* of the good in question, as well as changes in consumer incomes, expectations, and tastes.

3. How does the price of a good affect the quantity supplied by sellers?

The term *supply* means sellers' willingness and ability to offer products for sale in a market. In most markets, an increase in the price of a good will increase the quantity of the good that sellers are willing to supply. This relationship can be expressed by a positively sloped *supply curve*. The higher price gives producers an incentive to supply more, but rising opportunity costs set a limit on the amount they will supply at any given price.

4. How do changes in other market conditions affect supply?

A change in any of the items covered by the "other things being equal" clause of the supply curve will shift the curve. Examples include changes in technology, changes in the prices of inputs, changes in the prices of other goods that producers could make with the same resources, and changes in expectations.

5. How do supply and demand interact to determine the market price of a good or service?

In a market with a positively sloped supply curve and a negatively sloped demand curve, there is only one price at which the quantity of a good that sellers plan to supply will exactly match the quantity that buyers plan to purchase. We call that the *equilibrium price*. At any higher price, there will be a surplus; and at any lower price, there will be a shortage.

6. Why do market prices and quantities change in response to changes in market conditions?

A change in any market condition that shifts the supply or demand curve will change the equilibrium price and quantity in a market. For example, for a normal good, the demand curve will shift to the right if consumer incomes increase. That causes a shortage at the old price, and the price begins to rise. As the price rises, suppliers move up along the supply curve to a new equilibrium. An improvement in technology would shift the supply curve to the right. In that case there is a surplus at the old price, and the price will fall. As the price decreases, buyers will move down along their demand curve to a new equilibrium. No shift in the demand curve is required.

7. What are the unintended consequences of price floors and price ceilings?

Price floors, like those long imposed on milk and other farm products, are intended to help producers, but they lead to persistent surpluses. To prevent prices from falling, the government must buy surplus output and either store it or give it away. Price ceilings, like those on rent-controlled apartments, are intended to help low-income tenants, but they lead to persistent shortages. In the long run, construction slows and abandonments increase, so the shortages become more severe over time. Price ceilings and floors can still be found for some goods and services, but their unintended consequences have led many of them to be phased out over time.

Key Terms

Change in demand	45	Excess quantity supplied (surplus)	54
Change in quantity demanded	43	Inferior good	47
Change in quantity supplied	50	Inventory	54
Change in supply	50	Law of demand	42
Complementary goods	45	Law of supply	48
Demand	42	Normal good	47
Demand curve	42	Substitute goods	45
Equilibrium	52	Supply	42
Excess quantity demanded (shortage)	54	Supply curve	48

Problems and Topics for Discussion

1. A shifting demand curve

A vending machine company has studied the demand for soft drinks sold from machines. On a 70° day consumers in the firm's territory will buy about 2,000 cans at a price of $0.75. For each $0.05 rise in price, the quantity sold falls by 200 cans per day; for each 5° rise in temperature, the quantity sold rises by 150 cans per day. The same relationships hold for decreases in price or temperature. Using this information, draw a set of curves showing the demand for soft drinks on days when the temperature is 60°, 70°, and 85°. Then draw a separate diagram with temperature on the vertical axis and quantity on the horizontal axis. Draw a line representing the relationship between temperature and quantity when the price is $0.75. Next, draw additional temperature-quantity lines for prices of $0.50 and $1.00. Do the two diagrams give the same information? Discuss. (Note: If you have any trouble with this exercise, review the appendix to Chapter 1, "Working with Graphs," especially the section entitled "Packing Three Variables into Two Dimensions.")

2. Demand and the price of motor fuel

From 2007 to 2008, the price of gasoline in the United States rose from $2.76 per gallon to $3.20 per gallon. The quantity used decreased from 3,389 million barrels to 3,290 million barrels. In 2009, the price fell to $2.30 per gallon, yet the quantity used continued to decline, to 3,283 million barrels. After-tax personal income increased from 2007 to 2008, but it fell from 2008 to 2009.

Which one or more of the following hypotheses do you think best explain(s) the pattern of gasoline sales? Illustrate your chosen hypothesis with an appropriate diagram.

a. In 2008, the demand curve for gasoline had the usual negative slope. However, in 2009, the demand curve shifted to a positively sloped position.

b. The demand curve had a negative slope at all times, but because gasoline is a normal good, the demand curve shifted to the right in 2008 and then to the left in 2009.

3. Shortages, price controls, and queues

During the late 1980s and early 1990s, economic reforms initiated by Soviet president Mikhail Gorbachev began to raise consumer incomes; however, the Soviet government continued to impose price ceilings on basic goods like food, clothing, and household goods. As higher income led to increased demand, severe shortages of many goods and long lines at all kinds of stores became common. Finally, in January 1992, a new Russian government under President Boris Yeltsin removed retail price controls on most goods. Within a month, prices more than doubled on average, and lines disappeared. Analyze these events using the supply and demand model. First draw a supply and demand diagram for some normal good such as butter. Show the market in equilibrium at a price of 1 ruble per kilo before the beginning of the Gorbachev reforms. Draw a horizontal line at that level to represent the

price ceiling; no butter can be sold for more than 1 ruble per kilo. Next show the effect of rising income. Does it shift the supply curve? Does it shift the demand curve? What is the shortage or surplus at the controlled price? After the price control ends, assuming no further shift in the supply and demand curve, what happens to the price? What happens to the shortage or surplus?

4. Flexible pricing for rides

In most cities taxi fares stay the same every day and in every kind of weather. In contrast, ride services like Uber change prices more frequently with what is called *surge pricing*. One Halloween, some riders were shocked when they were charged far more than usual for a late evening ride from Uber. Do you think higher prices for rides on Halloween make sense from the point of view of supply and demand? Do you think it is ethical to charge a much higher price during a high-demand period like the evening of Halloween? (Uber says it always gives riders an estimate of the fare before they agree to the service.) Discuss in terms of efficiency *and* fairness.

5. The market for olive oil

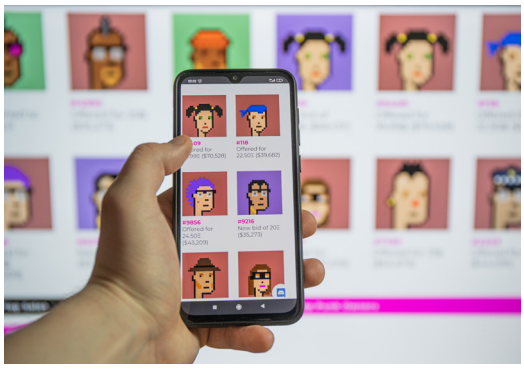
The chapter began by using olive oil as an example of a good whose price varies greatly from year to year. Using supply and demand diagrams, explain how each of the following would affect the market:

a. A severe drought hits Spain, the world's largest olive oil producer. Would the supply curve shift? What about the demand curve? What will happen to the price?

b. Medical research proves that the Mediterranean diet, which includes abundant use of olive oil, is not just a fad but is really good for you. In response, millions of consumers start following the diet. Would the supply curve shift? What about the demand curve? What will happen to the price?

Case for Discussion

What's Driving Up the Prices of Digital Art?



(Rokas Tenys/Shutterstock)

Larva Lab's CryptoPunks sell for an average of $48 per pixel.

How much would you pay for a *New York Times* article? Maybe you'd be willing to pay a dollar to get past a paywall for an article you really want to read. Or maybe you subscribe to the *Times* online (only $1 a week for students!) so you can read as many articles as you like. But how much would you be willing to pay not just to read an article, but to own sole digital rights to a PNG image file of an article?

If you said anything less than 350 ethereum (about $560,000 at the time) then you would have been outbid in the March 2021 auction of Kevin Roose's *New York Times* article "Buy This Column on the Blockchain!" The winner of the auction, Foundation app user 3fmusic, was not buying editorial rights to the article, and is not allowed to reproduce or republish the article. What 3fmusic bought was something called a non-fungible token, or NFT: a unique and uncopiable image file digitally signed with a complex bit of authentication code that is stored forever on the ethereum blockchain.

In early 2021, NFTs were being auctioned off like crazy. Larva Labs specializes in 24 × 24 pixel images of "CryptoPunks" that have unique combinations of features such as mohawks and sunglasses. They sell for tens of thousands of dollars. Jack Dorsey of Twitter sold an NFT of his first tweet for almost $3 million. Economics bloggers Tyler Cowen and Alex Tabarrok sold an NFT of their first blog post for a more modest, but still surprising, $2,300. Digital artist Beeple sold a new work for almost $70 million.

Why would someone pay this much for an image you could right-click and save forever for free, or a tweet or blog post that are still accessible online? We can't pretend to understand exactly what motivates the cryptoart enthusiasts who are driving up the prices of these digital certificates. But we do know that the same forces that determine the prices of traditional art are also at work here: supply and demand.

Just as with an original Frida Kahlo or Jean-Michel Basquiat masterpiece, the limited supply of these digital assets contributes to their high prices. When there is only one copy of something being sold, the seller only needs to attract one willing buyer. It's very easy for the price to skyrocket. If Roose or Dorsey or Beeple decided to sell thousands of individual NFTs of the same piece, the selling prices would likely have been much lower.

The demand side is a bit more mysterious. Roose interviewed several people who bid on his NFT and found that they had different motives. Some bidders believe strongly in the ability of verifiable digital ownership to empower digital artists. Others saw participating in the attention-getting sales of NFTs as an opportunity to get some attention for themselves. Still others are believers in the blockchain technology that supports cryptocurrencies and the NFT platform. And, just like with traditional artforms, some people are just very wealthy and like to collect things.

(continues)

Sources: Kevin Roose, "Buy this Column on the Blockchain!" *The New York Times*, http://bvtlab.com/aUNb9; Kevin Roose, "Why Did Someone Pay $560,000 for a Picture of My Column?" *New York Times*, http://bvtlab.com/vqnw6; http://bvtlab.com/V6jA5; http://bvtlab.com/27F96

Questions

1. If the sellers above had decided to sell multiple, unique NFT copies of their artworks or articles, the prices would not have risen quite so high. Can you explain in words why this is so? Can you explain using the tools of supply and demand?
2. Under what conditions do you think selling multiple copies of a piece of art (whether digital or not) increases the total value of all of the sales? Can you draw a supply and demand diagram in which total revenue for the artist rises when the supply increases? (Note: this is a sneak preview of the concept of *elasticity*, the subject of the next chapter.)
3. Think back to the "other things" that are assumed to remain constant when we draw a demand curve. Can you think of anything that could shift the demand curve for NFTs and cause the prices to fall? Anything that could send prices even higher?

Endnotes

1 Before continuing, you may want to review the Chapter 1 appendix, "Working with Graphs," especially the section entitled "Packing Three Variables into Two Dimensions."

2 The "plans" referred to need not be formal, or thought out in detail, and are subject to change. A consumer might, for example, make out a shopping list for the supermarket based on the usual prices for various foods, but then revise it to take into account unexpected price increases or sales on certain items. On specific occasions, consumer decisions may even be completely impulsive, with little basis in rational calculation. The model of supply and demand does not require people to base every decision on precise analysis; only that consumer intentions, on the average, are influenced by prices and other economic considerations.

3 Why might buyers and sellers enter the market expecting a price other than the one that permits equilibrium? It may be, for example, that market conditions have caused the supply or demand curve to shift unexpectedly, so that a price that formerly permitted equilibrium no longer does so; it may be that buyers or sellers expect conditions to change, but they do not change after all; or it may be that government policy has established a legal maximum or minimum price that differs from the equilibrium price. Later sections of the chapter will explore some of these possibilities.