CHAPTER 2
DEMAND AND SUPPLY IN COMPETITIVE MARKETS

What’s in It for You?

The average price of regular gasoline in the United States rose from $1.09 in January 2002 to $4.00 per gallon in July 2008 and then dropped to $1.68 per gallon in February 2016. What caused such wide fluctuations in the price of gas? What should you expect to happen to it in the future? Now suppose you are considering starting a web design business. The market for such services is currently booming. But is this trend likely to continue, so you should pursue your venture and expect it to be profitable? And here is another business dilemma. As organic food is becoming increasingly popular in the United States and worldwide, suppose your friend, a farmer, is wondering if she should go organic. Converting a conventional farm to organic takes years, and producing organic food is costlier than conventional farming. What advice should you give to your friend? To find the answers to all these and many other such questions, you must first understand how consumers’ demand interacts with producers’ supply.

In this chapter, we explain how buyers and sellers interact in competitive markets, how this interaction determines the quantities of goods and services produced and the prices at which they are sold, and how you can use the demand and supply model to explain the effects of various events on the market and predict changes in the market prices and quantities. For now, we assume that the forces of supply and demand alone determine the market outcomes. We will discuss how government economic policies influence markets in later chapters.

Learning Objectives

At completion of this learning module you are expected to be able to:

- Describe the characteristics of the markets where the competitive demand and supply model is applicable and explain how real-world markets can be analyzed using the demand and supply model.
- Describe the relationships reflected by the demand and supply curves and distinguish between movements along the curves and shifts of the curves.
- Explain how an equilibrium is reached in competitive markets.
- List key factors that influence buyers’ and sellers’ decisions and explain how they shift the demand and supply curves.
• Use the demand and supply model to explain observed changes in prices and quantities sold in competitive markets and predict how changes in demand and supply will affect the market equilibrium.
• Explain the concepts and assess the values of consumer surplus, producer surplus, total surplus, and deadweight loss.
• Define economic efficiency and list the conditions necessary for competitive markets to be efficient.

2.1 Applying the Demand and Supply Model

Recall from Chapter 1 that in microeconomics we view modern economies as collections of markets and that by a market we mean any arrangement that enables buyers and sellers to interact with each other. Many things are traded in various kinds of markets, from farmers’ markets, Walmart, and eBay to markets for real estate, financial assets, and foreign exchange. In this chapter though, we’ll focus on markets for goods and services.

Where Can We Use the Demand and Supply Model?

The demand and supply model that we study here can be applied to markets for various things, including all those mentioned above. But the model assumes that no individual buyer or seller can significantly influence the market price (and no groups of buyers or sellers are acting together as one), so the price is determined by all buyers and sellers in the market with each of them acting independently. Economists use the term competitive market to describe this kind of buyers’ and sellers’ interaction.

The demand and supply model works best when the market is perfectly competitive. We will discuss the features of perfectly competitive markets in more detail in Chapter 7. For now, the two conditions necessary for a market to be perfectly competitive are: (1) Buyers view products offered in the market as exactly the same no matter who sells them. (2) There are so many buyers and sellers in the market that each of them accounts for a very small fraction of the total sales so that the influence of each buyer or seller on the market is negligible. Since in this situation buyers and sellers must accept the market price as a given, economists call them price takers.

Although some markets can be viewed as perfectly competitive (e.g., the markets for grain, beef, orange juice, metals, and other commodities), most markets do not exactly meet the conditions above. Many markets, however, meet them closely enough, so we can ignore the imperfections. For example, consider the U.S. market for gasoline. Regular gas is a standardized product. Different gas stations may charge different prices, but the deviations are small and due mainly to the differences in gas stations’ locations and conveniences they offer (such as food, clean restrooms, ATM machines, etc.), not to the gas they sell. Thus, if we want to predict or explain changes in the average price of regular gas in the United States, we can safely ignore those differences and use the demand and supply model for the purposes of our analysis.

We can even use the demand and supply model to analyze markets where the products sold by different firms differ significantly. For example, suppose we want to analyze the market for laptop computers. Of course, laptops sold by different firms differ by their technical
characteristics, quality, design, etc. Nevertheless, if we want to see, for instance, why laptops in general have become cheaper, we can combine all kinds of laptops into a single whole and treat them as the same good. Thus, the uses of the demand and supply framework discussed in this chapter go far beyond perfectly competitive markets. The model can be applied to gain important insights into how prices and quantities sold are determined in many real-world markets.

**Checkpoint 1**

“The demand and supply model is applicable only to perfectly competitive markets, and few real-world markets are perfectly competitive.” True or false? Explain.

**What Is a Price?**

The answer to the question above seems obvious. Is not it the number of dollars you pay for a unit of a good? Not exactly. Recall, from Chapter 1 that economists measure the cost of everything as opportunity cost and that the opportunity cost of a good you get is the value of your best alternative given up. For example, if you buy a concert ticket for $28, and your second-best choice is to go to the movies, paying $7 per ticket, then the opportunity cost of your attending the concert is $28/$7 = 4 movies. This ratio of one nominal price to another is called a relative price or real price. And it is the relative prices, not nominal prices, that are relevant when examining how the forces of demand and supply interact in a market.

In practice, however, we don’t need to calculate the price of the good in question in terms of every other related good. Instead, we can calculate the price of any good of our interest in terms of a “basket” that represents all goods and services and then compare this relative price with the relative prices of other goods calculated the same way. As you might remember from your first economics course, this can be done using the Consumer Price Index (CPI). For example, the prices of gas quoted at the beginning of this chapter are money prices (also called nominal prices). For more meaningful comparisons, we can convert them into relative (i.e. real) prices using the CPI. Since in January 2002 the CPI was 1.77, we can say that the relative price of gas in January 2002 was $1.09/1.77 = $0.62 per gallon. In July 2008, the CPI was 2.20, so the relative price of gas in July 2008 was $4.00/2.20 = $1.82. Comparing these numbers, we can see that the price of gas still rose substantially (2.9 times), but not as much as the nominal prices suggest (3.7 times). The 2.9 times price increase was caused by the forces of demand and supply, while the rest of the increase in the nominal price of gas was due to inflation, which is a macroeconomic monetary phenomenon and therefore is irrelevant to our analysis of what’s going on in a particular market such as the market for gas.
Checkpoint 2

“In the demand and supply model, the market price is the money that buyers pay and sellers receive per unit of the good they exchange.” True or false? Explain.

2.2 Demand, Supply, and Market Equilibrium

The demand curve

The buyers’ side of the market is reflected by the demand relationship, the graphical representation of which is called the demand curve. You should be familiar with the demand curve, as it is a key concept studied in all introductory economics courses. The term “demand” is also widely used (and often misused) in the media, political debates, and everyday life. Here is the precise definition of the demand relationship that economists use:

The market demand curve for a good shows how much of the good offered in the market consumers are willing to buy over a certain period of time at each given price, holding constant all other factors that influence their choice.

Figure 2-1 presents an example of a demand curve that reflects the demand relationship in a (hypothetical) market for gasoline. The demand curve shows, for instance, that when the price of gasoline is $1.60 per gallon, the quantity of gasoline demanded is 260 million gallons per month (point A) and when the price rises to $2.20 per gallon, the quantity demanded decreases to 245 million gallons per month (point B). The demand relationship shown by the graph seems pretty straightforward and self-explanatory. This simplicity, however, can be deceptive. In fact, misconceptions about what “demand” means are widespread. Students, business people, politicians, government officials, and the media alike tend to use the term demand in meanings that do not accurately reflect the definition of demand that economists use. Since that definition of demand plays a key role when applying the demand and supply model, it is important to keep in mind the following when analyzing demand.


**Demand is not the same as a want or a need**

Consumers may want a lot of things, but they don't necessarily have demand for them. An individual has a demand for a good only if she is willing to buy it given the price of the good and her budget constraint. For example, Alissa wants a new car priced at $20,000, but she would not buy it because, given her budget constraint, she prefers to spend this amount of money on other goods. Thus, she does not have a demand for the car. As clear from this example, a consumer's demand is based on her choice that takes into account the opportunity costs. This is discussed in detail in Chapter 5.

**Quantity demanded and quantity bought are two different concepts**

The demand curve tells us nothing about the availability of the good to consumers. For example, the demand curve in Figure 2-1 shows that at $1.60, consumers are willing to buy 260 million gallons of gas (point A). But it does not tell whether that quantity of gas is available for them to purchase, since it does not show what quantity of gas sellers are willing to supply at this price.

**Demand is the relationship between price and quantity demanded**

A typical demand curve slopes downward, reflecting a negative relationship between the price and the quantity demanded. For instance, in Figure 2-1, if the price of gas rises from $2.20 to $2.80 per gallon, the quantity of gas demanded decreases from 245 million to 230 million gallons. Note that quantity demanded is always measured over a certain period of time, a month in our example. This relationship seems obvious: the more expensive the good is, the less of it people want to buy. However, this is not what we always observe in reality. For example, in 2004 the real price of gas in the United States was 15.6% higher than in 2003, but the consumption of gas still increased by 2.2%. This fact may look puzzling, but the explanation of it is quite simple: price is not the only factor that influences consumer choice. Therefore, to correctly account for the effect of price, and only price, on quantity demanded, we must hold constant all other factors that affect quantity demanded, such as consumer income, prices of related goods, etc. As we explain in Chapter 1, holding all other factors constant when examining the influence of the factor of our interest is a powerful method that economists apply to discover and analyze economic relationships. Thus, when drawing a demand curve, we hold all influences on consumers’ choices other than the price of the good fixed at certain levels. Then, our demand curve will reflect what economists call the law of demand:

> When the price of a good rises, the quantity of the good demanded decreases, holding constant all other factors that influence consumers’ choices.

Obviously, the law of demand works in the opposite direction as well: when the price falls, the quantity demanded increases. It is referred to as a law because the negative relationship between the price and the quantity demanded holds in most markets most of the time.
Demand and quantity demanded are two different terms

The term demand refers to the whole relationship between the price of the good and the quantity of the good demanded, not to a particular quantity that consumers are willing to buy. To avoid confusion, we’ll call that quantity “quantity demanded,” as opposed to “demand,” which refers to the entire curve. This change in quantity demanded is reflected by a movement along the same demand curve, (for example, from point A to point B in Figure 2-1). The demand—i.e. the existing relationship between the price and the quantity demanded—does not change in that case. Note that the only factor that can change quantity demanded without changing demand, i.e. cause a movement along the same demand curve, is the price of the good. A change in any other factor that influences buyers’ choices will shift the demand curve. For example, if more consumers become environmentally conscious and want to decrease their consumption of gasoline, they will want to buy less gasoline at each given price, which will shift the demand curve leftward, from D₁ to D₂ as illustrated in Figure 2-2. That is, for instance, at $2.80, consumers will want to buy 215 million gallons instead of 230 million gallons, at $2.20, they will want to buy 230 million gallons instead of 245 million gallons, etc. We will study key factors that influence demand in the next section.

Checkpoint 3

Which of the following statements are true and which are false? Explain.

A. The price of a good and the quantity of the good demanded are negatively related.
B. Other thing being equal, the demand for a good will increase if its price falls.
C. An increase in consumer income causes a downward movement along the demand curve.
D. A rise in the price of a good will result in a leftward shift of the demand curve.

The supply curve

The counterpart of the demand relationship on the sellers’ side of the market is the supply relationship, which is graphically represented by the supply curve. Just like demand, the term “supply” is widely used and often misused. The definition of the supply relationship used in economics is:
The market supply curve for a good shows how much of the good sellers are willing to offer over a certain period of time at each given price, holding constant all other factors that influence their decisions.

Let’s consider again the market for gasoline in the previous example. Figure 2-3 presents the supply curve that reflects the sellers’ decisions. For instance, when the price of gasoline is $1.60 per gallon, the quantity of gasoline supplied is 215 million gallons per month (point F) and when the price rises to $2.20 per gallon, the quantity supplied increases to 245 million gallons per month (point E). Since misconceptions about the meaning of the term “supply” are as widespread as those about the term “demand,” it is important to clarify the following.

**Supply is not what sellers have in stock**

In business, the word “supply” is commonly used to mean a stock of a good available for sale or something that the firm gets from its suppliers. This is not what economists mean by supply. In economics, the term “supply” is used to reflect a firm’s decision to offer the quantity of a good that would maximize its profit given the cost of producing and selling the good. In Chapter 7, we will have much more to say about how competitive firms make their profit maximizing decisions and how these decisions result in a certain market supply curve.

**Quantity supplied and quantity sold are two different concepts**

The supply curve tells us nothing about how much of the good sellers will actually be able to sell. For example, the supply curve in Figure 2-3 shows that at $2.80, sellers are willing to offer 275 million gallons of gas (point G). But it does not tell whether consumers will want to buy that quantity of gas at that price. And if consumers don’t want that much gas at $2.80, sellers won’t be able to sell it at that price.

**Supply is the relationship between price and quantity supplied**

A typical supply curve slopes upward, reflecting a positive relationship between the price and the quantity supplied. For instance, as shown in Figure 2-3, if the price of gas rises from $2.20 to $2.80 per gallon, the quantity of gas supplied increases from 245 million to 275 million gallons. Note that, just like quantity demanded, quantity supplied is always measured over a certain period of time (a month in our example). Why does the quantity supplied increase when the price of the good rises? In a nutshell, this is because a rise in price makes producing a greater quantity of the good more profitable. Recall from Chapter 1 that an increase in output will always increase profit if the extra revenue from selling the additional units of output exceeds the additional costs. A higher market price of its product increases the firm’s additional revenue from selling more of it, covering the firm’s additional costs. Thus, to increase its profit, the firm will want to sell a greater quantity of the product. In
Chapter 7, we’ll discuss in detail how firms choose their profit maximizing quantity of output given the market price of their product.

Note further that, just like with the quantity demanded, to correctly account for the effect of the price alone on the quantity supplied, we must hold constant all other factors that affect firms’ supply decisions, such as technology, prices of inputs, etc. So, when drawing a supply curve, we hold all influences on sellers’ choices other than the price of the good fixed at certain levels. Then, our supply curve will reflect the law of supply:

When the price of a good rises, the quantity of the good supplied increases, holding constant all other factors that influence sellers’ decisions.

Obviously, the law of supply works in the opposite direction as well: when the price falls, the quantity supplied decreases.

Supply and quantity supplied are two different terms

Similarly to demand, the term supply refers to the whole relationship between the price of the good and the quantity of the good supplied, not to a particular quantity that sellers are willing to offer. To make it clear, we’ll call that quantity “quantity supplied,” as opposed to “supply,” which refers to the entire curve. A change in quantity supplied is reflected by a movement along the same supply curve, (for example, from point F to point G in Figure 2-3). The supply—i.e. the relationship between the price and the quantity supplied—does not change in that case. And just like with demand, the only factor that can change quantity supplied without changing supply, i.e. cause a movement along the same supply curve, is the price of the good. A change in any other factor that influences sellers’ decisions will shift the supply curve. For example, if a technological advance allows oil refineries to produce more gasoline with the same amount of resources, they will want to supply more gas at any given price, which will shift the supply curve rightward, from $S_1$ to $S_2$ as illustrated in Figure 2-4. For instance, at $1.60,$ sellers will want to sell 245 million gallons instead of 215 million gallons, at $2.20,$ they will want to sell 275 million gallons instead of 245 million gallons, etc. We will study key factors that influence supply in the next section.
When supply increases, can you say that since it “goes up,” the supply curve shifts upward? And when supply decreases, does this mean the curve shifts downward? If you look at Figure 2.4, you can see that a rightward shift of the supply curve, which is an increase in supply is actually a downward shift. While using “rightward”/“upward” and “leftward”/“downward” interchangeably may work when speaking about shifts of the demand curve, even in that case it makes more sense to describe them as rightward or leftward rather than upward or downward.

Recall, for instance, that a decrease in demand means that consumers are willing to buy less of the good at each given price, as illustrated in Figure 2.2. That is, all points on the original demand curve (D₁) shift leftward along the quantity axis so that the entire curve shifts leftward. The same logic applies to an increase in demand, when all points on the original curve shift rightward, and to changes in supply reflecting sellers’ willingness to supply a greater or a lower quantity at each given price.

Later in the course, we’ll see that sometimes it make more sense to talk about upward or downward shifts of the supply and demand curves (for example, when analyzing the effects of taxes or subsidies). But when you use the demand and supply model to analyze the kinds of problems and applications that are discussed in this chapter, it is best to view changes in demand and supply as rightward or leftward shifts of the curves.

Checkpoint 4

Which of the following statements are true and which are false? Explain.
A. The price of a good and the quantity of the good supplied are negatively related.
B. Other thing being equal, the supply of a good will increase if its price rises.
C. A technological improvement will cause an upward shift of the supply curve.
D. A fall in the price of a good will result in a leftward and downward movement along the supply curve.

Check your answer


**Market equilibrium**

To see how the forces of demand and supply determine market prices and quantities, let’s put the two sides of the market together. Figure 2-5 combines the demand and supply curves in the market for gasoline shown in Figures 2-1 and 2-3. The demand curve (D) represents buyers’ choices and the supply curve represents sellers’ decisions at each given price. As you can see, when the price is $2.20 per gallon, the demand curve shows that buyers are willing to purchase 245 million gallons of gas. And the supply curve shows that sellers want to offer the same quantity of gas. Graphically, this is the point where the two curves intersect (point E). Since buyers want to buy the same quantity of gas as sellers want to sell, the market is in a steady state or, as economists call it, in equilibrium. The price at which the quantity demanded (Q_d) equals the quantity supplied (Q_s) is called the equilibrium price, and the quantity that corresponds to this price is called the equilibrium quantity.

In the real-world, markets are not always in equilibrium. Rather, prices and quantities gravitate to the equilibrium point while fluctuating around it. That is, every time a deviation from equilibrium occurs, the market tends to move back toward it. To see why, let’s consider a situation when the price is below the equilibrium, such as that depicted in the left panel of Figure 2-6. Suppose the current price of gas is $1.60 per gallon. As the demand curve shows, at this price consumers want 260 million gallons of gas (point A). But, as evident from the supply curve, sellers are willing to offer only 215 million gallons at this price (point F). That is, there is an excess demand of 45 million gallons. As buyers want a greater quantity of...
gas than is available in the market, they will be willing to pay a higher price to get more gas. And as buyers bid up the price, the quantity of gas supplied—as well as the actual quantity sold—increases along the supply curve. On the other hand, as the price rises, the quantity of gas demanded decreases along the demand curve. The price continues to rise and the market continues to adjust until the quantity of gas demanded equals the quantity supplied so that the excess demand disappears and the market is in equilibrium at point E, where $Q_D = Q_S = 245$ million.

Now suppose the price of gas is currently $2.80 per gallon. As the right panel of Figure 2-6 illustrates, at this price sellers are willing to offer 275 million gallons of gas (point G), but buyers only want 230 million gallons (point B). That is, there is an excess supply of 45 million gallons. As sellers compete with each other to sell their gas, they lower the price. As a result, the quantity of gas demanded—as well as the actual quantity purchased—increases along the demand curve. On the other hand, as the price falls, the quantity of gas supplied decreases along the supply curve. The price continues to fall and the market continues to adjust until the quantity of gas demanded equals the quantity supplied so that the excess supply disappears and the market is in equilibrium again with $Q_D = Q_S = 245$ million (point E). Thus, if for some reason the current price deviates either up or down from its equilibrium level, the competitive forces of demand and supply will work to bring the market back to equilibrium.

**Checkpoint 5**

The figure below shows a market for gasoline. Suppose the price is currently $2.40 per gallon. What is the quantity of gasoline demanded? Quantity supplied? Quantity sold? What do you predict will happen to the price of gasoline?
The Mathematics of Demand and Supply

As noted in Chapter 1, economics speaks three languages: words, graphs, and mathematical formulas. In our analysis above, to find the equilibrium price and quantity graphically, we drew the demand curve and the supply curve on the same graph. Then we marked the point where the two curves intersect, which showed us the equilibrium price on the vertical axis and the equilibrium quantity on the horizontal axis. We can also find the market equilibrium using algebraic representations of the demand and supply curves.

To simplify our analysis, we’ll assume that both curves are linear, i.e. are straight lines. Although the real-world demand and supply curves may have different shapes, for practical purposes, they are usually reasonably close to their linear approximations in the price and quantity ranges of our interest. The demand curve shown in Figure 2-5 can be represented by the following equation:

\[ Q_D = 300 - 25P \]

where \( Q_D \) is the quantity of gas demanded (millions of gallons) and \( P \) is the price of gas ($ per gallon). The coefficient of \( P \) in this equation tells us that for every $1 increase in price, the quantity of gas demanded decreases by 25 million gallons. The constant term (300) reflects the influence on the quantity demanded of all other factors, which we held constant when drawing the demand curve.

The supply curve in Figure 2-5 is given by:

\[ Q_S = 135 + 50P \]

where \( Q_S \) is the quantity of gas supplied and \( P \) is the price of gas. The coefficient of \( P \) in this equation tells us that for every $1 increase in price, the quantity of gas supplied increases by 50 million gallons. The constant term (135) reflects the influence on the quantity supplied of the factors held constant.

Note that in both equations, since the quantity depends on the price, the quantity is the dependent variable and the price is the independent variable. This means the demand and supply graph reverses the common practice of putting the independent (“X”) variable on the horizontal axis and the dependent (“Y”) variable on the vertical axis. Although this might seem arbitrary and inconvenient at this point, you’ll see later on in the course why economists prefer to graph the demand and supply curves that way. Also, recall from Chapter 1 that modeling economic relationships is based on real-world observations. Therefore, the mathematical models that economists come up with work only for the values of the variables that can actually be observed. For example, if in the market for gas the actual price has never fallen below $1.20 per gallon and never risen above $3 per gallon, our demand and supply equations are applicable only to that price range.
Now let’s find the market equilibrium price using the demand and supply equations above. We know that the market is in equilibrium when the quantity of gas demanded equals the quantity supply, that is:

\[ Q_D = Q_S \]

Using the demand and supply equations above, we can write:

\[ 300 - 25P = 135 + 50P \]

Since the only unknown in this equation is \( P \), we can use the rules of algebra to isolate \( P \) on the left side of the equation. First, we subtract 300 from both sides of the equation, which gives us:

\[ -25P = -165 + 50P \]

Second, we subtract 50\( P \) from both sides, resulting in

\[ -75P = -165 \]

Third, we divide both sides by -75 and get

\[ P = 2.2 \]

Thus, the market equilibrium price is $2.20, which is what our graph in Figure 2-5 shows as well.

Since the equilibrium price equates the quantity demanded with the quantity supplied, we can find the equilibrium quantity by plugging it into either the demand or the supply equation. Using the demand equation:

\[ Q_D = 300 - 25 \times 2.20 \]
\[ Q_D = 245 \]

Thus, the equilibrium quantity is 245 million gallons, which is the equilibrium quantity shown in Figure 2-5. To verify our solution, we can plug the equilibrium price into the supply equation as well:

\[ Q_S = 135 + 50 \times 2.20 \]
\[ Q_S = 245 \]

As you can see, our solution is correct: at $2.20 per gallon, and the equilibrium quantity is 245 million gallons, \( Q_D = Q_S = 245 \) million gallons.

The market equilibrium price and quantity will remain unchanged as far as the demand curve and the supply curve stay intact. But what will happen if some event shifts one of the curves or both curves? We address this question in the next section.
2.3 Changes in Demand and Supply and How They Affect the Market

Key Factors That Shift the Demand Curve

As noted in the previous section, a change in any factor influencing buyers’ choices other than the price of the good changes demand, i.e. shifts the demand curve. Let’s discuss key factors that affect demand, key “demand shifter,” so to speak. Remember that when discussing the effect of each of those factors, we follow the ceteris paribus principle, i.e. change one factor at a time while holding constant all others, including the price.

Consumer tastes and preferences

The most obvious influences on demand are those associated with changes in consumer tastes and preferences. Consumers’ attitudes toward a good may change for different reasons. We’ve already discussed one example: when more consumers become environmentally conscious and want to decrease their gas consumption—e.g., by switching to hybrid or fully electric cars—they will want to buy less gas at each given price, which will shift the demand curve leftward, as shown in Figure 2-2.

Consumer preferences may change for different reasons. In the example above, the shift of preferences away from gasoline is likely due to consumers’ becoming increasingly informed of the credible scientific evidence suggesting that carbon dioxide (CO₂) released into the atmosphere when we burn gas is a major contributor to global warming, which endangers our health, hurts the economy, and even jeopardizes national security.

Consumer tastes may also be altered by advertising, whether it is informative, i.e. providing information about the existence and features of the product, or persuasive, i.e. trying to influence consumers psychologically. An example is a “buy American” advertising campaign appealing to consumers’ patriotic sentiments. If it is successful, consumers will want to buy more of a domestically produced good—say, American made cars—at each given price, shifting the demand curve for that good rightward.

Finally, consumer tastes may change as a result of changing social and cultural attitudes, fashions, or fads. For example, the recent nostalgia for analog music spontaneously developed among the younger generation of consumers has substantially increased the demand for vinyl disks and audio cassettes, as well as for turntables and cassette players.

Income and wealth

Income is another factor whose influence on demand seems to be pretty obvious. The higher the income, the more of a good consumers will be able to afford at each given price, which means when consumers’ incomes increase, their demand for a good increases, i.e. the demand curve shifts rightward. And when consumer income decreases, the demand curve shifts leftward. This positive relationship holds for most goods, which are therefore called normal goods.

For some goods, however, the direction of the relationship between consumer income and demand is negative. That is, a rise in income results in a decrease in demand, and a fall in income decreases demand. For example, consumers who want to buy used cars do so mainly because they cannot afford a new car. But when their income rises, they are likely to switch
to more expensive and appealing new cars. Other examples are fast food and cheap grocery items, such as instant noodles or canned meat. During the Great Recessions of 2007–2009, when real median household income in the United States fell by almost 5%, the purchases of canned and preserved food increased by about 6%. And when the economy started to recover and incomes began to rise, consumers started to replace those inferior food items with more expensive fresher and healthier products, so by 2013, the purchases of canned and preserved food fell by about 5%. Goods for which demand decreases when income rises and increases when it falls are called inferior goods.

Note that whether a good is normal or inferior is determined by how the demand for it reacts on a change in consumer income, not the other way around. That is, we can only speculate if a good is likely to be normal or inferior considering its physical qualities, but we can’t tell that for sure until we see how the demand for the good changes in response to a change in consumer income other things being equal. Moreover, a good can be inferior for some groups of consumers but normal for others. For example, used cars are an inferior good for the middle-class Americans, but for the poor, who can’t afford a new car even if their income rises, a used car is a normal good, as their demand for used cars is likely to increase in response to an increase in income.

Consumer wealth influences demand in a similar same way income does. It is important, however, to see the difference between these two concepts when analyzing factors influencing demand. Income is what you earn over a certain period of time, for example your monthly salary. Wealth is what you own (i.e. your assets such as cash, bank accounts, stocks, real estate, etc.), minus what you owe (i.e. your liabilities such as home mortgage, student loan, credit card debt, etc.) at a certain point in time. Saved income increases wealth, e.g., when you deposit part of your salary in your savings account. And wealth can generate income, e.g., dividends paid to stock owners. However, a higher income does not necessarily mean a greater wealth, and vice versa, so both factors need to be taken into account when analyzing demand. For example, other things being equal, a college graduate with a job paying $3,000 per month, an unpaid student loan of $70,000, and no savings will probably want to go out for dinner less frequently than an individual with a salary of $2,500 per month, no debt, and $100,000 in his savings account. In general:

An increase in consumer income or wealth increases the demand for a normal good and decreases the demand for an inferior good.

Obviously, the inverse is also true, i.e. a decrease in consumer income or wealth decreases the demand for a normal good and increases the demand for an inferior good.

Prices of related goods

As we’ve shown in the previous section, a change in the price of the good itself does not shift the demand curve. But changes in prices of other goods do. There are two kinds of related goods that affect the demand for the good in question, substitutes and complements.

---

A substitute is a good that can be used in place of another good because it serves more or less the same purpose. For example, both pizza and sandwiches satisfy your demand for food, and so do pasta and rice, chicken and pork, and so on. To see how the price of a substitute influences the demand for the good we are analyzing, let’s consider the market for strawberries produced using conventional farming systems, i.e. with synthetic chemical fertilizers, pesticides, herbicides and other inorganic inputs. A higher-quality substitute for conventional strawberries are organic strawberries, i.e. strawberries produced using only organic inputs. Suppose advances in the technology of organic farming lower the price of organic strawberries. How will this influence the demand for conventional strawberries? As organic strawberries become relatively less expensive, consumers will be willing to buy more organic strawberries, substituting them for conventional ones. As a result, at each given price of conventional strawberries, which means the demand curve for conventional strawberries shifts leftward. In general:

A fall in the price of a substitute decreases the demand for a good, shifting the demand curve leftward.

By the same logic, when the price of a substitute rises, the demand for the good in question increases, i.e. the demand curve shifts rightward.

A complement is a good that is used together with another good. Examples are cars and gasoline, computers and software, pancakes and maple syrup, etc. Let’s consider the market for pickup trucks to see how the price of a complement, gasoline, influences the demand there. When the real price of gas almost tripled over the period from 2002 to 2008, using gas guzzling vehicles such as pickup trucks became significantly more expensive. As a result, many consumers wanted to switch to more fuel-efficient vehicles, which shifted the demand curve for pickup trucks leftward. In general:

A rise in the price of a complement decreases the demand for a good, shifting the demand curve leftward.

By the same logic, a fall in the price of a complement rises the demand for the good in question shifting the demand curve rightward.

**Consumers’ Expectations**

Consumers’ expectations—particularly those about future prices—can also influence current demand for the good. This is particularly true about goods that can be stored. For example, if you expect the price of coffee to go up, you may want to buy more coffee now, before the price rises, which means your current demand for coffee increases. Expected future prices is a major factor affecting demand in speculative markets, such as the markets for stocks, bonds, foreign currency, and real estate. For example, if you expect the price of Apple stock to rise next month, you may want to buy it now so that you’d be able to sell it later at a profit. In general:

An expectation that the price of a good will rise in the future increases the current demand for the good, shifting the demand curve rightward.
Similarly, if consumers expect a lower price of a good in the future, they are likely to postpone the purchase until then, which causes the current demand for the good to decrease.

**Population**

The market demand depends on the number of potential buyers:

> The more potential buyers are in the market, the greater the demand.

The number of potential buyers depends not only on the size of the population within the market’s reaches, but also on its demographic and social structure. For example, aging population increases the demand for health care, and a higher proportion of high school and college students results in greater demand for laptop computers, smart phones, and music downloads.

**Checkpoint 6**

Explain how the following events will affect the demand for:

A. Honda cars when the price of Toyota cars rises  
B. Pizza in Statesboro when a new semester begins at Georgia Southern  
C. Large SUV’s when the price of gas falls  
D. Junk food when consumers become warier of health risks associated with it  
E. TVs this month when consumers expect the prices of TVs to fall next month  
F. Orange juice when the price of orange juice falls

**Key Factors That Shift the Supply Curve**

A change in any factor influencing sellers’ choices other than the price of the good changes supply, i.e. shifts the supply curve. Let’s now discuss key factors that affect supply, i.e. key “supply shifter.” Again, it is important to keep in mind that when discussing the effect of each of these factors, we follow the *ceteris paribus* principle, i.e. change one factor at a time while holding constant all others, *including the price*.

**Technology**

As we discussed earlier, a technological advance allows producers to increase output using the same amount of resources, which shifts the supply curve rightward, as shown in Figure 2-4. Improvements in technology can increase supply quite dramatically. For example, new technologies used in corn production doubled the corn yields in the United States over the
last 40 years, which was a major contributing factor to the 2.4 times increase in corn production.\(^2\) Thus:

Technological advances in the production of a good increase the supply of the good, shifting the supply curve rightward.

**Input prices**

By an input we mean any resource, material, part, or ingredient used to produce a good. For example, oil refineries process crude oil, a raw material, to produce gasoline (and other petroleum products). To process crude oil, a refinery needs a chemical plant, a system of processing units with piping running throughout. Economists call it a capital input. The refinery also needs workers who operate the plant, i.e. a labor input. Now suppose that the price of crude oil falls. Then, refineries will be able to buy more oil at the same cost. As a result, they will be willing to supply more gasoline at each given price. That is:

A fall in the price of an input increases supply, shifting the supply curve rightward.

Conversely, when inputs become more costly, supply decreases, i.e. the supply curve shifts leftward.

**Prices in alternative markets**

When producers are making decisions about how much of their product to supply to a particular market, they consider alternative markets and alternative products. An alternative product is another good that the firm can produce with the resources it has or can easily get. An alternative market is another market where the firm can sell its product.

Consider, for example, the market for wheat in the United States. When farmers make their decisions how much of their land to use to produce wheat, they consider how profitable wheat production is relative to other crops that can be grown on that land, such as corn. Over the period of 2006–2016, for instance, the price of corn relative to wheat has increased by about 50%, making corn relatively more profitable. In response, farmers have reallocated their land and other resources to produce more corn, leaving fewer resources to produce wheat. As the data show, the acreage of land used for growing wheat decreased by 13%, while the acreage used for corn increased by 20%.\(^3\) Other things being equal, using fewer resources to produce wheat will cause the supply of wheat to decrease.

Now suppose the price of wheat in Canada increases relative to that in the United States. Since it becomes more profitable for U.S. farmers to export wheat to Canada than sell it domestically, they will want to supply more wheat to the Canadian market rather than to the U.S. market. On the other hand, Canadian farmers will want to sell more of their wheat domestically rather than exporting it to the United States. As a result, the supply of wheat to the U.S. market will decrease. Thus:


A rise in the price in a market for an alternative product or in a different market for the same product decreases the supply in the market in question, shifting the supply curve leftward.

Likewise, a fall in the price in an alternative market increases the supply in the market in question, shifting the supply curve rightward.

_Sellers’ Expectations_

Sellers’ expectations—especially about the price of the good in the future—can also influence the current supply of the good. This factor is particularly relevant when sellers can hold inventories of the goods or when producers can easily vary the levels of their output over time. For example, if producers of condensed milk expect a higher price of condensed milk in the future, they may want to sell less of condensed milk now at any given price, storing it until they can sell it at a higher price. Just like on the buyers’ side, expected future prices is a major factor affecting sellers’ decisions in speculative markets. For instance, if United Airlines stock holders expect the price of the stock to go down next month, they may want to sell it now to avoid a capital loss. Thus:

An expectation that the price of a good will rise in the future decreases the current supply of the good, shifting the supply curve leftward.

Similarly, if sellers expect a lower price of a good in the future, they will want to supply more of it now, before the lower price makes selling the good less profitable.

_Number of firms_

The market supply curve shows how much of the good a certain number of producers are willing to supply at each given price. If the number of sellers in the market increases, the total quantity they want to sell at any given price will increases, shifting the market supply curve rightward. For example, in the late 1990s—a period of rapid growth in the usage and adaptation of the Internet by businesses and consumers—a lot of new companies providing e-commerce services (so called “dot-coms”) were founded, so the supply of those services increased sharply. That is:

An increase in the number of sellers in a market increases the market supply, shifting the supply curve rightward.

Conversely, all else equal, a decrease in the number of sellers in the market will decrease the market supply.

_Natural events_

Natural events can also affect supply, especially when production depends on natural conditions such as weather and climate. These conditions can be viewed as natural technology. For instance, in agriculture, favorable weather results in higher crop yields. It increases supply much like better technology does in general. On the other hand, as a recent national climate
assessment report indicates, the global warming has had and will continue to have a destructive impact on the U.S. agriculture, causing declines in crop and livestock production due to weeds, diseases, pests, and other climate change induced stresses.\(^4\) Natural events can also affect the supply of goods whose production does not directly rely on natural technologies. Natural disasters such as hurricanes, earthquakes, and tsunamis destroy productive resources and therefore decrease supply in industries that use them. For example, the damage from Hurricane Matthew, which hit the United States in 2016, reached about $10 billion. In Georgia alone, over 250,000 customers were left without electric power.

**Checkpoint 7**

Explain how the following events will affect the supply of:

A. Smart phones if new firms enter the market for smart phones
B. Solar panels when technological advances in the production of solar panels occur
C. Chicken in the United States when the price of chicken in Europe falls
D. Milk when the price of milk falls
E. Desktop computers this year when sellers expect the price of desktop computers to fall next year
F. Wheat (in the long run) if the price of corn falls steadily relative to the price of wheat
G. Cars if U.S. automakers move their assembly facilities from Mexico back to the United States, where the wages of assembly workers are higher

**Predicting the Effects of Changes in Demand and Supply**

The demand and supply model we study in this chapter is a powerful tool of economics that allows us to predict what will happen to the market prices and quantities of goods sold and bought in response to various events that affect the markets. As we’ve noted earlier in this chapter, prices and quantities of goods sold and bought in a market gravitate toward the market equilibrium. Every time a deviation from the equilibrium point occurs, the market tends to move back toward it, and once an equilibrium is reached, the market price and quantity will remain unchanged as far as the demand curve and the supply curve stay intact. But if some event shifts one of the curves or both curves, the market will move toward a new equilibrium along the path depending on which curve has shifted and in which direction it has shifted. Thus, to predict what will happen to the market price and quantity of a good in response to a certain event we need to determine (1) which curve is affected (demand, supply, or both); (2) in which direction (rightward or leftward) the affected curves shift; (3) where the new market equilibrium is. Perhaps the best way to learn how to make such predictions is to consider some examples.

**Example 1: Consumer Income Increases**

Consider the market for gasoline we’ve discussed in the previous section. Figure 2-7 shows it again, with the initial equilibrium at point E₁, where the price is $2.20 per gallon and the quantity of gasoline sold is 245 million gallons per month. Suppose that the average income of buyers in this market increases. As we could see earlier in this section, consumer income is one of the factors that affect demand. Next, we can reason that gasoline is a normal good, i.e. consumers are willing to buy more of it as their incomes rise (and econometric studies support this theory). This means the demand curve for gasoline will shift rightward, from D₁ to D₂, as shown in Figure 2-7. Now, as the new demand curve indicates, at $2.20 consumers want to buy 275 million gallons of gas (point A), while—since the supply curve remains intact—sellers are still willing to offer only 245 million gallons at this price. That is, the market is no longer in equilibrium at $2.20 per gallon, there is excess demand at that price. And we know what happens when there is excess demand: as buyers bid up the price, the quantity of gas supplied increases along the supply curve together with the actual quantity sold. On the other hand, as the price rises, the quantity of gas demanded decreases along the demand curve D₂. The price continues to rise and the market continues to adjust until the quantity of gas demanded equals the quantity supplied in a new equilibrium. As shown in Figure 2-7, the new equilibrium occurs at point E₂, where the price is $2.60 per gallon, and Q₀ = Qₛ = 265 million gallons. Thus, the increase in consumer income causes the equilibrium price to rise from $2.20 per gallon to $2.60 per gallon and the equilibrium quantity to increase from 245 million gallons to 265 million gallons.

It is important to note that while the shift of the demand curve has caused a movement along the supply curve from point E₁ to point E₂, increasing the quantity supplied in response to a rise in price, the supply itself has not changed, i.e. the supply curve has not shifted, as none of the other factors that influence sellers’ decisions has changed.
Chapter 2  
DEMAND AND SUPPLY  

Example 2: The Price of Oil Falls

Now let’s go back to the initial equilibrium in the market for gasoline where the price is $2.20 per gallon and the quantity of gasoline sold is 245 million gallons per month (point E₁ in Figure 2-8). Suppose now that the price of oil falls. As we’ve mentioned before, oil refineries process crude oil to produce gasoline, i.e. oil as an input used to produce gas. We also know from our previous discussion that a fall in the price of an input increases supply, that is shifts the supply curve rightward, from $S₁$ to $S₂$, as shown in Figure 2-8. As the new supply curve shows, at $2.20 sellers now offer 260 million gallons of gas (point B), while—since the demand curve remains intact—consumers are still willing to buy only 245 million gallons. That is, the market is no longer in equilibrium at $2.20 per gallon: there is excess supply. So, sellers lower the price, and as they do so, the quantity of gas demanded—as well as the actual quantity sold—increases along the demand curve. On the other hand, as the price falls, the quantity of gas supplied decreases along the supply curve. The price continues to fall and the market continues to adjust until the quantity of gas demanded equals the quantity supplied in a new equilibrium, which occurs at point E₃, where the price is $2.00 per gallon and $Q_D = Q_S = 250$ million gallons. Thus, the fall in the price of oil causes the equilibrium price of gasoline to fall from $2.20 per gallon to $2.00 per gallon and the equilibrium quantity to increase from 245 million gallons to 250 million gallons.

Note again that while the shift of the supply curve has caused a movement along the demand curve from point E₁ to point E₃, increasing the quantity demanded in response to a fall in price, the demand itself has not changed, i.e. the demand curve has not shifted, as none of the other factors that influence buyers’ decisions has changed.
Example 3: Consumer Income Increases while the Price of Oil Falls

Now let’s see what happens when the two events described above occur at the same time. In such situations, we should still analyze the effects of each event separately and then combine the results of our analysis. Figure 2-9 shows the effects of the two events together combining our analyses in the previous examples. The increase in income shifts the demand curve rightward, from D₁ to D₂. The fall in the price of oil shifts the supply curve rightward, from S₁ to S₂. The resulting equilibrium occurs at point E₄, where the new demand curve (D₂) intersects the new supply curve (S₂) and where the price is $2.40 per gallon and the quantity is 270 million gallons.

As you can see, when the two events happen at the same time, the equilibrium quantity increases from 245 million gallons at E₁ to 270 million gallons at E₄, i.e. the increase in quantity is even greater than when each of the events happened alone. This is because a rightward shift in the demand curve alone causes the equilibrium quantity to increase, as shown by the blue arrow in Figure 2-9. And a rightward shift in the supply curve alone causes the equilibrium quantity to increase as well, as shown by the orange arrow. So, when both curves shift rightward, the combined effect is always an increase in equilibrium quantity.

But what about the equilibrium price? As shown in Figure 2-9, it rises from $2.20 at E₁ to $2.40 at E₄. Notice, however, that in this case the effects of the two events have opposite directions. The rightward shift of the demand curve raises the price (as shown by the blue arrow), whereas the rightward shift of the supply curve lower the price (as shown by the orange arrow). In our example, the demand driven rise in price is greater than the supply driven price fall and therefore the combined effect is a rise in price. But if the effect of the increased supply was greater than that of the increased demand, the equilibrium price would fall. Figure 2-10 shows this possibility. In this case the demand driven rise in price (shown by the blue arrow) is smaller than the supply driven price fall (shown by the orange arrow). Therefore the combined effect is a fall in price from $2.20 in the initial equilibrium (E₁) to $2.00 in the new equilibrium (E₇). Thus, unless we know the magnitudes of the demand and supply shifts, we...
can’t predict what will happen to the equilibrium price: it may rise, fall, or remain unchanged depending on which of the two events has a greater impact on it.

### Make the Grade

When predicting how a market equilibrium will change in response to certain events, it is important to keep in mind the difference between changes in *demand or supply*, which are *shifts* of the curves, and changes in *quantity demanded or quantity supplied*, which are *movements along* the curves. Consider Example 2 again. Suppose an exam question asks you to predict what will happen to the equilibrium price of gasoline when the price of crude oil falls. After you’ve figured out that a lower price of oil shifts the supply curve for gasoline rightward, causing the equilibrium price of gas to fall, you continue to reason as follows: “As the price of gas falls, the demand for it increases, i.e. the demand curve shifts rightward. This causes the price to rise.” So, you answer: “The price may fall, rise, or remain unchanged depending on whether the supply change or the demand change has a greater impact on it.” This answer is incorrect.

Where is your mistake? As explained in Example 2, the supply curve does shift rightward causing the price to fall. But a lower price does *not* cause an increase in demand. That is, there will be no shift of the demand curve. Instead, a lower price will cause an increase in *quantity demanded*, i.e. a downward-leftward movement along the demand curve, as shown in Figure 2-8. So, the correct answer is that the equilibrium price of gas will definitely fall.

Our examples illustrate how particular changes in demand and supply affect the market equilibrium price and quantity. Of course, there are other possibilities. Table 2-1 summarizes all possible demand and supply shifts and their combinations and shows how the equilibrium price and quantity change in each case.

### A Four-Step Process of Analyzing Influences on a Market Equilibrium

Although Table 2-1 is a useful summary, you should not simply try to memorize it. As we’ve emphasized in Chapter 1, economics is an art and science of analytical thinking where simply memorizing and mechanically applying concepts and tools may often lead to erroneous results. Also, the key “shifters” of demand and supply that we’ve discussed are not the only factors that can influence the demand and supply curves. Keep in mind that no summaries or cheat sheets can take into account all the varieties of situations and specific circumstances that we face when analyzing real-world events. To help you organize your analysis of events affecting a market and predict the resulting new equilibrium price and quantity, we suggest a four-step analytical process.
Table 2-1 The effects of shifts in demand and supply on equilibrium price and quantity

<table>
<thead>
<tr>
<th>Demand</th>
<th>Supply</th>
<th>Price</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>No change</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>↓</td>
<td>No change</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>No change</td>
<td>↑</td>
<td>?</td>
<td>↑</td>
</tr>
<tr>
<td>No change</td>
<td>↓</td>
<td>?</td>
<td>↓</td>
</tr>
</tbody>
</table>

*Step 1: Define the Market*

Before we examine what happens in a market, we need to clarify to ourselves what that market exactly is. For example, are we examining the demand for and supply of gasoline only or all motor fuels? It is important to clarify because in the former case the market for diesel fuel is an alternative market, while in the latter case it is part of the same market. We also need to clarify who the buyers and sellers in the market are. If, for instance, we are examining the market for cars in the United States only, then a change in incomes of American consumers will directly affect the demand, while a change in incomes in China will not. Finally, we need to define the time period we are looking at. For example, in a long run, the supply of wheat will decrease if the price of corn (an alternative product for farmers) rises, but it is not likely to happen in a short run, when farmers don’t have enough time to reallocate their land from wheat to corn.

*Step 2: Define the Initial Equilibrium*

Sketch a demand and supply graph, find and clearly mark the equilibrium point and the corresponding price and quantity, just like we did in the examples above.
Chapter 2  
DEMAND AND SUPPLY  

Step 3: Find the New Equilibrium

First, determine which curve will the event in question affect and in which direction (rightward or leftward) the curve will shift. Then, shift the curve (draw a new curve) and find and clearly mark the new equilibrium. If you are analyzing the effects of several events or if an event affects both demand and supply curves, shift one curve at a time and mark each new equilibrium resulting from just this one shift, indicating that this is an intermediate equilibrium (as we did in Example 3). This will help you see whether different curve shifts affect the price or quantity in the same direction or in opposite directions. After that, find and clearly mark the final equilibrium resulting from the combined effects of all the changes.

Step 4: Compare the Initial Equilibrium with the New Equilibrium

Compare the new equilibrium price and quantity with the ones in the initial equilibrium. Be sure to check whether different curve shifts have offsetting effects on the price or quantity, in which case you can only be certain about the direction in which the equilibrium price or quantity will ultimately change if you know how far the curves shift.

The “Problem Solved!” box below provides an example of using this four-step process to analyze the effects of changes in demand and supply on the market equilibrium.

Consider the U.S. market for strawberries produced using conventional farming systems. Predict what will happen to the equilibrium price and quantity in this market over the current year if the following trends persist: (1) Consumers become increasingly aware that conventionally produced strawberries top the “Dirty Dozen” list of the fruits and vegetables contaminated with pesticide residues even after they are rinsed in the field and washed before eating; (2) Technological advances in organic farming lower the price of organically grown strawberries. Let’s employ our suggested four-step process to solve this problem.

Step 1. Define the Market

Since our purpose is to predict the changes in the equilibrium price and quantity of conventional strawberries in the United States over the current year, the market we are examining is for conventional strawberries only, the sellers are farmers who use conventional technologies of growing strawberries, the buyers are consumers living in the United States, and the relevant time period is one year.

Step 2: Define the Initial Equilibrium

The first graph below shows the initial equilibrium (E1) in the market for conventional strawberries, where D1 is the demand curve, S1 is the supply curve, P1 is the equilibrium price, and Q1 is the equilibrium quantity.
Step 3: Find the New Equilibrium

Now we need to determine which curve(s) will shift and in which direction. Let’s consider one event at a time.

First, when consumers become more aware of the pesticide residues contaminating conventional strawberries, which have adverse effects on their health, they become less willing to buy conventional strawberries at any given price. That is, the demand curve shifts leftward, say, from $D_1$ to $D_2$, as shown on the second graph. The new equilibrium resulting from this shift is at point $E_2$.

Second, organic strawberries are a (higher-quality) substitute for conventional strawberries. So, other things being equal, when the price of organic strawberries falls, consumers are willing to buy more organic strawberries, substituting them for conventional strawberries. As a result, at each given price of conventional strawberries, consumers want to buy fewer of them. That is, the demand curve for conventional strawberries shifts leftward, from $D_1$ to $D_3$. The new equilibrium resulting from this shift is at point $E_2$.

Since both events shift the demand curve leftward, their combined effect is an even farther leftward shift of the demand curve, with the resulting equilibrium at point $E_4$ where the price is $P_2$ and the quantity is $Q_2$.

Step 4. Compare the Initial Equilibrium with the New Equilibrium

As we can see on the graph, the equilibrium price of conventional strawberries decreases from $P_1$ to $P_2$ and the equilibrium quantity decreases from $Q_1$ to $Q_2$. Since each of the two events affects both price and quantity in the same direction, reinforcing each other, our prediction is certain, i.e. it does not depend on which of the events has a greater influence on the price or quantity.
The Mathematics of Demand and Supply Revisited

Earlier in this chapter, we showed how to find the market equilibrium using algebraic representations of the demand and supply curves. Now we'll show how we can use algebra to examine the effects of changes in demand and supply. We will use the same examples as we did for our graphical analysis.

The initial demand curve shown in Figure 2-9 is given by the following equation:

\[ Q_{D1} = 300 - 25P \]

where \( Q_{D1} \) is the quantity of gas demanded (millions of gallons) and \( P \) is the price of gas ($ per gallon). And the initial supply curve is given by

\[ Q_{S1} = 135 + 50P \]

where \( Q_{S1} \) is the quantity of gas supplied and \( P \) is the price of gas. As we've found previously using these demand and supply equations, the market is in equilibrium (\( Q_{D1} = Q_{S1} \)) where the price is $2.20 and the quantity is 245 million gallons, which are the initial equilibrium price and quantity shown in Figure 2-9 (point E₁).

Now suppose that as a result of an increase in consumer income, the demand curve shifts rightward by 30 million gallons (from \( D_1 \) to \( D_2 \)); that is, at each given price of gas, consumers are willing to buy 30 million gallons more. That is, the new demand curve (\( D_2 \)) is

\[ Q_{D2} = 300 - 25P + 30 \]

which simplifies to

\[ Q_{D2} = 330 - 25P \]

Further, suppose that as a result of a fall in the price of oil, the supply curve shifts rightward by 15 million gallons (from \( S_1 \) to \( S_2 \)); that is, at each given price of gas, sellers are willing to supply 15 million gallons more. That is, the new supply curve (\( S_2 \)) is

\[ Q_{S2} = 135 + 50P + 15 \]

which simplifies to

\[ Q_{S2} = 150 + 50P \]

Solving for the new equilibrium (\( Q_{D2} = Q_{S2} \)), we have:

\[
\begin{align*}
330 - 25P &= 150 + 50P \\
-25P &= -180 + 50P \\
-75P &= -180 \\
P &= 2.4
\end{align*}
\]

So, the market equilibrium price is $2.40.
To find the equilibrium quantity, we plug the new equilibrium price into either the \(D_2\) or \(S_2\) equation. Using the demand equation:

\[
Q_{D_2} = 330 - 25 \times 2.40 \\
Q_{D_2} = 270
\]

To verify this result, we plug the equilibrium price into the supply equation as well:

\[
Q_{S_2} = 150 + 50 \times 2.40 \\
Q_{S_2} = 270
\]

Thus, the new market equilibrium occurs where price is $2.40 per gallon, and the quantity is 270 million gallons, which is what Figure 2-9 shows as well.

Checkpoint 8

Suppose both buyers and sellers of coffee hear a credible forecast that the price of coffee will fall next month. What will happen to the current price of coffee in response to this news? What will happen to the quantity of coffee sold this month?

Check your answer

2.4 Demand, Supply, and Economic Efficiency

As you’ve learned in Chapter 1, one of the key ideas of economics is that voluntary exchange creates value and makes both participating parties better off. Recall that we’ve defined a market as an arrangement that enables buyers and sellers to interact with each other facilitating voluntary exchange between them. In the modern world where billions of voluntary transactions occur every day, market making is an important business itself. Companies such as Walmart, eBay, Amazon, Alibaba, and many others specialize in facilitating markets for billions of buyers and sellers around the world. More than 2 billion transactions per day take place on eBay alone. So far, we’ve used the demand and supply model to examine how the equilibrium prices and quantities are determined in competitive markets. Now we’ll see how the model can be used to measure the benefits that buyers’ and sellers’ get from voluntary exchange.

Willingness to Pay and Demand

Perhaps the best way to see the gains from voluntary exchange is to consider an online auction, such as eBay. Out of many markets facilitated by eBay, let’s focus on one: the market
for laptop computers.\(^5\) Further, although in reality there may be thousands of bidders for laptops on eBay, to keep our analysis simple, let’s first assume that there are only four: Anna, Bart, Cindy, and Don.

Individuals who bid for laptops will or will not be willing to buy them depending on the price. Obviously, buyers want to pay as little as possible, but each of them has in mind a certain highest price that he or she is willing to pay. Economists call this price the buyer’s reservation price or willingness to pay. Thus, each of the bidders in our example wants to purchase a laptop for a price that is as low as possible, but will continue to bid as far as the price does not exceed her reservation price. She will he stop bidding only when the price passes her reservation price.

Since willingness to pay depends on buyers’ individual preferences and budget constraints, it is likely to be different for different buyers. Let’s suppose that our four bidders have the reservation prices shown in Table 2-2. We can also present each buyer’s willingness to pay graphically, as in panel A of Figure 2-11. Let’s take a closer look at the graph. It shows

<table>
<thead>
<tr>
<th>Bidder</th>
<th>Willingness to Pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anna</td>
<td>$800</td>
</tr>
<tr>
<td>Bart</td>
<td>$650</td>
</tr>
<tr>
<td>Cindy</td>
<td>$500</td>
</tr>
<tr>
<td>Don</td>
<td>$350</td>
</tr>
</tbody>
</table>

\(^5\) As we’ve noted in the first section of this chapter, for the purposes of our analysis, we can safely assume that there is only one kind of laptops (think of a laptop with average technical characteristics, quality, design, etc.).
that none of our four buyers is willing to pay more than $800 for a laptop, so if the price is above $800, the quantity of laptops demanded \((Q_D)\) is zero. At a price of $800, only Anna would bid, so the quantity demanded is one. At $650, we'll have two bidders, Anna and Bart, which means \(Q_D = 2\). At $500, Cindy would also bid, so \(Q_D = 3\). And at $350 and below, all four potential buyers bid, so \(Q_D = 4\).

As you've probably noticed from the analysis above, our four consumers' willingness to pay curve is also their demand curve, since it shows how many laptops they are willing to buy given a certain price. The reason why it is not a smooth curve like the demand curves we've seen before is that it represents a small number of consumers, each buying only one unit of the good. If we drew it for a much larger market, with many consumers and many units of the good, ordering consumers according to their willingness to pay, the steps shown in panel A of Figure 2-11 would be very small, virtually invisible, so the curve would smooth out and look like one shown in panel B.

What is important to note is that in both panel A and panel B, the height of the demand curve shows consumers' willingness to pay for the corresponding unit of the good. For example, in the market shown in panel B, the highest price that consumers' are willing to pay for the 2,000th laptop is $500. In general:

A demand curve viewed as a willingness-to-pay curve shows the price that consumers are willing to pay given a certain quantity of the product in the market.

**Consumer Surplus**

Willingness to pay represents the value that consumers place on a good. For example, since the highest price Anna is willing to pay for a laptop is $800, she values it at $800, and since Bart's willingness to pay for a laptop is $650, he values it at $650, and so on.

Suppose now that the market price of a laptop is $380. This means three laptops will be purchased, since Anna, Bart, and Cindy are willing to pay even a higher price. In fact, given that these three consumers are willing to pay more than $380, the values they will receive will exceed the price they pay. These differences between the value each of them receives when purchasing a laptop and the price they pay are their surpluses. In general:

The difference between the value consumers receive when purchasing a good or a service and the price they pay for it is called **consumer surplus**. Consumer surplus measures the net benefits that consumers receive as a result of their participation in the market.

Figure 2-12 illustrates the consumer surplus in our example. As shown in panel A, since Anna values a laptop at $800 but gets it for $380, her surplus is $800 - $380 = $420. Bart values a laptop at $650 but gets it for $380, so his surplus is $650 - $380 = $270. And Cindy values it at $500 but pays $380, so her surplus is $500 - $380 = $100. Don, however, values a laptop at $350, which is below the market price, so he won't buy it and won't receive any consumer surplus. Thus, the total surplus received by our four consumers is $420 + $270 + $120 + $0 = $810. Graphically, this surplus is represented by the area below the demand curve and above the price.
Figure 2-12 Consumer surplus in the market for laptops

The same is true about a market with many consumers and a large quantity of the good, such as that shown in panel B of Figure 2-12. In this case, consumer surplus is represented by the distances between the demand curve and the price for each of the thousands of units sold. Together, these distances form the triangular area below the demand curve and above the price. The dollar amount of the consumer surplus then can be calculated using the formula for the area of a triangle:

\[
\text{Area} = \frac{\text{Base} \times \text{Height}}{2}
\]

In our example, the distance between the demand curve and the price when the quantity is zero can be viewed as the base of the triangle, and the quantity bought at the market price can be viewed as its height. Thus, the consumer surplus (CS) can be calculated as:

\[
\text{CS} = (800 - 380) \times 2,800 \div 2 = 588,000
\]

What does this number tell us? It tells us that the value consumers have received as a result of their participation in the market for laptops exceeds the amount they’ve paid for the laptops by $588,000. In other words, the 2,800 transactions in the market for laptops have generated an additional value of $588,000 for the participating consumers.

---

6 Assuming that the demand curve is a straight line.
Checkpoint 9

In the example above, suppose the market price rises from $380 to $510. How will this affect the consumer surplus in the market with the four consumers?

Willingness to Sell and Supply

Now let’s take a look at the seller’s side of the market for laptops. Again, although in reality there are many sellers, to keep our analysis simple, we’ll start with assuming that there are only four: Zach, Yoko, Xander, and Wendy. Obviously, each seller wants to sell his laptop for as much as possible, but each also has in mind a certain lowest price that he is willing to accept. This price is called the seller’s reservation price or willingness to sell. Thus, each of the sellers in our example wants to sell his laptop for a price that is as high as possible but will keep offering it unless the price falls below his reservation price.

Willingness to sell depends on sellers’ individual situations. For example, Zach might be a college graduate who was given a laptop as a graduation present but no longer needs it because he just landed a job that provides a laptop for him, so he is willing to sell his laptop for as low as $200. Wendy, on the other hand, might be a sales representative for a laptop producer, authorized to sell a laptop for a price of $600 or higher. The reservation prices of our four sellers are shown in Table 2-3 and in panel A of Figure 2-13. As you can see, none of our four sellers is willing to sell a laptop for less than $300, so if the price is below $300, the quantity of laptops supplied ($Q_s$) is zero. At a price of $300, only Zach would sell it, so the quantity supplied is one. At $400, we’ll have two sellers, Zach and Yoko, which means $Q_s = 2$. At $500, Xander would also sell his laptop, so $Q_s = 3$. And at $600 and above, all four sellers would sell their laptops, so $Q_s = 4$.

<table>
<thead>
<tr>
<th>Bidder</th>
<th>Willingness to Sell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zach</td>
<td>$300</td>
</tr>
<tr>
<td>Yoko</td>
<td>$400</td>
</tr>
<tr>
<td>Zander</td>
<td>$500</td>
</tr>
<tr>
<td>Wendy</td>
<td>$600</td>
</tr>
</tbody>
</table>

As you can see, our four-sellers’ willingness to sell curve is also their supply curve, as it shows how many laptops they are willing to sell given a certain price. And if we drew a willingness to sell curve for a market, with many sellers and a large number of units of the good, the steps shown in panel A of Figure 2-13 would be invisible, i.e. the curve would smooth out and look like the one shown in panel B.
Figure 2-13 Willingness to sell and the supply of laptops

Note that in both panel A and panel B, the height of the supply curve shows sellers' willingness to sell for the corresponding unit of the good. For example, in the market shown in panel B, the lowest price that sellers' are willing to accept for the 2,000\textsuperscript{th} laptop is $500. In general:

A supply curve viewed as a willingness-to-sell curve shows the price sellers are willing to accept given a certain quantity of the product in the market.

**Producer Surplus**

Willingness to sell a good is determined by the seller's opportunity cost of providing it. For a laptop user, for example, the opportunity cost of selling it is the value of its best alternative uses that the seller is giving up. For a laptop manufacturer, it is the opportunity cost of resources needed to produce it.

Suppose now that the market price of a laptop is $550. This means three laptops will be sold, since Zach, Yoko, and Xander are willing to accept even a lower price. And because these three sellers receive a higher price than the lowest price they are willing to accept, we know the price they receive exceeds their opportunity costs. These difference between the price they receive when selling a laptop and the opportunity cost of it to each of them are their surpluses. In general:

The difference between the price sellers receive for each unit of a good sold and the opportunity costs of those units is called **producer surplus**.\textsuperscript{7} Producer surplus measures the net benefits that sellers receive as a result of their participation in the market.

Figure 2-14 illustrates the producer surplus in our example. As shown in panel A, since Zach’s opportunity cost of his laptop is $300 but he gets $550 for it, his surplus is $550 − $300

---

\textsuperscript{7} The term “producer surplus” is used even if the seller is not a producer.
Yoko’s opportunity cost is $400, but she gets $550, so her surplus is $550 − $400 = $150. And Xander’s opportunity cost is $500, but the price he receives is $550, so he gets a surplus of $550 − $500 = $50. Wendy’s reservation price, however, is higher than $550, so she won’t sell her laptop and thus won’t receive any surplus. Then, the total surplus received by our four sellers is $250 + $150 + $50 + $0 = $450. Graphically, it is represented by the area below the price and above the supply curve.

Similarly, in a market with many sellers and a large quantity of the good, such as that shown in panel B of Figure 2-14, producer surplus is represented by the distances between the price and the supply curve for each of the thousands of units sold. Together, these distances form the triangular area below the price and above the supply curve. The dollar amount of the producer surplus then is the area of the triangle whose base is the distance between the price and the supply curve when the quantity is zero and whose height is the quantity of sold.\(^8\) Thus, the producer surplus (PS) is:

\[
PS = (\text{Price} - \text{Supply}) \times \text{Quantity} = (550 - 300)\times 2,500/2 = 312,500
\]

That is, the amount of revenue sellers have received as a result of their participation in the market for laptops exceeds their opportunity costs of providing laptops to the market by $312,500. In other words, the 2,500 transactions in the market for laptops have generated an additional value of $312,500 for the participating sellers.

---

\(^8\) Assuming that the supply curve is a straight line.
In the example above, suppose the market price falls from $550 to $410. How will this affect the producer surplus in the market with the four sellers?

**Total Surplus**

Once we understand what the consumer surplus is, what the producer surplus is and how buyers and sellers benefit from participating in the market, the next question is, what will be the actual market price that determines how much surplus consumers and producers receive? To answer this question, we’ll put the demand and supply curves together to see where the market equilibrium will be. Recall that a market equilibrium occurs when the quantity of the good consumers are willing to buy, i.e. the quantity demanded, equals the quantity sellers are willing to sell, i.e. the quantity supplied. Figure 2-15 combines the demand curve in panels B of Figure 2-12 with the supply curve in panel B of Figure 2-14. As you can see, the market is in equilibrium when the price of a laptop is $500. At this price, the quantity of laptops sold is 2,000. The consumer surplus then is the area below the demand curve and above $500 (area A on the graph), that is:

\[
CS = ($800 - $500) \times 2,000/2 = $300,000
\]

The producer surplus is the area above the supply curve and below $500 (area B), that is:

\[
PS = ($500 - $300) \times 2,000/2 = $200,000
\]

The amount of total gains from trade received by the market participants is called **total surplus**.

In our example, the total surplus (TS) in the market for laptops is:

\[
TS = CS + PS
\]

\[
TS = $300,000 + $200,000 = $500,000
\]
Checkpoint 11

“Since a fixed quantity of laptops is traded in the market, no additional value is created as a result of these transactions. Laptops just change hands. Therefore, it is a zero-sum game. When one market participant gains, another one loses an equal amount.” True or false? Explain.

Market Equilibrium and Efficiency

We’ve seen earlier in this chapter how free competitive markets work to equate the quantity of the good demanded with the quantity supplied through the price adjustment mechanism so that in equilibrium there is no excess demand or excess supply. The concepts of consumer surplus and producer surplus allow us to see another important aspect of market equilibrium: it is also the point where the market participants receive the greatest total surplus possible, i.e. the highest overall gains from trade given the values placed on the product by consumers and the opportunity costs of it to sellers. To see why, let’s return to our example of the market for laptops and consider what will happen if for some reason the market is not in equilibrium.

For example, the initial auction price is set above the equilibrium price, say at $650, so that sellers cannot offer laptops at a lower price. This situation is depicted in Figure 2.16.

The $150 increase in price decreases the quantity of laptops demanded, and therefore the quantity sold, from 2,000 to 1,000. As a result of a higher price and a lower quantity of laptops purchased, the consumer surplus—the area below the demand curve and above the price—decreases. It’s dollar value (represented by area A) is now:

\[ CS = (800 - 650) \times 1,000 / 2 = 75,000. \]

The producer surplus increases because of a higher price, but decreases because sellers now are only able to sell 1,000 laptops instead of 2,000. The value of the producer surplus is now represented by the trapezoid area B + F, which can be calculated using the following formula:

\[ \text{Area} = (\text{Longer base} + \text{Shorter base}) \times \text{Height} / 2 \]

In our example, the longer base is $650 - $300 = $350 and the shorter base is $650 - $400 = $250. The height is the quantity sold. Thus, the producer surplus is:

\[ PS = (350 + 250) \times 1,000 / 2 = 300,000 \]

Thus, as a result of a higher price that drives the market away from equilibrium, consumer surplus decreases by $225,000 while producer surplus increases by $100,000. Part of the loss
for consumers is a gain for producers. Area F in Figure 2-16 represent this transfer of surplus. Note, however, that area D is no longer part of either consumer or producer surplus. It is lost for both consumers and producers. This loss of the potential total surplus is called a **deadweight loss**. Notice that the deadweight loss (area D in Figure 2-16) is a triangle whose base equals the difference between the price consumers are paying ($650) and the cost to the producers of the last unit sold ($400). And the height of the deadweight loss triangle is the difference between the equilibrium quantity and the quantity actually sold ($2,000 - 1,000 = $1,000). Using the formula for the area of a triangle, we can calculate the deadweight loss (DWL) in the market for laptops as:

\[
DWL = (650 - 400) \times 1,000 / 2 = 125,000
\]

Thus, a deviation from the market equilibrium reduced the total surplus by $125,000. We can confirm this by calculating the total surplus when the price of a laptop is $650 as the sum of the consumer surplus and producer surplus:

\[
TS = 75,000 + 300,000 = 375,000
\]

which is $125,000 less than the $500,000 total surplus received by consumers and producers when the market was in equilibrium.

Likewise, total surplus will be reduced if the price is below the market equilibrium. Checkpoint 2-12 asks you to show this using our market for laptops example. An important point that follows from this discussion is:

> **Total surplus in a free competitive market is maximized, i.e. the greatest possible gains from trade are achieved, when the market is in equilibrium. In this situation, there is no deadweight loss, as all potential gains from trade in the market are realized. Such market outcome is called **efficient**. And if total surplus is below its potentially achievable level, i.e. there is a deadweight loss, the outcome is called **inefficient**.**

Efficiency of a competitive market equilibrium is a key reason why all modern advanced economies rely on markets. However, free markets are efficient only under certain conditions. We will address them in later chapters. Here is an overview of the conditions necessary for an unregulated market to be efficient.

**The market is perfectly competitive; that is, no individual seller or buyer can influence the price**

For instance, in our example above, if sellers of laptops could collude to fix the price at a level above the competitive equilibrium, say $650, they will gain producer surplus at the expense of consumers and will be better off by $100,000 (see Figure 2-16). But as you could see, this would lead to a deadweight loss that reduces the total surplus by $125,000. That is, the market outcome would be inefficient. We’ll address the inefficiencies caused by sellers’ market power in Chapters 8–10.

**No externalities are generated by production or consumption of the good**

An **externality** is a cost or benefit resulting from production or consumption of a good that is imposed on someone other than its buyers or sellers. For example, suppose a factory that produces laptops pollutes the nearby river with toxic chemicals. In an unregulated market, the factory decides how many laptops to produce and what price to accept based only on its
own internal costs of producing laptops. It does not take into account external costs imposed on bystanders downstream, such as dead fish, contaminated drinking water, and people getting sick. Since in cases like this free markets fail to account for all the costs imposed on society, they are not efficient. We will discuss the market failures due to externalities and what government can do about them in Chapter 4.

The good traded is a private good

Free markets can only be efficient when a private good or service is traded. They fail to efficiently provide so called public goods because of the nature of those goods. For example, a laptop is a private good. You can only use it if you pay a certain price for it, so you make your decision whether or not to buy it by comparing the value of it to you with the price for which you can get it. Then, if you buy it, you own it, i.e. no one else can use it without your permission. Compare this with a good such as national defense. Obviously, national defense has a certain value to everyone living in the country, as it protects the nation from external enemies. However, no private individual or entity would be willing to pay for the national defense system based on its value to them because (1) it is impossible to limit access to the protection to only those who pay for it and (2) once the system is in place, protecting an additional person does not reduce the benefits to others, i.e. the opportunity cost of protecting another individual is zero, which means the efficient price is also zero. Because markets cannot supply public goods efficiently, if at all, these goods are usually provided by government. We will have more to say about public goods in Chapter 4.

All relevant information is available to both buyers and sellers

When you are buying a laptop, you have a pretty good idea about what exactly you are getting and of what value it is to you. But when you get sick and are deciding whether or not to go to a doctor, you usually don’t know what exactly is wrong with you and of what value the doctor’s service will be to you. You leave it to the doctor to figure out, which basically means you let the doctor, the seller of the service, determine your willingness to pay for it! And you have to rely on the doctor’s conscience and integrity in the hope that his motive is to provide a treatment that is best for you and not to get the highest profit for himself. Conscience and integrity, however, are not market categories, and the profit motive is exactly what markets are all about. Thus, with a lack of information about the good or service traded, such as in the example above, free markets fail to provide efficient outcomes.

As you might suspect, in the real world it is rarely the case that all the conditions listed above hold. Therefore, none of the modern economic systems relies exclusively on free markets. In all of them government plays an important role, correcting inefficiencies caused by market failures and stepping in when markets fail to provide socially valuable goods or services. Unfortunately, the determination to what extent an economy relies on free markets and to what extent and where the government should intervene is often left to ideological doctrines and political power rather than economic efficiency considerations. Discussing why and how this occurs is beyond the scope of this course. We hope, however, that our discussion of economic efficiency in this chapter and then of the role of government later on in this course will help you see the economic truth behind the political demagogy of the preachers of both free markets almighty and omnipotent government.
Checkpoint 12

Show that total surplus will be reduced if the price falls below the equilibrium price. Suppose that in our example, the price is $400 instead of $500. How will this change the consumer surplus? The producer surplus? How much will be the deadweight loss?

Check your answer

Economics at Work: Explaining Oil Prices

As we discussed earlier in this chapter, since oil is an essential input used to produce gasoline, the price of oil is a key factor that determines gasoline prices. Indeed, as statistical data show, gas prices follow oil prices very closely. The importance of oil, however, expands far beyond that. In fact, oil is used to produce nearly everything, from heating and electricity generation to plastics, fertilizers, roofing, clothing, aspirin, and guitar strings. To satisfy the demand for all those products, the world produces about 100 million barrels (3.2 billion gallons) of oil per day. No wonder that fluctuations in oil prices affect nearly all industries and may even alter the global macroeconomic situation.

Because of such profound effects of oil prices on the global economy, it is important to examine the past trends in oil prices so that we could better predict how they might change in the future. And oil prices do tend to fluctuate substantially. Take a look at Figure 2.17,
which shows how the “spot” prices of crude oil changed over the last five years.\(^9\) Particularly remarkable is the steep slump from about $112 per barrel to about $31 per barrel that occurred over the period from June 2014 to January 2016. It is also worthy of note that despite this 72% price drop, the consumption of oil during this period increased rather modestly: from about 94 million to about 96 million barrels per day, i.e. by only about 2%.\(^10\) What caused such a dramatic drop in the price of oil accompanied by only a slight increase in quantity? The demand and supply model discussed in this chapter will help us answer this question.

Let’s go through the four steps we’ve suggested in the previous section to help us better organize our analysis of events influencing the market for oil. First, we need to define the market we want to analyze. Since our purpose is to explain a trend in the world price of oil, not oil prices in particular countries or regions, it makes sense to examine the market for oil as a global market.\(^11\) The suppliers in this global market are all oil producers around the world, and the buyers are all world’s consumers of oil, which are predominantly businesses that use oil to produce other goods.

One important question is whether the world market for oil fits our definition of a competitive market, i.e. one where no individual seller or buyer can influence the price. Recall that the two conditions necessary for the buyers and seller to take the market price as given are (1) the product is standardized, and (2) each buyer and seller holds a very small fraction of the market, so the influence of an individual buyer or seller on the price is negligible. The first condition is certainly present, since crude oil is a standardized product (commodity). The second one does not strictly hold. The reason is that about 40% of the world’s crude oil is produced by the Organization of the Petroleum Exporting Countries (OPEC), which controls (or at least tries to) oil production in its member countries by setting production targets.\(^12\)

Because OPEC accounts for such a large share of the world’s market for oil, it can affect its price. Historically, crude oil prices have risen when OPEC reduced its production targets. In our demand and supply model, we can reflect this OPEC’s influence by shifting the world oil supply curve accordingly. However, OPEC’s ability to shift the world supply curve cannot change the law of supply. That is, when the price of oil rises due to OPEC’s production cuts, other oil producers have the incentive to increase their output, since it becomes more profitable to produce more oil even if it results in higher costs. Thus, we can use the competitive demand and supply model to analyze the world market for oil.

The second step is to define the initial market equilibrium. We will start from June 2014, when the equilibrium price of oil was at its peak of about $112 per barrel and its equilibrium quantity was about 94 million barrels per day. In Figure 2.18, \(D_{14}\) and \(S_{14}\) are, respectively,

---

\(^9\) Spot prices are prices at which oil is actually sold and bought for immediate delivery (as opposed to futures prices, i.e. prices at which contracts promising future delivery of oil are bought and sold).


\(^11\) Note that examining regional prices of oil are of less interest. Those prices do not differ much, as they are equalized through worldwide trade. That is, if the price of oil is significantly higher in a particular region, it is pretty easy to ship more oil there, as the cost of shipping a barrel of oil from one world’s region to another is usually immaterial in comparison with its price.

\(^12\) OPEC has fourteen Member Countries, with Saudi Arabia accounting for about 32% of the Organization’s total oil production, seven other Middle Eastern countries producing another 49%, and Venezuela, Angola, and Nigeria producing almost all the rest.
the demand curve and the supply curve in June 2014, so point E_{14} marks the initial equilibrium.

The third step is to find the new equilibrium. Note, however, that our analysis here is a little different from what we’ve done before: we already know that in January 2016 the equilibrium price of oil was about $31 per barrel and the equilibrium quantity was about 96 million barrels per day. What we need to figure out is which curve shifted in which direction, as we want to explain how the market got there.

Let’s start with the supply side. Most remarkable there is the phenomenal growth of oil production in the United States. The U.S. oil boom started in 2008, when the first well was drilled into a shale. Since then, with the help of horizontal drilling and hydraulic fracturing (commonly known as fracking), billions of additional barrels of oil have been produced. Between 2008 and 2015, U.S. oil production almost doubled, reaching 9.4 million barrels per day and threatening to surpass Saudi Arabia as the world’s largest producer of oil.

In this situation, the OPEC countries faced a tough choice: cut their oil production to prop up the price, as they’ve done in the past, or maintain their output and let the price continue to fall with the purpose of driving the producers of the more costly shale oil—in the United States and everywhere else—out of business. Quite surprisingly, OPEC, led by Saudi Arabia, decided not just to go with the latter choice, but increase their oil production substantially in the hope to win the global battle for market share. The U.S. shale oil producers, however, did not back off. Armed with new drilling and other cost saving technologies, they continued to pump oil at near-record levels. The result was a large rightward shift of the supply curve in the world market for oil as shown in Figure 2-19, where S_{16} is the supply curve in January 2016.

But what happened on the buyers’ side of the market? Because, as we noted earlier, oil is used to produce nearly every product, the demand for it is largely driven by the demand for all those products, which increases when economies are growing. From this perspective, although the global demand for oil increased, driven mainly by continuing economic growth in

\[13\] You might recall that for meaningful comparisons of price changes over time, the demand and supply model should use real prices, i.e. prices adjusted for inflation, rather than nominal prices. However, during the period we are analyzing, the inflation rate was close to zero, so the difference between the nominal and real prices is immaterial here.
India and China, the increase was rather modest. China’s growth was shaky, and in Europe and the United States the annual rates of growth were below 3%. Thus, although the world’s demand curve for oil shifted rightward (from $D_{14}$ to $D_{16}$ in Figure 2-19), the effect of the demand shift was much smaller than that of the supply shift.

As you can see in Figure 2-19, since the downward effect on the price of the increased supply was much greater than the upward effect on it of the increased demand, the price dropped dramatically, from $112 per barrel in the June 2014 equilibrium ($E_{14}$) to $31 per barrel in the January 2016 equilibrium ($E_{16}$).

You might be wondering, however, why such a substantial drop in the price of oil resulted in only a relatively small increase in its quantity. Given that the rightward shifts of both supply and demand curves worked in the same direction, reinforcing each other to increase the equilibrium quantity, wouldn’t we expect a much greater quantity increase? The answer to this question is that, first, the shift in the demand curve was rather small. Second, along the new same demand curve ($D_{16}$) the responsiveness of the quantity of oil demanded to a change in price was very small. Economists call it a very price inelastic demand. We discuss the economic concept of the price elasticity of demand and the reasons why the demand for oil is very price inelastic in Chapter 3.

**Checkpoint Answers**

1. False. Most markets are not strictly perfectly competitive but meet the conditions for perfect competition closely enough for us to ignore their imperfections. We can even use the demand and supply model to analyze markets where the products sold by different firms differ significantly if we combine those products into a single good with typical characteristics. Thus, the uses of the demand and supply model go far beyond strictly perfectly competitive markets.

2. False. The money that buyers pay and sellers receive per unit of a good is a nominal price. But it is relative prices, not nominal prices, that are relevant when examining how the forces of demand and supply interact in a market. Nominal prices are influenced by inflation, which is a macroeconomic monetary phenomenon and thus irrelevant to the analysis of demand and supply particular markets.

3. A. True. This statement reflects the law of demand.
   B. False. Other thing being equal, a fall in price increases the quantity demanded. The demand for the good remains unchanged, i.e. the demand curve does not shift.
C. False. An increase in consumer income shifts the demand curve. The only factor that can cause a movement along the demand curve is the price of the good.
D. False. A rise in the price, of a good, other things being equal, will result in a leftward and upward movement along the demand curve. It won’t shift of the curve.

A. False. The price of a good and the quantity of the good supplied are positively related.
B. False. The quantity supplied of a the good will increase. The supply will not change, i.e. the supply curve won’t shift.
C. False. A technological improvement will cause a rightward shift of the supply curve, i.e. an increase in supply. An upward shift of the supply curve would also be a leftward shift, which means a decrease in supply.
D. True. According to the law of supply, other things being equal, a fall in the price of a good results in a decrease in quantity supplied, which means a leftward and downward movement along the supply curve.

As the demand curve shows, at $2.40, the quantity demanded is 200 million gallons. And as the supply curve shows, the quantity supplied at this price is 235 million gallons. Although sellers are willing to offer 235 million gallons, buyers only want 200 million gallons, i.e. there is an excess supply of 35 million gallons. As sellers compete to sell their gas, they lower the price, so the price will fall.

A. Honda cars and Toyota cars are substitutes. When the price of Toyotas rises, some consumers will choose to buy a Honda instead of a Toyota. Thus, the demand for Hondas will increase.
B. When students come for the new semester, the number of potential buyers of pizza increases. Thus, the demand for pizza will increase.
C. SUV’s and gas are complements. When the price of gas falls, driving large SUV’s, which consume a lot of gas, becomes significantly less expensive. As a results, the demand for large SUV’s will increase.
D. When consumers become more aware of health risks associated with junk food, their preferences change away from it, which will decrease the demand for junk food.
E. When buyers expect the prices of TVs to fall next month, some of them may decide to wait until then. As a results, the demand for TVs this month will decrease.
F. When the price of orange juice falls, the quantity of orange juice demanded will increase. The demand for orange juice, however, won’t change (i.e. there will be a movement along the demand curve, but the curve won’t shift).

A. As the number of sellers in the market for smartphones increases, the supply of smartphones will increase, i.e. the supply curve will shift rightward.

B. Technological advances in the production of solar panels allows the producers to increase output using the same amount of resources, which will increase the supply of solar panels, i.e. the supply curve will shift rightward.

C. When the price of chicken in Europe falls, it becomes more profitable for U.S. producers to sell more of their chicken domestically rather than exporting it to Europe. On the other hand, European producers will want to export more of their chicken to the United States, where the price becomes relatively higher. As a result, the supply of chicken to the U.S. market will increase, i.e. the supply curve will shift rightward.

D. When the price of milk falls, the quantity supplied of milk will decrease. The supply of milk, however, won’t change (i.e. there will be a movement along the supply curve, but the curve won’t shift).

E. When sellers expect the price of desktop computers to fall next year, they want to sell more desktop computers this year, before the price falls. As a result, the supply of desktop computers this year will increase, i.e. the supply curve will shift rightward.

F. When the price of corn falls relative to the price of wheat, it becomes more profitable to produce wheat compared with corn. Thus, farmers will reallocate their land and other resources to produce more wheat, leaving fewer resources to produce corn. As a result, the supply of wheat will increase, i.e. the supply curve will shift rightward.

G. Higher wages in the United States make the labor input more costly to the car producers. As a result, they will be able to hire fewer assembly workers at the same cost. Therefore, the supply of cars will decrease, i.e. the supply curve will shift leftward.
First, clarify to yourself that you are looking at the current market for coffee, not the market for coffee next month. In the figure, the initial equilibrium is at point $E_1$, where the price is $P_1$ and the quantity is $Q_1$. Buyers’ expectations of a lower future price decrease the current demand for coffee, shifting the demand curve leftward. The equilibrium resulting from this shift alone is at point $E_2$, where both price and quantity are lower. Sellers’ expectations of a lower future price increase the current supply of coffee, shifting the supply curve rightward. The equilibrium resulting from this shift alone is at point $E_3$, where the price is lower and the quantity is greater. Since both curve shifts lower the price, their combine effect is to lower the equilibrium price. But since the leftward shift of the demand curve decreases the quantity while the rightward shift of the supply curve increases it, the resulting effect on the quantity depends on how far each of the curves shifts. As shown in the figure, the equilibrium quantity remains at $Q_1$. But if, for example, the demand curve shifted further to the left, the quantity would decrease. And if the supply curve shifted further to the right, the quantity would increase.

The consumer surplus would shrink. Anna’s surplus will be $800 - 510 = 290$, Bart’s will be $650 - 510 = 140$, while Cindy and Don will not receive any surplus. The highest price they are willing to pay is below the market price, so they won’t buy a laptop. Thus, the total surplus received by our four consumers will be $290 + 140 + 0 + 0 = 430$.

The producer surplus would shrink. Zach’s surplus will be $410 - 300 = 110$, Yoko’s will be $410 - 400 = 10$, while Xander and Wendy will not receive any surplus. They won’t sell their laptops because the market price is below the lowest prices at which they are willing to sell. Thus, the producer surplus received by the four sellers will be $110 + 10 + 0 + 0 = 120$.

False. No one loses from voluntary exchange. As we could see from our example, each buyer and each seller of laptops gains a certain amount of surplus, i.e. everyone gains from trade.
Since the exchange is voluntary, people simply won’t engage in a transaction if they lose from it.

The situation is depicted in the figure below. The $100 increase in price decreases the quantity of laptops supplied, and therefore the quantity sold, from 2,000 to 1,000. As a result of a lower price and a smaller quantity sold, the producer surplus—the area below the price and above the supply curve—decreases. It’s dollar value (represented by area B) is now:

\[
\text{Producer surplus} = ($400 - $300) \times 1,000/2 = $50,000.
\]

The consumer surplus increases because of a lower price but decreases because consumers now are only able to sell 1,000 laptops instead of 2,000. The value of the consumer surplus is represented by the trapezoid area \( A + F \), which can be calculated as:

\[
\text{CS} = ($400 + $250) \times 1,000/2 = $325,000
\]

Thus, the consumer surplus increases by $25,000, while the producer surplus decreases by $150,000. Part of the loss for producers is a gain for consumers. Area \( F \) represents this transfer of surplus. However, area \( D \) is no longer part of either consumer or producer surplus. It is a deadweight loss. We can calculate the dollar value of the deadweight loss as:

\[
\text{DWL} = ($650 - $400) \times 1,000/2 = $125,000.
\]

That is, the deviation from the market equilibrium reduced the total surplus by $125,000. We can confirm this by calculating the total surplus when the price of a laptop is $400 as the sum of the consumer surplus and producer surplus:

\[
\text{TS} = $325,000 + $50,000 = $375,000
\]

which is $125,000 less than the $500,000 total surplus received by consumers and producers when the market was in equilibrium. Thus, a price below the equilibrium led to a deadweight loss in a way similar to how a price above the equilibrium did.