

Where Prices Come From: The Interaction of Supply and Demand

Chapter Outline and Learning Objectives

- 3.1 The Demand Side of the Market**, page 62
Discuss the variables that influence demand.
 - 3.2 The Supply Side of the Market**, page 69
Discuss the variables that influence supply.
 - 3.3 Market Equilibrium: Putting Buyers and Sellers Together**, page 73
Use a graph to illustrate market equilibrium.
 - 3.4 The Effect of Demand and Supply Shifts on Equilibrium**, page 77
Use demand and supply graphs to predict changes in prices and quantities.
- Appendix B: Quantitative Demand and Supply Analysis**, page 90
Use quantitative demand and supply analysis.

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Red Bull and the Market for Energy Drinks

Markets for some products suddenly explode. This was the case in the market for energy drinks. Red Bull was developed in Austria by Dietrich Mateschitz, who based it on a drink he discovered being sold in pharmacies in Thailand. Before Red Bull entered the market, few soft drinks included caffeine. Red Bull didn't enter the Canadian market until 2004, likely due to soft drink regulations. In Canada, caffeine may not be added to a traditional soft drink other than a cola. For example, Mountain Dew sold in the United States has a relatively high amount of caffeine, but the version sold in Canada contains none. Red Bull and other energy drinks are sold in Canada as natural health products, and are therefore subject to different regulations. Despite not being available in Canada before 2004, the Canadian sports and energy drink sector saw \$876 million in retail sales in 2012. The market for energy drinks has found a particularly valuable niche with students wanting an extra boost of energy for sports, gaming, or studying. Some people have speculated that energy drinks might replace coffee as the morning drink for the current generation.

The success of Red Bull, Monster Energy, and Rockstar Energy Drink has attracted the attention of huge multinational beverage corporations as well as entrepreneurs looking to introduce new products into a hot

market. Coca-Cola signed an agreement to distribute Monster Energy in Canada, 20 US states, and 6 Western European countries, and Pepsi struck a similar deal with Rockstar Energy Drink. A Canadian company that has recently entered the market, DD Beverage Company, produces Beaver Buzz Energy and other energy and sports beverages. Well over 200 energy drinks are now available in the North American marketplace.

The intense competition among firms selling energy drinks is a striking example of how the market responds to changes in consumer tastes. Although intense competition is not always good news for firms trying to sell products, it is great news to consumers. Competition among firms increases the variety of products available and reduces the price consumers pay for those products.

AN INSIDE LOOK on **page 84** discusses Kickstart, PepsiCo's latest high-energy breakfast drink, which the company hopes will attract young consumers who enjoy energy drinks but are looking for an alternative with the promise of health benefits.

Sources: "Sports and Energy Drinks in Canada," *Just-Drinks*, March 2013, http://www.just-drinks.com/market-research/sports-and-energy-drinks-in-canada_id166423.aspx?lk=pcl; "The Buzz Surrounding Energy Drinks," *Calgary Herald*, February 3, 2005; *National Geographic*, "Why We Love Caffeine," January 2005 edition.

Economics in Your Life

Red Bull or Beaver Buzz Energy: What's Your Beverage?

Suppose you are about to buy an energy drink and you are choosing between a Red Bull and a Beaver Buzz Energy. As the more established, well-known brand, Red Bull has many advantages over a recent entrant like Beaver Buzz Energy. One strategy DD Beverage Company can use to overcome Red Bull's advantages is to have Beaver Buzz Energy compete based on price and value. Would you choose to buy a can of Beaver Buzz Energy if it had a lower price than a can of Red Bull? Would you be less likely to drink Beaver Buzz Energy if your income dropped? As you read this chapter, see if you can answer these questions. You can check your answers against those we provide on page 82 at the end of this chapter.

Perfectly competitive market A market that meets the conditions of (1) many buyers and sellers, (2) all firms selling identical products, and (3) no barriers to new firms entering the market.

In Chapter 1, we explored how economists use models to predict human behaviour. In Chapter 2, we used the production possibilities frontier model to analyze scarcity and trade-offs. In this chapter, we explore the model of demand and supply, which is the most powerful tool in economics, and use it to explain how prices are determined.

Recall from Chapter 1 that because economic models rely on assumptions, they are simplifications of reality. In some cases, the assumptions of the model may not seem to match the economic situation being analyzed. For example, the model of demand and supply assumes that we are analyzing a *perfectly competitive market*. In a **perfectly competitive market**, there are many buyers and sellers, all the products sold are identical to consumers, and there are no barriers to new firms entering the market. These assumptions are very restrictive and only really describe a very small number of real world markets, such as the global market for wheat or a few other agricultural products. Experience has shown, however, that the model of demand and supply can be very useful in analyzing markets where competition among sellers is intense, even if there are relatively few sellers and the products being sold are not identical. In fact, in recent studies, the model of demand and supply has been successful analyzing markets with as few as four buyers and four sellers. In the end, the usefulness of a model depends on how well it can predict outcomes in a market. As we will see in this chapter, the model of demand and supply is often very useful in predicting changes in quantities and prices in many markets.

We begin exploring the model of demand and supply by discussing consumers and the demand side of the market, before turning to firms and the supply side. As you will see, we will apply this model throughout this book to understand business, the economy, and economic policy.

3.1 LEARNING OBJECTIVE

Discuss the variables that influence demand.

The Demand Side of the Market

Chapter 2 explained that in a market system, consumers ultimately determine which goods and services will be produced. The most successful businesses are those that respond best to consumer demand. But what determines consumer demand for a product? Many, many things influence the willingness of consumers to buy a particular product. For example, consumers who are considering buying an energy drink, such as Red Bull or Beaver Buzz Energy, will make their decisions based on, among other factors, the amount of money they can spend (income) and the effectiveness of advertising campaigns. The main factor in consumer decisions, however, will be the price. So, it makes sense to begin with price when analyzing the decision of consumers to buy a product. It is important to note that when we discuss demand, we are considering not what a consumer *wants* to buy but what the consumer is both willing and *able* to buy.

Demand schedule A table that shows the relationship between the price of a product and the quantity of the product demanded.

Quantity demanded The amount of a good or service that a consumer is willing and able to purchase at a given price.

Demand curve A curve that shows the relationship between the price of a product and the quantity of the product demanded.

Market demand The demand by all the consumers of a given good or service.

Demand Schedules and Demand Curves

Tables that show the relationship between the price of a product and the quantity of the product demanded are called **demand schedules**. The table in Figure 3.1 shows the number of cans of energy drinks consumers would be willing to buy over the course of a month at five different prices. The amount of a good or service that a consumer is willing and able to purchase at a given price is the **quantity demanded**. The graph in Figure 3.1 plots the numbers from the table as a **demand curve**, a curve that shows the relationship between the price of a product and the quantity of the product demanded. (Note that for convenience, we made the demand curve in Figure 3.1 a straight line, or linear. There is no reason to believe that all demand curves are straight lines.) The demand curve in Figure 3.1 shows the **market demand**, or the demand by all the consumers of a given good or service. The market for a product, such as restaurant meals, that is purchased locally would include all the consumers in a city or a relatively small area. The market for a product that is sold internationally, such as energy drinks, would include all the consumers in the world.

Demand Schedule	
Price (dollars per can)	Quantity (millions of cans per day)
\$3.00	60
2.50	70
2.00	80
1.50	90
1.00	100

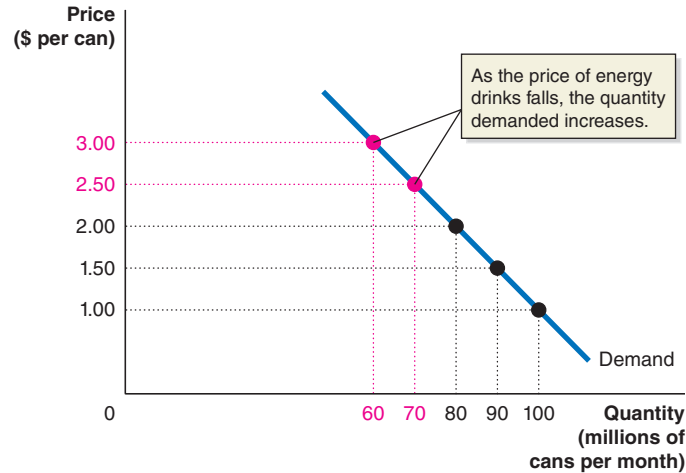


Figure 3.1

A Demand Schedule and Demand Curve

As the price changes, consumers change the quantity of energy drinks they are willing to buy. We can show this as a *demand schedule* in a table or as a *demand curve* on a graph. The table and graph both show that as the price of energy drinks falls, the quantity demanded increases. When the price of an energy drink is \$3.00, consumers buy 60 million cans per month. When the price drops to \$2.50, consumers buy 70 million cans per month. Therefore, the demand curve for energy drinks is downward sloping.

The demand curve in Figure 3.1 slopes downward because consumers will buy more cans over the same time period when the price falls. When the price is \$3.00 per can, consumers buy 60 million cans per month. If the price is \$2.50 per can, consumers buy 70 million cans per month. Buyers demand a larger quantity of a product as the price falls because the product becomes less expensive relative to other products and because they can afford to buy more at a lower price.

The Law of Demand

The inverse relationship between the price of a product and the quantity of the product demanded is known as the **law of demand**: Holding *everything else* constant, when the price of a product falls, the quantity demanded of the product will increase, and when the price of a product rises, the quantity demanded of the product will decrease. The law of demand holds for any market demand curve. Economists have found only a very few exceptions (after more than 100 years of research).

Law of demand The rule that, holding everything else constant, when the price of a product falls, the quantity demanded of the product will increase, and when the price of a product rises, the quantity demanded of the product will decrease.

What Explains the Law of Demand?

It makes sense that consumers will buy more of a good when the price falls and less of a good when the price rises, but let's take a closer look at why this is true. When the price of energy drinks falls, consumers buy a larger quantity because of two effects, the *substitution effect* and the *income effect*.

The Substitution Effect The **substitution effect** refers to the change in the quantity demanded of a good that results from a change in the relative price of that good. The *relative price* of a good is how much it costs compared with a good that could be purchased instead, a *substitute* good. When the price of energy drinks falls and becomes less expensive relative to coffee (a substitute good), consumers will buy *more* energy drinks and *less* coffee.

Substitution effect The change in the quantity demanded of a good that results from a change in price making the good more or less expensive relative to other goods, holding constant the effect of the price change on consumer purchasing power.

The Income Effect The **income effect** of a price change refers to the change in the quantity demanded of a good that results from the effect of a change in the good's price on consumers' purchasing power. *Purchasing power* is the quantity of goods (and services) a consumer can buy with a fixed amount of income. When the price of a good falls, a consumer can buy more of everything with the same amount of money, including the product whose price fell in the first place. For example, if the price of energy drinks falls, the increased purchasing power of consumers' incomes means that they can buy more energy drinks and other goods with the same amount of money. When the price of a good rises, the decreased purchasing power of consumers' incomes will usually lead them to purchase fewer goods, including the good whose price became higher.

Income effect The change in the quantity demanded of a good that results from the effect of a change in the good's price on consumers' purchasing power.

Note that although we can analyze them separately, the substitution effect and the income effect happen simultaneously whenever a price changes. Thus, a fall in the price of energy drinks leads consumers to buy more energy drinks, both because the cans are now less expensive relative to substitute products (such as coffee) and because the purchasing power of their incomes has increased.

That Magic Latin Phrase *Ceteris Paribus*

You likely noticed that the definition of the law of demand contains the phrase *holding everything else constant*. In constructing the market demand curve for energy drinks, we focused only on the effect that changes in the price of energy drinks would have on how many cans consumers would be willing and able to buy. We were holding constant all other variables that might affect the willingness of consumers to buy energy drinks. Economists refer to the necessity of holding all other variables constant in constructing a demand curve (or any other model) as the ***ceteris paribus condition***: *ceteris paribus* is Latin for “all else equal.”

What would happen if we allowed a change in a variable—other than price—that might affect the willingness of consumers to buy energy drinks? Consumers would then change the quantity they demanded at each price. We can illustrate this effect by shifting the market demand curve. A shift of a demand curve is *an increase or a decrease in demand*. A movement along a demand curve is *an increase or a decrease in the quantity demanded*. As Figure 3.2 shows, we shift the demand curve to the right if consumers decide to buy more of the good even when the price doesn’t change, and we shift the demand curve to the left when consumers decide to buy less of a good even if the price doesn’t change.

***Ceteris paribus* (“all else equal”) condition** The requirement that when analyzing the relationship between two variables—such as price and quantity demanded—other variables must be held constant.

Variables That Shift Market Demand

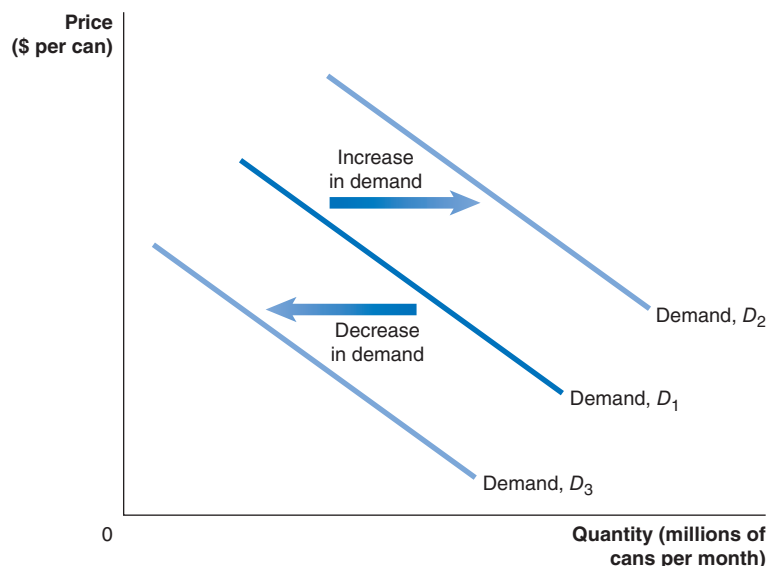
Many variables other than price can influence how much of a product consumers are willing and able to buy. These five are the most important:

- Income
- Prices of related goods
- Tastes
- Population and demographics
- Expectations

Figure 3.2

Shifting the Demand Curve

When consumers increase the quantity of a product they want to buy at a given price, the market demand curve shifts to the right, from D_1 to D_2 . When consumers decrease the quantity of a product they want to buy at a given price, the demand curve shifts to the left from D_1 to D_3 .



We next discuss how changes in each of these variables affect the market demand curve.

Income The income that consumers have available to spend affects their willingness and ability to buy a good. Suppose the market demand curve in Figure 3.1 on page 63 represents the willingness of consumers to buy energy drinks when average household income is \$60 000. If household income rises to \$65 000, the demand for energy drinks will increase, which we show by shifting the demand curve to the right. A good is a **normal good** when demand increases following a rise in income and decreases following a fall in income. Most goods are normal goods, but the demand for some goods falls when income rises and rises when income falls. For instance, when your income rises, you might buy fewer hot dogs and more steak. A good is an **inferior good** when demand decreases following a rise in income and increases following a fall in income. So, for you, hot dogs would be an example of an inferior good. Remember, when economists say a good is inferior, they aren't saying anything about the quality of the good, just that the amount people buy falls when income rises.

Normal good A good for which the demand increases as income rises and decreases as income falls.

Inferior good A good for which the demand increases as income falls and decreases as income rises.

Prices of Related Goods The price of other goods can also affect consumers' demand for a product. Goods and services that can be used for the same purpose—such as energy drinks and coffee—are **substitutes**. Two goods are substitutes if, when you

Substitutes Goods and services that can be used for the same purpose.

Making the Connection

Is Beer an Inferior Good?

For most Canadians, a beverage on a hot summer afternoon is part of the culture. In 2012, Canadians drank 8.1 litres of alcohol in various forms per person, including 80.3 litres of

beer. This is a profitable industry with the LCBO (Liquor Control Board of Ontario) making paying a dividend to the Government of Ontario of \$1.63 billion.

How does income affect the choices Canadians make at the liquor store? As Canadians have gotten wealthier, they have changed their drinking habits. There is an underlying trend: Instead of buying beer at the lowest possible price, more and more Canadians are opting for local micro-brewery beer or local wine. In 2009, New Brunswick's alcohol retailer (Alcool NB Liquor) launched its own brand of beer, which provided New Brunswickers with a low-cost alternative, but in July 2011, that brand was discontinued due to lack of sales. During the 2011 fiscal year, the LCBO noticed that the sales of its premium products recovered from the slump that started around the same time as the financial crisis; in Ontario, the volume of sales of alcoholic beverages changed little.

What we're seeing from beer sales in particular is that Canadians have begun to treat mainstream beer as an inferior good. As the average income of Canadians rises, they switch from low-cost beverages to more expensive ones. Recall that when economists describe a product as inferior, they aren't necessarily saying it is of poor quality, they're just saying that consumers buy less of it when their incomes rise.



Alcool NB Liquor discontinued its low cost brand of beer as the economy recovered from recession.

Sources: Statistics Canada, "Volume of Sales of Alcoholic Beverages in Litres of Absolute Alcohol and per Capita 15 Years and over, Fiscal Years Ended March 31, Annual," April 17, 2013, CANSIM Table 183-0019; Cigdem Iltan, "Emptying the Beer Fridge," *MacLeans*, July 7, 2011, <http://www2.macleans.ca/2011/07/07/emptying-the-beer-fridge/>; and http://www.lcbo.com/aboutlcbo/media_centre/quick_facts.shtml.

Your Turn: Test your understanding by doing related problem 1.4 on page 87 at the end of this chapter.

MyEconLab

buy more of one, you buy less of the other. A decrease in the price of a substitute causes the demand curve for a good to shift to the left. An increase in the price of a substitute causes the demand curve for a good to shift to the right.

Suppose that the market demand curve in Figure 3.1 represents the willingness and ability of consumers to buy energy drinks during a week when the average price of coffee is \$2.00. If the average price of coffee falls to \$1.50, how will the market for energy drinks change? Consumers will demand fewer cans of energy drinks at every price. We show this impact by shifting the demand curve for energy drinks to the left.

Complements Goods and services that are used together.

Goods and services that are used together—like hamburgers and buns—are **complements**. When two goods are complements, the more consumers buy of one, the more they will buy of the other. A decrease in the price of a complement causes the demand curve for a good to shift to the right. An increase in the price of a complement causes the demand curve to shift to the left.

Many people drink Red Bull, Monster Energy, or Beaver Buzz Energy when working out. So, for these people, energy drinks and gym memberships are complements. Suppose that the market demand curve in Figure 3.1 represents the willingness of consumers to buy energy drinks when the average price of a gym membership is \$40 per month. If the price of gym memberships drops to \$30 per month, consumers will buy more gym memberships *and* more energy drinks, making the demand curve for energy drinks shift to the right.

Tastes Consumers can be influenced by an advertising campaign for a product. If the firms making Red Bull, Monster Energy, Beaver Buzz Energy, or other energy drinks begin to advertise heavily online, consumers are more likely to buy cans at every price, and the demand curve will shift to the right. An economist would say that the advertising campaign has affected consumers' *taste* for energy drinks. Taste is a catchall category that refers to the many subjective elements that can enter into a consumer's decision to buy a product. A consumer's taste for a product can change for many reasons. Sometimes trends play a substantial role. For example, the popularity of low-carbohydrate diets caused a decline in demand for some goods, such as bread and donuts, and an increase in the demand for meat. In general, when consumers' taste for a product increases, the demand curve will shift to the right, and when consumers' taste for a product decreases, the demand curve for the product will shift to the left.

Demographics The characteristics of a population with respect to age, race, and gender.

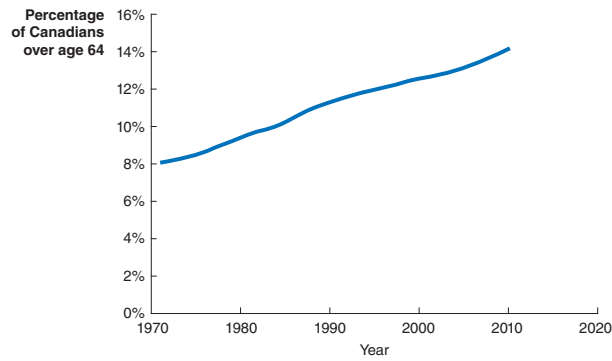
Population and Demographics Population and demographic factors can affect the demand for a product. As the population of Canada increases, so will the number of consumers, and the demand for most products will increase. The **demographics** of a population refers to its characteristics, with respect to age, race, and gender. As the demographics of a country or region change, the demand for particular goods will increase or decrease because different people have different tastes or preferences for those goods. For example, the population of Indo-Canadians (people whose ancestors originate from India) has increased over the last 20 years. Currently there are around 1 million Indo-Canadians, and this number is expected to rise. The increase in the Indo-Canadian population will expand the demand for Indian-made "Bollywood"

Making the Connection

The Aging Baby Boomers

The average age of Canadians is increasing. After World War II ended in 1945, Canada experienced a "baby boom" as birthrates rose and remained high through the early 1960s. Falling birthrates after 1965 mean that the baby boom generation is

larger than the generation before it or those after it. The figure below uses data from Statistics Canada to show how people over the age of 65 have become a significant portion of the population.



Source: Statistics Canada, “Estimates of Population, By Age Group and Sex for July 1, Canada, Provinces and Territories,” September 27, 2012, CANSIM Table 051-0001, <http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=0510001>.

What effects will the aging of the baby boom generation have on the economy? Older people need more medical care than younger adults, which means that there will be greater demand for doctors, nurses, and hospital facilities in the future. In Canada, a growing number of foreign-trained nurses and doctors are being recruited to help meet the growing demand for health care services.

Aging baby boomers will also have an impact on the housing market. Older folks often “downsize” their housing by moving from large, single-family homes with high maintenance costs to smaller homes, condominiums, or apartments. Hence, in coming years, demand for smaller homes may increase, while demand for large homes falls.

Source: Kaleigh Rogers, “Foreign physician Recruits Helping Meet City’s Growing Need for Doctors,” *CBC.ca*, March 21, 2013, <http://www.cbc.ca/hamilton/news/story/2013/03/20/hamilton-foreign-doctors.html>.

Your Turn: Test your understanding by doing related problem 1.5 on page 87 at the end of this chapter.

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films and Indo-Canadian cable television channels, as well as other cultural goods and services.

Expectations Consumers choose not only which products to buy but also when to buy them. For instance, if enough consumers become convinced that houses will be selling for lower prices in three months, the demand for houses will decrease now, as some consumers delay their purchases to wait for prices to fall. Alternatively, if enough consumers become convinced that house prices will rise over the next three months, the demand for houses will rise now as some people try to avoid the expected increase in prices.

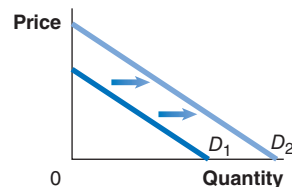
Expected future prices aren’t the only important expectations that affect consumer demand. Consumers also change their purchasing habits when their expected income changes. Most of you are probably consuming more now than your income would suggest. This is because you expect that your income will be higher in the future, meaning that you believe you can afford to consume more now. When the economy slows down and people expect their incomes to be lower in the future, they often put off major purchases or buy different things. How an expected income change affects the demand for a product depends on whether the product is a normal or an inferior good. When incomes are generally falling (e.g., when the economy is doing poorly), people tend to buy more inferior goods, even if their incomes haven’t actually changed.

Table 3.1 summarizes the most important variables that cause market demand curves to shift. Note that the table shows the shift in the demand curve that results from an *increase* in each of the variables. A *decrease* in these variables would cause the demand curve to shift in the opposite direction.

Table 3.1**Variables That Shift Market Demand Curves****An Increase in****Shifts the Demand Curve****Why?**

income (and the good is normal)

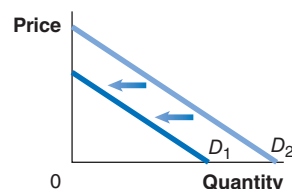
RIGHT



Consumers spend more of their higher incomes on the good.

income (and the good is inferior)

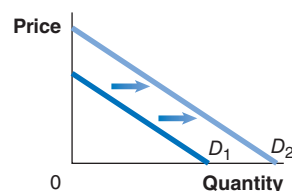
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Consumers spend less of their higher incomes on the good.

the price of a substitute good

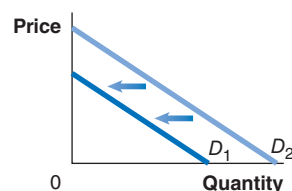
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Consumers buy less of the substitute good and more of this good.

the price of a complementary good

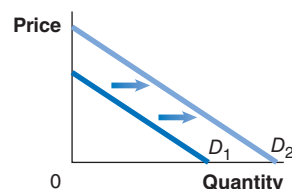
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Consumers buy less of the complementary good and less of this good too.

taste for the good

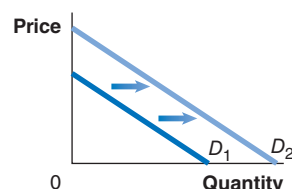
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Consumers are willing to buy a large quantity of the good at every price.

population

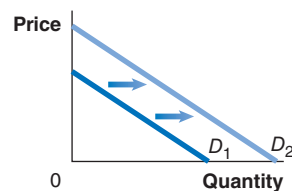
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Additional consumers result in a greater demand at every price.

the expected future price of the good

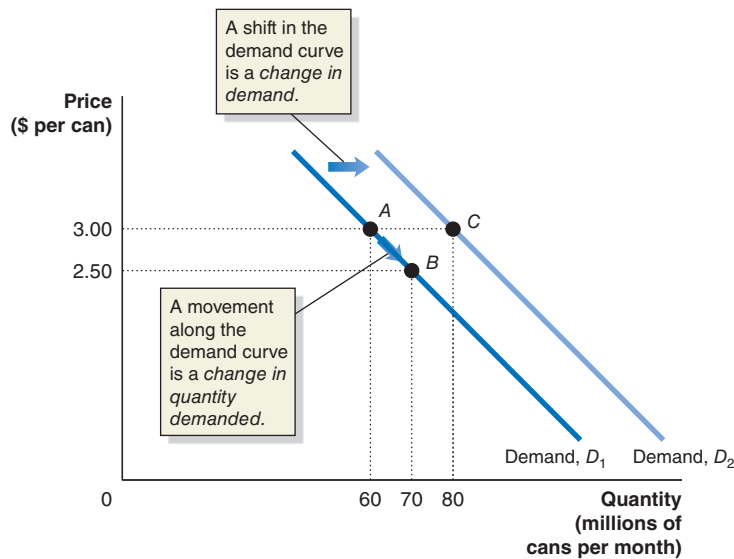
RIGHT



Consumers buy more of the good today to avoid the higher future price.

A Change in Demand versus a Change in Quantity Demanded

It is important to understand the difference between a *change in demand* and a *change in quantity demanded*. A change in demand refers to a shift of the demand curve. A shift occurs if there is a change in one of the variables, *other than the price of the product*, that

**Figure 3.3**

A Change in Demand versus a Change in Quantity Demanded

If the price of energy drinks falls from \$3.00 to \$2.50, the result will be a movement along the demand curve from point A to point B—an increase in quantity demanded from 60 million cans to 70 million cans. If consumers' incomes increase, or if another factor changes that makes consumers want more energy drinks at every price, the demand curve will shift to the right—an increase in demand. In this case, the increase in demand from D_1 to D_2 causes the quantity of energy drinks demanded at a price of \$3.00 to increase from 60 million cans at point A to 80 million cans at point C.

affects the willingness of consumers to buy the product. A change in quantity demanded refers to a movement along the demand curve as a result of a change in the product's price. Figure 3.3 illustrates this important distinction. If the price of energy drinks falls from \$3.00 to \$2.50 per can, the result will be a movement along the demand curve from point A to point B—an increase in quantity demanded from 60 million to 70 million. If consumers' incomes increase, or if another factor changes that makes consumers want more energy drinks *even if the price doesn't change*, the demand curve will shift to the right—an increase in demand. In this case, the increase in demand from curve D_1 to D_2 causes the quantity of energy drinks demanded at a price of \$3.00 to increase from 60 million at point A to 80 million at point C.

The Supply Side of the Market

Just as many variables influence the willingness and ability of consumers to buy a good or service, many variables also influence the willingness and ability of firms to sell a good or service. The most important of these variables is price. The amount of a good or service that a firm is willing and able to supply at a given price is the **quantity supplied**. Holding all other variables constant (recall the Latin phrase *ceteris paribus*), when the price of a good rises, producing (and selling) that good is more profitable, and the quantity supplied will increase. When the price of a good falls, the good is less profitable to produce, and the quantity supplied will decrease. In addition, as we saw in Chapter 2, devoting more and more resources to the production of a specific good results in increasing marginal costs. If, for example, Red Bull, Monster Energy, and DD Beverage Company increase production of their energy drinks during a given time period, they are likely to find that the cost of producing additional cans increases as they run existing factories for longer hours and pay higher prices for ingredients and higher wages for workers. As the marginal costs of making a product rises as output increases, a firm will supply more of that product only if the price is higher.

Supply Schedules and Supply Curves

A **supply schedule** is a table that shows the relationship between the price of a product and the quantity of the product supplied. The table in Figure 3.4 is a supply schedule showing the quantity of energy drinks that firms would be willing to supply per day at different prices. The graph in Figure 3.4 plots the numbers from the supply schedule as a **supply curve**. A **supply curve** shows the relationship between the price of a product

3.2 LEARNING OBJECTIVE

Discuss the variables that influence supply.

Quantity supplied The amount of a good or service that a firm is willing and able to supply at a given price.

Supply schedule A table that shows the relationship between the price of a product and the quantity of the product supplied.

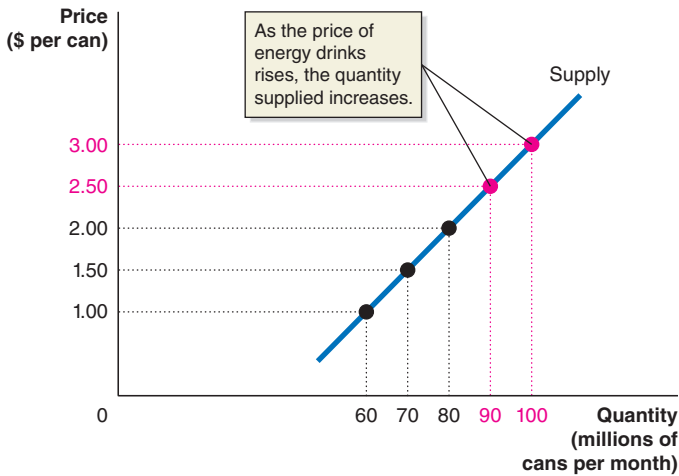
Supply curve A curve that shows the relationship between the price of a product and the quantity of the product supplied.

Figure 3.4

A Supply Schedule and Supply Curve

As the price changes, Red Bull, Monster Energy, DD Beverage Company, and other firms producing energy drinks change the quantity they are willing to supply. We can show this as a *supply schedule* in a table or a *supply curve* on a graph. The supply schedule and supply curve both show that as the price of energy drinks rises, firms will increase the quantity they supply. At a price of \$2.50 per can, firms will supply 90 million cans. At a price of \$3.00 per can, firms will supply 100 million cans.

Supply Schedule	
Price (dollars per can)	Quantity (millions of cans per month)
\$3.00	100
2.50	90
2.00	80
1.50	70
1.00	60



and the quantity of the product supplied. The supply schedule and the supply curve both show that as the price of energy drinks rises, firms will increase the quantity they supply. At a price of \$2.50 per can, firms will supply 90 million cans per month. At the higher price of \$3.00, firms will supply 100 million. (Once again, we are assuming that the relationship is linear—even though most supply curves are not actually straight lines.)

The Law of Supply

The *market supply curve* in Figure 3.4 is upward sloping. We expect most supply curves to be upward sloping based on the **law of supply**, which states that, holding everything else constant, increases in price cause increases in the quantity supplied, and decreases in price result in decreases in the quantity supplied. Notice that the definition of the law of supply—just like the definition of the law of demand—contains the phrase *holding everything else constant*. If only the price of the product changes, there is a movement along the supply curve, which is an *increase or a decrease in the quantity supplied*. As Figure 3.5 shows, if any other variable that affects the willingness of firms to supply a good changes, the supply curve will shift, which is an *increase or a decrease in the quantity supplied*. When firms increase the quantity of a product they would like to sell at a given price, the supply curve shifts to the right. The shift from S_1 to S_3 represents an

Figure 3.5

Shifting the Supply Curve

When firms increase the quantity of a product they want to sell at a given price, the supply curve shifts to the right. The shift from S_1 to S_3 represents an *increase in supply*. When firms decrease the quantity of a product they want to sell at a given price, the supply curve shifts to the left. The shift from S_1 to S_2 represents a *decrease in supply*.



increase in supply. When firms decrease the quantity of a product they would like to sell at a given price, the supply curve shifts to the left. The shift from S_1 to S_2 represents a *decrease in supply*.

Variables That Shift Market Supply

The following are the most important variables that shift the market supply curve:

- Price of inputs
- Technological change
- Prices of substitutes in production
- Number of firms in the market
- Expected future prices

We next discuss how each of these variables affects the market supply curve.

Prices of Inputs The factor most likely to cause the supply curve for a product to shift is a change in the price of an *input*. An input is anything used in the making of a good or service. For instance, if the price of guarana (a stimulant in many energy drinks) rises, the cost of producing energy drinks will increase, and energy drinks will be less profitable at every price. The supply of energy drinks will decline, and the market supply curve for energy drinks will shift to the left. Similarly, if the price of an input falls, the supply of energy drinks will increase, and the market supply curve for energy drinks will shift to the right. Any time something like wages or interest rates (the price of labour and capital) change, the market supply curve will shift.

Technological Change A second factor that causes a change in supply is *technological change*. **Technological change** is a positive or negative change in the ability of a firm to produce a given level of output from a given quantity of inputs. Positive technological change occurs when a firm is able to produce *more* output with the same amount of inputs. This change will happen when the *productivity* of workers or machines increases. If a firm can produce more output with the same amount of inputs, its costs will be lower, and the good will be more profitable to produce at any given price. As a result, when positive technological change occurs, a firm will want to sell more of its product at every given price, making the market supply curve shift to the right. Normally, we expect technological change to have a positive impact on a firm's willingness to supply a product.

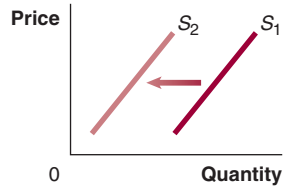
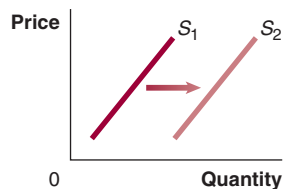
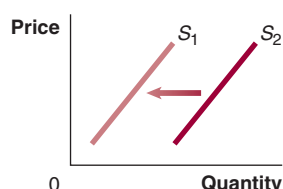
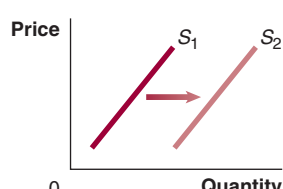
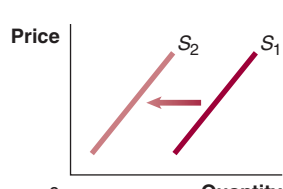
Negative technological change is rare, although it might be caused by a natural disaster or a war that reduces a firm's ability to supply as much output with a given amount of inputs. Negative technological change will raise a firm's costs, and the good will be less profitable to produce. Therefore, negative technological change causes the market supply curve to shift to the left.

Technological change A change in the quantity of output a firm can produce using a given quantity of inputs.

Prices of Substitutes in Production Firms often have to choose which goods they will produce at a particular time. Alternative products that a firm could produce with the same inputs are called *substitutes in production*. A number of companies produce both energy drinks and traditional soft drinks. For instance, the Coca-Cola Company produces Full Throttle in addition to the many varieties of Coke it sells. PepsiCo produces Amp in addition to Pepsi, Mountain Dew, and other drinks. If the price of colas falls, producing Pepsi and Coke will be less profitable, and Coca-Cola, PepsiCo, and other soft drink manufacturers will shift some of their productive capacity out of cola production and into making energy drinks. As a result, each company will offer more energy drinks for sale, even if the price doesn't change, so the market supply curve for energy drinks will shift to the right.

Number of Firms in the Market A change in the number of firms in the market will change supply. When new firms *enter* a market, the supply curve shifts to the right,

Table 3.2
Variables That Shift Market
Supply Curves

An Increase in	Shifts the Supply Curve	Why?
the price of an input	 LEFT	The costs of producing the good rise.
productivity	 RIGHT	The costs of producing the good fall.
the price of a substitute in production	 LEFT	More of the substitute is produced, and less of the good is produced.
the number of firms in the market	 RIGHT	Additional firms result in a greater quantity supplied at every price.
the expected future price of the product	 LEFT	Less of the good will be offered for sale today as firms wait to take advantage of the higher price expected in the future.

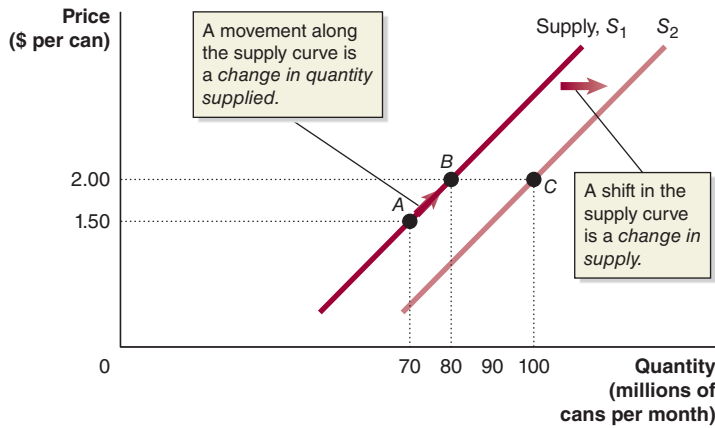
and when existing firms leave, or *exit*, a market, the supply curve shifts to the left. For example, when Beaver Buzz Energy was introduced, the market supply curve for energy drinks shifted to the right.

Expected Future Prices If a firm expects that the price of its product will be higher in the future than it is today, it has an incentive to decrease supply now and increase supply in the future. For example, if Red Bull believes that prices for energy drinks are temporarily low—perhaps due to low incomes of consumers—it may store some of its production today to sell later on, when it expects prices to be higher.

Table 3.2 summarizes the most important variables that cause market supply curves to shift. Note that the table shows the shift in the supply curve that results from an *increase* in each of the variables. A *decrease* in these variables would cause the supply curve to shift in the opposite direction.

A Change in Supply versus a Change in Quantity Supplied

We noted earlier the important difference between a change in demand and a change in quantity demanded. There is a similar difference between a *change in supply* and a *change in quantity supplied*. A change in supply refers to a shift in the supply curve. The supply curve will shift when there is a change in one of the variables, *other than the price*


Figure 3.6

A Change in Supply versus a Change in Quantity Supplied

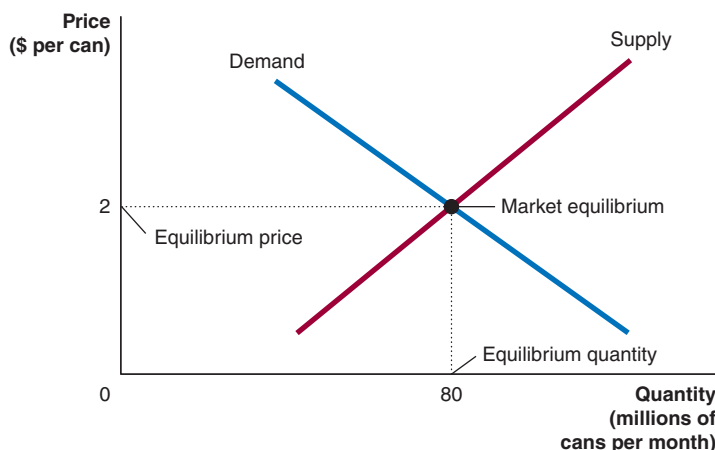
If the price of energy drinks rises from \$1.50 to \$2.00 per can, the result will be a movement up the supply curve from point A to point B—an increase in quantity supplied of Red Bull, Monster Energy, Beaver Buzz Energy, and other energy drinks from 70 million to 80 million cans. If the price of an input decreases or another factor changes that causes sellers to supply more of the product at every price, the supply curve will shift to the right—an increase in supply. In this case, the increase in supply from S_1 to S_2 causes the quantity of energy drinks supplied at a price of \$2.00 to increase from 80 million cans to 100 million cans.

of the product, that affects the willingness of firms to sell the product. A change in quantity supplied refers to a movement along the supply curve as a result of a change in the product's price. Figure 3.6 illustrates this important distinction. If the price of energy drinks rises from \$1.50 to \$2.00 per can, the result will be a movement up the supply curve from point A to point B—an increase in quantity supplied from 70 million cans per month to 80 million cans per month. If the price of an input decreases (or another factor makes sellers supply more of the product at every price), the supply curve will shift to the right—an increase in supply. In this case, the increase in supply from S_1 to S_2 causes the quantity of energy drinks supply to increase from 80 million to 100 million per day even if the price remains at \$2.00 per can (note the move from point B to point C in the figure).

Market Equilibrium: Putting Buyers and Sellers Together

The purpose of markets is to bring buyers and sellers together. As we saw in Chapter 2, instead of being chaotic and disorderly, the interaction of buyers and sellers in markets ultimately results in firms being led to produce the goods and services that consumers want. To understand how this happens, we first need to see how markets work to reconcile the plans of buyers and sellers.

In Figure 3.7, we bring the market demand curve and the market supply curve together. Notice that the demand curve crosses the supply curve at only one point.


Figure 3.7

Market Equilibrium

Where the demand curve crosses the supply curve determines market equilibrium. In this case, the demand curve for energy drinks crosses the supply curve at a price of \$2.00 and a quantity of 80 million cans. Only at this point is the quantity of energy drinks consumers want to buy equal to the quantity of energy drink suppliers are willing to sell: The quantity demanded is equal to the quantity supplied.

3.3 LEARNING OBJECTIVE

Use a graph to illustrate market equilibrium.

Market equilibrium A situation in which quantity demanded equals quantity supplied.

Competitive market equilibrium A market equilibrium with many buyers and many sellers.

Surplus A situation in which the quantity supplied is greater than the quantity demanded.

Shortage A situation in which the quantity demanded is greater than the quantity supplied.

This point represents the price of \$2.00 and a quantity of 80 million cans. Only at this point is the quantity of energy drinks consumers are willing to buy equal to the quantity of energy drinks firms are willing to sell. This is the point of **market equilibrium**. Only at market equilibrium will the quantity demanded equal the quantity supplied. In this case, the *equilibrium price* is \$2.00 and the *equilibrium quantity* is 80 million. As we noted at the beginning of the chapter, markets that have many buyers and many sellers are competitive markets, and equilibrium in these markets is a **competitive market equilibrium**. In the market for energy drinks, there are many buyers but only about 80 firms. Whether 80 firms are enough for our model of demand and supply to apply to this market is a matter of judgment. In this chapter, we are assuming that the market for energy drinks has enough sellers to be treated as competitive.

How Markets Eliminate Surpluses and Shortages: Getting to Equilibrium

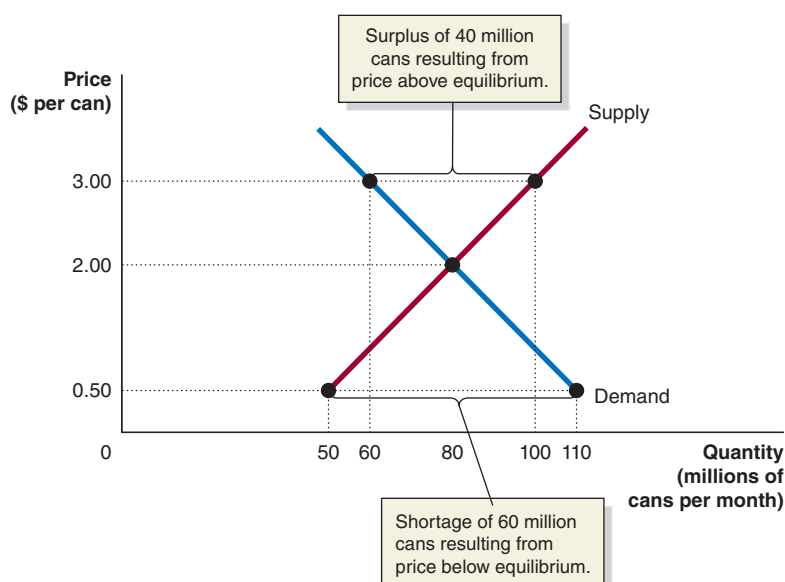
A market that is not in equilibrium moves toward equilibrium. Once a market is in equilibrium, it remains in equilibrium. To see why, consider what happens if the market is not in equilibrium. For instance, suppose that the price in the market for energy drinks is \$3.00, rather than the equilibrium price of \$2.00. As Figure 3.8 shows, at a price of \$3.00 the quantity of energy drinks demanded would be 60 million cans per day, while the quantity supplied would be 100 million cans per day. The quantity supplied is 40 million more than the quantity demanded (100 million–60 million). When the quantity supplied is greater than the quantity demanded, there is a **surplus** in the market. A surplus means that firms will be unable to sell all the goods they would like and the goods they're producing start piling up. Fortunately, firms have a handy method of getting rid of unwanted inventory, they put it on sale. Remember a sale is just a reduction in price. Cutting the price will simultaneously increase the quantity demanded and decrease the quantity supplied. This adjustment will reduce the surplus, but as long as the price remains above the equilibrium of \$2.00, there will be unsold energy drinks and downward pressure on the price. Only when the price has fallen to \$2.00 will firms have a reason to stop reducing the price.

What if the price was below market equilibrium, say \$0.50? If this were the case the quantity demanded would be 110 million and the quantity supplied would be only 50 million, as shown in Figure 3.8. When the quantity demanded is greater than the quantity supplied, there is a **shortage** in the market. In this case, the shortage is 60 million cans (110 million – 50 million). When a shortage occurs, some consumers will be unable to buy energy drinks at the current price. When this happens, firms will realize they can raise the price without losing sales. A higher price means a decrease in the quantity demanded and an increase in the quantity supplied. The increase in price will reduce the size of the shortage, but as long as the price remains below the equilibrium price of \$2.00 there will be a shortage and firms will have an incentive to increase the prices they charge. Only when the price has risen to \$2.00 will the market be in equilibrium.

At a competitive equilibrium, all consumers willing to pay the market price will be able to buy as much of the product as they want, and all firms willing to accept the market price will be able to sell as much as they want. As a result, neither consumers nor suppliers will have a reason to do anything differently. This means that the price of energy drinks will stay at \$2.00, unless the demand curve, the supply curve, or both shift.

Demand and Supply Both Count

Keep in mind that the interaction of demand and supply determines the equilibrium price. Neither consumers nor firms can dictate what the equilibrium price will be. No firm can sell anything, at any price, unless it can find a willing buyer, and no consumer can buy anything, at any price, without finding a willing seller.

**Figure 3.8****The Effect of Surpluses and Shortages on the Market**

When the market price is above equilibrium, there will be a *surplus*. In the figure, a price of \$3.00 per energy drink results in 100 million cans being supplied but only 60 million cans being demanded, or a surplus of 40 million cans. As the firms that produce Red Bull, Monster Energy, Beaver Buzz Energy, and other drinks cut the price to dispose of the surplus, the price will fall to the equilibrium of \$2.00. When the market price is below equilibrium, there will be a *shortage*. A price of \$0.50 results in 110 million cans being supplied, but only 50 million cans being demanded, or a shortage of 60 million cans. As firms find that consumers who are unable to find energy drinks for sale are willing to pay more for them, the price will rise to the equilibrium of \$2.00.

Solved Problem 3.1

Demand and Supply Both Count: A Tale of Two Cards

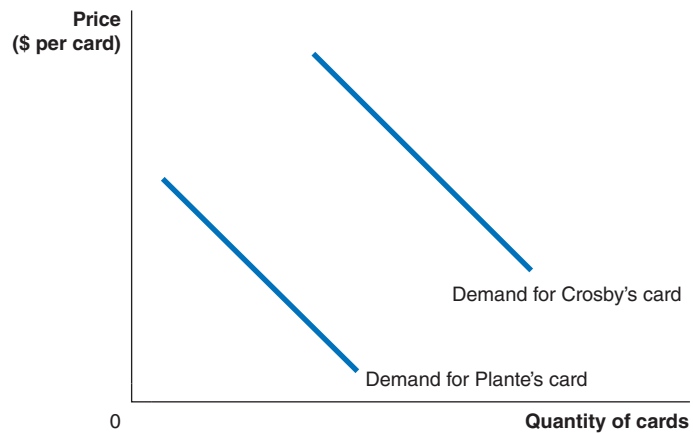
Which hockey card do you think is worth more: Sidney Crosby's rookie card or one of Jacques Plante's distributed free in a box of Quaker Oats? Sidney Crosby is one of the most popular hockey players in recent memory; his jersey sells exceptionally well even though he has missed many games due to concussions and other injuries. Jacques Plante was a goaltender from 1946 to 1975 and played for a number of NHL teams, including the Montreal Canadiens and the Edmonton Oilers. The demand for Sidney Crosby's rookie card is much higher than the demand for Jacques

Plante's cereal-box card. However, at auction, a Sidney Crosby rookie card can be expected to sell for about \$5000, while a Jacques Plante cereal-box card can be expected to fetch about \$12 000. Use a demand and supply graph to explain how it is that a card of a player from 50 years ago that was distributed free in a box of cereal has a higher price than a card of one of the most popular modern players that was sold in a sealed foil pack, even though the demand for Sidney Crosby's card is certain to be greater than the demand for Jacques Plante's card.

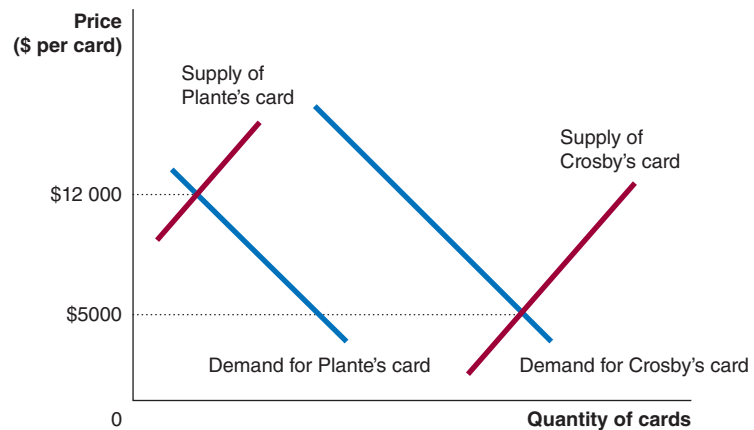
Solving the Problem

Step 1: Review the chapter material. This problem is about prices being determined at market equilibrium, so you may want to review the section "Market Equilibrium: Putting Buyers and Sellers Together."

Step 2: Draw demand curves that illustrate the greater demand for Sidney Crosby's card. Begin by drawing two demand curves. Label one "Demand for Crosby's card" and the other "Demand for Plante's card." Make sure that the Crosby demand curve is much farther to the right than the Plante demand curve. Make sure you label your axes.



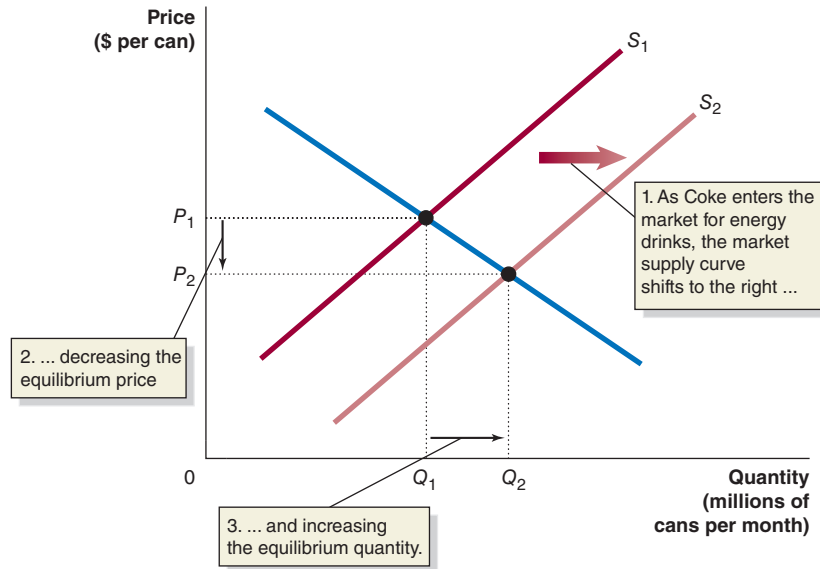
Step 3: Draw supply curves that illustrate the equilibrium price of Plante's card being higher than the equilibrium price of Crosby's card. Based on the demand curves you have just drawn, think about how it might be possible for the market price of Crosby's card to be lower than the market price of Plante's card. The only way this can be true is if the supply of Crosby's card is much greater than the supply of Plante's card. (Plante's card was distributed in a cereal box and were therefore easily damaged). In your graph, draw a supply curve for Crosby's card and a supply curve for Plante's card that will result in an equilibrium price of Plante's card of \$12 000 and an equilibrium price of Crosby's card of \$5000. You have now solved the problem.



Extra credit: The explanation for this puzzle is that both demand and supply count when determining market price. The demand for Crosby's card is much greater than the demand for Plante's card, but the supply of Crosby's card is also much greater. (Note that the supply curves for the cards of Plante and Crosby are upward sloping, even though only a fixed number of each of these types of cards is available and no more can be produced. The supply curves slope upwards because a higher price will induce more cards to be offered for sale by their current owners.) Try and come up with your own examples of goods with very low demand but very high prices and goods with high demand and very low prices.

Source: Nicholas Goss, "15 Most Valuable Hockey Cards of All-Time," *Bleacher Report*, August 19, 2011, <http://bleacherreport.com/articles/812055-nhl-the-15-most-valuable-hockey-cards-of-all-time/page/5#articles/812055-nhl-the-15-most-valuable-hockey-cards-of-all-time>

Your Turn: For more practice, do related problem 3.2 on page 88 at the end of this chapter.


Figure 3.9

The Effect of an Increase in Supply on Equilibrium

If a firm enters a market, as Coca-Cola Company did when it introduced Full Throttle, the equilibrium price will fall, and the equilibrium quantity will rise:

1. As Coke enters the market for energy drinks, a larger quantity of energy drinks will be supplied at every price, so the market supply curve shifts to the right, from S_1 to S_2 , which causes a surplus of energy drinks at the original price, P_1 .
2. The equilibrium price falls from P_1 to P_2 .
3. The equilibrium quantity rises from Q_1 to Q_2 .

The Effect of Demand and Supply Shifts on Equilibrium

We have seen that the interaction of demand and supply in markets determines the quantity of a good that is produced and the price at which it sells. We have also seen that several variables cause demand curves to shift, and other variables cause supply curves to shift. As a result, demand and supply curves in most markets are constantly moving around, and the prices and quantities that represent equilibrium are constantly changing. In this section, we look at how shifts in demand and supply curves affect equilibrium price and quantity.

The Effect of Shifts in Supply on Equilibrium

When Coke started selling the energy drink Full Throttle, the market supply curve for energy drinks shifted to the right. Figure 3.9 shows the supply curve shifting from S_1 to S_2 . When the supply curve shifts to the right, there will be a surplus at the original equilibrium price, P_1 . The surplus is eliminated as the equilibrium price falls to P_2 , and the equilibrium quantity rises from Q_1 to Q_2 . If existing firms exit the market, the supply curve will shift to the left, causing the equilibrium price to rise and the equilibrium quantity to fall.

3.4 LEARNING OBJECTIVE

Use demand and supply graphs to predict changes in prices and quantities.

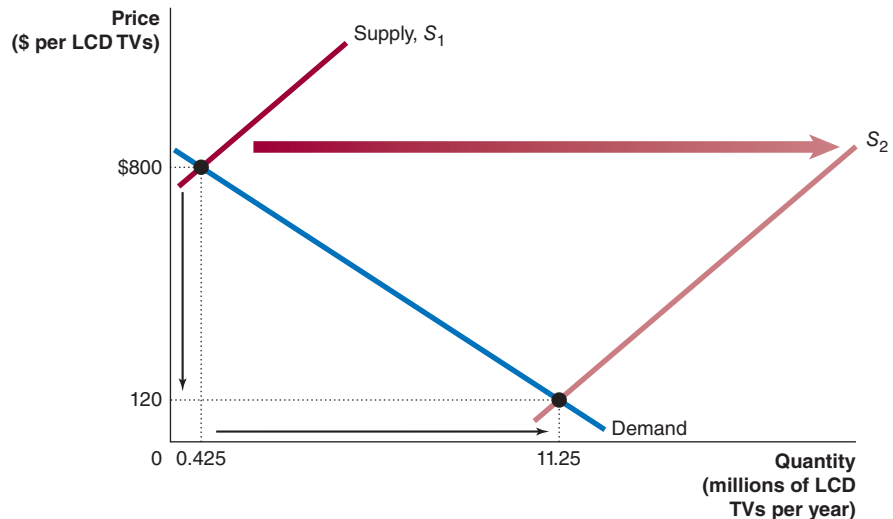
Making the Connection

The Falling Price of LCD TVs

Research on flat-screen televisions using liquid crystal displays (LCDs) began way back in the 1960s. However, it was surprisingly difficult to produce a television with a price low enough for many consumers to purchase. One researcher noted, “In

the 1960s, we used to say ‘In 10 years, we’re going to have the TV on the wall.’ ... We said the same thing in the ‘70s and then in the ‘80s.” A key technical problem in manufacturing LCD TVs was making glass large, thin, and clean enough to be used as LCD screens. Finally in 1999, Corning Inc., developed a manufacturing process that produced glass that was less than 1 millimetre thick and very clean because it didn’t come into contact with machinery.

Corning's breakthrough led to what the *Wall Street Journal* described as a "race to build new, better factories." For years, the leading firms were Korea's Samsung Electronics and LG Phillips LCD, Taiwan's AU Optronics, and Japan's Sharp Corporation. But in recent years, new firms, such as Vizio, and existing firms, such as Matsushita (the makers of Panasonic), have entered the market or expanded their offerings. Matsushita's Japanese factory can produce as many as 15 million LCD screens a year. The figure below shows how the entry of new firms and the expansion of existing firms has driven down the price of LCD TVs.



Sources: Daisuke Wakabayashi and Christopher Lawton, "TV Makers Confront a Stakeout," *Wall Street Journal*, January 20, 2009; David Richards, "Sony and Panasonic Flat Screen Kings," *Smarthouse.com*, February 13, 2007; and Evan Ramstad, Big Display: Once a Footnote, Flat Screens Grow into Huge Industry," *Wall Street Journal*, August 30, 2004.

MyEconLab

Your Turn: Test your understanding by doing related problem 4.7 on page 89 at the end of this chapter.

The Effect of Shifts in Demand on Equilibrium

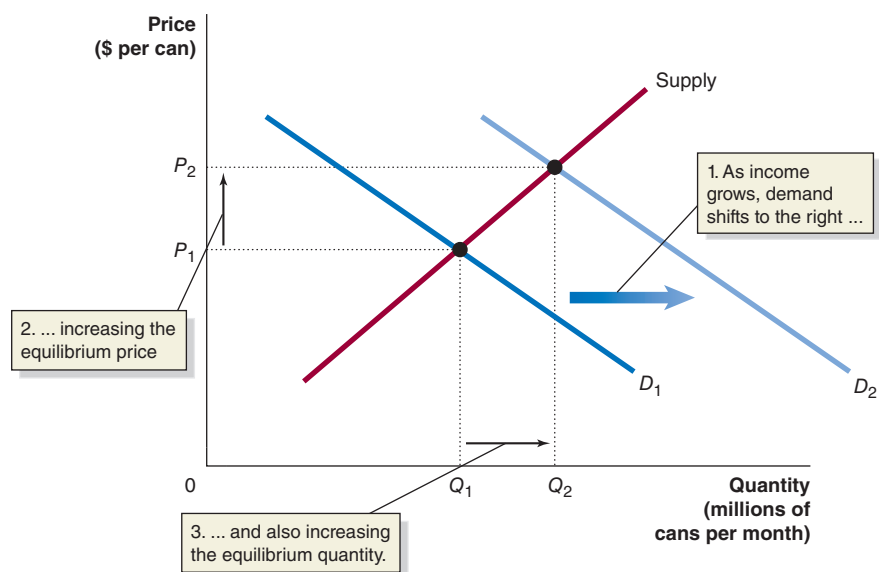
Because energy drinks are generally a normal good, when incomes increase, the market demand for energy drinks shifts to the right. Figure 3.10 shows the effect of a demand curve shifting to the right, from D_1 to D_2 . This shift causes a shortage at the original

Figure 3.10

The Effect of an Increase in Demand on Equilibrium

Increases in income will cause equilibrium price and quantity to rise:

1. Because energy drinks are a normal good, as income grows, the quantity demanded increases at every price, and the market demand curve shifts to the right, from D_1 to D_2 , which causes a shortage of energy drinks at the original price, P_1 .
2. The equilibrium price rises from P_1 to P_2 .
3. The equilibrium quantity rises from Q_1 to Q_2 .



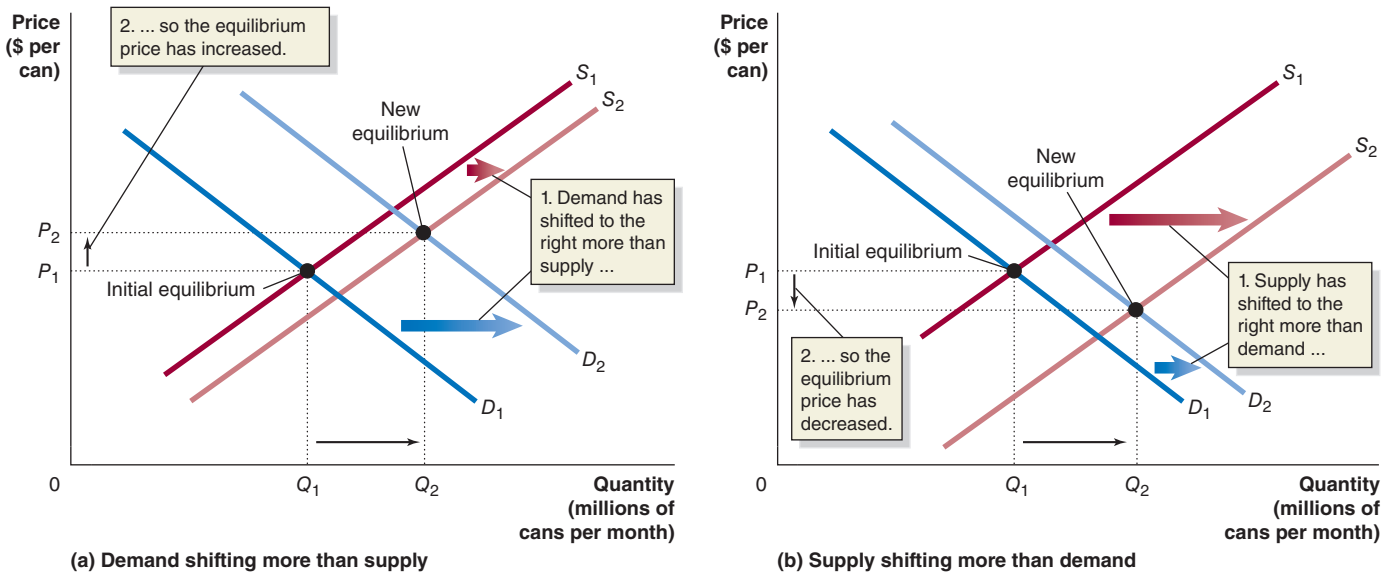


Figure 3.11 Shifts in Demand and Supply

Whether the price of a product rises or falls over time depends on whether demand shifts to the right more than supply. In panel (a), demand shifts to the right more than supply, and the equilibrium price rises:

1. Demand shifts to the right more than supply.
2. The equilibrium price rises from P_1 to P_2 .

In panel (b), supply shifts to the right more than demand, and the equilibrium price falls:

1. Supply shifts to the right more than demand.
2. The equilibrium price falls from P_1 to P_2 .

equilibrium price, P_1 . To eliminate this new shortage, equilibrium price rises to P_2 , and the equilibrium quantity rises from Q_1 to Q_2 . In contrast, if the price of a substitute good, such as coffee, were to fall, the demand for energy drinks would decrease, shifting the demand curve for energy drinks to the left. When the demand curve shifts to the left, the equilibrium price and quantity both decrease.

The Effect of Shifts in Demand and Supply over Time

Whenever only demand or only supply shifts, we can easily predict the effect on equilibrium price and quantity. Things are more complicated when *both* supply and demand shift at the same time. For instance, in many markets, the demand curve shifts to the right over time as populations and incomes grow. The supply often shifts to the right over time too, as new firms enter the market or technology improves. Whether the equilibrium price rises or falls over time depends on which shift is bigger. If the shift in the demand curve is bigger than the shift in the supply curve, the price will rise. If the shift in the supply curve is bigger than the shift in the demand curve, the price will fall. Panel (a) of Figure 3.11 shows that when demand shifts to the right more than supply, the equilibrium price rises. But as panel (b) shows, when supply shifts to the right more than demand, the equilibrium price falls.

Table 3.3 summarizes all possible combinations of shifts in demand and supply over time and the effects of the shifts on equilibrium price (P) and quantity (Q). For example, the entry in red in the table shows that if the demand curve shifts to the right and the supply curve also shifts to the right, the equilibrium quantity will increase, while the equilibrium price may increase, decrease, or remain unchanged. To be sure you understand each entry in the table, draw demand and supply graphs to check whether you can reproduce the predicted changes in equilibrium price and quantity. If the entry in the table says the predicted change in equilibrium price or quantity can be either an increase or a decrease, draw two graphs similar to panels (a) and (b) of Figure 3.11—one showing the equilibrium price or quantity increasing and the other showing it decreasing. Note also that in the ambiguous cases where either price or quantity might increase or decrease, it is also possible that price or quantity might remain unchanged. Be sure you understand why.

Table 3.3

How Shifts in Demand and Supply Affect Equilibrium Price (P) and Quantity (Q)

	Supply Curve Unchanged	Supply Curve Shifts Right	Supply Curve Shifts to the Left
Demand curve unchanged	Q unchanged P unchanged	Q increases P decreases	Q decreases P increases
Demand curve shifts right	Q increases P increases	Q increases P increases or decreases	Q increases or decreases P increases
Demand curve shifts left	Q decreases P decreases	Q increases or decreases P decreases	Q decreases P increases or decreases

Solved Problem 3.2

High Demand and Low Prices in the Lobster Market

For many communities in the Maritimes, the lobster fishery is an essential part of the local economy. Lobster is fished only in season, and different communities are allowed to fish at different times of the year. For example, the fishing season for the area of Yarmouth, Nova Scotia, is from late November to the end of May. It isn't uncommon for the price of lobster to fluctuate during the season. In some cases, it can change from below \$5 per pound to \$8 or \$9

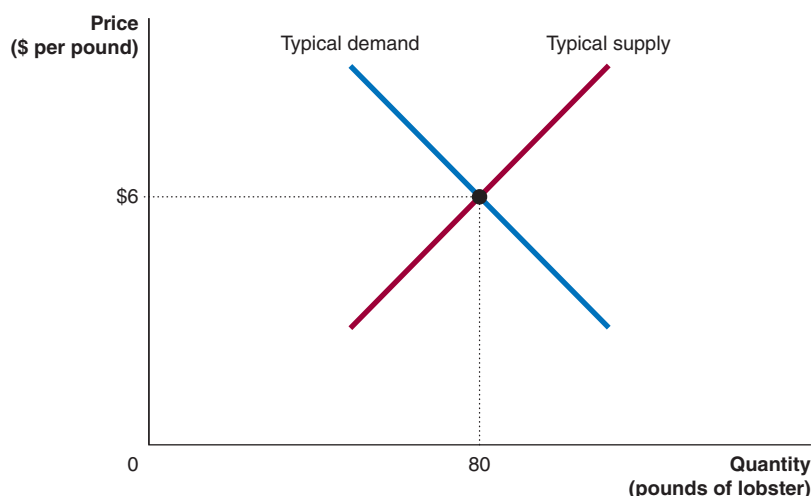
per pound. A patch of really bad weather can drive up the price quickly, but so does Christmas (lobster tends to be a popular part of winter festivities in Canada, Europe, and other parts of the world).

What would happen if the weather just before Christmas was particularly good, allowing fishers to spend more time on the water and catch more lobster?

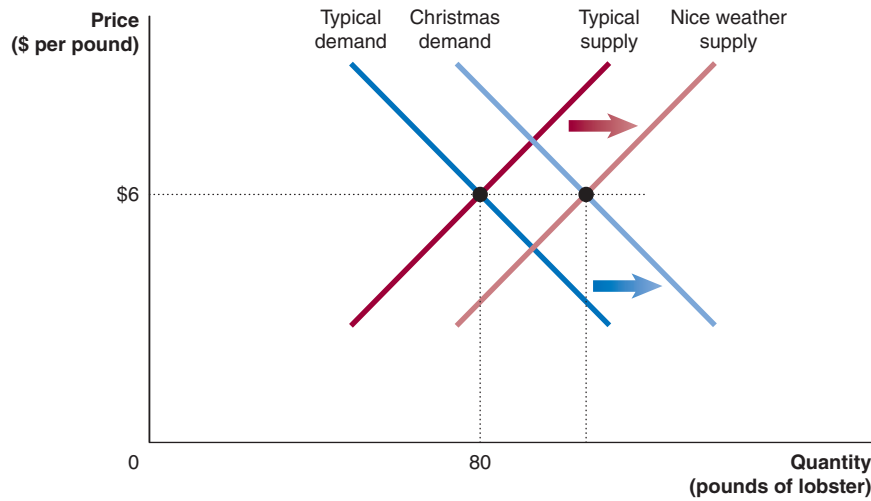
Solving the Problem

Step 1: Review the chapter material. This problem is about how shifts in demand and supply curves affect the equilibrium price, so you may want to review the section “The Effect of Shifts in Demand and Supply over Time.”

Step 2: Draw the demand and supply graph. Draw a demand and supply graph, showing the market equilibrium before the Christmas rush and with normal weather. Label the equilibrium price \$6.00. Label both the demand and supply curves “Typical.”



Step 3: Add a demand and supply curve Add a demand curve to account for the increase in the demand for lobster from Europe. Add a supply curve to account for the nicer-than-usual weather.



Step 4: Explain the graph. After studying the graph, you should see how the two events of increased demand from Europe and the nicer-than-usual weather combine to move the equilibrium price. The increase in supply due to the nicer-than-usual weather is offset by some of the increase in demand from Europeans. We can't say for sure which way the price will go. The price of lobster will rise if the shift in demand is greater than the shift in supply. If the shift in supply is greater than the shift in demand, prices will actually fall. All that we can say for certain is that the quantity of lobster sold (and eaten) will go up.

Source: Province of Nova Scotia, "Lobster Fishing Seasons in Atlantic Canada," *Nova Scotia Fisheries and Aquaculture*, May 17, 2012, <http://www.gov.ns.ca/fish/marine/map/lobarea.shtml>.

Your Turn: For more practice, do related problems 4.3 and 4.4 on page 88 at the end of this chapter.

Don't Let This Happen to You

Remember: A Change in a Good's Price Does *Not* Cause the Demand or Supply Curve to Shift

Suppose a student is asked to draw a demand and supply graph to illustrate how an increase in the price of oranges would affect the market for apples, other variables being constant. He draws the graph on the left below and explains it as follows: "Because apples and oranges are substitutes, an increase in the price of oranges will cause an initial shift to the right in the demand curve for apples, from D_1 to D_2 . However, because this initial shift in the demand curve for

apples results in a higher price for apples, P_2 , consumers will find apples less desirable, and the demand curve will shift to the left, from D_2 to D_3 , resulting in a final equilibrium price of P_3 ." Do you agree or disagree with the student's analysis?

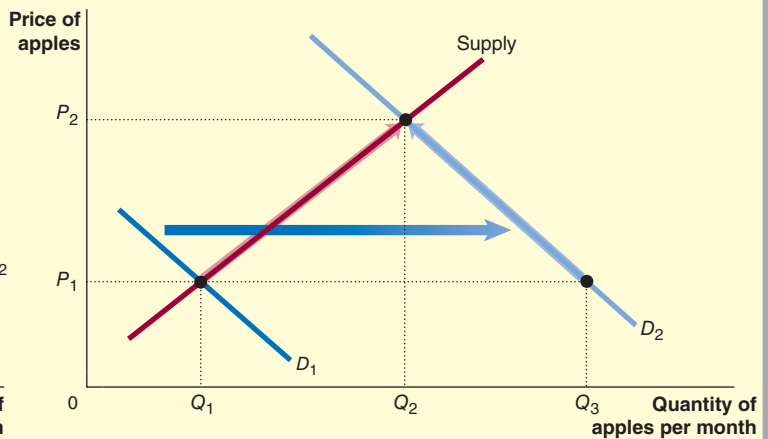
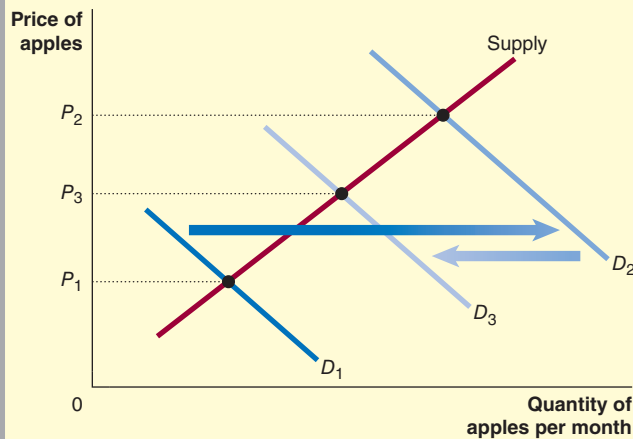
You should disagree. The student has correctly understood that an increase in the price of oranges will cause the demand curve for apples to shift to the right. But the second demand curve shift the student describes, from D_2 to D_3 , will not take place. Changes in the price of a product do not result in shifts in the product's demand curve. Changes in the price of a product result only in movements along a demand curve.

The graph on the right below shows the correct analysis. The increase in the price of oranges causes the demand curve for apples to increase from D_1 to D_2 . At the original price, P_1 , the increase in demand initially results in a shortage of apples equal to $Q_3 - Q_1$. But, as we have seen, a shortage causes the price to increase until the shortage is eliminated. In this case, the price will rise to P_2 , where the quantity demanded and the quantity supplied are

both equal to Q_2 . Notice that the increase in price causes a decrease in the *quantity demanded*, from Q_3 to Q_2 , but does not cause a decrease in demand.

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Your Turn: Test your understanding by doing related problems 4.6 and 4.7 on page 89 at the end of this chapter.



Shifts in a Curve versus Movements along a Curve

When analyzing markets using demand and supply curves, it is important to remember that *when a shift in a demand or supply curve causes a change in equilibrium price, the change in price does not cause a further shift in demand or supply*. For instance, suppose an increase in supply causes the price of a good to fall, while everything else that affects the willingness of consumers to buy the good is constant. The result will be an increase in the quantity demanded, but not an increase in demand. For demand to increase, the whole curve must shift. The point is the same for supply: If the price of the good falls but everything else that affects the willingness of sellers to supply the good is constant, the quantity supplied decreases, but the supply does not. For supply to decrease, the whole curve must shift.

Economics in Your Life

Red Bull or Beaver Buzz Energy: What's Your Beverage?

At the beginning of the chapter, we asked you to consider two questions: Would you choose to buy a can of Beaver Buzz Energy if it had a lower price than a can of Red Bull? Would you be less likely to drink Beaver Buzz Energy if your income dropped? To determine the answer to the first question, you have to recognize that Beaver Buzz Energy and Red Bull are substitutes. If you consider the two drinks to be very close substitutes, then you are likely to buy the one with the lower price. In the market, if consumers generally believe that Beaver Buzz Energy and Red Bull are close substitutes, a fall in the price of Beaver Buzz Energy will increase the quantity of Beaver Buzz Energy demanded and decrease the demand for Red Bull. Suppose that you are currently leaning toward buying Red Bull because you believe that it is better tasting than Beaver Buzz Energy. If a decrease in your income made you more likely to buy Beaver Buzz Energy, then you consider Beaver Buzz Energy as an inferior good.

Conclusion

The interaction of demand and supply determines market equilibrium. The model of demand and supply is a powerful tool for predicting how changes in the actions of consumers and firms will cause changes in equilibrium prices and quantities. As we have seen in this chapter, we can use the model to analyze markets that do not meet all of the requirements for being perfectly competitive. As long as there is intense competition among sellers, the model of demand and supply can often successfully predict changes in prices and quantities.

Before moving on to Chapter 4, read *An Inside Look* on the next page for a discussion of PepsiCo's Kickstart, a high-energy breakfast drink that the company hopes will help it capture part of the market for energy drinks.

PepsiCo Tries to Create a New Category of Drinks That Promises Energy and Health Benefits

ABC NEWS

Mountain Dew for Breakfast? Soda Giant's New Morning Beverage Is Packed with Caffeine and Vitamins (Just Don't Call It an Energy Drink)

If you don't like coffee or tea, Mountain Dew has a new breakfast drink that might perk you up.

a PepsiCo Inc. is rolling out a new drink called Kickstart this month that has Mountain Dew flavour but is made with 5% juice and Vitamins B and C, along with an extra jolt of caffeine.

The company, based in Purchase, N.Y., is hoping to boost sales by reaching Mountain Dew fans at a new time of day: morning.

PepsiCo said it doesn't consider Kickstart to be an energy drink, noting that it still has far less caffeine than drinks such as Monster and Red Bull and none of the mysterious ingredients that have raised concerns among lawmakers and consumer advocates.

But Kickstart, which comes in flavours such as "energizing orange citrus" and "energizing fruit punch," could nevertheless give the company a side-door into the fast-growing energy drink market without getting tangled in any of its controversies.

It also comes in the same 16-ounce cans as popular energy drinks made by

Monster Beverage Corp., which also offers options with juice content.

Simon Lowden, chief marketing officer for PepsiCo's Americas beverages, says the idea for Kickstart came about after the company learned through consumer research that Mountain Dew fans were looking for an alternative to traditional morning drinks such as coffee, tea and juice.

Kickstart was developed independently from a Taco Bell breakfast drink last year

"They didn't really see anything that fit their needs," he said.

Lowden said Kickstart was developed independently from a Taco Bell breakfast drink introduced last year that combines Mountain Dew and orange juice.

b With the growth of energy drinks such as Monster and Red Bull expected to slow, Kickstart could also signal the emergence of a new category that plays off the promise of energy and other health benefits, said John Sicher, publisher of the trade journal *Beverage Digest*.

In a nod to the growing concerns about sugary drinks, for example, Kickstart also uses artificial sweeteners to reduce its caloric content to about half that of regular soda; a can has 80 calories.

"It's a very interesting experiment capturing a number of attributes," Sicher said, likening it to Starbucks' Refreshers drinks, which promise "natural energy" from green coffee extract.

PepsiCo and the Coca-Cola Co. have largely watched the growth of energy drinks from the sidelines

The promise of "energy" has been a big seller in the beverage industry in recent years, with the energy drink market increasing 17% in 2011 even as broader soft drink consumption has continued to decline, according to *Beverage Digest*. PepsiCo and the Coca-Cola Co. have largely watched that growth from the sidelines, however, with players such as Monster Beverage and Red Bull dominating the market.

c "But the surging popularity of energy drinks has also led to sharper scrutiny. This summer, New York's attorney general launched an investigation into the marketing prices of energy drink makers including Monster and PepsiCo, which also makes Amp. Lawmakers and consumer advocacy groups have also called on the Food and Drug Administration to investigate the safety of the high levels of caffeine in energy drinks for younger people.

Although Kickstart may look like an energy drink, it has far less caffeine, at 92 milligrams for a 16-ounce can. A comparable amount of regular Mountain Dew would have 72 milligrams of caffeine while a can of PepsiCo's Amp energy drink has 142 milligrams, according to the Center for Science in the Public Interest.

By comparison, a 16-ounce cup of Starbucks coffee has 330 milligrams of caffeine.

Source: Associated Press, "Mountain Dew for Breakfast? Soda Giant's New Morning Beverage Is Packed with Caffeine and Vitamins (Just Don't Call It an Energy Drink)," *Mail Online*, February 11, 2013, <http://www.dailymail.co.uk/femail/article-2277065/Mountain-Dew-breakfast-Soda-giants-new-morning-beverage-packed-caffeine-vitamins-just-dont-energy-drink.html>.

Key Points in the Article

PepsiCo has introduced a new product intended to fill the space between traditional coffee/tea and the more caffeinated energy drinks. Soft drink giants Coca Cola and PepsiCo hadn't entered the caffeinated drink market with the same intensity they have other drinks markets, but PepsiCo is now focusing on increasing its sales in this market. Kickstart is based on a mix of orange juice and Mountain Dew, which was developed by Taco Bell (that's owned by Yum! Brands Inc., which was part of PepsiCo).

Analyzing the News

a In addition to the growth in the demand for energy drinks, demand for healthier drinks has expanded as well. PepsiCo is hoping to capture parts of both markets by

offering a product that fits into both categories. The new product also addresses some of the concerns about the large amount of caffeine in energy drinks by offering much less in Kickstart.

b The energy drink market has been dominated by Red Bull and Monster Energy, two firms that are not part of either major soft drink maker (Coca Cola and PepsiCo). Kickstart also offers less sugar than many other soft drinks by using artificial sweeteners, thereby reducing the calories in the new product. By trying to meet the concerns of different consumers, PepsiCo is entering not only the energy drink market, but also the market for vitamin-fortified drinks at the same time.

c As energy drinks have become more popular, many people have become concerned about the impact of large doses

of caffeine on health, particularly in younger consumers. Kickstart has much less caffeine than an energy drink or even a medium-sized coffee at some of the most popular coffee shops in Canada.

Thinking Critically

1. How would you show the impact of the launch of Kickstart on the market for energy drinks in a graph?
2. If health researchers find strong evidence that high-caffeine beverages damage the health of younger consumers, what would be the impact on the market for energy drinks?

Chapter Summary and Problems

Key Terms

<i>Ceteris paribus</i> (“all else equal”) condition, p. 64	Demographics, p. 66	Normal good, p. 65	Substitution effect, p. 63
Competitive market equilibrium, p. 74	Income effect, p. 63	Perfectly competitive market, p. 62	Supply curve, p. 69
Complements, p. 66	Inferior good, p. 65	Quantity demanded, p. 62	Supply schedule, p. 69
Demand curve, p. 62	Law of demand, p. 63	Quantity supplied, p. 69	Surplus, p. 74
Demand schedule, p. 62	Law of supply, p. 70	Shortage, p. 74	Technological change, p. 71
	Market demand, p. 62	Substitutes, p. 65	
	Market equilibrium, p. 74		

Summary

***LO 3.1** The model of demand and supply is the most powerful tool in economics. The model applies exactly only to *perfectly competitive markets*, where there are many buyers and sellers, all the products sold are identical, and there are no barriers to new sellers entering the market. But the model can also be useful in analyzing markets that don’t meet all these requirements. The *quantity demanded* is the amount of a good or service that a consumer is willing and able to purchase at a given price. A *demand schedule* is a table that shows the relationship between the price of a product and the quantity of the product demanded. A *demand curve* is a graph that shows the relationship between the price of a good and the quantity of the good demanded. *Market demand* is the demand by all consumers of a given good or service. The *law of demand* states that *ceteris paribus*—holding everything else constant—the quantity of a product demanded increases when the price falls and decreases when the price rises. Demand curves slope downward because of the *substitution effect*, which is the change in quantity demanded that results from a price change that makes one good more or less expensive relative to another good, and the *income effect*, which is the change in quantity demanded of a good that results from the effect of a change in the good’s price on consumer purchasing power. Changes in income, the prices of related goods, tastes, population and demographics, and expectations all cause the demand curve to shift. *Substitutes* are goods that can be used for the same purpose. *Complements* are goods that are used together. A *normal good* is a good for which demand increases as income increases. An *inferior good* is a good for which demand decreases as income increases. *Demographics* refers to the characteristics of a population with respect to age, race, and gender. A change in demand refers to a shift of the demand curve. A change in quantity demanded refers to a movement along the demand curve as a result of a change in the product’s price.

LO 3.2 The *quantity supplied* is the amount of a good that a firm is willing and able to supply at a given price. A *supply*

schedule is a table that shows the relationship between the price of a product and the quantity of the product supplied. A *supply curve* shows on a graph the relationship between the price of a product and the quantity of the product supplied. When the price of a product rises, producing the product is more profitable, and a greater amount will be supplied. The *law of supply* states that, holding everything else constant, the quantity of a product supplied increases when the price rises and decreases when the price falls. Changes in the prices of inputs, technology, the prices of substitutes in production, expected future prices, and the number of firms in a market all cause the supply curve to shift. *Technological change* is a positive or negative change in the ability of a firm to produce a given level of output with a given quantity of inputs. A change in supply refers to a shift of the supply curve. A change in quantity supplied refers to a movement along the supply curve as a result of a change in the product’s price.

LO 3.3 *Market equilibrium* occurs where the demand curve intersects the supply curve. A *competitive market equilibrium* has a market equilibrium with many buyers and many sellers. Only at this point is the quantity demanded equal to the quantity supplied. Prices above equilibrium result in *surpluses*, with the quantity supplied being greater than the quantity demanded. Surpluses cause the market price to fall. Prices below equilibrium result in *shortages*, with the quantity demanded being greater than the quantity supplied. Shortages cause the market price to rise.

LO 3.4 In most markets, demand and supply curves shift frequently, causing changes in equilibrium prices and quantities. Over time, if demand increases more than supply, equilibrium price will rise. If supply increases more than demand, equilibrium price will fall.

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Review Questions

LO 3.1

- 1.1 What is a demand schedule? What is a demand curve?
- 1.2 What is the difference between a change in demand and a change in the quantity demanded?
- 1.3 What are the main variables that will cause the demand curve to shift? Give an example of each.

LO 3.2

- 2.1 What is a supply schedule? What is a supply curve?
- 2.2 What is the difference between a change in supply and a change in the quantity supplied?
- 2.3 What is the law of supply? What are the main variables that will cause a supply curve to shift? Give an example of each.

LO 3.3

- 3.1 What do economists mean by *market equilibrium*?
- 3.2 What do economists mean by a *shortage*? By a *surplus*?

- 3.3 What happens in a market if the current price is above the equilibrium price? What happens if the current price is below the equilibrium price?

LO 3.4

- 4.1 Draw a demand and supply graph to show the effect on the equilibrium price in a market in the following two situations:
 - a. The demand curve shifts to the right.
 - b. The supply curve shifts to the left.
- 4.2 If, over time, the demand curve for a product shifts to the right more than the supply curve does, what will happen to the equilibrium price? What will happen to the equilibrium price if the supply curve shifts to the right more than the demand curve? For each case, draw a demand and supply graph to illustrate your answer.

Problems and Applications

LO 3.1

- 1.1 For each of the following pairs of products, state which are complements, which are substitutes, and which are unrelated.
 - a. Gasoline and electric car batteries
 - b. Houses and household appliances
 - c. UGG boots and Kindle e-readers
 - d. iPads and Kindle e-readers
- 1.2 [Related to the Chapter Opener on page 61] Many people are concerned about the health effects of consuming large quantities of energy drinks. In fact, Health Canada began a review of its regulation of the energy drink industry in 2012. One proposal, not made by Health Canada but by others, is that energy drinks only be sold in pharmacies or liquor stores. What impact do you think this proposal would have on the market for energy drinks? What do you think will happen to the price of these products?
- 1.3 Imagine that the table below shows the quantity demanded of UGG boots at five different prices in 2012 and in 2013:

Price	Quantity Demanded	
	2012	2013
\$160	5000	4000
170	4500	3500
180	4000	3000
190	3500	2500
200	3000	2000

Name two different variables that could cause the quantity demanded of UGG boots to change as indicated from 2012 to 2013.

- 1.4 [Related to Making the Connection on page 65] A student makes the following argument:

The chapter says that Canadian consumers, as a group, have begun to treat mainstream beer as an inferior good and wine as a normal good. But I like the taste of mainstream beer better than I like the taste of wine, so for me wine is an inferior good and beer is a normal good.

Do you agree with the student's reasoning? Briefly explain.

- 1.5 [Related to the Making the Connection on page 67] Name three products whose demand is likely to increase rapidly if the following demographic groups increase at a faster rate than the population as a whole:
 - a. Teenagers
 - b. Children under age five
 - c. Recent immigrants
- 1.6 Suppose the following table shows the price of a base model Toyota Prius hybrid and the quantity of Priuses sold for three years. Do these data indicate that the demand curve for Priuses is upward sloping? Explain.

Year	Price	Quantity
2010	\$24 880	35 265
2011	24 550	33 250
2012	25 250	36 466

- 1.7 Richard Posner is a US federal court judge who also writes on economic topics. A newspaper reporter summarized Posner's view on the effect of online bookstores and e-books on the demand for books:

Posner's [argument] is that the disappearance of bookstores is to be celebrated and not mourned, partly because e-books and online stores will reduce the cost of books and thus drive up demand for them.

Do you agree with Posner's statements as given by the reporter? Briefly explain.

From Christopher Shea, "Judge Posner Hails the Demise of Bookstores," *Wall Street Journal*, January 13, 2011.

LO 3.2

- 2.1 Briefly explain whether each of the following statements describes a change in supply or a change in the quantity supplied:
- To take advantage of high prices for snow shovels during a snowy winter, Alexander Shovels, Inc., decides to increase output.
 - The success of the Apple iPad leads more firms to begin producing tablet computers.
 - In the six months following the Japanese earthquake and tsunami in 2011, production of automobiles in Japan declined by 20 percent.
- 2.2 Suppose that the following table shows the quantity supplied of UGG boots at five different prices in 2012 and in 2013:

Price	Quantity Supplied	
	2012	2013
\$160	300 000	200 000
170	350 000	250 000
180	400 000	300 000
190	450 000	350 000
200	500 000	400 000

Name two different variables that would cause the quantity supplied of UGG boots to change as indicated in the table from 2012 to 2013.

- 2.3 Will each firm in the tablet computer industry always supply the same quantity as every other firm at each price? What factors might cause the quantity of tablet computers supplied by different firms to be different at a particular price?
- 2.4 If the price of a good increases, is the increase in the quantity of the good supplied likely to be smaller or larger, the longer the time period being considered? Briefly explain.

LO 3.3

- 3.1 Briefly explain whether you agree with the following statement: “When there is a shortage of a good, consumers eventually give up trying to buy it, so the demand for the good declines, and the price falls until the market is finally in equilibrium.”
- 3.2 [Related to Solved Problem 3.1 on page 75] In *The Wealth of Nations*, Adam Smith discussed what has come to be known as the “diamond and water paradox”:

Nothing is more useful than water: but it will purchase scarce anything; scarce anything can be had in exchange for it. A diamond, on the contrary, has scarce any value in use; but a very great quantity of other goods may frequently be had in exchange for it.

Graph the market for diamonds and the market for water. Show how it is possible for the price of water to be much lower than the price of diamonds, even though the demand for water is much greater than the demand for diamonds.

From Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Vol. I, (Oxford, UK: Oxford University Press, 1976 original edition, 1776).

- 3.3 If a market is in equilibrium, is it necessarily true that all buyers and all sellers are satisfied with the market price? Briefly explain.

LO 3.4

- 4.1 As oil prices rose during 2006, the demand for alternative fuels increased. Ethanol, one alternative fuel, is made from corn. According to an article in the *Wall Street Journal*, the price of tortillas, which are made from corn, also rose during 2006: “The price spike [in tortillas] is part of a ripple effect from the ethanol boom.”
- Draw a demand and supply graph for the corn market and use it to show the effect on this market of an increase in the demand for ethanol. Be sure to indicate the equilibrium price and quantity before and after the increase in the demand for ethanol.
 - Draw a demand and supply graph for the tortilla market and use it to show the effect on this market of an increase in the price of corn. Once again, be sure to indicate the equilibrium price and quantity before and after the increase in the demand for ethanol.
 - During 2009, the demand for gasoline had fallen, lowering its price. The demand for ethanol had declined as well. In response, ethanol producers asked regulators to raise the allowable amount of ethanol in gasoline blends from 10 percent to 15 percent. If regulators were to agree to this proposal, what would be the likely effect on tortilla prices?

Based on Stephen Power, “Industry Seeks to Raise Ethanol Levels in Fuel,” *Wall Street Journal*, March 7, 2009; and Mark Gongloff, “Tortilla Soup,” *Wall Street Journal*, January 25, 2007.

- 4.2 [Related to Making the Connection on page 77] During 2013, the demand for LCD TVs appeared to be falling. At the same time, some industry observers expected that several smaller TV manufacturers might exit the market. Use a demand and supply graph to analyze the effects of these factors on the equilibrium price and quantity of LCD TVs. Clearly show on your graph the old equilibrium price and quantity and the new equilibrium price and quantity. Can you tell for certain whether the new equilibrium price will be higher or lower than the old equilibrium price? Briefly explain.
- 4.3 [Related to Solved Problem 3.2 on page 80] The demand for watermelons is highest during summer and lowest during winter. Yet watermelon prices are normally lower in summer than in winter. Use a demand and supply graph to demonstrate how this is possible. Be sure to carefully label the curves in your graph and to clearly indicate the equilibrium summer price and the equilibrium winter price.
- 4.4 [Related to Solved Problem 3.2 on page 80] Tourism is an important part of the economies of the Maritime provinces. The tourist season is generally the summer months; with June, July, and August being the most popular months. Shediac, New Brunswick, and Prince Edward Island as a whole are particularly popular with tourists. The lobster fishing season in Shediac doesn’t begin until mid-August and ends in mid-October. Use a demand and supply graph to explain whether lobster prices would be higher or lower if the lobster fishing season were to begin in June and end in August.
- 4.5 An article in the *Wall Street Journal* noted that the demand for Internet advertising was declining at the same time that the number of websites accepting advertising was increasing. After reading the article, a student argues: “From this information, we know that the price of Internet ads should

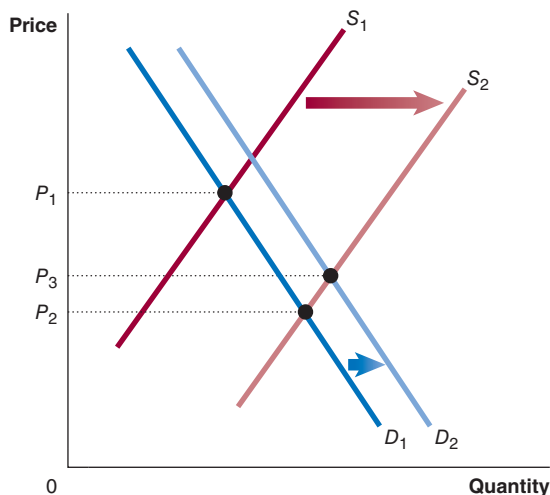
fall, but we don't know whether the total quantity of Internet ads will increase or decrease." Is the student's analysis correct? Illustrate your answer with a demand and supply graph.

Based on Martin Peers, "Future Shock for Internet Ads?" *Wall Street Journal*, February 17, 2009.

- 4.6 [Related to **Don't Let This Happen to You** on page 81] A student writes the following: "Increased production leads to a lower price, which in turn increases demand." Do you agree with the student's reasoning? Briefly explain.
- 4.7 [Related to **Don't Let This Happen to You** on page 81] A student was asked to draw a demand and supply graph to illustrate the effect on the tablet computers market of a fall in the price of displays used in tablet computers, holding everything else constant. She drew the graph below and explained it as follows:

Displays are an input to tablet computers, so a fall in the price of displays will cause the supply curve for tablets to shift to the right (from S_1 to S_2). Because this shift in the supply curve results in a lower price (P_2), consumers will want to buy more tablets, and the demand curve will shift to the right (from D_1 to D_2). We know that more tablets will be sold, but we can't be sure whether the price of tablets will rise or fall. That depends on whether the supply curve or the demand curve has shifted farther to the right. I assume that the effect on supply is greater than the effect on demand, so I show the final equilibrium price (P_3) as being lower than the initial equilibrium price (P_1).

Explain whether you agree or disagree with the student's analysis. Be careful to explain exactly what—if anything—you find wrong with her analysis.



- 4.8. Proposals have been made to increase government regulation of firms providing child-care services by, for instance, setting education requirements for child-care workers. Suppose that these regulations increase the quality of child-care and cause the demand for child-care services to increase. At the same time, assume that complying with the new government regulations increases the costs of firms providing child-care services. Draw a demand and supply graph to illustrate the effects of these changes in the market for child-care services. Briefly explain whether the total quantity of child-care services purchased will increase or decrease as a result of regulation.
- 4.9. The following graphs show the supply and demand curves for two markets. One of the markets is for BMW automobiles, and the other is for a cancer-fighting drug, without which lung cancer patients will die. Briefly explain which graph most likely represents which market.



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Appendix B



Use quantitative demand and supply analysis.

Quantitative Demand and Supply Analysis

Graphs help us understand economic change *quantitatively*. For instance, a demand and supply graph can tell us that if household incomes rise, the demand curve for a normal good will shift to the right, and its price will rise. Often, though, economists, business managers, and policymakers want to know more than the qualitative direction of change; they want a *quantitative estimate* of the size of the change.

In this chapter, we carried out qualitative analysis of market equilibriums. We saw that an increase in demand would increase the market price and an increase in supply would decrease the market price. To better understand how different shifts in the market impact price and quantity, we need to know how large the effects are. A quantitative analysis of market equilibrium will tell us how much prices and quantities change after a demand or supply curve shifts.

Demand and Supply Equations

The first step in a quantitative analysis is to supplement our use of demand and supply curve with demand and supply *equations*. We noted briefly in this chapter that economists often statistically estimate equations for demand curves. Supply curves can also be statistically estimated. For example, suppose that economists have estimated that the demand for apartments in Toronto is:

$$Q^D = 3\,000\,000 - 1000P$$

and the supply of apartments is:

$$Q^S = -450\,000 + 1300P.$$

We have used Q^D for the quantity of apartments demanded per month, Q^S for the quantity of apartments supplied per month, and P for the apartment rent, in dollars per month. In reality, both the quantity of apartments demanded and quantity of apartments supplied will depend on more than just the rental price of apartments in Toronto. For instance, the demand for apartments in Toronto will also depend on the average incomes of families in the Toronto area and on the rents of apartments in surrounding cities. For simplicity, we will ignore these other factors.

The competitive market equilibrium occurs when the quantity demanded equals the quantity supplied, or:

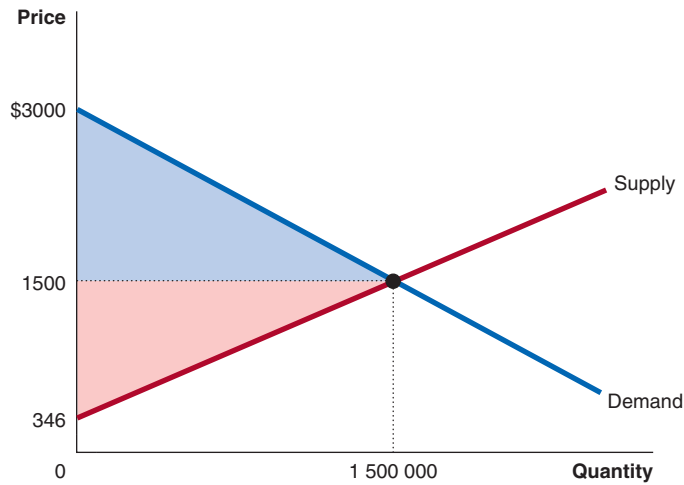
$$Q^D = Q^S.$$

We can use this equation, which is called an *equilibrium condition*, to solve for the equilibrium monthly apartment rent by setting the quantity demanded from the demand equation equal to the quantity demanded from the supply equation:

$$3\,000\,000 - 1000P = -450\,000 + 1300P$$

$$3\,450\,000 = 2300P$$

$$P = \frac{3\,450\,000}{2300} = \$1500.$$



(a) Determining the equilibrium apartment price (monthly rent) in Toronto

Figure 3B.1a

Graphing Supply and Demand Equations

After statistically estimating supply and demand equations, we can use the equations to draw supply and demand curves. In this case, as Panel (a) shows, the equilibrium rent for apartments is \$1500 per month, and the equilibrium quantity of apartments rented is 1 500 000. The supply equation tells us that at a rent of \$346, the quantity of apartments supplied will be zero. The demand equation tells us that at a rent of \$3000, the quantity of apartments demanded will be zero. Panel (b), below, shows the shift in the equilibrium price from \$1500 to \$1283 when the demand for apartments decreases.

We can then substitute this price back into either the demand equation or the supply equation to find the equilibrium quantity of apartments rented:

$$Q^D = 3\,000\,000 - 1000P = 3\,000\,000 - 1000(1500) = 1\,500\,000$$

$$Q^S = -450\,000 + 1300P = -450\,000 + 1300(1500) = 1\,500\,000.$$

Panel (a) of Figure 3B.1 shows in a graph *the same information as we just found using algebra*.

If the economy of Toronto is not performing as well as it has in the past, fewer people are likely to want to live in Toronto, all else being equal. We can represent this idea by reducing the number of apartments that would be rented at every price. This makes the new demand equation:

$$Q^D = 2\,500\,000 - 1000P$$

and the supply equation remains unchanged:

$$Q^S = -450\,000 + 1300P.$$

The new equilibrium price is:

$$2\,500\,000 - 1000P = -450\,000 + 1300P$$

$$2\,950\,000 = 2300P$$

$$P = \frac{2\,950\,000}{2300} = \$1283.$$

The new quantity of apartments rented can be found by substituting this price into either the demand equation or the supply equation:

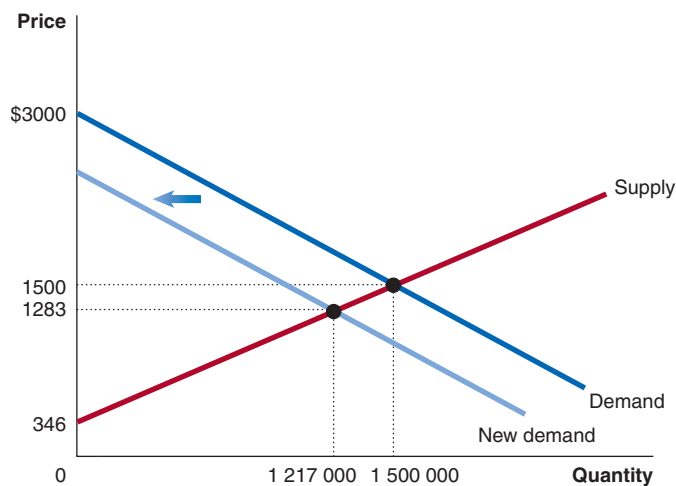
$$Q^D = 2\,500\,000 - 1000P = 2\,500\,000 - 1000(1283) = 1\,217\,000$$

$$Q^S = -450\,000 + 1300P = -450\,000 + 1300(1283) = 1\,217\,000.$$

When the demand for apartments decreases, the equilibrium price falls from \$1500 to \$1283, and the equilibrium number of apartments rented falls from 1 500 000 to 1 217 000. Panel (b) of Figure 3B.1 illustrates the result of this shift. Notice that the qualitative results (a decrease in price and quantity) match the quantitative results we just found.

Figure 3B.1b**Graphing Supply and Demand Equations**

The process of finding the new equilibrium remains the same no matter whether the demand curve, the supply curve, or both shifts. You set the quantity demanded equal to the quantity supplied and solve for price. Then you substitute the price you found into either the demand equation or the supply equation.



(b) Determining the equilibrium apartment price (monthly rent) in Toronto: when demand decreases

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LO Use quantitative demand and supply analysis.

Review Questions

- 3B.1** In a linear demand equation, what economic information is conveyed by the intercept on the price axis? Similarly, what information is conveyed by the intercept on the price axis in a linear supply equation.

Problems and Applications

- 3B.1** Suppose that you have been hired to analyze wages in a simple market. The demand for labour and supply of labour can be represented by the following equations:

$$\text{Demand: } L^D = 100 - 4W$$

$$\text{Supply: } L^S = 6W$$

- Calculate the equilibrium wage (price) and quantity of labour employed in this market.
- A new employer enters the market causing labour demand to become:

$$\text{New Demand: } L^D = 120 - 4W$$

Calculate the new equilibrium wage (price) and quantity of workers employed in this market.

- 3B.2** Suppose the demand and supply of leather shoes can be represented by the following equations:

$$Q^D = 200 - 2P$$

$$Q^S = 2P$$

- Calculate the equilibrium price and quantity in this market.
- Assume that an increase in the cost of leather causes the supply of shoes to change to:

$$Q^S = -50 + 2P$$

Calculate the new equilibrium price and quantity in this market.

- Assume that in addition to the increase in the price of leather, the demand for leather shoes falls due to a change in fashion and is now as follows:

$$150 - 2P$$

Calculate the equilibrium price and quantity in this market. Remember to use the same supply curve as in part (b).