Chapter

DEMAND AND SUPPLY

3

Answers to the Review Quizzes

Page 60

1. What is the distinction between a money price and a relative price?

   The money price of a good is the dollar amount that must be paid for it. The relative price of a good is its money price expressed as a ratio to the money price of another good. Thus the relative price is the amount of the other good that must be foregone to purchase a unit of the first good.

2. Explain why a relative price is an opportunity cost.

   The relative price of a good is the opportunity cost of buying that good because it shows how much of the next best alternative good must be forgone to buy a unit of the first good.

3. Think of examples of goods whose relative price has risen or fallen by a large amount.

   Some examples of items where both the money price and the relative price have risen over time are gasoline, college tuition, and food. Some examples of items where both the money price and the relative price have fallen over time are personal computers, HD televisions, and calculators.

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1. Define the quantity demanded of a good or service.

   The *quantity demanded* of a good or service is the amount that consumers plan to buy during a given time period at a particular price.

2. What is the law of demand and how do we illustrate it?

   The *law of demand* states: "Other things remaining the same, the higher the price of a good, the smaller is the quantity demanded; and the lower the price of a good, the greater is the quantity demanded." The law of demand is illustrated by a downward-sloping demand curve

drawn with the quantity demanded on the horizontal axis and the price on the vertical axis. The slope is negative to show that the higher the price of a good, the smaller is the quantity demanded and the lower the price of a good, the greater is the quantity demanded.

3. What does the demand curve tell us about the price that consumers are willing to pay?

For any fixed quantity of a good available, the vertical distance of the demand curve from the *x*-axis shows the *maximum price* that consumers are willing to pay for that quantity of the good. The price on the demand curve at this quantity indicates the marginal benefit to consumers of the last unit consumed at that quantity.

4. List all the influences on buying plans that change demand, and for each influence, say whether it increases or decreases demand.

Influences that *change the demand* for a good include:

- ***The prices of related goods*. A rise (fall) in the price of a substitute increases (decreases) the demand for the first good. A rise (fall) in the price of a complement decreases (increases) the demand for the first good.**
- ***The expected future price of the good*. A rise (fall) in the expected future price of a good increases (decreases) the demand in the current period.**
- ***Income*. An increase (decrease) in income increases (decreases) the demand for a normal good. An increase in income decreases (increases) the demand for an inferior good.**
- ***Expected future income and credit*. An increase (decrease) in expected future income or credit increases (decreases) the demand.**
- ***The population*. An increase (decrease) in population increases (decreases) the demand.**
- ***People's preferences*. If people's preferences for a good rise (fall), the demand increases (decreases).**

5. Why does demand not change when the price of a good changes with no change in the other influences on buying plans?

If the price of a good falls and nothing else changes, then the *quantity of the good demanded* increases and there is a movement down along the demand curve, but the *demand* for the good

remains unchanged and the demand curve does not shift.

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1. Define the quantity supplied of a good or service.

   The quantity supplied of a good or service is the amount of the good or service that firms plan to sell in a given period of time at a specified price.

2. What is the law of supply and how do we illustrate it?

   The law of supply states that "other things remaining the same, the higher the price of a good, the greater is the quantity supplied; and the lower the price of a good, the smaller is the quantity supplied." The law of supply is illustrated by an upward-sloping supply curve drawn with the quantity supplied on the horizontal axis and the price on the vertical axis. The slope is positive to show that the higher the price of a good, the greater is the quantity supplied and the lower the price of a good, the smaller is the quantity supplied.

3. What does the supply curve tell us about the producer's minimum supply price?

   For any quantity, the vertical distance between the supply curve and the *x*-axis shows the *minimum price* that suppliers must receive to produce that quantity of output. As a result, the price is the marginal cost of the last unit produced at this level of output.

4. List all the influences on selling plans, and for each influence, say whether it changes supply.

   Changes in the price of the good change the quantity supplied. They do not change the supply of the good.

   Influences that *change the supply* of a good include:

   - ***Prices of factor of production*. A rise (fall) in the price of a factor of production increases firms' costs of production and decreases (increases) the supply of the good.**
   - ***Prices of related goods produced*. If the price of a substitute in production rises (falls), firms decrease (increase) their sales of the original good and the supply for the original good decreases (increases). A rise (fall) in the price of a complement in production increases (decreases) production of the original good,**

causing the supply of the original good to increase (decrease).

- ***The expected future price of the good.*** **A rise (fall) in the expected future price of the good decreases (increases) the amount suppliers sell today. This change in expectations decreases (increases) the supply in the current period.**
- ***The number of sellers.*** **An increase (decrease) in the number of sellers in a market increases the quantity of the good available at every price, and increases (decreases) the supply.**
- ***Technology.*** **An advance in technology increases the supply.**
- ***The state of nature.*** **A good (bad) state of nature, such as good (bad) weather for agricultural products, increases (decreases) the supply.**

5. What happens to the quantity of smartphones supplied and the supply of smartphones if the price of a smartphone falls?

   If the price of a smartphones falls and nothing else changes, then the *quantity of smartphones supplied* will decrease and there is a movement down along the supply curve for smartphones. The *supply* of smartphones, however, remains unchanged and the supply curve does not shift.

Page 71

1. What is the equilibrium price of a good or service?

   The *equilibrium price* is the price at which the quantity demanded by the buyers is equal to the quantity supplied by the sellers.

2. Over what range of prices does a shortage arise? What happens to the price when there is a shortage?

   A shortage arises at market prices below the equilibrium price. A *shortage* causes the price to rise, decreasing quantity demanded and increasing quantity supplied until the equilibrium price is attained.

3. Over what range of prices does a surplus arise? What happens to the price when there is a surplus?

   A surplus arises at market prices above the equilibrium price. A *surplus* causes the price to fall, decreasing quantity supplied and increasing quantity demanded until the equilibrium price is attained.

4. Why is the price at which the quantity demanded equals the quantity supplied the equilibrium price?

At the equilibrium price, the quantity demanded by consumers equals the quantity supplied by producers. At this price, the plans of producers and consumers are coordinated and there is no influence on the price to move away from equilibrium.

5. Why is the equilibrium price the best deal available for both buyers and sellers?

The equilibrium price reflects that the highest price consumers are willing to pay for that amount of the good or service and is just equal to the minimum price that suppliers require for delivering it. Demanders would prefer to pay a lower price, but suppliers are unwilling to supply that quantity at a lower price. Suppliers would prefer a higher price, but demanders are unwilling to pay a higher price for that quantity. Hence neither demanders not suppliers can do business at a better price.

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What is the effect on the price and quantity of smartphones if

1. The price of a music-streaming subscription falls or the price of a wireless plan rises? (Draw the diagrams!)

Because a large majority of smartphone owners listen to streaming music on their smartphones (68 percent according to a study published by Digital Music News), streaming music is a *complement* of a smartphone. A fall in the price of a music-streaming subscription increases the demand for smartphones. The demand curve for smartphones shifts rightward. Supply remains unchanged. The price of a smartphone rises and the quantity increases. Figure 3.8 on page 72 illustrates this sort of change.

A rise in the price of a wireless plan decreases the demand for smartphones because a wireless plan is a *complement* of a smartphone. The demand curve for smartphones shifts leftward. Supply remains unchanged. The price of a smartphone falls and the quantity decreases.

2. More firms produce smartphones or electronics workers' wages rise? (Draw the diagrams!)

An increase in the number of firms that produce smartphones increases the supply of smartphones. The supply curve of smartphones

shifts rightward. Demand remains unchanged. The price of a smartphone falls and the quantity of smartphones increases. You can illustrate this outcome by drawing a diagram like Figure 3.9 on page 74.

A rise in the wages of electronic workers decreases the supply of smartphones because it increases the cost of producing smartphones. The supply curve of smartphones shifts leftward. Demand remains unchanged. The price of a smartphone rises and the quantity of smartphones decreases.

3. Any two of these events in questions 1 and 2 occur together? (Draw the diagrams!)

There are six combinations:

(1) If the price of a music streaming service falls and the price of a wireless plan rises, supply is unchanged and demand might increase, decrease, or not change so the outcome cannot be predicted.

(2) If the price of a music streaming service falls and more firms produce smartphones, demand increases and supply increases so the quantity increases and the price might rise, fall, or not change.

(3) If the price of a music-streaming service falls and the wages paid electronic workers rise, demand increases and supply decreases so the price rises and the quantity might increase, decrease, or not change.

(4) If the price of a wireless plan rises and more firms produce smartphones, demand decreases and supply increases so the price falls and quantity might increase, decrease, or remain the same.

(5) If the price of a wireless plan rises and the wages paid electronic workers rise, demand decreases and supply decreases so the quantity decreases and the price might rise, fall, or remain the same.

(6) If more firms produce smartphones and the wages paid electronics workers rise, demand is unchanged and supply might increase or decrease or remain unchanged, so the outcome cannot be predicted.

Answers to the Study Plan Problems and Applications

1. In April 2014, the money price of a carton of milk was $2.01 and the money price of gallon of gasoline was $3.63. Calculate the relative price of a gallon of gasoline in terms of milk.

   The relative price of a gallon of gasoline in terms of milk equals ($3.63 per gallon of gasoline)/($2.01 per carton of milk) = 1.81 cartons of milk per gallon of gasoline.

2. The price of food increased during the past year.
   a. Explain why the law of demand applies to food just as it does to other goods and services.

      The law of demand applies to food because there is both a substitution and an income effect that reinforce each other. When the price of food rises, people substitute to different foods. For instance, some might substitute home cooked meals for dining at a restaurant. And when the price rises, there is a negative income effect, so people buy less food overall with the rising price. On both counts, the higher price of food decreases the quantity of food demanded.

   b. Explain how the substitution effect influences food purchases when the price of food rises and other things remain the same.

      When the price of food rises, people substitute away from (some) foods and toward other foods and other activities. People substitute cheaper foods for more expensive foods and they also substitute diets for food.

   c. Explain how the income effect influences food purchases and provide some examples of the income effect.

      Food is a normal good so a rise in the price, which decreases people's real incomes, decreases the quantity of food demanded. In the United States, restaurants suffer as the negative income effect from a higher price of food leads people to cut back their trips to restaurants. At home, people will buy fewer steaks and instead will buy more noodles. In poor countries (and among the poor in the United States), people literally eat less when the price of food rises and in extremely poor countries starvation increases.

3. Which of the following goods are likely substitutes and which are likely complements? (You may use an item in more than once.):
   coal, oil, natural gas, wheat, corn, pasta, pizza, sausage, skateboard, roller blades,
   video game, laptop, iPad, smartphone, text message, email

   Substitutes include: coal and oil; coal and natural gas; oil and natural gas; wheat and corn; pasta and

pizza; pasta and sausage; pizza and sausage (they type of sausage that cannot be used as a topping on pizza); skateboard and roller blades; skateboard and video game; roller blades and video game; laptop and iPad; and, text message and email.

Complements include: pizza and sausage (the type of sausage that can be used as a topping on pizza); skateboard and iPad; roller blades and iPad; video game (those played on a computer) and laptop; smartphone and text message; and, smartphone and email.

4. As the average income in China continues to increase, explain how the following would change:

   a. The demand for beef

      Beef is a normal good. The increase in income increases the demand for beef.

   b. The demand for rice

      Rice is probably an inferior good. The increase in income decreases the demand for rice.

5. In 2016, the price of corn fell and some corn farmers will switch from growing corn in 2017 to growing soybeans.

   a. Does this fact illustrate the law of demand or the law of supply? Explain your answer.

      This fact illustrates the law of supply: the lower price of corn decreases the quantity of corn grown.

   b. Why would a corn farmer grow soybeans?

      Corn and soybeans are substitutes in production and soybeans have become more profitable. A corn farmer would switch to soybeans because the profit from growing soybeans exceeds that from growing corn.

6. Dairies make low-fat milk from full-cream milk, and in the process they produce cream, which is made into ice cream. The following events occur one at a time:

   (i) The wage rate of dairy workers rises.
   (ii) The price of cream rises.
   (iii) The price of low-fat milk rises.
   (iv) With a drought forecasted, dairies raise their expected price of low-fat milk next year.
   (v) New technology lowers the cost of producing ice cream.

   Explain the effect of each event on the supply of low-fat milk.

   (i) Dairy workers are a factor used to produce low-fat milk. The price of a factor of production rises, which decreases the supply of low-fat milk. (ii) Cream and low fat milk are complements in production. The price of a complement in

production rises, which increases the supply of low fat milk.
(iii) A rise in the price of low-fat milk does not change the supply of low-fat milk. It does, however, increase the quantity of low-fat milk supplied.
(iv) The higher expected price of low-fat milk decreases the (current) supply of low-fat milk.
(v) Ice cream and low-fat milk are complements in production. The lower cost of producing ice cream increases the quantity of ice cream produced, which increases the supply of low-fat milk.

7. The demand and supply schedules for gum are in the table.

Price (cents per pack)	Quantity demanded (millions of packs a week)	Quantity supplied (millions of packs a week)
20	180	60
40	140	100
60	100	140
80	60	180

a. Suppose that the price of gum is 70¢ a pack. Describe the situation in the gum market and explain how the price adjusts.

At 70 cents a pack, there is a surplus of gum and the price falls. At 70 cents a pack, the quantity demanded is 80 million packs a week and the quantity supplied is 160 million packs a week. There is a surplus of 80 million packs a week. The price falls until market equilibrium is restored at a price of 50 cents a pack.

b. Suppose that the price of gum is 30¢ a pack. Describe the situation in the gum market and explain how the price adjusts.

At 30 cents a pack, there is a shortage of gum and the price rises. At 30 cents a pack, the quantity demanded is 160 million packs a week and the quantity supplied is 80 million packs a week. There is a shortage of 80 million packs a week. The price rises until market equilibrium is restored at a price of 50 cents a pack.

8. The following events occur one at a time:
(i) The price of crude oil rises.
(ii) The price of a car rises.
(iii) All speed limits on highways are abolished.
(iv) Robots cut car production costs.
Explain the effect of each of these events on the market for gasoline.

(ii) and (iii) and (iv) change the demand for gasoline. The demand for gasoline will change if the price of a car rises, all speed limits on highways are abolished, or robot production cuts the cost of producing a car. If the price of a car rises, the quantity of cars bought decrease and the demand for gasoline decreases. If all speed limits on highways are abolished, people will drive faster and use more gasoline. The demand for gasoline increases. If robot production plants lower the cost of producing a car, the supply of cars will increase. With no change in the demand for cars, the price of a car will fall and more cars will be bought. The demand for gasoline increases.

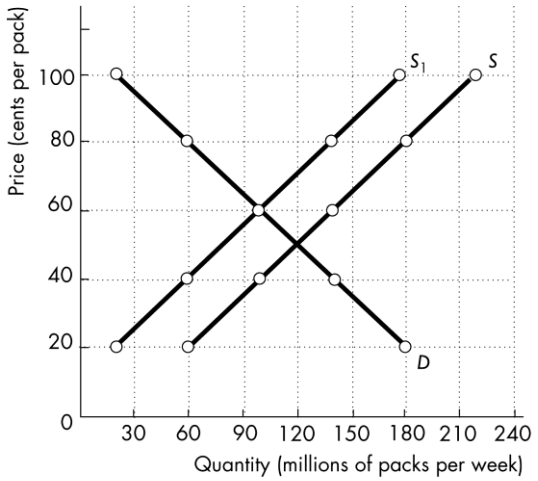
(i) changes the supply of gasoline. The supply of gasoline will change if the price of crude oil (a factor of production used in the production of gasoline) changes. If the price of crude oil rises, the cost of producing gasoline rises and the supply of gasoline decreases.

9. In Problem 7, a fire destroys some factories that produce gum and the quantity of gum supplied decreases by 40 million packs a week at each price.

a. Explain what happens in the market for gum and draw a graph to illustrate the changes.

As the number of gum-producing factories decreases, the supply of gum decreases. There is a new supply schedule and, in Figure 3.1, the supply curves shifts leftward by 40 million packs at each price to the new supply curve S_1. After the fire, the quantity supplied at 50 cents is now only 80 million packs, and there is a shortage of gum. The price rises to 60 cents a pack, at which the new quantity supplied equals the quantity demanded. The new equilibrium price is 60 cents and the new equilibrium quantity is 100 million packs a week.

FIGURE **3.1**
Problem 9

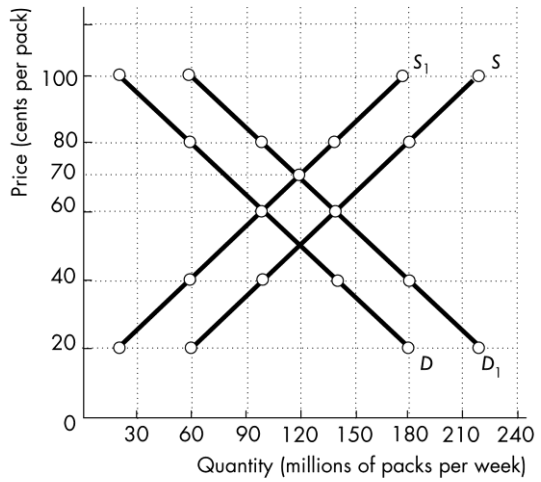


b. If, at the time as the fire the teenage population increases and

the quantity of gum demanded increases 40 million packs a week at each price. What is the new market equilibrium? Show the changes on your graph.

The new price is 70 cents a pack, and the quantity is 120 million packs a week. The demand for gum increases and the demand curve shifts rightward by 40 million packs at each price. Supply decreases by 40 millions packs a week and the supply curve shifts leftward by 40 million packs at each price. These changes are shown in Figure 3.2 by the shift of the demand curve from *D* to D_1 and the shift of the supply curve from *S* to S_1. At any price below 70 cents a pack there is a shortage of gum. The price of gum rises until the shortage is eliminated.

FIGURE **3.2**
Problem 9b



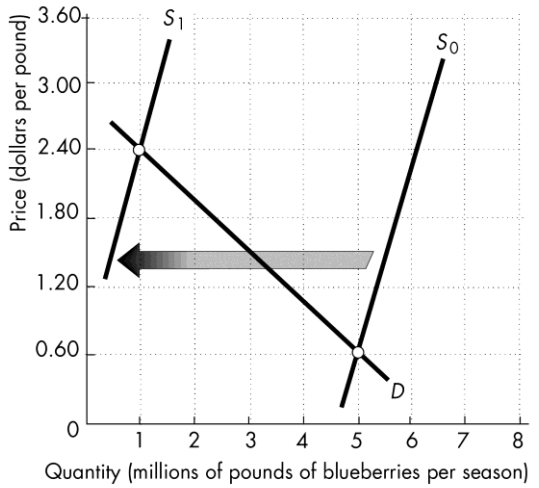
10. **Singing the Blues: March Frost Destroys State Blueberry Crop**
Chris and Rhonda Luther had big plans for their small blueberry farm, but freezing temperatures killed these plans, reducing their usual output by about 95 percent. The Georgia Department of Agriculture estimates the freeze to have cut production 80 percent.

Source: *Red and Black*, March 25, 2017

Make a graph to illustrate the market for blueberries before and after the unusually cold March weather.

Figure 3.3 shows the effect of the freezing temperatures on the blueberry market. The demand curve is labeled *D*. The freeze did not affect the demand for blueberries, so the demand curve does not shift. The freeze was a bad state of nature and decreased the supply of blueberries, shifting the supply curve leftward. The supply curve labeled S_0 reflects the supply before the freeze and the supply curve labeled S_1 shows the supply after the freeze. The equilibrium price of a pound of blueberries rises from $0.60 per pound to $2.40 per pound and the equilibrium quantity decreases from 5 million pounds of blueberries 1 million pounds.

FIGURE **3.3**
Problem 10



Answers to Additional Problems and Applications

11. What features of the world market for crude oil make it a competitive market?

The world oil market is a competitive market because there are a large number of sellers and a large number of buyers. There are so many sellers and so many buyers that no individual seller or individual buyer can influence the price of oil.

12. The money price of a textbook is $90 and the money price of the Wii game *Super Mario Galaxy* is $45.

a. What is the opportunity cost of a textbook in terms of the Wii game?

A textbook costs $90 and a Wii game costs $45. Purchasing 1 textbook forces the buyer to give up 2 Wii games. So the opportunity cost of a textbook in terms of Wii games is 2 Wii games per textbook.

b. What is the relative price of the Wii game in terms of textbooks?

The relative price of a Wii game in terms of textbooks equals ($45 per Wii)/($90 per textbook), which is 1/2 of a textbook per Wii game.

13. The price of gasoline has increased during the past year.

a. Explain why the law of demand applies to gasoline just as it does to all other goods and services.

When the price of gasoline rises, people decrease the quantity of gasoline they demand. Both the substitution effect and the income effect lead consumers to decrease the quantity of gasoline demanded.

b. Explain how the substitution effect influences gasoline purchases and provide some examples of substitutions that people might make when the price of gasoline rises and other things remain the same.

When the price of gasoline rises, people substitute other goods and services for gasoline. For instance, people substitute public transport (such as buses), carpools, motorcycles, walking, and bicycles for driving alone in a car to work.

c. Explain how the income effect influences gasoline purchases and provide some examples of the income effects that might occur when the price of gasoline rises and other things remain the same.

When the price of gasoline rises, people's real incomes fall. People respond by decreasing their demand for normal goods, such as gasoline. In the

gasoline market, some people trade in large, fuel guzzling cars because they can no longer afford to fuel the large vehicle. Others will not purchase a car or truck because they are not able to afford the gasoline necessary to use it.

14. Think about the demand for the three game consoles: Xbox One, PlayStation 4, and Wii U. Explain the effect of the following events on the demand for Xbox One games and the quantity of Xbox One games demanded, other things remaining the same. The events are:

a. The price of an Xbox One falls.

An Xbox One and an Xbox One game are complements. When the price of an Xbox One falls, consumers respond by increasing the quantity of Xbox Ones demanded so the equilibrium quantity of Xbox Ones increases. Consumers increase their demand for Xbox one games because an Xbox One console is useless without Xbox One games.

b. The prices of a PlayStation 4 and a Wii U fall.

A PlayStation 4 and a Wii U are substitutes for an Xbox One. When these game consoles fall in price, the demand for Xbox One consoles decreases and so the equilibrium quantity of Xbox Ones decreases. Consumers decrease their demand for Xbox One games because an Xbox One game is useless without an Xbox One console.

c. The number of people writing and producing Xbox One games increases.

The increase in the number of people writing Xbox One games increases the supply of Xbox One games. The demand for Xbox One games does not change but the increase in the supply lowers the price of an Xbox One game. The fall in the price of Xbox One games increases the quantity of Xbox Ones demanded.

d. Consumers' incomes increase.

Xbox One games are surely a normal good. So an increase in consumers' incomes increases the demand for Xbox One games.

e. Programmers who write code for Xbox One games become more costly to hire.

The increase in the cost of programmers decreases the supply of Xbox One games. When the supply of a good or service decreases, the price of that good or service rises. Xbox One games are not an exception, so the price of an Xbox One game rises. The rise in the price of an Xbox One

game decreases the quantity of Xbox One games demanded.

f. The expected future price of an Xbox One game falls.

When the price of an Xbox One game is expected to fall, the (current) demand for Xbox One games decreases.

g. A new game console that is a close substitute for Xbox One comes onto the market.

The new game console decreases the demand for Xbox One consoles. As a result, the equilibrium quantity of Xbox One consoles decreases. Consumers decrease their demand for Xbox One games because an Xbox One game is useless without an Xbox One console.

15. Classify the following pairs of goods and services as substitutes in production, complements in production, or neither.

a. Bottled water and health club memberships

Bottled water and health club memberships are neither substitutes in production nor complements in production. (For consumers, these are complements because people in health clubs drink a lot of bottled water.)

b. French fries and baked potatoes

For a restaurant that produces both French fries and baked potatoes, they are substitutes in production. (For a consumer, they are substitutes.)

c. Leather boots and leather shoes

Leather boots and leather shoes are substitutes in production.

d. Hybrids and SUVs

For an auto company that produces both on the same assembly line, they are substitutes in production. (For a consumer, hybrids and SUVs are substitutes.)

e. Diet coke and regular coke

For a soda company that produces both on the same assembly line, they are substitutes in production. (For a consumer, Diet coke and regular coke are substitutes.)

16. When a timber mill makes logs from trees it also produces sawdust, which is used to make plywood.

a. Explain how a rise in the price of sawdust influences the supply of logs.

The rise in the price of sawdust motivates timber mills to make more sawdust, which thereby increases the demand for logs and raises the price

of logs. There is no change in the supply of logs but instead a change in the quantity of logs supplied.

b. Explain how a rise in the price of sawdust influences the supply of plywood.

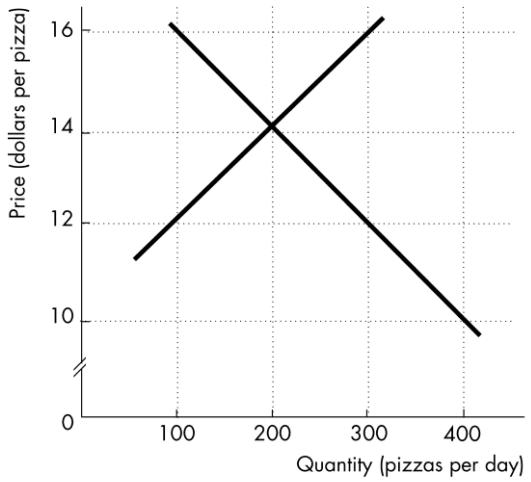
The rise in the price of sawdust motivates timber mills to make more sawdust, which thereby increases the supply of plywood.

17. **New Maple Syrup Sap Method**
With the new way to tap maple trees, farmers could produce 10 times as much maple syrup per acre.
Source: cbc.ca, February 5, 2014
Will the new method change the supply of maple syrup or the quantity supplied of maple syrup, other things remaining the same. Explain.
The new technology increases the supply of maple syrup. At each price, the new technology increases the quantity that will be supplied. The supply curve shifts rightward.

Use Figure 3.4 to work Problems 18 and 19.

18. a. Label the curves. Which curve shows the willingness to pay for a pizza?
The demand curve is the downward sloping curve and the supply curve is the upward sloping curve. The demand curve shows the willingness to pay for a pizza.

FIGURE **3.4**
Problems 18 and 19



b. If the price of a pizza is $16, is there a shortage or a surplus and does the price rise or fall?
If the price of a pizza is $16, there is a surplus of pizza; the quantity supplied of pizzas exceeds the quantity demanded. The surplus forces the price lower to the equilibrium price of $14 a pizza.

c. Sellers want to receive the highest possible price, so why would they be willing to accept less than $16 a pizza?
Sellers are willing to accept less than $16 because if they charge $16 the surplus means that some sellers have unsold pizzas. From their perspective it is better to have a lower price for the pizza and sell the (decreased) quantity they produce than to keep the price at $16 and be left with unsold pizza.

19. a. If the price of a pizza is $12, is there a shortage or a surplus and does the price rise or fall?
If the price of a pizza is $12, there is a shortage of pizza; the quantity demanded of pizzas exceeds the quantity supplied. The shortage forces the

price higher to the equilibrium price of $14 a pizza.

b. Buyers want to pay the lowest possible price, so why would they be willing to pay more than $12 for a pizza?

If the price of a pizza is $12 the shortage means that not all buyers can buy a pizza. From their perspective they would rather pay more than $12 and be able to purchase a pizza than to keep the price at $12 and leave them without a pizza.

Price (cents per bag)	Quantity demanded (millions of bags a week)	Quantity supplied (millions of bags a week)
50	160	130
60	150	140
70	140	150
80	130	160
90	120	170
100	110	180

20. The demand and supply schedules for potato chips are in the table.

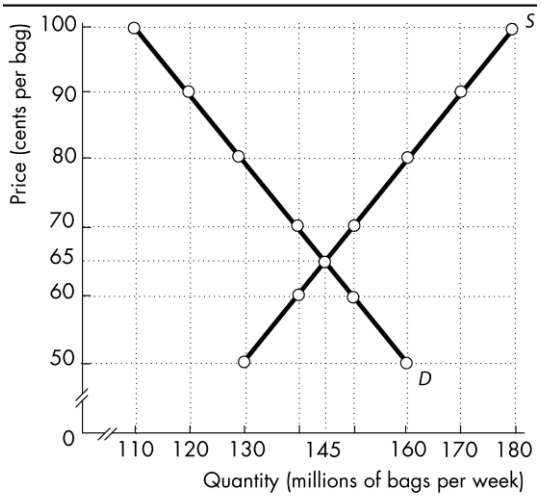
a. Draw a graph of the potato chip market and mark in the equilibrium price and quantity.

Figure 3.5 draws the supply and demand curves for this market. The equilibrium price is 65¢ a bag, and the equilibrium quantity is 145 million bags a week.

b. If the price is 60¢ a bag, is there a shortage or a surplus, and how does the price adjust?

At 60¢ a bag, there is a shortage of potato chips and the price rises. At 60¢ a bag, the quantity demanded is 150 million bags a week and the quantity supplied is 140 million bags a week. The difference is a shortage of 10 million bags a week. The price rises until market equilibrium is restored—65¢ a bag and 145 million bags a week.

FIGURE 3.5
Problem 20a



21. In Problem 20, a new dip increases the quantity of potato chips that people want to buy by 30 million bags per week at each price.

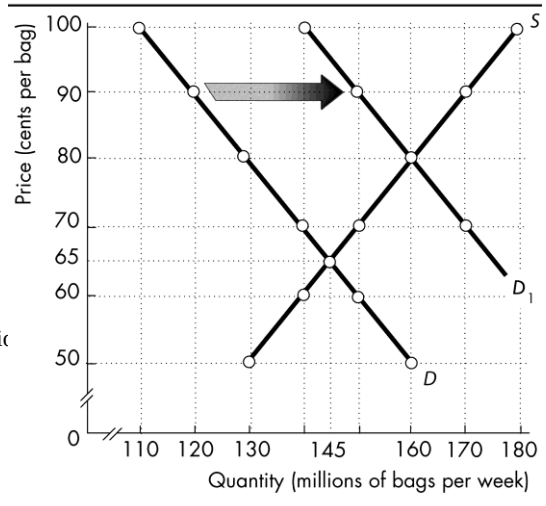
a. Does the demand for chips change? Does the supply of chips change? Describe the change.

As the new dip comes onto the market, the demand for potato chips increases. Supply does not change. The demand curves shifts rightward.

b. How do the equilibrium price and equilibrium quantity of chips change?

Demand increases by 30 million bags a week. The demand curve shifts rightward as shown in Figure 3.6 by the shift from *D* to D_1. The quantity demanded at each price increases by 30 million bags. The quantity demanded at 65¢ is now 175 million

FIGURE 3.6
Problem 21b



bags a week of potato chips. The price rises to 80¢ a bag, at which the quantity supplied equals the quantity demanded (160 million bags a week). The new equilibrium price is 80¢ per bag and the new equilibrium quantity is 160 million bags.

22. In Problem 20, if a virus destroys potato crops and the quantity of potato chips produced decreases by 40 million bags a week at each price, how does the supply of chips change?

The supply of potato chips decreases, and the supply curve shifts leftward by 40 million bags. The price rises to 85¢ a bag and the quantity decreases to 125 million bags a week.

23. If the virus in Problem 22 hits just as the new dip in Problem 21 comes onto the market, how do the equilibrium price and equilibrium quantity of chips change?

The result by itself of the new dip entering the market is a price of 80¢ a bag and a quantity of 160 million bags. But now with the virus affecting the market, at this price there is a shortage of potato chips. The price of potato chips rises until the shortage is eliminated. The new equilibrium price is 100¢ a bag, and the new equilibrium quantity is 140 million bags a week.

24. U.S. Craft Beer Bolsters U.K. Hop Production
U.K. hop farmers stepped up production in response to a rapid growth of U.S. craft beer production. U.S. craft beer makers prefer the subtle taste of U.K. hop varieties.
Source: BBC, October 3, 2014

a. Describe the changes in the market for U.S. craft beer.

In the United States, the "rapid growth of U.S. craft beer production" indicates that the supply of craft beers has increased, shifting the supply curve rightward. The increased supply results in a movement along the demand curve for beer so that there is an increase in the quantity demanded of U.S.-brewed craft beer.

b. Explain whether the increase in U.K. hop production is a change in supply or a change in the quantity supplied.

The increased demand for U.K. hops means that the demand curve for U.K. hops shifts rightward. There is a movement up along the U.K. hop supply curve, so there is a change in the quantity supplied.

c. What could be the impact on the price of U.K. hops if U.S. farmers switched to U.K. hop varieties.

If U.S. farmers switched to producing U.K. hop varieties and U.S. craft brewers switch from buying U.K.-produced hops to buying U.K. hop

varieties produced in the United States, then the demand for U.K.-produced hops decreases so that the demand curve for U.K. produced hops shifts leftward. The price of U.K. produced hops falls.

25. Vietnamese Farmers Switch to Pepper as Coffee Prices Fall
The high pepper price and falling coffee price have made Vietnamese farmers replace coffee plants with pepper plants. Analysts fear farmers have used diseased pepper plants which could fail.

Source: *VietNam News*, May 28, 2016

a. Explain how the market for Vietnamese coffee will change as farmers switch to pepper.

As farmers switch some of their crop away from coffee to pepper, the supply of Vietnamese coffee will decrease. The demand for Vietnamese coffee does not change, so the decrease in supply raises the price of Vietnamese coffee and decreases the quantity.

b. If pepper plants fail, what would happen to the price of pepper?

If the pepper plants fail, the supply of pepper decreases. The decrease in the supply of pepper results in the price of pepper rising and the quantity decreasing.

26. **Watch Out for Rising Dry-Cleaning Bills**
In the past year, the price of dry-cleaning solvent doubled. More than 4,000 dry cleaners across the United States disappeared as budget-conscious consumers cut back. This year the price of hangers used by dry cleaners is expected to double.

Source: CNN Money, June 4, 2012

a. Explain the effect of rising solvent prices on the market for dry cleaning.

Solvents are used to produce dry cleaning, so a rise in the price of solvents increases the cost of dry cleaning. The increase in the cost of dry cleaning decreases the supply of dry cleaning and the supply curve of dry cleaning shifts leftward. The demand for dry cleaning does not change. By itself, the decrease in the supply raises the equilibrium price of dry cleaning and decreases the equilibrium quantity of dry cleaning.

b. Explain the effect of consumers becoming more budget conscious along with the rising price of solvent on the price of dry cleaning.

Consumers becoming more budget conscious means that the demand for dry cleaning decreases and the demand curve for dry cleaning shifts leftward. Combined with the decrease in supply from rising solvent prices, the equilibrium

quantity of dry cleaning decreases. The effect on the equilibrium price of dry cleaning, however, is ambiguous. If the decrease in supply exceeds the decrease in demand, the price rises; if the decrease in supply is less than the decrease in demand, the price falls; and, if the decrease in supply equals the decrease in demand, the price does not change.

c. If the price of hangers does rise this year, do you expect additional dry cleaners to disappear? Explain why or why not.

The increase in the price of hangers raises the costs of dry cleaners but the cost increase is much smaller than the cost increase that resulted from the doubling of the price of dry-cleaning solvent. Therefore the decrease in supply is smaller, which means that the decrease in the equilibrium quantity of dry cleaning also is smaller. If the small decrease in the equilibrium quantity leads some additional dry cleaners to close, the number will be small.

Economics in the News

27. After you have studied *Economics in the news* on pp. 78–79, answer the following questions:

a. Would you classify frozen concentrated orange juice as a normal good or an inferior good? Why?

Frozen concentrated orange juice is an inferior good if, as incomes increase the demand for orange juice decreases. The article notes that as incomes have increased, the demand for frozen concentrated orange juice has decreased, which indicates it is an inferior good.

b. What would happen to the price of orange juice if citrus greening wiped out the Florida orange crop?

If citrus greening wiped out the Florida orange crop, the price of oranges rises. Oranges are an input into making orange juice, so a rise in their price represents an increase in the cost of making orange juice. Consequently the supply of orange juice would decrease. The decrease in supply raises the price of orange juice.

c. What are some of the substitutes for orange juice and what would happen to the demand, supply, price, and quantity in the markets for each of these items if citrus greening became more severe?

Substitutes for orange juice include other beverages, such as tropical smoothies and energy drinks. If citrus greening becomes more severe, the price of orange juice will rise. The rise in the price of orange juice will lead to consumers

switching away from orange juice to its substitutes, so the demand for the substitute beverages will increase. The supply will not change so the price and quantity of the substitute beverages will increase.

d. What are some of the complements of orange juice and what would happen to the demand, supply, price, and quantity in the markets for each of these items if citrus greening became more severe?

Complements for orange juice include other "classic" breakfast foods, such eggs and bacon. If citrus greening becomes more severe, the price of orange juice will rise. The rise in the price of orange juice decreases the demand for its complements. The supply will not change, so the price and quantity of the complements will decrease.