Chapter

3 DEMAND AND SUPPLY

Answers to the Review Quizzes

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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; food. Some examples of items where both the money price and the relative price have fallen over time are personal computers; HD televisions; 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 cell phones supplied and the supply of cell phones if the price of a cell phone falls?

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

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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 MP3 players (such as the iPod) if

1. The price of a PC falls or the price of an MP3 download rises? (Draw the diagrams!)

   A fall in the price of a PC decreases the demand for MP3 players because a PC is a *substitute* for an MP3 player. The demand curve for MP3 players shifts leftward. Supply remains unchanged. The price of an MP3 player falls and the quantity of MP3 players decreases. You can illustrate this outcome by drawing a diagram like Figure 3.10c on page 73.

   A rise in the price of an MP3 download decreases the demand for MP3 players because an MP3 download is a *complement* of an MP3 player. The demand curve for MP3 players shifts leftward. Supply remains unchanged. The price of an MP3 player falls and the quantity of MP3 players decreases. You can illustrate this outcome by drawing a diagram like Figure 3.10c on page 73.

2. More firms produce MP3 players or electronics workers' wages rise? (Draw the diagrams!)

An increase in the number of firms that produce MP3 players increases the supply of MP3 players. The supply curve of MP3 players shifts rightward. Demand remains unchanged. The price of an MP3 player falls and the quantity of MP3 players increases. You can illustrate this outcome by drawing a diagram like Figure 3.10d on page 73.

A rise in the wages of electronic workers decreases the supply of MP3 players because it increases the cost of producing MP3 players. The supply curve of MP3 players shifts leftward. Demand remains unchanged. The price of an MP3 player rises and the quantity of MP3 players decreases. You can illustrate this outcome by drawing a diagram like Figure 3.10g on page 73.

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 PC rises and the price of an MP3 download rises, demand decreases, supply is unchanged, so the price falls and the quantity decreases.

(2) If the price of a PC rises and more firms produce MP3 players, demand decreases and supply increases so the price falls and the quantity might increase, decrease, or not change.

(3) If the price of PC falls and the wages paid electronic workers rise, demand decreases and supply decreases so the quantity decreases and the price might rise, fall, or not change.

(4) If the price of an MP3 download rises and more firms produce MP3 players, demand decreases and supply increases so the price falls and quantity might increase or decrease or remain the same.

(5) If the price of an MP3 download falls and the wages paid electronic workers rise, demand decreases and supply decreases so the quantity decreases and the price might rise or fall or remain the same.

(6) If more firms produce MP3 players and the wages paid electronics workers rise, supply might increase or decrease or remain unchanged, demand is unchanged, so the outcome cannot be predicted.

Answers to the Study Plan Problems and Applications

1. William Gregg owned a mill in South Carolina. In December 1862, he placed a notice in the *Edgehill Advertiser* announcing his willingness to exchange cloth for food and other items. Here is an extract:
   1 yard of cloth for 1 pound of bacon
   2 yards of cloth for 1 pound of butter
   4 yards of cloth for 1 pound of wool
   8 yards of cloth for 1 bushel of salt
   a. What is the relative price of butter in terms of wool?
      1 pound of butter exchanged for 2 yards of cloth and 4 yards of cloth exchanged for 1 pound of wool. So pound of butter exchanged for 2 yards of cloth and 2 yards of cloth exchanged for 1/2 pound of wool. So the relative price of butter in terms of wool was 1/2 pound of wool per pound of butter.
   b. If the money price of bacon was 20¢ a pound, what do you predict was the money price of butter?
      1 pound of bacon exchanged for 1 yard of cloth and 2 yards of cloth exchanged for 1 pound of butter. Hence it took 2 pounds of bacon to exchange for 1 pound of butter. As a result, if the money price of a pound of bacon was 20¢, the money price of 1 pound of butter was 40¢.
   c. If the money price of bacon was 20¢ a pound and the money price of salt was $2.00 a bushel, do you think anyone would accept Mr. Gregg's offer of cloth for salt?
      If the money price of bacon is 20¢ a pound, Mr. Gregg's offer to exchange 1 pound of bacon for 1 yard of cloth means that anyone could obtain 1 yard of cloth for a money price of 20¢. Mr. Gregg's further offer to exchange 8 yards of cloth for 1 bushel of salt means that anyone could acquire 1 bushel of salt for $1.60, the price of 8 yards of cloth. If the money price of salt is $2.00 a bushel, many would accept Mr. Gregg's offer of cloth for salt because it enables them to obtain salt at a money price of only $1.60 a bushel.
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 all 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 and provide some examples of substitutions that people might make 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 that might occur when the price of food rises and other things remain the same.
      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. Place the following goods and services into pairs of likely substitutes and pairs of likely

complements. (You may use an item in more than one pair.) The goods and services are coal, oil, natural gas, wheat, corn, rye, pasta, pizza, sausage, skateboard, roller blades, video game, laptop, iPod, cell phone, text message, email, phone call, voice mail

Substitutes include: coal and oil; coal and natural gas; oil and natural gas; wheat and corn; wheat and rye; corn and rye; 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; text message and email; text message and phone call; email and voice mail; and, email and phone call.

Complements include: pizza and sausage (the type of sausage that can be used as a topping on pizza); skateboard and iPod; roller blades and iPod; video game (those played on a computer) and laptop; cell phone and text message; cell phone and phone call; cell phone and voice mail; and, phone call and voice mail.

4. During 2010, the average income in China increased by 10 percent. Compared to 2009, how do you expect the following would change:
   a. The demand for beef. Explain your answer.
      Beef is a normal good. The increase in income increases the demand for beef.
   b. The demand for rice. Explain your answer.
      Rice is probably an inferior good. The increase in income decreases the demand for rice.
5. In January 2010, the price of gasoline was $2.70 a gallon. By spring 2010, the price had increased to $3.00 a gallon. Assume that there were no changes in average income, population, or any other influence on buying plans. Explain how the rise in the price of gasoline would affect
   a. The demand for gasoline.
      The rise in the price of gasoline does not change the demand for gasoline. The *demand for gasoline* changes *only* when some other relevant factor other than the price of the good changes.
   b. The quantity of gasoline demanded.
      The rise in the price of gasoline decreases the quantity of gasoline demanded. A rise in the price of a good or service decreases the quantity of that good or service demanded.
6. In 2008, the price of corn increased by 35 percent and some cotton farmers in Texas stopped growing cotton and started to grow corn.
   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 higher price of corn increases the quantity of corn grown.
   b. Why would a cotton farmer grow corn?
      A cotton farmer would switch to corn because the profit from growing corn exceeds that from growing cotton. Cotton and corn are substitutes in production and corn has become more profitable.

Use the following information to work Problems 7 to 9.

Dairies make low-fat milk from full-cream milk. In the process of making low-fat milk, the dairies produce cream, which is made into ice cream. In the market for low-fat milk, 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 the period of low rainfall extending, dairies raise their expected price of low-fat milk next year.
(v) With advice from health-care experts, dairy farmers decide to switch from producing full cream milk to growing vegetables.
(vi) A new technology lowers the cost of producing ice cream.

7. 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) Full-cream milk and low-fat milk are substitutes in production. The decrease in the production of full-cream milk increases the supply of low-fat milk.

(vi) 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.

8. Use a graph to illustrate the effect of each event.

FIGURE **3.1**

Problem 8

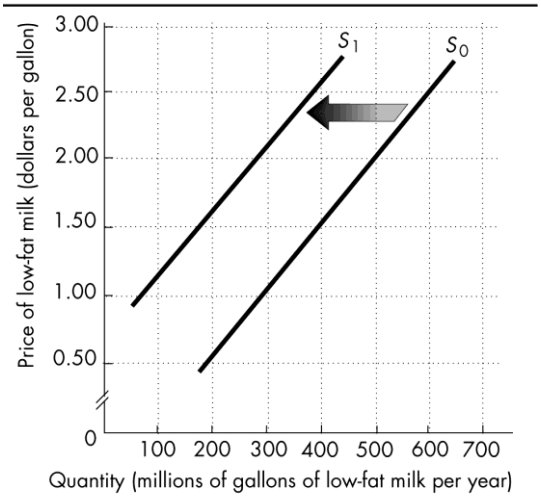


FIGURE **3.2**

Problem 8

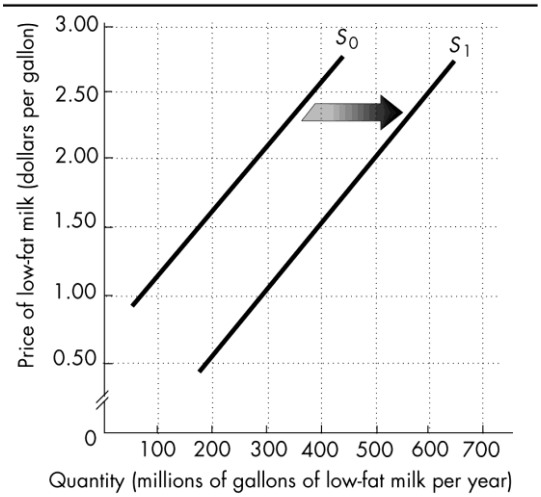
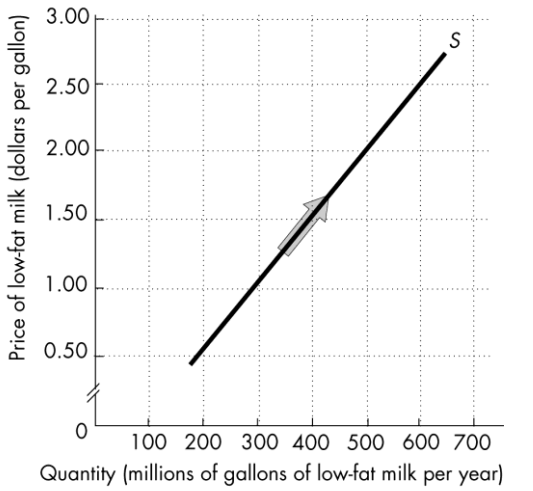


Figure 3.1 illustrates events (i) and (iv), both of which decrease the supply of low-fat milk. Figure 3.2 illustrates events (ii), (v), and (vi), all of which increase the supply of low-fat milk. Figure 3.3 illustrates event (iii), which increases the quantity of low-fat milk supplied.

FIGURE **3.3**
Problem 8



9. Does any event (or events) illustrate the law of supply?

   Event (iii), the rise in the price of low-fat milk, illustrates the law of supply because it leads to a change in the quantity supplied.

10. "As more people buy computers, the demand for Internet service increases and the price of Internet service decreases. The fall in the price of Internet service decreases the supply of Internet service." Explain what is wrong with this statement.

    The statement is wrong for several reasons. First, if the demand for Internet services increases and nothing else changes, the price of Internet service will rise *not* fall. Second, if the price of Internet services falls, the supply of Internet services does not change. Rather, there is a decrease in the quantity supplied, that is, a movement along the supply curve rather than a shift of the supply curve.

11. 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
100	20	220

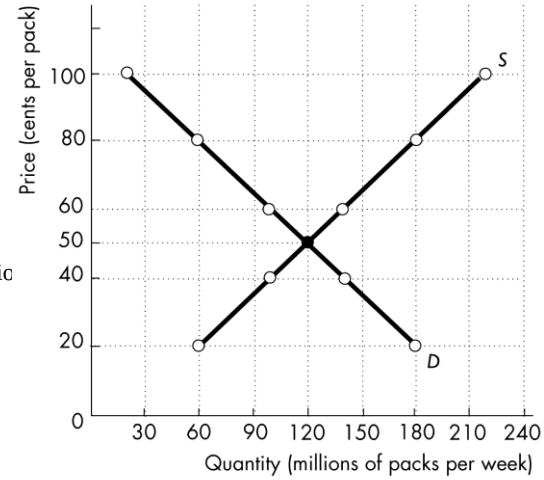
    a. Draw a graph of the market for gum and mark in the equilibrium price and quantity.

       Figure 3.4 shows the demand and supply curves. The equilibrium price is 50 cents a pack, and the equilibrium quantity is 120 million packs a week. The price of a pack adjusts until the quantity demanded equals the quantity supplied. At 50 cents a pack, the quantity demanded is 120 million packs a week and the quantity supplied is 120 million packs a week.

    b. 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

FIGURE **3.4**
Problem 11a



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.

c. 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.

12. 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.

Which of these events will increase or decrease (state which occurs)

a. The demand 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.

b. The supply of gasoline?

(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.

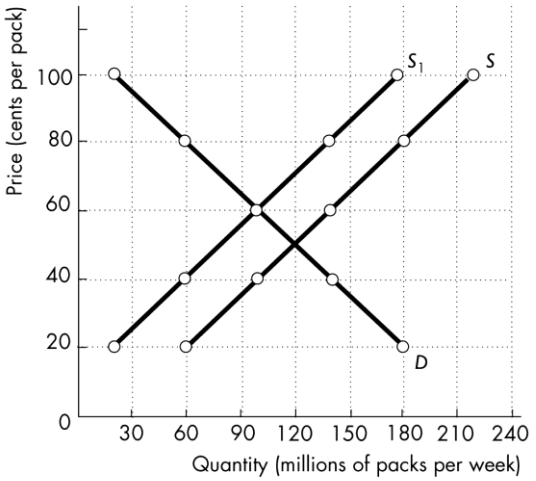
c. The quantity of gasoline demanded?

(i) changes the quantity of gasoline demanded.
If the price of crude oil rises, the cost of producing gasoline rises and the supply of gasoline decreases. The demand for gasoline does not change. The price of gasoline rises and there is a movement up the demand curve for gasoline. The quantity of gasoline demanded decreases.

d. The quantity of gasoline supplied?

(ii) and (iii) and (iv) change the quantity of gasoline supplied.
If the price of a car rises, the quantity of cars bought decrease so the demand for gasoline decreases. The supply of gasoline does not change. The price of gasoline falls and there is a movement down the supply curve of gasoline. The quantity of gasoline supplied decreases.
If all speed limits on highways are abolished, people will drive faster and use more gasoline. The demand for gasoline increases. The supply of gasoline does not change, so the price of gasoline rises and there is a movement up along the supply curve. The quantity of gasoline supplied increases.
If robot production plants lower the cost of producing a car, the supply of cars will increase.

FIGURE **3.5**
Problem 13a



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. The supply of gasoline does not change, so the price of gasoline rises and the quantity of gasoline supplied increases.

13. In Problem 11, a fire destroys some factories that produce gum and the quantity of gum supplied decreases by 40 million packs a week at each price.

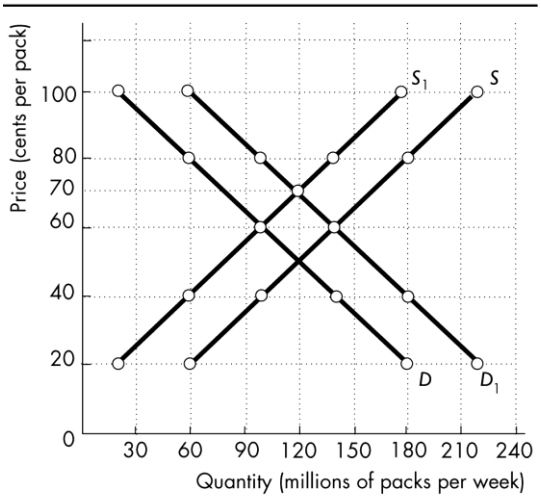
a. Explain what happens in the market for gum and draw a graph to illustrate the changes.

As the number of gum-producing factories decreases, the supply of gum decreases. There is a new supply schedule and, in Figure 3.5, 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.

b. If at the time the fire occurs there is an increase in the teenage population, which increases the quantity of gum demanded by 40 million packs a week at each price, what are the new equilibrium price and quantity of gum? Illustrate these 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 3.6 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 **3.6**
Problem 13b



14. Indian Weddings Boost Gold Price Hopes

Indian weddings traditionally take place between late September and December. The predilection for jewelry at this time usually gives a big boost to gold sales, and the record shows the price of gold has generally risen during this period.

Source: *Financial News*, September 9, 2011

a. Describe the changes in demand and supply in the market for gold in India before and during the wedding season.

The number of people (couples) demanding gold increases during the wedding season, so the demand for gold increases during the wedding season. This factor, by itself, raises the price of gold during the wedding season. Because this event is predictable, the rise in the price also is predictable, which has further consequences on the demand and supply. The rise in the expected future price *during* the

wedding season increases the demand for gold *before* wedding season and decreases the supply of gold *before* the wedding season.

b. Given that the wedding season is a predictable event, how might expectations influence the market for gold in India?

The expected rise in price during the wedding season increases the demand before the wedding season and decreases the supply before the wedding season. Before the wedding season, these changes in demand and supply raise the price of gold from what it otherwise would be; the effect on the quantity, however, is ambiguous. Because the demand increased before wedding season, the demand during wedding season will be less than otherwise. Similarly because the supply decreased before the wedding season, the supply during the wedding season will be larger than otherwise. These changes in demand and supply mean that the price during wedding season will be lower than otherwise, though the effect on the quantity is ambiguous.

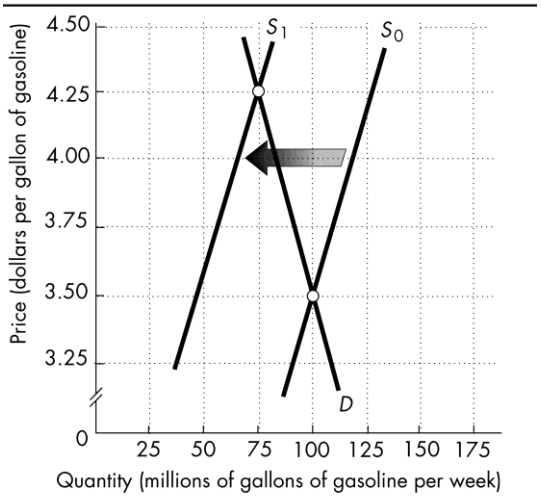
15. **Pump Prices on Pace to Top 2009 High by Weekend**
The cost of filling up the car is rising as the crude oil price soars and pump prices may exceed the peak price of 2009.

Source: *USA Today*, January 7, 2010

a. Does demand for or the supply of gasoline or both change when the price of oil soars?
Oil is used to produce gasoline, so when the price of oil rises, the price of a factor used to produce gasoline rises. The higher price of oil decreases the supply of gasoline. The demand for gasoline does not change.

b. Use a demand-supply graph to illustrate what happens to the equilibrium price of gasoline and the equilibrium quantity of gasoline bought when the price of oil soars.
Figure 3.7 shows the impact of the higher price of oil. The supply of gasoline decreases so that the supply curve shifts leftward from S_0 to S_1. The equilibrium price of gasoline rises, in the figure from \$3.50 per gallon to \$4.25 per gallon, and the equilibrium quantity decreases, in the figure from 100 million gallons per week to 75 million gallons per week.

FIGURE **3.7**
Problem 15



16. **American to Cut Flights, Charge for Luggage**
American Airlines announced that it will charge passengers \$15 for their first piece of checked luggage and cut domestic flights as it grapples with record-high fuel prices.

Source: *Boston Herald*, May 22, 2008

a. According to the news clip, what is the influence on the supply of American Airlines flights?
Fuel prices are a cost of a factor of production. As the cost rises, the supply decreases. American Airlines is decreasing the supply of its flights by cutting domestic flights.

b. Explain how supply changes.
An increase in the cost of the factor of production decreases the supply and shifts the supply curve leftward.

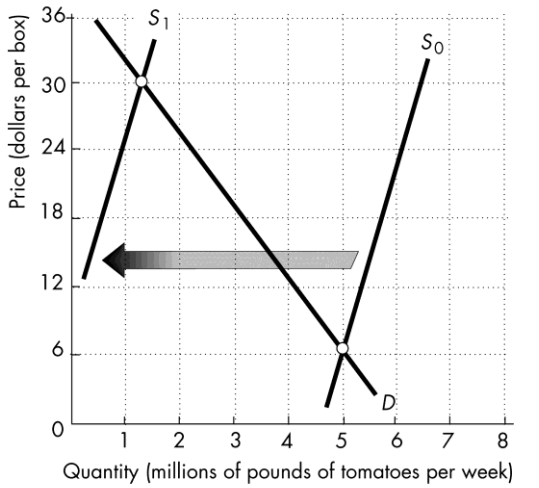
17. **Frigid Florida Winter is Bad News for Tomato Lovers**
An unusually cold January in Florida destroyed entire fields of tomatoes. Florida's growers are shipping only a quarter of their usual 5 million pounds a week. The price has risen from $6.50 for a 25-pound box a year ago to $30 now.

Source: *USA Today*, March 3, 2010

a. Make a graph to illustrate the market for tomatoes in January 2009 and January 2010.

Figure 3.8 shows the tomato market in January 2009 and January 2010. In both years the demand curve is labeled *D*. The supply curve for 2009 is labeled S_0 and the supply curve for 2010 is labeled S_1. The supply curve for 2010 lies to the left of the supply curve for 2009 because the cold January was a bad state of nature and decreased the supply of tomatoes.

FIGURE **3.8**
Problem 17



b. On the graph, show how the events in the news clip influence the market for tomatoes.

The cold weather shifted the supply curve leftward, from S_0 to S_1. The equilibrium price of a box of tomatoes rises from $6.25 per box to $30.00 per box and the equilibrium quantity decreases from 5 million pounds of tomatoes per week to 1.25 million pounds of tomatoes per week.

c. Why is the news "bad for tomato lovers"?

The news is bad for tomato lovers because the price of tomatoes rises and "tomato lovers" respond to the higher price by decreasing the quantity of tomatoes they consume. Tomato lovers consume fewer of the tomatoes they love.

Answers to Additional Problems and Applications

18. 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 he price of oil.

19. 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.

20. 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.

21. Think about the demand for the three game consoles: Xbox, PS3, and Wii. Explain the effect of the following events on the demand for Xbox games and the quantity of Xbox games demanded, other things remaining the same.

    a. The price of an Xbox falls.

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

    b. The prices of a PS3 and a Wii fall.

    A PS3 and a Wii are substitutes for an Xbox. When these game consoles fall in price, the demand for Xbox consoles decreases and so the equilibrium quantity of Xboxes decreases. Consumers decrease their demand for Xbox games because an Xbox game is useless without an Xbox console.

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

    The increase in the number of people writing Xbox games increases the supply of Xbox games. The demand for Xbox games does not change but the increase in the supply lowers the price of an Xbox

game. The fall in the price of Xbox games increases the quantity of Xboxes demanded.

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

e. Programmers who write code for Xbox games become more costly to hire.
The increase in the cost of programmers decreases the supply of Xbox games. When the supply of a good or service decreases, the price of that good or service rises. Xbox games are not an exception, so the price of an Xbox game rises. The rise in the price of an Xbox game decreases the quantity of Xbox games demanded.

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

g. A new game console that is a close substitute for Xbox comes onto the market.
The new game console decreases the demand for Xbox consoles. As a result, the equilibrium quantity of Xbox consoles decreases. Consumers decrease their demand for Xbox games because an Xbox game is useless without an Xbox console.

22. 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 purses and leather shoes
Leather purses 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.)

23. As the prices of homes fell across the United States in 2008, the number of homes offered for sale decreased.

a. Does this fact illustrate the law of demand or the law of supply? Explain your answer.
This fact illustrates the law of supply: As the price falls, the quantity supplied decreases.

b. Why would home owners decide not to sell?
Home owners delay selling their homes because they believe the price they would receive is too low and the price they will receive in the future will be higher.

24. **G.M. Cuts Production for Quarter**
General Motors cut its fourth-quarter production schedule by 10 percent because Ford Motor, Chrysler, and Toyota sales declined in August.

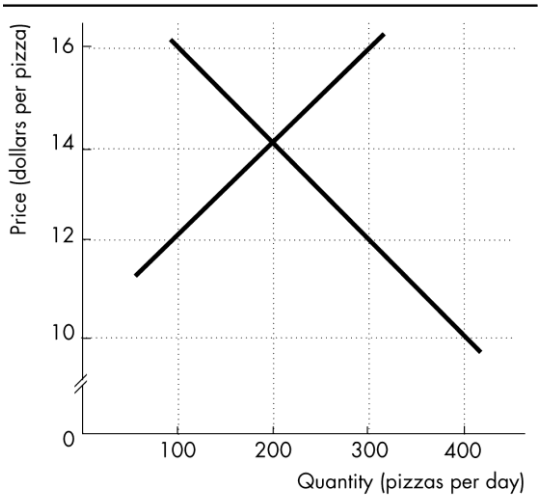
Source: *The New York Times*, September 5, 2007

Explain whether this news clip illustrates a change in the supply of cars or a change in the quantity supplied of cars.

The lower sales of Ford, Chrysler, and Toyota cars probably reflect a decrease in the demand for these cars. G.M. believes that the demand for its cars will decrease, so G.M. is responding to this decrease in demand by decreasing the quantity of its cars supplied.

Use Figure 3.9 to work Problems 25 and 26.

FIGURE **3.9**
Problems 25 and 26



25. 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.

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.

26. 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.

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

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

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

Figure 3.10 (on the next page) 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.

28. In Problem 27, 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 3.11 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 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.

FIGURE **3.10**
Problem 27a

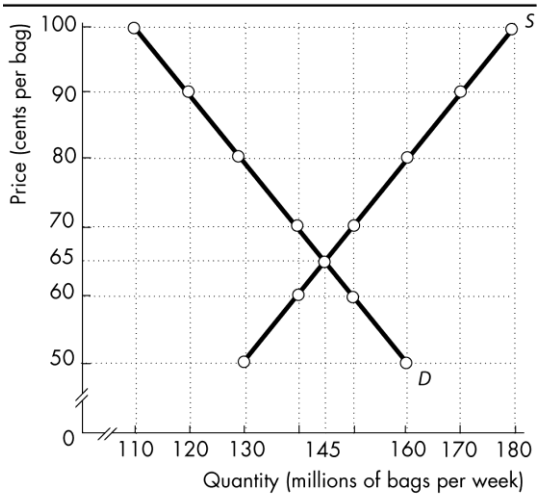
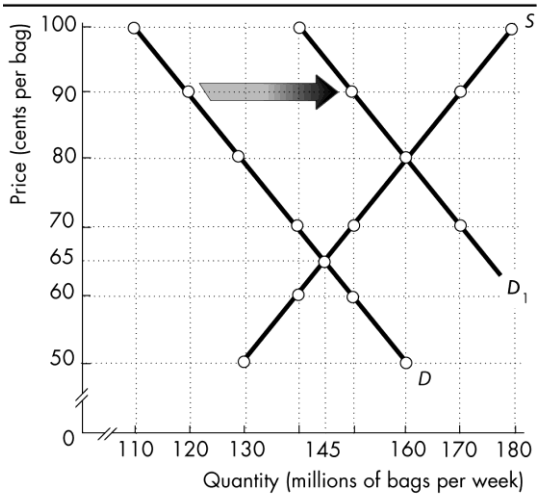


FIGURE **3.11**
Problem 28b



29. In Problem 27, 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.
30. If the virus in Problem 29 hits just as the new dip in Problem 28 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.
31. **Strawberry Prices Drop as Late Harvest Hits Market**
    Shoppers bought strawberries in March for $1.25 a pound rather than the $3.49 a pound they paid last year. With the price so low, some growers plowed over their strawberry plants to make way for spring melons; others froze their harvests and sold them to juice and jam makers.
    Source: *USA Today*, April 5, 2010

a. Explain how the market for strawberries would have changed if growers had not plowed in their plants but offered locals "you pick for free."

If the growers had offered "you pick for free" deals, the supply of strawberries increases. The demand for strawberries at local grocery stores would have decreased as people substituted picking their own berries for buying them in the store. The demand curve for store-bought strawberries would have shifted leftward and the equilibrium price of strawberries purchased in the store would have fallen and the equilibrium quantity would have decreased.

b. Describe the changes in demand and supply in the market for strawberry jam.

Growers increased the quantity of strawberries they sold to jam makers. The increased supply of strawberries to made into jam decreases the price of these strawberries. In turn, the lower price of strawberries lowers the cost of producing strawberry jam. In the market for jam, the supply of strawberry jam increased. The demand for strawberry jam did not change.

32. **"Popcorn Movie" Experience Gets Pricier**

Cinemas are raising the price of popcorn. Demand for field corn, which is used for animal feed, corn syrup, and ethanol, has increased and its price has exploded. That's caused some farmers to shift from growing popcorn to easier-to-grow field corn.

Source: *USA Today*, May 24, 2008

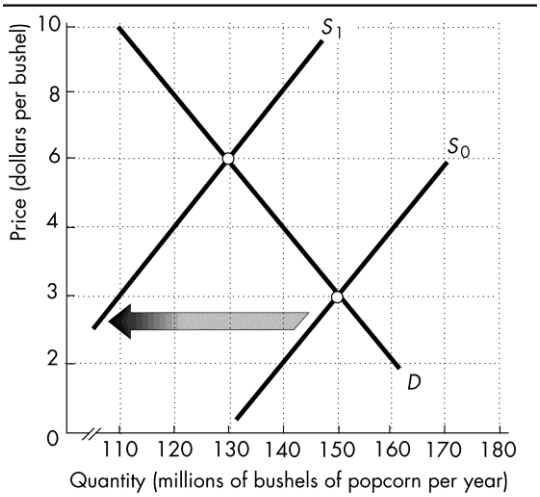
Explain and illustrate graphically the events described in the news clip in the market for

a. Popcorn

As illustrated in Figure 3.12, the farmers' actions decrease the supply of popcorn and the supply curve of popcorn shifts leftward. The demand curve does not shift. The equilibrium price of popcorn rises and the quantity decreases.

FIGURE **3.12**

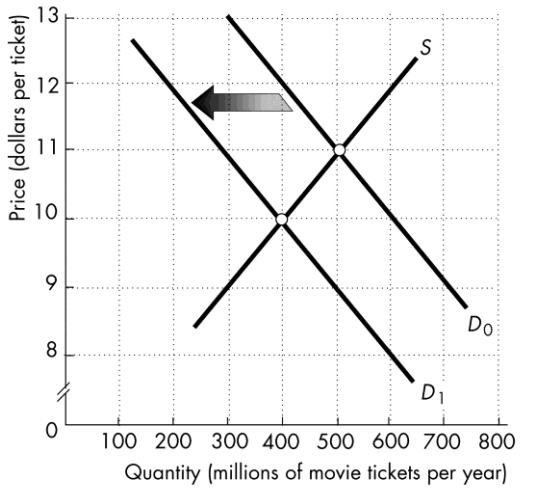
Problem 32a



b. Movie tickets

In the market for movie tickets—essentially the market for viewing movies in the theater—popcorn and viewing movies are complements. The increase in the price of popcorn decreases the demand for attending movies in the theater. As a result, Figure 3.13 shows the demand curve shifting leftward. The equilibrium price of attending a movie in the theater falls and the equilibrium quantity decreases.

FIGURE **3.13**
Problem 32b



33. **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

34. After you have studied *Reading Between the Lines* on pp. 74–75, answer the following questions:

a. What happened to the price of peanut butter in 2011?

The price of peanut butter rose.

b. What substitutions do you expect might have been made to decrease the quantity of peanut butter demanded?

Peanut butter users could substitute other nut butters, such as cashew, almond, or hazelnut butter. They might also substitute other sandwich items, such as cheese slices.

c. What is the main complement of peanut butter and what do you predict happened in its market in 2011?

The classic complement for peanut butter is jelly. The rise in the price of peanut butter decreases the demand for jelly, so the demand curve for jelly shifts leftward. The supply of jelly is unaffected. The decrease in the demand for jelly lowers the equilibrium price of jelly and decreases the equilibrium quantity of jelly.

d. What is one of the main substitutes in production for peanuts and what do you predict happened in its market in 2011?

For producers, growing cotton is a substitute for growing peanuts. As farmers switch from growing peanuts to growing cotton, the supply of cotton increases and the supply curve of cotton shifts rightward. The demand for cotton does not change. The increase in the supply of cotton lowers the equilibrium price of cotton and increases the equilibrium quantity of cotton.

e. Do you predict that the higher prices of peanuts and peanut butter will persist or will they return to normal after one year?

The higher prices will return to normal after a year. It is likely that the peanut growing season in 2012 will be better than that in 2011. In addition, some farmers who switched away from growing peanuts to growing cotton will switch back because the profit from peanuts appears higher than the profit from cotton. Both effects increase the supply of peanuts and thereby lower its equilibrium price back to normal. With the fall in the price of peanuts, the supply of peanut butter increases. The increase in the supply of peanut butter lowers its equilibrium price back to normal.

f. Why did the percentage rise in the price of peanuts exceed the percentage rise in the price of peanut butter?

Peanuts, while an important component of peanut butter, are not the only cost of producing peanut butter. The cost of capital equipment, the cost of the workers, the cost of transporting the peanut butter to the stores, and so forth are all additional costs, which did not rise. The cost of producing peanut butter did not rise by the same percentage as did the price of peanuts so the supply of peanut butter did not decrease by as much as the supply of peanuts, which moderates the price hike. Additionally, the demand curve for peanut butter might be flatter than the demand curve for peanuts, which also would moderate the rise in the equilibrium price.