

Chapter 3

Demand and Supply

■ Overview

This chapter introduces one of the major analytical areas of economics, demand and supply, that forms the basis for much of theoretical analysis used throughout the text. The concepts of the difference between money price and relative price, the law of demand, income and substitution effects, the distinction between a change in demand (supply) and change in quantity demanded (quantity supplied), the law of supply, equilibrium, surpluses, and shortages are introduced. These concepts form the core of the theoretical analysis. It is of equal importance that these concepts be explained as theories of human behavior. Economics is a social science and, as such, attempts to describe and predict human behavior.

■ Learning Objectives

After studying this chapter students should be able to:

- 3.1 Explain the law of demand
- 3.2 Distinguish between changes in demand and changes in quantity demanded
- 3.3 Explain the law of supply
- 3.4 Distinguish between changes in supply and changes in quantity supplied
- 3.5 Understand how the interaction of the demand for and supply of a commodity determines the market price of the commodity and the equilibrium quantity of the commodity that is produced and consumed

■ Outline

- I. **Demand:** A schedule showing how much of a good or service people will purchase at any price during a specified time period, other things being equal
 - A. **The Law of Demand:** The observation that there is a negative or inverse relationship between the price of any good and the quantity demanded, holding other factors constant
 - B. **Relative Prices versus Money Prices:** Relative price is the price of a good or service in terms of another. It is the money price of one commodity divided by the price of another or the number of units of one commodity that must be sacrificed to purchase one unit of another commodity. Money price is the price that is observed in terms of today's dollars. (See Table 3-1.)
 1. **The Relative Price of a House:** The relative price of a house is the money price of a house divided by the price of another good, such as a car.
 2. **Comparing Relative Prices of Digital Storage Devices:** Although the money prices of both flash memory drives and external hard drives has declined, the relative price of external hard drives might have risen relative to that of flash memory drives.

- C. The Demand Schedule:** The demand schedule is a numerical representation of the inverse relationship between specific prices and quantities demanded of a good measured in terms of constant quality units in a given time period. (See **Figure 3-1(a)**.)
- 1. The Demand Curve:** The demand curve is a graphic representation of the demand schedule. It is a negatively sloped line showing the inverse relationship between the price and the quantity demanded, other things being equal. (See **Figure 3-1(b)**.)
 - 2. Individual versus Market Demand Curves:** Individual demand shows the quantity demanded of a good or service by an individual consumer at different prices. Market demand is the demand of all consumers in the marketplace for a good or service and found by summing the quantity demanded by each individual at each price. (See **Figure 3-2, Figure 3-3**.)
- II. Shifts in Demand:** A shift of the entire demand curve so that at each price the quantity demanded changes. A leftward shift of the demand curve means the quantity demanded at each price decreases, while a rightward shift of the demand curve means the quantity demanded at each price increases. (See **Figure 3-4**.)
- A. The Other Determinants of Demand:** These are nonprice factors that determine how much will be bought, other things held constant. A change in any one of these factors will cause a change in demand.
- 1. Income:** For a normal good, an increase in income leads to an increase in demand, while a decrease in income leads to a decrease in demand. For an inferior good, an increase in income leads to a decrease in demand, while a decrease in income leads to an increase in demand.
 - 2. Tastes and Preferences:** If consumer tastes change in favor of a good, then there is an increase in demand for it. If consumer tastes move against the good, then there is a decrease in demand for it.
 - 3. Prices of Related Goods: Substitutes and Complements:** When two goods are related, a change in the price of one of them changes the demand for the other. Substitutes are goods that can be used to satisfy a similar want. If the price of one changes, demand for the other changes in the same direction. Complements are goods that are consumed together. If the price of one changes, the demand for the other changes in the opposite direction.
 - 4. Expectations:** Expectations of future increases in the price of a good, increases in income, and reduced availability lead to an increase in demand now. Expectations of future decreases in the price of a good, decreases in income, and increased availability lead to a decrease in demand now.
 - 5. Market Size (Number of Potential Buyers):** An increase in the number of buyers in the market causes an increase in demand. A decrease in the number of buyers causes a decrease in demand.
- B. Changes in Demand versus Changes in Quantity Demanded:** A change in demand refers to a shift of the entire demand curve to the right or left if there is a change in a determinant of demand other than price. (See **Figure 3-4**.) A change in quantity demanded refers to a movement along a given demand curve caused by a change in price. (See **Figure 3-6**.)
- III. Supply:** A schedule showing the relationship between price and quantity supplied at different prices in a specified time period, other things being equal.
- A. The Law of Supply:** The observation that the higher the price of a good, the larger the quantity sellers will make available over a specified time, other things being equal.

- B. The Supply Schedule:** A table that shows a direct relationship between price and quantity supplied at each price in a given time period. (See **Figure 3-7(a)**.)
- 1. Supply Curve:** The graphical representation of the supply schedule, which is a curve that generally slopes upward (has a positive slope), other things being equal. (See **Figure 3-7(b)**.)
 - 2. The Market Supply Curve:** A market supply curve is the sum of the supply curves of all individual producers in the market. Summing the quantity supplied at each price by each producer (horizontal summing of the individual supply curves) derives the market supply curve. (See **Figure 3-8**, **Figure 3-9**.)
- IV. Shifts in Supply:** A change in supply is a shift of the entire supply curve so that at each price the quantity supplied changes. A leftward shift of the supply curve means that the quantity supplied at each price decreases and is called a decrease in supply, while a rightward shift of the supply curve means that quantity supplied at each price increases and is called an increase in supply. (See **Figure 3-10**.)
- A. The Other Determinants of Supply:** These are factors other than price that determine how much will be produced and are held constant when identifying supply. A change in one of these factors will cause the supply curve to shift.
- 1. Technology and Productivity:** An improvement in technology will cause an increase in supply.
 - 2. Cost of Inputs Used to Produce the Product:** An increase (decrease) in the price of one or more inputs will cause a decrease (increase) in supply.
 - 3. Price Expectations:** An expected increase (decrease) in the relative price of a good can lead to a decrease (increase) in supply.
 - 4. Taxes and Subsidies:** Increases (decreases) in indirect taxes have the same effect as raising (lowering) costs and thus decreases (increases) supply. A subsidy is a negative tax.
 - 5. Number of Firms in the Industry:** If the number of firms increases (decreases), supply will increase (decrease).
- B. Changes in Supply versus Changes in Quantity Supplied:** A change in quantity supplied refers to a movement along a given supply curve caused by a change in price. A change in supply refers to a shift of the entire supply curve to the right or left caused by a change in a nonprice determinant of supply.
- V. Putting Demand and Supply Together:** The intersection of demand and supply determines the prices that prevail in the U.S. economy and other economies.
- A. Demand and Supply Schedules Combined:** When the supply and demand schedules are combined, an equilibrium or market-clearing price is determined. This is a price at which quantity demanded equals quantity supplied. There is neither an excess quantity supplied (surplus) nor an excess quantity demanded (shortage). (See **Figure 3-11**.)
- B. Equilibrium:** Equilibrium is a stable point. When equilibrium is reached, there is no tendency for change unless supply and/or demand change. Equilibrium is a situation where quantity supplied equals quantity demanded at a particular price. Equilibrium occurs where the supply and demand curves intersect. (See **Figure 3-11**.)
- C. Shortages:** A shortage is a situation in which quantity demanded is greater than quantity supplied at a price below the market-clearing price. *Shortages and scarcity are not the same thing.* A shortage is corrected when price increases. Quantity demanded will fall, and quantity supplied will increase until equilibrium is reached. (See **Figure 3-11**.)
- D. Surpluses:** A surplus is a situation in which quantity demanded is less than quantity supplied at a price above the market-clearing price. A surplus is corrected when price decreases. Quantity demanded will rise, and quantity supplied will fall until equilibrium is reached. (See **Figure 3-11**.)

■ Points to Emphasize

Relative and Money Price

In the discussion of the law of demand, the inverse relationship is between relative price and quantity demanded, not between money price and quantity demanded. The distinction between relative and money price is difficult to understand. Because incomes can be related to price level, the use of the example of a family's income rising by 5 percent while the price level rises by 10 percent is often helpful. It is apparent that the family would be worse off. If the family's income had risen by 20 percent, the family would be better off, while a 5 percent rise in income would have left them no better off. Now suppose that the price level is rising by 10 percent per year while the price of gasoline is rising by 5 percent. When the relative price of gasoline is falling, it is becoming cheaper compared to other goods. Economists would predict that the quantity of gasoline demanded would rise even though its money price rises.

Constant Quality Units

It is important to recognize that the units of the good or service being examined in supply and demand analysis be comparable. In the computer market, it would not be appropriate to put low-end laptops and high-end desktop computers together because their computing power and applications will be quite different.

Changes in Relative Prices

Consumers will substitute relatively less expensive goods for relatively more expensive ones. When the money price of a can of Coke increases by less than the price of a can of Pepsi increases, then buyers will drink more Coke and fewer Pepsi. Suppose that the money price of both Pepsi and Coke is \$0.50 per can. One can of Coke equals one can of Pepsi. Let the money price of one can of Coke increase to \$0.75 while the price of a can of Pepsi increases to \$1.50. Now two cans of Coke equal one can of Pepsi, or one can of Coke equals one-half of a can of Pepsi. This is a fall in the relative price of Coke or a rise in the relative price of Pepsi. Because Coke is now relatively cheaper, more of them will be purchased, and less Pepsi will be purchased. The **quantity of Coke demanded** will increase, while the **demand for Pepsi** will decrease.

Shifts in Demand (Supply) versus Changes in Quantity Demanded (Supplied)

A shift in a demand (supply) curve can only occur if there is a change in a determinant of demand (supply) other than price. Also, the entire curve moves so that at each price the quantity demanded (supplied) changes. A simple way to show what happens when demand increases is to take a demand schedule and make the quantity demanded values bigger at each price and then show the shift graphically. By contrast, a change in quantity demanded (supplied) is a movement along a demand curve (supply curve) and can only occur when price changes.

| Price \$ | Quantity Demanded 1 | Quantity Demanded 2 | Quantity Supplied |
|--------------|------------------------|------------------------|----------------------|
| 5 | 10 | 25 | 40 |
| $P_{E2} = 4$ | 20 | $Q_{D2} = 35$ | $Q_{S2} = 35$ |
| $P_{E1} = 3$ | $Q_{D1} = 30$ | 45 | $Q_{S1} = 30$ |
| 2 | 40 | 55 | 25 |
| 1 | 50 | 65 | 20 |

The initial Demand schedule is shown as Price and Quantity Demanded 1 and the Supply schedule is shown by Price and Quantity Supplied. The equilibrium price, P_{E1} , is \$3 and the equilibrium quantity supplied, Q_{S1} , and quantity demanded, Q_{D1} , are equal at 30 units.

An increase in demand is shown when quantity demanded increases at each price and is shown in the Quantity Demanded 2 column. Such an increase in demand is the result of a change in a nonprice determinant of demand, such as an increase in income for a normal good. The equilibrium price increases to $P_{E1} = \$4$, and the equilibrium quantity supplied, Q_{S1} , increases to 35 units equilibrium, and quantity demanded, Q_{D1} , increases to 35 units.

Because price increased as a result of the increase in demand, the quantity supplied increased from 30 to 35 units. Supply did not increase because the supply schedule as a whole remained unchanged. If the demand curve is plotted, it will be shown to increase, that is, shift outward to the right. A similar movement can be demonstrated by simply changing the numbers in the Quantity Supplied column, leaving demand unchanged.

Equilibrium or Market-Clearing Price

Equilibrium price is stable because it is a price at which plans or intentions are realized. Demand refers to planned rates of purchase at different prices, other things being equal, while supply refers to planned rates of production that producers expect to sell at different prices, other things being equal. Equilibrium price is a price where the planned rate of purchases equals the planned rate of production, other things being equal. At any price below equilibrium, a shortage exists. In this situation, producers' plans are realized in the sense that they sell all they are willing to produce at the market price. Buyers cannot realize their purchase plans. They will put upward pressure on price. Price will rise, and quantity demanded will fall. Concurrently, quantity supplied will rise. This process will continue until the equilibrium price is reached.

When price is above equilibrium, a surplus exists. In this case, buyers' plans are realized, but producers cannot sell all they are producing and do not realize their plans. Producers react by reducing price and quantity supplied. At a lower price, quantity supplied decreases, while the quantity demanded increases. The process continues until an equilibrium price is reached. The concepts of surpluses and shortages can be used effectively to explain why equilibrium price changes when there is a shift in either the supply or demand curve. In effect, buying or selling plans change, so one group's plans are no longer realized. The result is a price change that changes both the planned rate of purchase and the planned rate of production until the two are equal.

Resource allocation systems could be discussed. Identify ways to allocate the available amount of the product. The market allocates goods to the highest bidder. Other ways could be need, first-come first-served, equity, custom, or government decree. As an exercise in normative economics, the fairness of each method can be discussed.

■ For Those Who Wish to Stress Theory

Demand and Marginal Utility

The law of demand can be approached from the point of view of diminishing marginal utility. Since a buyer gets less and less additional utility or satisfaction as successive additional units are consumed per time period, she places less and less value on each additional unit. If a utility-maximizing consumer is to be induced to buy additional units of a good per time period, price must be lowered to offset the decline in marginal utility.

Supply and Marginal Costs

The law of supply can be explained by increasing marginal costs and by an explanation of incentives. A discussion of rising marginal costs requires the introduction of the law of diminishing returns. As more units of labor are employed in the short run, the marginal product of labor begins to fall after some point. At a constant wage, the labor cost per additional unit rises because more labor time is required to produce that extra unit. Thus, price must rise to induce a producer to incur the additional cost. A firm that can produce more than one product will try to produce the most profitable one(s). A retailer with limited shelf space will allocate more space to those products whose prices are increasing relative to the prices of other goods that he sells, other things held constant.

■ Further Questions for Class Discussion

1. “If price rises, then demand decreases. But if demand decreases, then equilibrium price will fall. Therefore one cannot say with certainty what the net effect of an initial increase in price will be.” Have students evaluate this statement. The word “demand” is used incorrectly in the first sentence. The fact that demand is used correctly in the second sentence does not solve the problem. Students usually have trouble with the terms “changes in demand” versus “changes in quantity demanded.” They often wonder why economists make such a fuss about this terminology. The correct use of terminology is important because it allows people using the terminology to communicate precisely. Point out to the class that they would not want two surgeons who were operating on them to remove an appendix to have different meanings for the word “appendix.”
2. A video outlet rents DVDs of old movies for \$0.99 for 48 hours. It typically rents 200 DVDs per day. The outlet gets in multiple copies of a smash hit movie and charges \$2.50 to rent it for 24 hours. Total rentals rise to 250 videos per day even though the average price of videos is higher. Does this refute the law of demand? The answer is no. In fact, what we have here are two separate goods. Old videos and a new smash hit should be represented by two different demand curves. This situation can be viewed as differences in quality or as goods subject to different tastes and preferences.
3. After Hurricane Katrina, the price of gasoline increased because of extensive damage to refineries on the Gulf Coast. How would an economist use supply-and-demand analysis to explain the increase in the price of gasoline in the United States right after Hurricane Katrina? The damage to the Gulf Coast refineries decreased the supply of gasoline in the United States. The decrease in supply resulted in an increase in the price of gasoline.
4. A major political issue in the United States since the BP oil spill in the Gulf of Mexico is whether or not to allow drilling for oil offshore in deep water to continue. Large deposits of oil are believed to exist in the deeper water areas there based on the results of exploration and drilling. Use the supply and demand model to explain the likely effect on the supply and demand for oil over time if drilling is prohibited, other things held constant. The effect would be to decrease the supply of oil. There would be no effect on the demand for oil.
5. In recent years the price of natural gas has decreased relative to the price of coal. Both of these fuels are used to produce electricity. What would the supply and demand model predict would have happened to the demand for coal used to produce electricity? Are coal and natural gas substitutes or complements? Because they are both used to produce electricity, they are substitutes. If the price of a good decreases, the demand for substitute goods decreases, other things held constant. Because the demand for natural gas decreased, the demand for coal to produce electricity would have decreased.

6. Oilman T. Boone Pickins has proposed a plan to build wind farms in the center of the United States to produce about 20 percent of the electricity consumed in the United States to replace that same percentage of electricity currently produced by natural gas. The natural gas saved would be used to replace gasoline to run cars and light trucks. According to Pickins, oil imports could be reduced by one third. The United States currently uses about 25 percent of global oil production. Using the supply-and-demand model, explain how Pickins's plan would affect the global price of oil if it were to be successfully implemented. The global demand for oil would decrease, thus decreasing the price of oil, other things held constant.

■ Answers to Questions for Critical Analysis

The Law of Demand in the Market for Cable TV Subscription (p. 51)

Is there an inverse relationship between the price of cable TV subscriptions and the number of subscriptions that people purchase? Explain.

There is an inverse relationship between the price of cable TV subscriptions and the number of subscriptions that people purchase. As the price of cable TV subscriptions increased between 2000 and 2017, the quantity of cable TV subscriptions that people purchase decreased.

Tips and Quality-Adjusted Prices (p. 52)

How could laws that ban tips cause a reduction in the quality of the delivery of services?

If the government passes a law to ban tipping, then consumers will no longer be allowed to pay a price consistent with the overall quality of the service they actually receive. The quality of the service will decrease as a result.

Altered Tastes and Preferences Generate Lower Demand for Chewing Gum (p. 57)

What has happened to the position of the U.S. market demand curve for chewing gum? Explain briefly.

The U.S. market demand curve for chewing gum has shifted leftward. This is the result of a decrease in the amount of chewing gum purchased without any increase in the inflation-adjusted price of chewing gum.

A Global Substitution from Coal to Natural Gas as an Energy Source (p. 57)

What do you suppose has happened since 2008 to the demand for nuclear energy in Europe, the United States, and China, other things being equal?

The demand for nuclear energy would have decreased in those countries because natural gas and nuclear energy are substitutes to each other as different sources of energy power.

Policies Generate Higher Water Input Costs and Cut Agricultural Commodity Supplies (p. 64)

What do you suppose has happened to the positions of the supply curves in the markets for commodities such as almonds, apples, cotton, oranges, grapes, lemons, rice, and walnuts?

As a result of an increase in the input prices, the supply curves of those agricultural commodities has shifted leftward.

An Increase in the Supply of Automobiles in China (p. 64)

Has the market supply curve in China shifted rightward or leftward? Explain.

The market supply curve of automobiles in China has shifted rightward. The number of automobile-manufacturing plants in China has increased from fewer than 100 in 2010 to more than 140 today.

Long Lines at Restaurants Specializing in Barbecued Brisket Signal a Shortage (p. 67)

Why do you suppose that prices of barbecued brisket have been rising in many U.S. cities?

When those U.S. cities experienced shortages in their local markets for barbecued brisket, the prices of barbecued brisket would rise until the shortages were eliminated.

Should Shortages in the Ticket Market Be Solved by Scalpers? (p. 68)

What happens to ticket scalpers who are still holding tickets after an event has started?

Ticket scalpers who are still holding tickets after the event has started may find that they cannot sell them or they must sell them at any price they can get, which may be even less than what they paid because the tickets will have no value at all after the event is over.

■ You Are There

The Breakfast Cereal Industry Confronts Changing Tastes and Preferences (p. 69)

1. What has been the direction of the shift in the demand for breakfast cereals?

The demand for breakfast cereals has shifted leftward as its demand has decreased at the existing prices of breakfast cereals.

2. What direction might the supply of breakfast cereals have shifted to help explain why the market prices of these cereals have not changed very much during the past few years?

Given the decrease in the market demand for breakfast cereals, fairly stable market prices would be the result of a corresponding decrease in the market supply of breakfast cereals. Without the decrease in market supply, the market prices would have decreased.

■ Issues & Applications

The U.S. Oil Gusher Produces Shortages of Oil Storage Space (p. 70)

1. What do you predict has happened to oil storage prices whenever shortages of storage space have arisen?

When shortages of storage space have arisen, oil storage prices would have increased.

2. Why might increases in oil storage prices be required to induce owners of aged storage tanks to increase the quantity of tank storage space supplied? (Hint: Owners must incur expenses to refurbish storage tanks.)

Because aged oil storage tanks cannot readily be filled to capacity, an increase in quantity of oil storage would add to their owners' operating costs, which in turn would induce the owners to raise the oil storage prices.

■ Research Project

1. Learn more about the U.S. government's estimates of the nation's oil storage capabilities in the Web Links in MyEconLab.
2. Consider data regarding U.S. oil production and quantities of stored oil in the Web Links in MyEconLab.

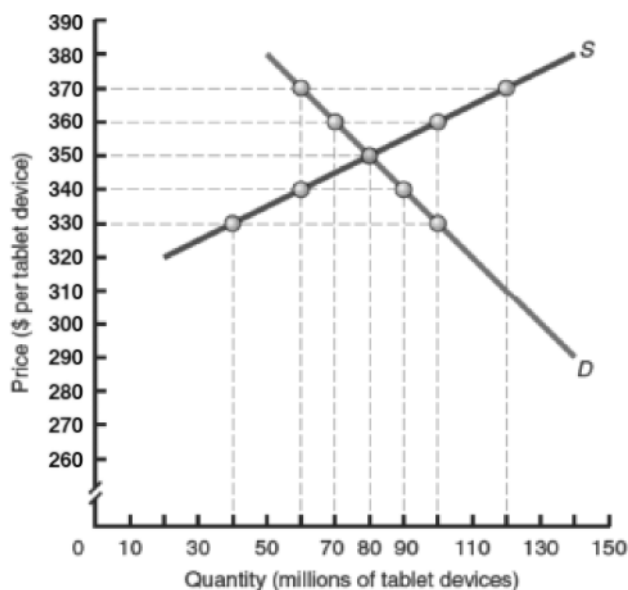
■ Answers to Problems

- 3-1. Suppose that in a recent market period, the following relationship existed between the price of tablet devices and the quantity supplied and quantity demanded.

| Price | Quantity Demanded | Quantity Supplied |
|-------|-------------------|-------------------|
| \$330 | 100 million | 40 million |
| \$340 | 90 million | 60 million |
| \$350 | 80 million | 80 million |
| \$360 | 70 million | 100 million |
| \$370 | 60 million | 120 million |

Graph the supply and demand curves for tablet devices using the information in the table. What are the equilibrium price and quantity? If the industry price is \$340, is there a shortage or surplus of tablet devices? How much is the shortage or surplus?

The equilibrium price is \$350 per tablet device, and the equilibrium quantity is 80 million tablet devices. At a price of \$340 per tablet device, the quantity of tablet devices demanded is 90 million, and the quantity of tablet devices supplied is 60 million. Hence, there is a shortage of 30 million tablet devices at a price of \$340 per tablet.



- 3-2. Suppose that in a later market period, the quantities supplied in the table in Problem 3-1 are unchanged. The amount demanded, however, has increased by 30 million at each price. Construct the resulting demand curve in the illustration you made for Problem 3-1. Is this an increase or a decrease in demand? What are the new equilibrium quantity and the new market price? Give two examples of changes in *ceteris paribus* conditions that might cause such a change.**

If quantity demanded increases by 30 million at each price, then the new equilibrium price is \$360 per tablet device, and the new equilibrium quantity is 100 million tablet devices. This is an increase in demand, which could be brought about by a change in any of the *ceteris paribus* conditions relating to the demand curve. For example, an increase in the demand for tablet devices could arise from either a decrease in the price of a complement, such as tablet-device apps, or an increase in the price of a substitute, such as laptop computers or sophisticated smartphones.

- 3-3. Consider the market for cable-based Internet access service, which is a normal good. Explain whether the following events would cause an increase or a decrease in demand or an increase or a decrease in the quantity demanded.**
- a. Firms providing wireless (an alternative to cable) Internet access services reduce their prices.
 - b. Firms providing cable-based Internet access services reduce their prices.
 - c. There is a decrease in the incomes earned by consumers of cable-based Internet access services.
 - d. Consumers' tastes shift away from using wireless Internet access in favor of cable-based Internet access services.
- a. Wireless and cable Internet access services are substitutes, so a reduction in the price of wireless Internet access services causes a decrease in the demand for cable-based Internet access services.
 - b. A decrease in the price of cable-based Internet access services generates an increase in the quantity of these services demanded.
 - c. Cable-based Internet access services are a normal good, so a fall in the incomes of consumers reduces the demand for these services.
 - d. If consumers' tastes shift away from wireless Internet access services in favor of cable-based Internet services, then the demand for the latter services increases.
- 3-4. In the market for portable power banks (a normal good), explain whether the following events would cause an increase or a decrease in demand or an increase or a decrease in the quantity demanded. Also explain what happens to the equilibrium quantity and the market clearing price.**
- a. There are increases in carry cases for portable power banks.
 - b. There is a decrease in the price of devices used to charge portable power banks.
 - c. There is an increase in the number of consumers of portable power banks.
 - d. A booming economy increases the income of the typical buyer of portable power banks.
 - e. Consumers of portable power banks anticipate that the price of this good will decline in the future.
- a. Carry cases are complements in the consumption of portable power banks, so increases in their prices cause the demand for portable power banks to decline. The market clearing price of and equilibrium quantity of portable power banks both decline.
 - b. Devices used to charge portable power banks are a complement in the consumption of portable power banks, so a fall in the price of this item generates an increase in the demand for portable power banks. The market clearing price of and equilibrium quantity of portable power banks both increase.

- c. An increase in number of consumers of portable power banks generates an increase in the demand for this item, which causes the both the market clearing price and equilibrium quantity of portable power banks to increase.
- d. As long as portable power banks are a normal good, the rise in consumers' incomes causes the demand for portable power banks to increase. This causes both the market clearing price and equilibrium quantity of portable power banks to increase.
- e. Because consumers expect a lower price of portable power banks in the future, their current demand for portable power banks decreases. The result is a decrease in both the market clearing price and equilibrium quantity of portable power banks in the present.

3-5. Give an example of a complement and a substitute in consumption for each of the following items.

a. Bacon

b. Tennis racquets

c. Coffee

d. Automobiles

- a. Complement: eggs; Substitute: sausage
- b. Complement: tennis balls; Substitute: racquetball racquets
- c. Complement: cream; Substitute: tea
- d. Complement: gasoline; Substitute: city bus

3-6. For each of the following shifts in the demand curve and associated price change of a complement or substitute item, explain whether the price of the complement or substitute must have increased or a decreased.

- a. A rise in the demand for a dashboard global-positioning-system device follows a change in the price of automobiles, which are complements.**
- b. A fall in the demand for e-book readers follows a change in the price of e-books, which are complements.**
- c. A rise in the demand for tablet devices follows a change in the price of ultrathin laptop computers, which are substitutes.**
- d. A fall in the demand for physical books follows a change in the price of e-books, which are substitutes.**

- a. decrease in price of automobiles
- b. increase in price of e-books
- c. increase in price of ultrathin laptop computers
- d. decrease in the price of e-books

3-7. Identify which of the following would generate an increase in the market demand for tablet devices, which are a normal good.

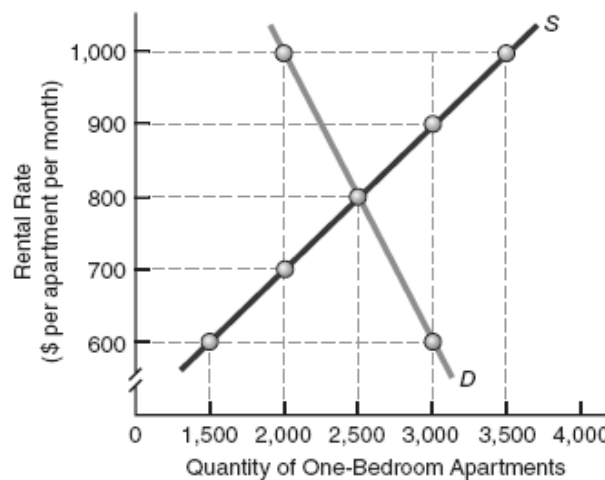
- a. A decrease in the incomes of consumers of tablet devices**
- b. An increase in the price of ultrathin computers, which are substitutes**
- c. An increase in the price of online apps, which are complements**
- d. An increase in the number of consumers in the market for tablet devices**

b and d

- 3-8. Identify which of the following would generate a decrease in the market demand for e-book readers, which are a normal good.**
- An increase in the price of downloadable apps utilized to enhance the e-book reading experience, which are complements
 - An increase in the number of consumers in the market for e-book readers
 - A decrease in the price of tablet devices, which are substitutes
 - A reduction in the incomes of consumers of e-book readers

a, c, and d

- 3-9. Consider the following diagram of a market for one-bedroom rental apartments in a college community.**



- At a rental rate of \$1,000 per month, is there an excess quantity supplied, or is there an excess quantity demanded? What is the amount of the excess quantity supplied or demanded?
 - If the present rental rate of one-bedroom apartments is \$1,000 per month, through what mechanism will the rental rate adjust to the equilibrium rental rate of \$800?
 - At a rental rate of \$600 per month, is there an excess quantity supplied, or is there an excess quantity demanded? What is the amount of the excess quantity supplied or demanded?
 - If the present rental rate of one-bedroom apartments is \$600 per month, through what mechanism will the rental rate adjust to the equilibrium rental rate of \$800?
- At the \$1,000 rental rate, the quantity of one-bedroom apartments supplied is 3,500 per month, but the quantity demanded is only 2,000 per month. Thus, there is an excess quantity of one-bedroom apartments supplied equal to 1,500 apartments per month.
 - To induce consumers to lease unrented one-bedroom apartments, some landlords will reduce their rental rates. As they do so, the quantity demanded will increase. In addition, some landlords will choose not to offer apartments for rent at lower rates, and the quantity supplied will decrease. At the equilibrium rental rate of \$800 per month, there will be no excess quantity supplied.

- c. At the \$600 rental rate, the quantity of one-bedroom apartments demanded is 3,000 per month, but the quantity supplied is only 1,500 per month. Thus, there is an excess quantity of one-bedroom apartments demanded equal to 1,500 apartments per month.
- d. To induce landlords to make more one-bedroom apartments available for rent, some consumers will offer to pay higher rental rates. As they do so, the quantity supplied will increase. In addition, some consumers will choose not to try to rent apartments at higher rates, and the quantity demanded will decrease. At the equilibrium rental rate of \$800 per month, there will be no excess quantity demanded.

3-10. Consider the market for paperbound economics textbooks. Explain whether the following events would cause an increase or a decrease in supply or an increase or a decrease in the quantity supplied.

- a. The market price of paper increases.**
 - b. The market price of economics textbooks increases.**
 - c. The number of publishers of economics textbooks increases.**
 - d. Publishers expect that the market price of economics textbooks will increase next month.**
- a. The rise in the price of paper, a key input in textbook production, causes a decrease in the supply of textbooks.
 - b. An increase in the market price of economics textbooks causes an increase in the quantity of textbooks supplied.
 - c. A rise in the number of textbook publishers increases the supply of textbooks.
 - d. If publishers expect the market price of textbooks will rise next week, the current supply of textbooks will decline.

3-11. Consider the market for smartphones. Explain whether the following events would cause an increase or a decrease in supply or an increase or a decrease in the quantity supplied. Illustrate each, and show what would happen to the equilibrium quantity and the market price.

- a. The price of touch screens used in smartphones declines.**
 - b. The price of machinery used to produce smartphones increases.**
 - c. The number of manufacturers of smartphones increases.**
 - d. There is a decrease in the market demand for smartphones.**
- a. Because touchscreens are an input in the production of smartphones, a decrease in the price of touchscreens causes an increase in the supply of smartphones. The market supply curve shifts to the right, which causes the market price of smartphones to fall and the equilibrium quantity of smartphones to increase.
 - b. Machinery used to produce smartphones is an input in the production of these devices, so an increase in the price of machinery generates a decrease in the supply of smartphones. The market supply curve shifts to the left, which causes the market price of smartphones to rise and the equilibrium quantity of smartphones to decrease.
 - c. An increase in the number of manufacturers of smartphones causes an increase in the supply of smartphones. The market supply curve shifts rightward. The market price of smartphones declines, and the equilibrium quantity of smartphones increases.
 - d. The demand curve for smartphones shifts to the left along the supply curve, so there is a decrease in the quantity supplied. The market price falls, and the equilibrium quantity declines.

- 3-12. If the price of flash memory chips used in manufacturing smartphones decreases, what will happen in the market for smartphones? How will the equilibrium price and equilibrium quantity of smartphones change?**

Because flash memory chips are an input in the production of smartphones, a decrease in the price of flash memory chips generates an increase in the supply of smartphones. The market price of smartphones will decrease, and the equilibrium quantity will increase.

- 3-13. Assume that the cost of aluminum used by soft-drink companies increases. Which of the following correctly describes the resulting effects in the market for soft drinks distributed in aluminum cans? (More than one statement may be correct.)**
- The demand for soft drinks decreases.**
 - The quantity of soft drinks demanded decreases.**
 - The supply of soft drinks decreases.**
 - The quantity of soft drinks supplied decreases.**

Aluminum is an input in the production of canned soft drinks, so an increase in the price of aluminum reduces the supply of canned soft drinks (option c). The resulting rise in the market price of canned soft drinks brings about a decrease in the quantity of canned soft drinks demanded (option b). In equilibrium, the quantity of soft drinks supplied decreases (option d) to an amount equal to the quantity demanded. The demand curve does not shift, however, so option b does not apply.

- 3-14. In Figure 3-2, what are the effects of a price decrease from \$4 per portable power bank to \$2 per portable power bank on the quantities of portable power banks demanded by buyer 1 and by buyer 2 individually and combined?**

For Buyer 1, the price decrease from \$4 per portable power bank to \$2 per portable power bank causes a 20-unit increase in the quantity of portable power banks demanded, from 20 to 40. For Buyer 2, the price decrease generates a 30-unit increase in the quantity of portable power banks demanded, from 20 to 50. Thus, for the two buyers combined, there is a 50-unit increase in the total quantity demanded, from 40 units to 90 units.

- 3-15. In Figure 3-2, what are the effects of a price increase from \$1 per portable power bank to \$3 per portable power bank on the quantities demanded by buyer 1 and by buyer 2 individually and combined?**

For Buyer 1, the price increase from \$1 per portable power bank to \$3 per portable power bank causes a 20-unit decrease in the quantity of portable power banks demanded, from 50 to 30. For Buyer 2, the price increase generates a 20-unit decrease in the quantity of portable power banks demanded, from 60 to 40. Thus, for the two buyers combined, there is a 40-unit decrease in the total quantity demanded, from 110 units to 70 units.

- 3-16. In figure 3-4, the current position of the demand curve is D_1 , and the price of a portable power bank is \$3. If there is an increase in the price of tablet devices that are complements to portable power banks, will the demand curve shift to D_2 or to D_3 ? What is the change in the amount of portable power bank demanded?**

The increase in the price of tablet devices that are complements to portable power banks causes a leftward shift in the demand for portable power banks, from D_1 to D_3 . At the price of \$3 per portable power bank, the amount of portable power banks demanded decreases by 2 million units, from 6 million units to 4 million units.

- 3-17. In figure 3-4, the current position of the demand curve is D_1 , and the price of a portable power bank, which is a normal good, is \$3. If there is an increase in consumer incomes, will the demand curve shift to D_2 or to D_3 ? What is the change in the amount of portable power banks demanded?**

The increase in consumer incomes generates a rightward shift in the demand curve, from D_1 to D_2 . At the price of \$3 per portable power bank, the amount of portable power banks demanded increases by 4 million units, from 6 million units to 10 million units.

- 3-18. In Figure 3-7, what are the effects of a price decrease from \$5 per portable power bank to \$3 per portable bank on the quantities supplied by supplier 1 and by supplier 2 individually and combined?**

For Supplier 1, the price decrease from \$5 per portable power bank to \$3 per portable power bank causes a 20-unit decrease in the quantity of portable power banks demanded, from 55 to 35. For Supplier 2, the price decrease generates a 15-unit decrease in the quantity of portable power banks demanded, from 35 to 20. Thus, for the two buyers combined, there is a 35-unit decrease in the total quantity demanded, from 90 to 55.

- 3-19. In Figure 3-7, what are the effects of a price increase from \$2 per portable power bank to \$4 per portable power bank on the quantities supplied by supplier 1 and by supplier 2 individually and combined?**

For Supplier 1, the price increase from \$2 per portable power bank to \$4 per portable power bank causes a 15-unit increase in the quantity of portable power banks demanded, from 25 to 40. For Supplier 2, the price increase generates a 15-unit increase in the quantity of portable power banks demanded, from 15 to 30. Thus, for the two buyers combined, there is a 30-unit increase in the total quantity demanded, from 40 to 70.

- 3-20. In Figure 3-9, the current position of the supply curve is S_1 , and the price of a portable power bank is \$3. If suppliers anticipate a higher price of portable power banks in the future, will the supply curve shift to S_2 or to S_3 ? What is the change in the amount of portable power banks supplied?**

The increase in the anticipated future price of portable power banks induces suppliers to withhold from the market part of their current supply, which causes a leftward shift in the supply curve for portable power banks, from S_1 to S_3 . At the price of \$3 per portable power bank, the amount of portable power banks supplied decreases by about 3 million units, from 6 million units to about 3 million units.

- 3-21. In Figure 3-9, the current position of the supply curve is S_1 , and the price of a portable power bank is \$3. If the cost of inputs that suppliers utilize to produce portable power banks decreases, will the supply curve shift to S_2 or to S_3 ? What is the change in the amount of portable power banks supplied?**

The decrease in the cost of inputs used to produce portable power packs causes a rightward shift in the supply curve for portable power banks, from S_1 to S_2 . At the price of \$3 per portable power bank, the amount of portable power banks supplied increases by about 3 million units, from 6 million units to about 9 million units.

■ Selected References

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