

### Summary

- ◆ The fundamental lessons about individual decisionmaking are that people face tradeoffs among alternative goals, that the cost of any action is measured in terms of forgone opportunities, that rational people make decisions by comparing marginal costs and marginal benefits, and that people change their behavior in response to the incentives they face.
- ◆ The fundamental lessons about interactions among people are that trade can be mutually beneficial, that markets are usually a good way of coordinating trade among people, and that the government can potentially improve market outcomes if there is some market failure or if the market outcome is inequitable.
- ◆ The fundamental lessons about the economy as a whole are that productivity is the ultimate source of living standards, that money growth is the ultimate source of inflation, and that society faces a short-run tradeoff between inflation and unemployment.

### Key Concepts

scarcity, p. 4	marginal changes, p. 6	productivity, p. 12
economics, p. 4	market economy, p. 9	inflation, p. 13
efficiency, p. 5	market failure, p. 11	Phillips curve, p. 14
equity, p. 5	externality, p. 11	
opportunity cost, p. 6	market power, p. 11	

### Questions for Review

- Give three examples of important tradeoffs that you face in your life.
- What is the opportunity cost of seeing a movie?
- Water is necessary for life. Is the marginal benefit of a glass of water large or small?
- Why should policymakers think about incentives?
- Why isn't trade among countries like a game with some winners and some losers?
- What does the "invisible hand" of the marketplace do?
- Explain the two main causes of market failure and give an example of each.
- Why is productivity important?
- What is inflation, and what causes it?
- How are inflation and unemployment related in the short run?

### Problems and Applications

- Describe some of the tradeoffs faced by the following:
  - a family deciding whether to buy a new car
  - a member of Congress deciding how much to spend on national parks
  - a company president deciding whether to open a new factory
  - a professor deciding how much to prepare for class
- You are trying to decide whether to take a vacation. Most of the costs of the vacation (airfare, hotel, forgone wages) are measured in dollars, but the benefits of the vacation are psychological. How can you compare the benefits to the costs?
- You were planning to spend Saturday working at your part-time job, but a friend asks you to go skiing. What is the true cost of going skiing? Now suppose that you had been planning to spend the day studying at the library. What is the cost of going skiing in this case? Explain.
- You win \$100 in a basketball pool. You have a choice between spending the money now or putting it away for a year in a bank account that pays 5 percent interest. What is the opportunity cost of spending the \$100 now?
- The company that you manage has invested \$5 million in developing a new product, but the development is not quite finished. At a recent meeting, your salespeople report that the introduction of competing products has reduced the expected sales of your new product to \$3 million. If it would cost \$1 million to finish

development and make the product, should you go ahead and do so? What is the most that you should pay to complete development?

6. Three managers of the Magic Potion Company are discussing a possible increase in production. Each suggests a way to make this decision.

HARRY: We should examine whether our company's productivity—gallons of potion per worker—would rise or fall.

RON: We should examine whether our average cost—cost per worker—would rise or fall.

HERMIONE: We should examine whether the extra revenue from selling the additional potion would be greater or smaller than the extra costs.

Who do you think is right? Why?

7. The Social Security system provides income for people over age 65. If a recipient of Social Security decides to work and earn some income, the amount he or she receives in Social Security benefits is typically reduced.
- How does the provision of Social Security affect people's incentive to save while working?
  - How does the reduction in benefits associated with higher earnings affect people's incentive to work past age 65?
8. A recent bill reforming the government's antipoverty programs limited many welfare recipients to only two years of benefits.
- How does this change affect the incentives for working?
  - How might this change represent a tradeoff between equity and efficiency?
9. Your roommate is a better cook than you are, but you can clean more quickly than your roommate can. If your roommate did all of the cooking and you did all of the cleaning, would your chores take you more or less time than if you divided each task evenly? Give a similar example of how specialization and trade can make two countries both better off.
10. Suppose the United States adopted central planning for its economy, and you became the chief planner. Among the millions of decisions that you need to make for next year are how many compact discs to produce, what artists to record, and who should receive the discs.
- To make these decisions intelligently, what information would you need about the compact disc industry? What information would you need about each of the people in the United States?
  - How would your decisions about CDs affect some of your other decisions, such as how many CD players to make or cassette tapes to produce? How might some of your other decisions about the economy change your views about CDs?
11. Explain whether each of the following government activities is motivated by a concern about equity or a concern about efficiency. In the case of efficiency, discuss the type of market failure involved.
- regulating cable-TV prices
  - providing some poor people with vouchers that can be used to buy food
  - prohibiting smoking in public places
  - breaking up Standard Oil (which once owned 90 percent of all oil refineries) into several smaller companies
  - imposing higher personal income tax rates on people with higher incomes
  - instituting laws against driving while intoxicated
12. Discuss each of the following statements from the standpoints of equity and efficiency.
- "Everyone in society should be guaranteed the best health care possible."
  - "When workers are laid off, they should be able to collect unemployment benefits until they find a new job."
13. In what ways is your standard of living different from that of your parents or grandparents when they were your age? Why have these changes occurred?
14. Suppose Americans decide to save more of their incomes. If banks lend this extra saving to businesses, which use the funds to build new factories, how might this lead to faster growth in productivity? Who do you suppose benefits from the higher productivity? Is society getting a free lunch?
15. Suppose that when everyone wakes up tomorrow, they discover that the government has given them an additional amount of money equal to the amount they already had. Explain what effect this doubling of the money supply will likely have on the following:
- the total amount spent on goods and services
  - the quantity of goods and services purchased if prices are sticky
  - the prices of goods and services if prices can adjust
16. Imagine that you are a policymaker trying to decide whether to reduce the rate of inflation. To make an intelligent decision, what would you need to know about inflation, unemployment, and the tradeoff between them?

### Problems and Applications

1. Describe some unusual language used in one of the other fields that you are studying. Why are these special terms useful?
2. One common assumption in economics is that the products of different firms in the same industry are indistinguishable. For each of the following industries, discuss whether this is a reasonable assumption.
  - a. steel
  - b. novels
  - c. wheat
  - d. fast food
3. Draw a circular-flow diagram. Identify the parts of the model that correspond to the flow of goods and services and the flow of dollars for each of the following activities.
  - a. Sam pays a storekeeper \$1 for a quart of milk.
  - b. Sally earns \$4.50 per hour working at a fast food restaurant.
  - c. Serena spends \$7 to see a movie.
  - d. Stuart earns \$10,000 from his 10 percent ownership of Acme Industrial.
4. Imagine a society that produces military goods and consumer goods, which we'll call "guns" and "butter."
  - a. Draw a production possibilities frontier for guns and butter. Explain why it most likely has a bowed-out shape.
  - b. Show a point that is impossible for the economy to achieve. Show a point that is feasible but inefficient.
  - c. Imagine that the society has two political parties, called the Hawks (who want a strong military) and the Doves (who want a smaller military). Show a point on your production possibilities frontier that the Hawks might choose and a point the Doves might choose.
  - d. Imagine that an aggressive neighboring country reduces the size of its military. As a result, both the Hawks and the Doves reduce their desired production of guns by the same amount. Which party would get the bigger "peace dividend," measured by the increase in butter production? Explain.
5. The first principle of economics discussed in Chapter 1 is that people face tradeoffs. Use a production possibilities frontier to illustrate society's tradeoff between a clean environment and high incomes. What do you suppose determines the shape and position of the frontier? Show what happens to the frontier if engineers develop an automobile engine with almost no emissions.
6. Classify the following topics as relating to microeconomics or macroeconomics.
  - a. a family's decision about how much income to save
  - b. the effect of government regulations on auto emissions
  - c. the impact of higher national saving on economic growth
  - d. a firm's decision about how many workers to hire
  - e. the relationship between the inflation rate and changes in the quantity of money
7. Classify each of the following statements as positive or normative. Explain.
  - a. Society faces a short-run tradeoff between inflation and unemployment.
  - b. A reduction in the rate of growth of money will reduce the rate of inflation.
  - c. The Federal Reserve should reduce the rate of growth of money.
  - d. Society ought to require welfare recipients to look for jobs.
  - e. Lower tax rates encourage more work and more saving.
8. Classify each of the statements in Table 2-2 as positive, normative, or ambiguous. Explain.
9. If you were president, would you be more interested in your economic advisers' positive views or their normative views? Why?
10. The *Economic Report of the President* contains statistical information about the economy as well as the Council of Economic Advisers' analysis of current policy issues. Find a recent copy of this annual report at your library and read a chapter about an issue that interests you. Summarize the economic problem at hand and describe the council's recommended policy.
11. Who is the current chairman of the Federal Reserve? Who is the current chair of the Council of Economic Advisers? Who is the current secretary of the treasury?
12. Look up one of the Web sites listed in Table 2-1. What recent economic trends or issues are addressed there?
13. Would you expect economists to disagree less about public policy as time goes on? Why or why not? Can their differences be completely eliminated? Why or why not?

### Summary

- ◆ Each person consumes goods and services produced by many other people both in our country and around the world. Interdependence and trade are desirable because they allow everyone to enjoy a greater quantity and variety of goods and services.
- ◆ There are two ways to compare the ability of two people in producing a good. The person who can produce the good with the smaller quantity of inputs is said to have an *absolute advantage* in producing the good. The person who has the smaller opportunity cost of producing the good is said to have a *comparative advantage*. The gains from trade are based on comparative advantage, not absolute advantage.
- ◆ Trade makes everyone better off because it allows people to specialize in those activities in which they have a comparative advantage.
- ◆ The principle of comparative advantage applies to countries as well as to people. Economists use the principle of comparative advantage to advocate free trade among countries.

### Key Concepts

absolute advantage, p. 53  
opportunity cost, p. 53

comparative advantage, p. 53  
imports, p. 57

exports, p. 57

### Questions for Review

1. Explain how absolute advantage and comparative advantage differ.
2. Give an example in which one person has an absolute advantage in doing something but another person has a comparative advantage.
3. Is absolute advantage or comparative advantage more important for trade? Explain your reasoning, using the example in your answer to Question 2.
4. Will a nation tend to export or import goods for which it has a comparative advantage? Explain.
5. Why do economists oppose policies that restrict trade among nations?

### Problems and Applications

1. Consider the farmer and the rancher from our example in this chapter. Explain why the farmer's opportunity cost of producing 1 pound of meat is 2 pounds of potatoes. Explain why the rancher's opportunity cost of producing 1 pound of meat is 1/8 pound of potatoes.
2. Maria can read 20 pages of economics in an hour. She can also read 50 pages of sociology in an hour. She spends 5 hours per day studying.
  - a. Draw Maria's production possibilities frontier for reading economics and sociology.
  - b. What is Maria's opportunity cost of reading 100 pages of sociology?
3. American and Japanese workers can each produce 4 cars a year. An American worker can produce 10 tons of grain a year, whereas a Japanese worker can produce 5 tons of grain a year. To keep things simple, assume that each country has 100 million workers.
  - a. For this situation, construct a table analogous to Table 3-1.
  - b. Graph the production possibilities frontier of the American and Japanese economies.
  - c. For the United States, what is the opportunity cost of a car? Of grain? For Japan, what is the opportunity cost of a car? Of grain? Put

this information in a table analogous to Table 3-3.

- d. Which country has an absolute advantage in producing cars? In producing grain?
  - e. Which country has a comparative advantage in producing cars? In producing grain?
  - f. Without trade, half of each country's workers produce cars and half produce grain. What quantities of cars and grain does each country produce?
  - g. Starting from a position without trade, give an example in which trade makes each country better off.
4. Pat and Kris are roommates. They spend most of their time studying (of course), but they leave some time for their favorite activities: making pizza and brewing root beer. Pat takes 4 hours to brew a gallon of root beer and 2 hours to make a pizza. Kris takes 6 hours to brew a gallon of root beer and 4 hours to make a pizza.
- a. What is each roommate's opportunity cost of making a pizza? Who has the absolute advantage in making pizza? Who has the comparative advantage in making pizza?
  - b. If Pat and Kris trade foods with each other, who will trade away pizza in exchange for root beer?
  - c. The price of pizza can be expressed in terms of gallons of root beer. What is the highest price at which pizza can be traded that would make both roommates better off? What is the lowest price? Explain.
5. Suppose that there are 10 million workers in Canada, and that each of these workers can produce either 2 cars or 30 bushels of wheat in a year.
- a. What is the opportunity cost of producing a car in Canada? What is the opportunity cost of producing a bushel of wheat in Canada? Explain the relationship between the opportunity costs of the two goods.
  - b. Draw Canada's production possibilities frontier. If Canada chooses to consume 10 million cars, how much wheat can it consume without trade? Label this point on the production possibilities frontier.
  - c. Now suppose that the United States offers to buy 10 million cars from Canada in exchange for 20 bushels of wheat per car. If Canada continues to consume 10 million cars, how much wheat does this deal allow Canada to consume? Label this point on your diagram. Should Canada accept the deal?
6. Consider a professor who is writing a book. The professor can both write the chapters and gather the needed data faster than anyone else at his university. Still, he pays a student to collect data at the library. Is this sensible? Explain.
7. England and Scotland both produce scones and sweaters. Suppose that an English worker can produce 50 scones per hour or 1 sweater per hour. Suppose that a Scottish worker can produce 40 scones per hour or 2 sweaters per hour.
- a. Which country has the absolute advantage in the production of each good? Which country has the comparative advantage?
  - b. If England and Scotland decide to trade, which commodity will Scotland trade to England? Explain.
  - c. If a Scottish worker could produce only 1 sweater per hour, would Scotland still gain from trade? Would England still gain from trade? Explain.
8. Consider once again the farmer and rancher discussed in the chapter.
- a. Suppose that a technological advance makes the farmer better at producing meat, so that he now needs only 2 hours to produce 1 pound of meat. What is his opportunity cost of meat and potatoes now? Does this alter his comparative advantage?
  - b. Is the deal that the rancher proposes—3 pounds of meat for 1 pound of potatoes—still good for the farmer? Explain.
  - c. Propose another deal to which the farmer and rancher might agree now.
9. The following table describes the production possibilities of two cities in the country of Baseballia:

	PAIRS OF RED SOCKS PER WORKER PER HOUR	PAIRS OF WHITE SOCKS PER WORKER PER HOUR
BOSTON	3	3
CHICAGO	2	1

- a. Without trade, what is the price of white socks (in terms of red socks) in Boston? What is the price in Chicago?
- b. Which city has an absolute advantage in the production of each color sock? Which city has a comparative advantage in the production of each color sock?
- c. If the cities trade with each other, which color sock will each export?

- d. What is the range of prices at which trade can occur?
10. Suppose that all goods can be produced with fewer worker hours in Germany than in France.
- In what sense is the cost of all goods lower in Germany than in France?
  - In what sense is the cost of some goods lower in France?
  - If Germany and France traded with each other, would both countries be better off as a result? Explain in the context of your answers to parts (a) and (b).
11. Are the following statements true or false? Explain in each case.
- "Two countries can achieve gains from trade even if one of the countries has an absolute advantage in the production of all goods."
  - "Certain very talented people have a comparative advantage in everything they do."
  - "If a certain trade is good for one person, it can't be good for the other one."

### Key Concepts

market, p. 66	complements, p. 68	supply curve, p. 76
competitive market, p. 66	demand schedule, p. 69	equilibrium, p. 80
quantity demanded, p. 67	demand curve, p. 70	equilibrium price, p. 80
law of demand, p. 68	<i>ceteris paribus</i> , p. 70	equilibrium quantity, p. 80
normal good, p. 68	quantity supplied, p. 75	surplus, p. 81
inferior good, p. 68	law of supply, p. 75	shortage, p. 81
substitutes, p. 68	supply schedule, p. 76	law of supply and demand, p. 81

### Questions for Review

1. What is a competitive market? Briefly describe the types of markets other than perfectly competitive markets.
2. What determines the quantity of a good that buyers demand?
3. What are the demand schedule and the demand curve, and how are they related? Why does the demand curve slope downward?
4. Does a change in consumers' tastes lead to a movement along the demand curve or a shift in the demand curve? Does a change in price lead to a movement along the demand curve or a shift in the demand curve?
5. Popeye's income declines and, as a result, he buys more spinach. Is spinach an inferior or a normal good? What happens to Popeye's demand curve for spinach?
6. What determines the quantity of a good that sellers supply?
7. What are the supply schedule and the supply curve, and how are they related? Why does the supply curve slope upward?
8. Does a change in producers' technology lead to a movement along the supply curve or a shift in the supply curve? Does a change in price lead to a movement along the supply curve or a shift in the supply curve?
9. Define the equilibrium of a market. Describe the forces that move a market toward its equilibrium.
10. Beer and pizza are complements because they are often enjoyed together. When the price of beer rises, what happens to the supply, demand, quantity supplied, quantity demanded, and the price in the market for pizza?
11. Describe the role of prices in market economies.

### Problems and Applications

1. Explain each of the following statements using supply-and-demand diagrams.
  - a. When a cold snap hits Florida, the price of orange juice rises in supermarkets throughout the country.
  - b. When the weather turns warm in New England every summer, the prices of hotel rooms in Caribbean resorts plummet.
  - c. When a war breaks out in the Middle East, the price of gasoline rises, while the price of a used Cadillac falls.
2. "An increase in the demand for notebooks raises the quantity of notebooks demanded, but not the quantity supplied." Is this statement true or false? Explain.
3. Consider the market for minivans. For each of the events listed here, identify which of the determinants of demand or supply are affected. Also indicate whether demand or supply is increased or decreased. Then show the effect on the price and quantity of minivans.
  - a. People decide to have more children.

- b. A strike by steelworkers raises steel prices.
  - c. Engineers develop new automated machinery for the production of minivans.
  - d. The price of station wagons rises.
  - e. A stock-market crash lowers people’s wealth.
4. During the 1990s, technological advance reduced the cost of computer chips. How do you think this affected the market for computers? For computer software? For typewriters?
  5. Using supply-and-demand diagrams, show the effect of the following events on the market for sweatshirts.
    - a. A hurricane in South Carolina damages the cotton crop.
    - b. The price of leather jackets falls.
    - c. All colleges require morning calisthenics in appropriate attire.
    - d. New knitting machines are invented.
  6. Suppose that in the year 2005 the number of births is temporarily high. How does this baby boom affect the price of baby-sitting services in 2010 and 2020? (Hint: 5-year-olds need baby-sitters, whereas 15-year-olds can be baby-sitters.)
  7. Ketchup is a complement (as well as a condiment) for hot dogs. If the price of hot dogs rises, what happens to the market for ketchup? For tomatoes? For tomato juice? For orange juice?
  8. The case study presented in the chapter discussed cigarette taxes as a way to reduce smoking. Now think about the markets for other tobacco products such as cigars and chewing tobacco.
    - a. Are these goods substitutes or complements for cigarettes?
    - b. Using a supply-and-demand diagram, show what happens in the markets for cigars and chewing tobacco if the tax on cigarettes is increased.
    - c. If policymakers wanted to reduce total tobacco consumption, what policies could they combine with the cigarette tax?
  9. The market for pizza has the following demand and supply schedules:

PRICE	QUANTITY DEMANDED	QUANTITY SUPPLIED
\$4	135	26
5	104	53
6	81	81
7	68	98
8	53	110
9	39	121

Graph the demand and supply curves. What is the equilibrium price and quantity in this market? If the actual price in this market were *above* the equilibrium price, what would drive the market toward the equilibrium? If the actual price in this market were *below* the equilibrium price, what would drive the market toward the equilibrium?

10. Because bagels and cream cheese are often eaten together, they are complements.
  - a. We observe that both the equilibrium price of cream cheese and the equilibrium quantity of bagels have risen. What could be responsible for this pattern—a fall in the price of flour or a fall in the price of milk? Illustrate and explain your answer.
  - b. Suppose instead that the equilibrium price of cream cheese has risen but the equilibrium quantity of bagels has fallen. What could be responsible for this pattern—a rise in the price of flour or a rise in the price of milk? Illustrate and explain your answer.
11. Suppose that the price of basketball tickets at your college is determined by market forces. Currently, the demand and supply schedules are as follows:

PRICE	QUANTITY DEMANDED	QUANTITY SUPPLIED
\$ 4	10,000	8,000
8	8,000	8,000
12	6,000	8,000
16	4,000	8,000
20	2,000	8,000

- a. Draw the demand and supply curves. What is unusual about this supply curve? Why might this be true?
- b. What are the equilibrium price and quantity of tickets?
- c. Your college plans to increase total enrollment next year by 5,000 students. The additional students will have the following demand schedule:

PRICE	QUANTITY DEMANDED
\$ 4	4,000
8	3,000
12	2,000
16	1,000
20	0



Now add the old demand schedule and the demand schedule for the new students to calculate the new demand schedule for the entire college. What will be the new equilibrium price and quantity?

12. An article in *The New York Times* described a successful marketing campaign by the French champagne industry.

The article noted that “many executives felt giddy about the stratospheric champagne prices. But they also feared that such sharp price increases would cause demand to decline, which would then cause prices to plunge.” What mistake are the executives making in their analysis of the situation? Illustrate your answer with a graph.

the economy. You are now well on your way to becoming an economist (or, at least, a well-educated parrot).

### Summary

- ◆ The price elasticity of demand measures how much the quantity demanded responds to changes in the price. Demand tends to be more elastic if the good is a luxury rather than a necessity, if close substitutes are available, if the market is narrowly defined, or if buyers have substantial time to react to a price change.
- ◆ The price elasticity of demand is calculated as the percentage change in quantity demanded divided by the percentage change in price. If the elasticity is less than 1, so that quantity demanded moves proportionately less than the price, demand is said to be inelastic. If the elasticity is greater than 1, so that quantity demanded moves proportionately more than the price, demand is said to be elastic.
- ◆ Total revenue, the total amount paid for a good, equals the price of the good times the quantity sold. For inelastic demand curves, total revenue rises as price rises. For elastic demand curves, total revenue falls as price rises.
- ◆ The income elasticity of demand measures how much the quantity demanded responds to changes in consumers' income. The cross-price elasticity of demand measures how much the quantity demanded of one good responds to the price of another good.
- ◆ The price elasticity of supply measures how much the quantity supplied responds to changes in the price. This elasticity often depends on the time horizon under consideration. In most markets, supply is more elastic in the long run than in the short run.
- ◆ The price elasticity of supply is calculated as the percentage change in quantity supplied divided by the percentage change in price. If the elasticity is less than 1, so that quantity supplied moves proportionately less than the price, supply is said to be inelastic. If the elasticity is greater than 1, so that quantity supplied moves proportionately more than the price, supply is said to be elastic.
- ◆ The tools of supply and demand can be applied in many different kinds of markets. This chapter uses them to analyze the market for wheat, the market for oil, and the market for illegal drugs.

### Key Concepts

elasticity, p. 94

price elasticity of demand, p. 94

total revenue, p. 98

income elasticity of demand, p. 102

cross-price elasticity of demand, p. 104

price elasticity of supply, p. 104

### Questions for Review

1. Define the price elasticity of demand and the income elasticity of demand.
2. List and explain some of the determinants of the price elasticity of demand.
3. If the elasticity is greater than 1, is demand elastic or inelastic? If the elasticity equals 0, is demand perfectly elastic or perfectly inelastic?
4. On a supply-and-demand diagram, show equilibrium price, equilibrium quantity, and the total revenue received by producers.
5. If demand is elastic, how will an increase in price change total revenue? Explain.
6. What do we call a good whose income elasticity is less than 0?
7. How is the price elasticity of supply calculated? Explain what this measures.
8. What is the price elasticity of supply of Picasso paintings?
9. Is the price elasticity of supply usually larger in the short run or in the long run? Why?
10. In the 1970s, OPEC caused a dramatic increase in the price of oil. What prevented it from maintaining this high price through the 1980s?

**Problems and Applications**

1. For each of the following pairs of goods, which good would you expect to have more elastic demand and why?
  - a. required textbooks or mystery novels
  - b. Beethoven recordings or classical music recordings in general
  - c. heating oil during the next six months or heating oil during the next five years
  - d. root beer or water
2. Suppose that business travelers and vacationers have the following demand for airline tickets from New York to Boston:

PRICE	QUANTITY DEMANDED (BUSINESS TRAVELERS)	QUANTITY DEMANDED (VACATIONERS)
\$150	2,100	1,000
200	2,000	800
250	1,900	600
300	1,800	400

- a. As the price of tickets rises from \$200 to \$250, what is the price elasticity of demand for (i) business travelers and (ii) vacationers? (Use the midpoint method in your calculations.)
  - b. Why might vacationers have a different elasticity than business travelers?
3. Suppose that your demand schedule for compact discs is as follows:

PRICE	QUANTITY DEMANDED (INCOME = \$10,000)	QUANTITY DEMANDED (INCOME = \$12,000)
\$ 8	40	50
10	32	45
12	24	30
14	16	20
16	8	12

- a. Use the midpoint method to calculate your price elasticity of demand as the price of compact discs increases from \$8 to \$10 if (i) your income is \$10,000, and (ii) your income is \$12,000.
  - b. Calculate your income elasticity of demand as your income increases from \$10,000 to \$12,000 if (i) the price is \$12, and (ii) the price is \$16.
4. Emily has decided always to spend one-third of her income on clothing.
    - a. What is her income elasticity of clothing demand?

- b. What is her price elasticity of clothing demand?
  - c. If Emily's tastes change and she decides to spend only one-fourth of her income on clothing, how does her demand curve change? What are her income elasticity and price elasticity now?
5. *The New York Times* reported (Feb. 17, 1996, p. 25) that subway ridership declined after a fare increase: "There were nearly four million fewer riders in December 1995, the first full month after the price of a token increased 25 cents to \$1.50, than in the previous December, a 4.3 percent decline."
    - a. Use these data to estimate the price elasticity of demand for subway rides.
    - b. According to your estimate, what happens to the Transit Authority's revenue when the fare rises?
    - c. Why might your estimate of the elasticity be unreliable?
  6. Two drivers—Tom and Jerry—each drive up to a gas station. Before looking at the price, each places an order. Tom says, "I'd like 10 gallons of gas." Jerry says, "I'd like \$10 worth of gas." What is each driver's price elasticity of demand?
  7. Economists have observed that spending on restaurant meals declines more during economic downturns than does spending on food to be eaten at home. How might the concept of elasticity help to explain this phenomenon?
  8. Consider public policy aimed at smoking.
    - a. Studies indicate that the price elasticity of demand for cigarettes is about 0.4. If a pack of cigarettes currently costs \$2 and the government wants to reduce smoking by 20 percent, by how much should it increase the price?
    - b. If the government permanently increases the price of cigarettes, will the policy have a larger effect on smoking one year from now or five years from now?
    - c. Studies also find that teenagers have a higher price elasticity than do adults. Why might this be true?
  9. Would you expect the price elasticity of *demand* to be larger in the market for all ice cream or the market for vanilla ice cream? Would you expect the price elasticity of *supply* to be larger in the market for all ice cream or the market for vanilla ice cream? Be sure to explain your answers.
  10. Pharmaceutical drugs have an inelastic demand, and computers have an elastic demand. Suppose that

technological advance doubles the supply of both products (that is, the quantity supplied at each price is twice what it was).

- a. What happens to the equilibrium price and quantity in each market?
  - b. Which product experiences a larger change in price?
  - c. Which product experiences a larger change in quantity?
  - d. What happens to total consumer spending on each product?
11. Beachfront resorts have an inelastic supply, and automobiles have an elastic supply. Suppose that a rise in population doubles the demand for both products (that is, the quantity demanded at each price is twice what it was).
- a. What happens to the equilibrium price and quantity in each market?
  - b. Which product experiences a larger change in price?
  - c. Which product experiences a larger change in quantity?
  - d. What happens to total consumer spending on each product?
12. Several years ago, flooding along the Missouri and Mississippi rivers destroyed thousands of acres of wheat.
- a. Farmers whose crops were destroyed by the floods were much worse off, but farmers whose crops were not destroyed benefited from the floods. Why?
  - b. What information would you need about the market for wheat in order to assess whether farmers as a group were hurt or helped by the floods?
13. Explain why the following might be true: A drought around the world raises the total revenue that farmers receive from the sale of grain, but a drought only in Kansas reduces the total revenue that Kansas farmers receive.
14. Because better weather makes farmland more productive, farmland in regions with good weather conditions is more expensive than farmland in regions with bad weather conditions. Over time, however, as advances in technology have made all farmland more productive, the price of farmland (adjusted for overall inflation) has fallen. Use the concept of elasticity to explain why productivity and farmland prices are positively related across space but negatively related over time.

### Key Concepts

price ceiling, p. 118

price floor, p. 118

tax incidence, p. 129

### Questions for Review

1. Give an example of a price ceiling and an example of a price floor.
2. Which causes a shortage of a good—a price ceiling or a price floor? Which causes a surplus?
3. What mechanisms allocate resources when the price of a good is not allowed to bring supply and demand into equilibrium?
4. Explain why economists usually oppose controls on prices.
5. What is the difference between a tax paid by buyers and a tax paid by sellers?
6. How does a tax on a good affect the price paid by buyers, the price received by sellers, and the quantity sold?
7. What determines how the burden of a tax is divided between buyers and sellers? Why?

### Problems and Applications

1. Lovers of classical music persuade Congress to impose a price ceiling of \$40 per ticket. Does this policy get more or fewer people to attend classical music concerts?
2. The government has decided that the free-market price of cheese is too low.
  - a. Suppose the government imposes a binding price floor in the cheese market. Use a supply-and-demand diagram to show the effect of this policy on the price of cheese and the quantity of cheese sold. Is there a shortage or surplus of cheese?
  - b. Farmers complain that the price floor has reduced their total revenue. Is this possible? Explain.
  - c. In response to farmers' complaints, the government agrees to purchase all of the surplus cheese at the price floor. Compared to the basic price floor, who benefits from this new policy? Who loses?
3. A recent study found that the demand and supply schedules for Frisbees are as follows:
 

PRICE PER FRISBEE	QUANTITY DEMANDED	QUANTITY SUPPLIED
\$11	1 million	15 million
10	2	12
9	4	9
8	6	6
7	8	3
6	10	1

  - a. What are the equilibrium price and quantity of Frisbees?
  - b. Frisbee manufacturers persuade the government that Frisbee production improves scientists' understanding of aerodynamics and thus is important for national security. A concerned Congress votes to impose a price floor \$2 above the equilibrium price. What is the new market price? How many Frisbees are sold?
  - c.irate college students march on Washington and demand a reduction in the price of Frisbees. An even more concerned Congress votes to repeal the price floor and impose a price ceiling \$1 below the former price floor. What is the new market price? How many Frisbees are sold?
4. Suppose the federal government requires beer drinkers to pay a \$2 tax on each case of beer purchased. (In fact, both the federal and state governments impose beer taxes of some sort.)
  - a. Draw a supply-and-demand diagram of the market for beer without the tax. Show the price paid by consumers, the price received by producers, and the quantity of beer sold. What is the difference between the price paid by consumers and the price received by producers?
  - b. Now draw a supply-and-demand diagram for the beer market with the tax. Show the price paid by consumers, the price received by producers, and

PRICE PER FRISBEE	QUANTITY DEMANDED	QUANTITY SUPPLIED
\$11	1 million	15 million
10	2	12
9	4	9
8	6	6
7	8	3
6	10	1

- the quantity of beer sold. What is the difference between the price paid by consumers and the price received by producers? Has the quantity of beer sold increased or decreased?
5. A senator wants to raise tax revenue and make workers better off. A staff member proposes raising the payroll tax paid by firms and using part of the extra revenue to reduce the payroll tax paid by workers. Would this accomplish the senator's goal?
  6. If the government places a \$500 tax on luxury cars, will the price paid by consumers rise by more than \$500, less than \$500, or exactly \$500? Explain.
  7. Congress and the president decide that the United States should reduce air pollution by reducing its use of gasoline. They impose a \$0.50 tax for each gallon of gasoline sold.
    - a. Should they impose this tax on producers or consumers? Explain carefully using a supply-and-demand diagram.
    - b. If the demand for gasoline were more elastic, would this tax be more effective or less effective in reducing the quantity of gasoline consumed? Explain with both words and a diagram.
    - c. Are consumers of gasoline helped or hurt by this tax? Why?
    - d. Are workers in the oil industry helped or hurt by this tax? Why?
  8. A case study in this chapter discusses the federal minimum-wage law.
    - a. Suppose the minimum wage is above the equilibrium wage in the market for unskilled labor. Using a supply-and-demand diagram of the market for unskilled labor, show the market wage, the number of workers who are employed, and the number of workers who are unemployed. Also show the total wage payments to unskilled workers.
    - b. Now suppose the secretary of labor proposes an increase in the minimum wage. What effect would this increase have on employment? Does the change in employment depend on the elasticity of demand, the elasticity of supply, both elasticities, or neither?
      - c. What effect would this increase in the minimum wage have on unemployment? Does the change in unemployment depend on the elasticity of demand, the elasticity of supply, both elasticities, or neither?
      - d. If the demand for unskilled labor were inelastic, would the proposed increase in the minimum wage raise or lower total wage payments to unskilled workers? Would your answer change if the demand for unskilled labor were elastic?
  9. Consider the following policies, each of which is aimed at reducing violent crime by reducing the use of guns. Illustrate each of these proposed policies in a supply-and-demand diagram of the gun market.
    - a. a tax on gun buyers
    - b. a tax on gun sellers
    - c. a price floor on guns
    - d. a tax on ammunition
  10. The U.S. government administers two programs that affect the market for cigarettes. Media campaigns and labeling requirements are aimed at making the public aware of the dangers of cigarette smoking. At the same time, the Department of Agriculture maintains a price support program for tobacco farmers, which raises the price of tobacco above the equilibrium price.
    - a. How do these two programs affect cigarette consumption? Use a graph of the cigarette market in your answer.
    - b. What is the combined effect of these two programs on the price of cigarettes?
    - c. Cigarettes are also heavily taxed. What effect does this tax have on cigarette consumption?
  11. A subsidy is the opposite of a tax. With a \$0.50 tax on the buyers of ice-cream cones, the government collects \$0.50 for each cone purchased; with a \$0.50 subsidy for the buyers of ice-cream cones, the government pays buyers \$0.50 for each cone purchased.
    - a. Show the effect of a \$0.50 per cone subsidy on the demand curve for ice-cream cones, the effective price paid by consumers, the effective price received by sellers, and the quantity of cones sold.
    - b. Do consumers gain or lose from this policy? Do producers gain or lose? Does the government gain or lose?

chapter work well, and the conclusion of market efficiency applies directly. Moreover, our analysis of welfare economics and market efficiency can be used to shed light on the effects of various government policies. In the next two chapters we apply the tools we have just developed to study two important policy issues—the welfare effects of taxation and of international trade.

### Summary

- ◆ Consumer surplus equals buyers' willingness to pay for a good minus the amount they actually pay for it, and it measures the benefit buyers get from participating in a market. Consumer surplus can be computed by finding the area below the demand curve and above the price.
  - ◆ Producer surplus equals the amount sellers receive for their goods minus their costs of production, and it measures the benefit sellers get from participating in a market. Producer surplus can be computed by finding the area below the price and above the supply curve.
  - ◆ An allocation of resources that maximizes the sum of consumer and producer surplus is said to be efficient.
- Policymakers are often concerned with the efficiency, as well as the equity, of economic outcomes.
- ◆ The equilibrium of supply and demand maximizes the sum of consumer and producer surplus. That is, the invisible hand of the marketplace leads buyers and sellers to allocate resources efficiently.
  - ◆ Markets do not allocate resources efficiently in the presence of market failures such as market power or externalities.

### Key Concepts

welfare economics, p. 142  
willingness to pay, p. 142  
consumer surplus, p. 143

cost, p. 148  
producer surplus, p. 148

efficiency, p. 153  
equity, p. 153

### Questions for Review

1. Explain how buyers' willingness to pay, consumer surplus, and the demand curve are related.
2. Explain how sellers' costs, producer surplus, and the supply curve are related.
3. In a supply-and-demand diagram, show producer and consumer surplus in the market equilibrium.
4. What is efficiency? Is it the only goal of economic policymakers?
5. What does the invisible hand do?
6. Name two types of market failure. Explain why each may cause market outcomes to be inefficient.

### Problems and Applications

1. An early freeze in California sours the lemon crop. What happens to consumer surplus in the market for lemons? What happens to consumer surplus in the market for lemonade? Illustrate your answers with diagrams.
2. Suppose the demand for French bread rises. What happens to producer surplus in the market for French bread? What happens to producer surplus in the market for flour? Illustrate your answer with diagrams.

3. It is a hot day, and Bert is very thirsty. Here is the value he places on a bottle of water:

Value of first bottle	\$7
Value of second bottle	5
Value of third bottle	3
Value of fourth bottle	1

- From this information, derive Bert's demand schedule. Graph his demand curve for bottled water.
  - If the price of a bottle of water is \$4, how many bottles does Bert buy? How much consumer surplus does Bert get from his purchases? Show Bert's consumer surplus in your graph.
  - If the price falls to \$2, how does quantity demanded change? How does Bert's consumer surplus change? Show these changes in your graph.
4. Ernie owns a water pump. Because pumping large amounts of water is harder than pumping small amounts, the cost of producing a bottle of water rises as he pumps more. Here is the cost he incurs to produce each bottle of water:

Cost of first bottle	\$1
Cost of second bottle	3
Cost of third bottle	5
Cost of fourth bottle	7

- From this information, derive Ernie's supply schedule. Graph his supply curve for bottled water.
  - If the price of a bottle of water is \$4, how many bottles does Ernie produce and sell? How much producer surplus does Ernie get from these sales? Show Ernie's producer surplus in your graph.
  - If the price rises to \$6, how does quantity supplied change? How does Ernie's producer surplus change? Show these changes in your graph.
5. Consider a market in which Bert from Problem 3 is the buyer and Ernie from Problem 4 is the seller.
- Use Ernie's supply schedule and Bert's demand schedule to find the quantity supplied and quantity demanded at prices of \$2, \$4, and \$6. Which of these prices brings supply and demand into equilibrium?
  - What are consumer surplus, producer surplus, and total surplus in this equilibrium?
  - If Ernie produced and Bert consumed one less bottle of water, what would happen to total surplus?

- If Ernie produced and Bert consumed one additional bottle of water, what would happen to total surplus?

6. The cost of producing stereo systems has fallen over the past several decades. Let's consider some implications of this fact.
- Use a supply-and-demand diagram to show the effect of falling production costs on the price and quantity of stereos sold.
  - In your diagram, show what happens to consumer surplus and producer surplus.
  - Suppose the supply of stereos is very elastic. Who benefits most from falling production costs—consumers or producers of stereos?
7. There are four consumers willing to pay the following amounts for haircuts:

Jerry: \$7    Oprah: \$2    Sally Jessy: \$8    Montel: \$5

There are four haircutting businesses with the following costs:

Firm A: \$3    Firm B: \$6    Firm C: \$4    Firm D: \$2

Each firm has the capacity to produce only one haircut. For efficiency, how many haircuts should be given? Which businesses should cut hair, and which consumers should have their hair cut? How large is the maximum possible total surplus?

8. Suppose a technological advance reduces the cost of making computers.
- Use a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for computers.
  - Computers and adding machines are substitutes. Use a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for adding machines. Should adding machine producers be happy or sad about the technological advance in computers?
  - Computers and software are complements. Use a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for software. Should software producers be happy or sad about the technological advance in computers?
  - Does this analysis help explain why Bill Gates, a software producer, is one of the world's richest men?



9. Consider how health insurance affects the quantity of health care services performed. Suppose that the typical medical procedure has a cost of \$100, yet a person with health insurance pays only \$20 out-of-pocket when she chooses to have an additional procedure performed. Her insurance company pays the remaining \$80. (The insurance company will recoup the \$80 through higher premiums for everybody, but the share paid by this individual is small.)
- Draw the demand curve in the market for medical care. (In your diagram, the horizontal axis should represent the number of medical procedures.) Show the quantity of procedures demanded if each procedure has a price of \$100.
  - On your diagram, show the quantity of procedures demanded if consumers pay only \$20 per procedure. If the cost of each procedure to society is truly \$100, and if individuals have health insurance as just described, will the number of procedures performed maximize total surplus? Explain.
  - Economists often blame the health insurance system for excessive use of medical care. Given your analysis, why might the use of care be viewed as “excessive”?
  - What sort of policies might prevent this excessive use?
10. Many parts of California experienced a severe drought in the late 1980s and early 1990s.
- Use a diagram of the water market to show the effects of the drought on the equilibrium price and quantity of water.
  - Many communities did not allow the price of water to change, however. What is the effect of this policy on the water market? Show on your diagram any surplus or shortage that arises.
  - A 1991 op-ed piece in *The Wall Street Journal* stated that “all Los Angeles residents are required to cut their water usage by 10 percent as of March 1 and another 5 percent starting May 1, based on their 1986 consumption levels.” The author criticized this policy on both efficiency and equity grounds, saying “not only does such a policy reward families who ‘wasted’ more water back in 1986, it does little to encourage consumers who could make more drastic reductions, [and] . . . punishes consumers who cannot so readily reduce their water use.” In what way is the Los Angeles system for allocating water inefficient? In what way does the system seem unfair?
  - Suppose instead that Los Angeles allowed the price of water to increase until the quantity demanded equaled the quantity supplied. Would the resulting allocation of water be more efficient? In your view, would it be more or less fair than the proportionate reductions in water use mentioned in the newspaper article? What could be done to make the market solution more fair?

### Key Concepts

deadweight loss, p. 165

### Questions for Review

1. What happens to consumer and producer surplus when the sale of a good is taxed? How does the change in consumer and producer surplus compare to the tax revenue? Explain.
2. Draw a supply-and-demand diagram with a tax on the sale of the good. Show the deadweight loss. Show the tax revenue.
3. How do the elasticities of supply and demand affect the deadweight loss of a tax? Why do they have this effect?
4. Why do experts disagree about whether labor taxes have small or large deadweight losses?
5. What happens to the deadweight loss and tax revenue when a tax is increased?

### Problems and Applications

1. The market for pizza is characterized by a downward-sloping demand curve and an upward-sloping supply curve.
  - a. Draw the competitive market equilibrium. Label the price, quantity, consumer surplus, and producer surplus. Is there any deadweight loss? Explain.
  - b. Suppose that the government forces each pizzeria to pay a \$1 tax on each pizza sold. Illustrate the effect of this tax on the pizza market, being sure to label the consumer surplus, producer surplus, government revenue, and deadweight loss. How does each area compare to the pre-tax case?
  - c. If the tax were removed, pizza eaters and sellers would be better off, but the government would lose tax revenue. Suppose that consumers and producers voluntarily transferred some of their gains to the government. Could all parties (including the government) be better off than they were with a tax? Explain using the labeled areas in your graph.
2. Evaluate the following two statements. Do you agree? Why or why not?
  - a. "If the government taxes land, wealthy land-owners will pass the tax on to their poorer renters."
  - b. "If the government taxes apartment buildings, wealthy landlords will pass the tax on to their poorer renters."
3. Evaluate the following two statements. Do you agree? Why or why not?
  - a. "A tax that has no deadweight loss cannot raise any revenue for the government."
  - b. "A tax that raises no revenue for the government cannot have any deadweight loss."
4. Consider the market for rubber bands.
  - a. If this market has very elastic supply and very inelastic demand, how would the burden of a tax on rubber bands be shared between consumers and producers? Use the tools of consumer surplus and producer surplus in your answer.
  - b. If this market has very inelastic supply and very elastic demand, how would the burden of a tax on rubber bands be shared between consumers and producers? Contrast your answer with your answer to part (a).
5. Suppose that the government imposes a tax on heating oil.
  - a. Would the deadweight loss from this tax likely be greater in the first year after it is imposed or in the fifth year? Explain.
  - b. Would the revenue collected from this tax likely be greater in the first year after it is imposed or in the fifth year? Explain.
6. After economics class one day, your friend suggests that taxing food would be a good way to raise revenue because the demand for food is quite inelastic. In what sense is taxing food a "good" way to raise revenue? In what sense is it not a "good" way to raise revenue?

7. Senator Daniel Patrick Moynihan once introduced a bill that would levy a 10,000 percent tax on certain hollow-tipped bullets.
  - a. Do you expect that this tax would raise much revenue? Why or why not?
  - b. Even if the tax would raise no revenue, what might be Senator Moynihan’s reason for proposing it?
8. The government places a tax on the purchase of socks.
  - a. Illustrate the effect of this tax on equilibrium price and quantity in the sock market. Identify the following areas both before and after the imposition of the tax: total spending by consumers, total revenue for producers, and government tax revenue.
  - b. Does the price received by producers rise or fall? Can you tell whether total receipts for producers rise or fall? Explain.
  - c. Does the price paid by consumers rise or fall? Can you tell whether total spending by consumers rises or falls? Explain carefully. (Hint: Think about elasticity.) If total consumer spending falls, does consumer surplus rise? Explain.
9. Suppose the government currently raises \$100 million through a \$0.01 tax on widgets, and another \$100 million through a \$0.10 tax on gadgets. If the government doubled the tax rate on widgets and eliminated the tax on gadgets, would it raise more money than today, less money, or the same amount of money? Explain.
10. Most states tax the purchase of new cars. Suppose that New Jersey currently requires car dealers to pay the state \$100 for each car sold, and plans to increase the tax to \$150 per car next year.
  - a. Illustrate the effect of this tax increase on the quantity of cars sold in New Jersey, the price paid by consumers, and the price received by producers.
  - b. Create a table that shows the levels of consumer surplus, producer surplus, government revenue, and total surplus both before and after the tax increase.
  - c. What is the change in government revenue? Is it positive or negative?
  - d. What is the change in deadweight loss? Is it positive or negative?
  - e. Give one reason why the demand for cars in New Jersey might be fairly elastic. Does this make the additional tax more or less likely to increase

government revenue? How might states try to reduce the elasticity of demand?

11. Several years ago the British government imposed a “poll tax” that required each person to pay a flat amount to the government independent of his or her income or wealth. What is the effect of such a tax on economic efficiency? What is the effect on economic equity? Do you think this was a popular tax?
12. This chapter analyzed the welfare effects of a tax on a good. Consider now the opposite policy. Suppose that the government subsidizes a good: For each unit of the good sold, the government pays \$2 to the buyer. How does the subsidy affect consumer surplus, producer surplus, tax revenue, and total surplus? Does a subsidy lead to a deadweight loss? Explain.
13. (This problem uses some high school algebra and is challenging.) Suppose that a market is described by the following supply and demand equations:

$$Q^S = 2P$$

$$Q^D = 300 - P$$

- a. Solve for the equilibrium price and the equilibrium quantity.
- b. Suppose that a tax of  $T$  is placed on buyers, so the new demand equation is

$$Q^D = 300 - (P + T).$$

Solve for the new equilibrium. What happens to the price received by sellers, the price paid by buyers, and the quantity sold?

- c. Tax revenue is  $T \times Q$ . Use your answer to part (b) to solve for tax revenue as a function of  $T$ . Graph this relationship for  $T$  between 0 and 300.
- d. The deadweight loss of a tax is the area of the triangle between the supply and demand curves. Recalling that the area of a triangle is  $1/2 \times \text{base} \times \text{height}$ , solve for deadweight loss as a function of  $T$ . Graph this relationship for  $T$  between 0 and 300. (Hint: Looking sideways, the base of the deadweight loss triangle is  $T$ , and the height is the difference between the quantity sold with the tax and the quantity sold without the tax.)
- e. The government now levies a tax on this good of \$200 per unit. Is this a good policy? Why or why not? Can you propose a better policy?

### Problems and Applications

1. The United States represents a small part of the world orange market.
  - a. Draw a diagram depicting the equilibrium in the U.S. orange market without international trade. Identify the equilibrium price, equilibrium quantity, consumer surplus, and producer surplus.
  - b. Suppose that the world orange price is below the U.S. price before trade, and that the U.S. orange market is now opened to trade. Identify the new equilibrium price, quantity consumed, quantity produced domestically, and quantity imported. Also show the change in the surplus of domestic consumers and producers. Has domestic total surplus increased or decreased?
2. The world price of wine is below the price that would prevail in the United States in the absence of trade.
  - a. Assuming that American imports of wine are a small part of total world wine production, draw a graph for the U.S. market for wine under free trade. Identify consumer surplus, producer surplus, and total surplus in an appropriate table.
  - b. Now suppose that an unusual shift of the Gulf Stream leads to an unseasonably cold summer in Europe, destroying much of the grape harvest there. What effect does this shock have on the world price of wine? Using your graph and table from part (a), show the effect on consumer surplus, producer surplus, and total surplus in the United States. Who are the winners and losers? Is the United States as a whole better or worse off?
3. The world price of cotton is below the no-trade price in Country A and above the no-trade price in Country B. Using supply-and-demand diagrams and welfare tables such as those in the chapter, show the gains from trade in each country. Compare your results for the two countries.
4. Suppose that Congress imposes a tariff on imported autos to protect the U.S. auto industry from foreign competition. Assuming that the U.S. is a price taker in the world auto market, show on a diagram: the change in the quantity of imports, the loss to U.S. consumers, the gain to U.S. manufacturers, government revenue, and the deadweight loss associated with the tariff. The loss to consumers can be decomposed into three pieces: a transfer to domestic producers, a transfer to the government, and a deadweight loss. Use your diagram to identify these three pieces.
5. According to an article in *The New York Times* (Nov. 5, 1993), “many Midwest wheat farmers oppose the [North American] free trade agreement [NAFTA] as much as many corn farmers support it.” For simplicity, assume that the United States is a small country in the markets for both corn and wheat, and that without the free trade agreement, the United States would not trade these commodities internationally. (Both of these assumptions are false, but they do not affect the qualitative responses to the following questions.)
  - a. Based on this report, do you think the world wheat price is above or below the U.S. no-trade wheat price? Do you think the world corn price is above or below the U.S. no-trade corn price? Now analyze the welfare consequences of NAFTA in both markets.
  - b. Considering both markets together, does NAFTA make U.S. farmers as a group better or worse off? Does it make U.S. consumers as a group better or worse off? Does it make the United States as a whole better or worse off?
6. Imagine that winemakers in the state of Washington petitioned the state government to tax wines imported from California. They argue that this tax would both raise tax revenue for the state government and raise employment in the Washington state wine industry. Do you agree with these claims? Is it a good policy?
7. Senator Ernest Hollings once wrote that “consumers *do not* benefit from lower-priced imports. Glance through some mail-order catalogs and you’ll see that consumers pay exactly the same price for clothing whether it is U.S.-made or imported.” Comment.
8. Write a brief essay advocating or criticizing each of the following policy positions:
  - a. The government should not allow imports if foreign firms are selling below their costs of production (a phenomenon called “dumping”).
  - b. The government should temporarily stop the import of goods for which the domestic industry is new and struggling to survive.
  - c. The government should not allow imports from countries with weaker environmental regulations than ours.
9. Suppose that a technological advance in Japan lowers the world price of televisions.

- a. Assume the U.S. is an importer of televisions and there are no trade restrictions. How does the technological advance affect the welfare of U.S. consumers and U.S. producers? What happens to total surplus in the United States?
  - b. Now suppose the United States has a quota on television imports. How does the Japanese technological advance affect the welfare of U.S. consumers, U.S. producers, and the holders of import licenses?
10. When the government of Tradeland decides to impose an import quota on foreign cars, three proposals are suggested: (1) Sell the import licenses in an auction. (2) Distribute the licenses randomly in a lottery. (3) Let people wait in line and distribute the licenses on a first-come, first-served basis. Compare the effects of these policies. Which policy do you think has the largest deadweight losses? Which policy has the smallest deadweight losses? Why? (Hint: The government's other ways of raising tax revenue all cause deadweight losses themselves.)
11. An article in *The Wall Street Journal* (June 26, 1990) about sugar beet growers explained that "the government props up domestic sugar prices by curtailing imports of lower-cost sugar. Producers are guaranteed a 'market stabilization price' of \$0.22 a pound, about \$0.09 higher than the current world market price." The government maintains the higher price by imposing an import quota.
- a. Illustrate the effect of this quota on the U.S. sugar market. Label the relevant prices and quantities under free trade and under the quota.
  - b. Analyze the effects of the sugar quota using the tools of welfare analysis.
  - c. The article also comments that "critics of the sugar program say that [the quota] has deprived numerous sugar-producing nations in the Caribbean, Latin America, and Far East of export earnings, harmed their economies, and caused political instability, while increasing Third World demand for U.S. foreign aid." Our usual welfare analysis includes only gains and losses to U.S. consumers and producers. What role do you think the gains or losses to people in other countries should play in our economic policymaking?
  - d. The article continues that "at home, the sugar program has helped make possible the spectacular rise of the high-fructose corn syrup industry." Why has the sugar program had this effect? (Hint: Are sugar and corn syrup substitutes or complements?)
12. (This question is challenging.) Consider a small country that exports steel. Suppose that a "pro-trade" government decides to subsidize the export of steel by paying a certain amount for each ton sold abroad. How does this export subsidy affect the domestic price of steel, the quantity of steel produced, the quantity of steel consumed, and the quantity of steel exported? How does it affect consumer surplus, producer surplus, government revenue, and total surplus? (Hint: The analysis of an export subsidy is similar to the analysis of a tariff.)

### Summary

- ◆ When a transaction between a buyer and seller directly affects a third party, the effect is called an externality. Negative externalities, such as pollution, cause the socially optimal quantity in a market to be less than the equilibrium quantity. Positive externalities, such as technology spillovers, cause the socially optimal quantity to be greater than the equilibrium quantity.
- ◆ Those affected by externalities can sometimes solve the problem privately. For instance, when one business confers an externality on another business, the two businesses can internalize the externality by merging. Alternatively, the interested parties can solve the problem by negotiating a contract. According to the Coase theorem, if people can bargain without cost, then they can always reach an agreement in which resources are allocated efficiently. In many cases, however, reaching a bargain among the many interested parties is difficult, so the Coase theorem does not apply.
- ◆ When private parties cannot adequately deal with external effects, such as pollution, the government often steps in. Sometimes the government prevents socially inefficient activity by regulating behavior. Other times it internalizes an externality using Pigovian taxes. Another way to protect the environment is for the government to issue a limited number of pollution permits. The end result of this policy is largely the same as imposing Pigovian taxes on polluters.

### Key Concepts

externality, p. 206

internalizing an externality, p. 209

Coase theorem, p. 213

transaction costs, p. 214

Pigovian tax, p. 216

### Questions for Review

1. Give an example of a negative externality and an example of a positive externality.
2. Use a supply-and-demand diagram to explain the effect of a negative externality in production.
3. In what way does the patent system help society solve an externality problem?
4. List some of the ways that the problems caused by externalities can be solved without government intervention.
5. Imagine that you are a nonsmoker sharing a room with a smoker. According to the Coase theorem, what determines whether your roommate smokes in the room? Is this outcome efficient? How do you and your roommate reach this solution?
6. What are Pigovian taxes? Why do economists prefer them over regulations as a way to protect the environment from pollution?

### Problems and Applications

1. Do you agree with the following statements? Why or why not?
  - a. "The benefits of Pigovian taxes as a way to reduce pollution have to be weighed against the deadweight losses that these taxes cause."
  - b. "A negative production externality calls for a Pigovian tax on producers, whereas a negative consumption externality calls for a Pigovian tax on consumers."
2. Consider the market for fire extinguishers.
  - a. Why might fire extinguishers exhibit positive externalities in consumption?
  - b. Draw a graph of the market for fire extinguishers, labeling the demand curve, the social-value

- curve, the supply curve, and the social-cost curve.
- c. Indicate the market equilibrium level of output and the efficient level of output. Give an intuitive explanation for why these quantities differ.
  - d. If the external benefit is \$10 per extinguisher, describe a government policy that would result in the efficient outcome.
3. Contributions to charitable organizations are deductible under the federal income tax. In what way does this government policy encourage private solutions to externalities?
  4. Ringo loves playing rock and roll music at high volume. Luciano loves opera and hates rock and roll. Unfortunately, they are next-door neighbors in an apartment building with paper-thin walls.
    - a. What is the externality here?
    - b. What command-and-control policy might the landlord impose? Could such a policy lead to an inefficient outcome?
    - c. Suppose the landlord lets the tenants do whatever they want. According to the Coase theorem, how might Ringo and Luciano reach an efficient outcome on their own? What might prevent them from reaching an efficient outcome?
  5. It is rumored that the Swiss government subsidizes cattle farming, and that the subsidy is larger in areas with more tourist attractions. Can you think of a reason why this policy might be efficient?
  6. Greater consumption of alcohol leads to more motor vehicle accidents and, thus, imposes costs on people who do not drink and drive.
    - a. Illustrate the market for alcohol, labeling the demand curve, the social-value curve, the supply curve, the social-cost curve, the market equilibrium level of output, and the efficient level of output.
    - b. On your graph, shade the area corresponding to the deadweight loss of the market equilibrium. (Hint: The deadweight loss occurs because some units of alcohol are consumed for which the social cost exceeds the social value.) Explain.
  7. Many observers believe that the levels of pollution in our economy are too high.
    - a. If society wishes to reduce overall pollution by a certain amount, why is it efficient to have different amounts of reduction at different firms?
    - b. Command-and-control approaches often rely on uniform reductions among firms. Why are these approaches generally unable to target the firms that should undertake bigger reductions?
  8. Economists argue that appropriate Pigovian taxes or tradable pollution rights will result in efficient pollution reduction. How do these approaches target the firms that should undertake bigger reductions?
  8. The Pristine River has two polluting firms on its banks. Acme Industrial and Creative Chemicals each dump 100 tons of glop into the river each year. The cost of reducing glop emissions per ton equals \$10 for Acme and \$100 for Creative. The local government wants to reduce overall pollution from 200 tons to 50 tons.
    - a. If the government knew the cost of reduction for each firm, what reductions would it impose to reach its overall goal? What would be the cost to each firm and the total cost to the firms together?
    - b. In a more typical situation, the government would not know the cost of pollution reduction at each firm. If the government decided to reach its overall goal by imposing uniform reductions on the firms, calculate the reduction made by each firm, the cost to each firm, and the total cost to the firms together.
    - c. Compare the total cost of pollution reduction in parts (a) and (b). If the government does not know the cost of reduction for each firm, is there still some way for it to reduce pollution to 50 tons at the total cost you calculated in part (a)? Explain.
  9. Figure 10-5 shows that for any given demand curve for the right to pollute, the government can achieve the same outcome either by setting a price with a Pigovian tax or by setting a quantity with pollution permits. Suppose there is a sharp improvement in the technology for controlling pollution.
    - a. Using graphs similar to those in Figure 10-5, illustrate the effect of this development on the demand for pollution rights.
    - b. What is the effect on the price and quantity of pollution under each regulatory system? Explain.
  10. Suppose that the government decides to issue tradable permits for a certain form of pollution.
    - a. Does it matter for economic efficiency whether the government distributes or auctions the permits? Does it matter in any other ways?
    - b. If the government chooses to distribute the permits, does the allocation of permits among firms matter for efficiency? Does it matter in any other ways?
  11. The primary cause of global warming is carbon dioxide, which enters the atmosphere in varying amounts from

different countries but is distributed equally around the globe within a year. In an article in *The Boston Globe* (July 3, 1990), Martin and Kathleen Feldstein argue that the correct approach to global warming is “not to ask individual countries to stabilize their emissions of carbon dioxide at current levels,” as some have suggested. Instead, they argue that “carbon dioxide emissions should be reduced in countries where the costs are least, and the countries that bear that burden should be compensated by the rest of the world.”

- a. Why is international cooperation necessary to reach an efficient outcome?
  - b. Is it possible to devise a compensation scheme such that all countries would be better off than under a system of uniform emission reductions? Explain.
12. Some people object to market-based policies to reduce pollution, claiming that they place a dollar value on cleaning our air and water. Economists reply that society *implicitly* places a dollar value on environmental cleanup even under command-and-control policies. Discuss why this is true.

13. (This problem is challenging.) There are three industrial firms in Happy Valley.

FIRM	INITIAL POLLUTION LEVEL	COST OF REDUCING POLLUTION BY 1 UNIT
A	70 units	\$20
B	80	25
C	50	10

The government wants to reduce pollution to 120 units, so it gives each firm 40 tradable pollution permits.

- a. Who sells permits and how many do they sell? Who buys permits and how many do they buy? Briefly explain why the sellers and buyers are each willing to do so. What is the total cost of pollution reduction in this situation?
- b. How much higher would the costs of pollution reduction be if the permits could not be traded?



### Problems and Applications

1. The text says that both public goods and common resources involve externalities.
  - a. Are the externalities associated with public goods generally positive or negative? Use examples in your answer. Is the free-market quantity of public goods generally greater or less than the efficient quantity?
  - b. Are the externalities associated with common resources generally positive or negative? Use examples in your answer. Is the free-market use of common resources generally greater or less than the efficient use?
2. Think about the goods and services provided by your local government.
  - a. Using the classification in Figure 11-1, explain what category each of the following goods falls into:
    - ◆ police protection
    - ◆ snow plowing
    - ◆ education
    - ◆ rural roads
    - ◆ city streets
  - b. Why do you think the government provides items that are not public goods?
3. Charlie loves watching *Teletubbies* on his local public TV station, but he never sends any money to support the station during their fund-raising drives.
  - a. What name do economists have for Charlie?
  - b. How can the government solve the problem caused by people like Charlie?
  - c. Can you think of ways the private market can solve this problem? How does the existence of cable TV alter the situation?
4. The text states that private firms will not undertake the efficient amount of basic scientific research.
  - a. Explain why this is so. In your answer, classify basic research in one of the categories shown in Figure 11-1.
  - b. What sort of policy has the United States adopted in response to this problem?
  - c. It is often argued that this policy increases the technological capability of American producers relative to that of foreign firms. Is this argument consistent with your classification of basic research in part (a)? (Hint: Can excludability apply to some potential beneficiaries of a public good and not others?)
5. Why is there litter along most highways but rarely in people's yards?
6. The Washington, D.C., metro (subway) system charges higher fares during rush hours than during the rest of the day. Why might it do this?
7. Timber companies in the United States cut down many trees on publicly owned land and many trees on privately owned land. Discuss the likely efficiency of logging on each type of land in the absence of government regulation. How do you think the government should regulate logging on publicly owned lands? Should similar regulations apply to privately owned land?
8. An *Economist* article (March 19, 1994) states: "In the past decade, most of the rich world's fisheries have been exploited to the point of near-exhaustion." The article continues with an analysis of the problem and a discussion of possible private and government solutions:
  - a. "Do not blame fishermen for overfishing. They are behaving rationally, as they have always done." In what sense is "overfishing" rational for fishermen?
  - b. "A community, held together by ties of obligation and mutual self-interest, can manage a common resource on its own." Explain how such management can work in principle, and what obstacles it faces in the real world.
  - c. "Until 1976 most world fish stocks were open to all comers, making conservation almost impossible. Then an international agreement extended some aspects of [national] jurisdiction from 12 to 200 miles offshore." Using the concept of property rights, discuss how this agreement reduces the scope of the problem.
  - d. The article notes that many governments come to the aid of suffering fishermen in ways that encourage increased fishing. How do such policies encourage a vicious cycle of overfishing?
  - e. "Only when fishermen believe they are assured a long-term and exclusive right to a fishery are they likely to manage it in the same far-sighted way as good farmers manage their land." Defend this statement.
  - f. What other policies to reduce overfishing might be considered?
9. In a market economy, information about the quality or function of goods and services is a valuable good in its

own right. How does the private market provide this information? Can you think of any way in which the government plays a role in providing this information?

10. Do you think the Internet is a public good? Why or why not?
11. High-income people are willing to pay more than lower-income people to avoid the risk of death. For example,

they are more likely to pay for safety features on cars. Do you think cost-benefit analysts should take this fact into account when evaluating public projects? Consider, for instance, a rich town and a poor town, both of which are considering the installation of a traffic light. Should the rich town use a higher dollar value for a human life in making this decision? Why or why not?

### Problems and Applications

1. Government spending in the United States has grown as a share of national income over time. What changes in our economy and our society might explain this trend? Do you expect the trend to continue?
2. In a published source or on the Internet, find out whether the U.S. federal government had a budget deficit or surplus last year. What do policymakers expect to happen over the next few years? (Hint: The Web site of the Congressional Budget Office is [www.cbo.gov](http://www.cbo.gov).)
3. The information in many of the tables in this chapter is taken from the *Economic Report of the President*, which appears annually. Using a recent issue of the report at your library, answer the following questions and provide some numbers to support your answers.
  - a. Figure 12-1 shows that government revenue as a percentage of total income has increased over time. Is this increase primarily attributable to changes in federal government revenue or in state and local government revenue?
  - b. Looking at the combined revenue of the federal government and state and local governments, how has the composition of total revenue changed over time? Are personal income taxes more or less important? Social insurance taxes? Corporate profits taxes?
  - c. Looking at the combined expenditures of the federal government and state and local governments, how have the relative shares of transfer payments and purchases of goods and services changed over time?
4. The chapter states that the elderly population in the United States is growing more rapidly than the total population. In particular, the number of workers is rising slowly, while the number of retirees is rising quickly. Concerned about the future of Social Security, some members of Congress propose a “freeze” on the program.
  - a. If total expenditures were frozen, what would happen to benefits per retiree? To tax payments per worker? (Assume that Social Security taxes and receipts are balanced in each year.)
  - b. If benefits per retiree were frozen, what would happen to total expenditures? To tax payments per worker?
    - c. If tax payments per worker were frozen, what would happen to total expenditures? To benefits per retiree?
    - d. What do your answers to parts (a), (b), and (c) imply about the difficult decisions faced by policymakers?
5. Suppose you are a typical person in the U.S. economy. You pay a flat 4 percent of your income in a state income tax and 15.3 percent of your labor earnings in federal payroll taxes (employer and employee shares combined). You also pay federal income taxes as in Table 12-3. How much tax of each type do you pay if you earn \$20,000 a year? Taking all taxes into account, what are your average and marginal tax rates? What happens to your tax bill and to your average and marginal tax rates if your income rises to \$40,000?
6. Some states exclude necessities, such as food and clothing, from their sales tax. Other states do not. Discuss the merits of this exclusion. Consider both efficiency and equity.
7. Explain how individuals’ behavior is affected by the following features of the federal tax code.
  - a. Contributions to charity are tax deductible.
  - b. Sales of beer are taxed.
  - c. Interest that a homeowner pays on a mortgage is tax deductible.
  - d. Realized capital gains are taxed, but accrued gains are not. (When someone owns a share of stock that rises in value, she has an “accrued” capital gain. If she sells the share, she has a “realized” gain.)
8. Suppose that your state raises its sales tax from 5 percent to 6 percent. The state revenue commissioner forecasts a 20 percent increase in sales tax revenue. Is this plausible? Explain.
9. Consider two of the income security programs in the United States: Temporary Assistance for Needy Families (TANF) and the Earned Income Tax Credit (EITC).
  - a. When a woman with children and very low income earns an extra dollar, she receives less in TANF benefits. What do you think is the effect of this feature of TANF on the labor supply of low-income women? Explain.
  - b. The EITC provides greater benefits as low-income workers earn more income (up to a point). What do you think is the effect of this program on the labor supply of low-income individuals? Explain.

- c. What are the disadvantages of eliminating TANF and allocating the savings to the EITC?
10. The Tax Reform Act of 1986 eliminated the deductibility of interest payments on consumer debt (mostly credit cards and auto loans) but maintained the deductibility of interest payments on mortgages and home equity loans. What do you think happened to the relative amounts of borrowing through consumer debt and home equity debt?
11. Categorize each of the following funding schemes as examples of the benefits principle or the ability-to-pay principle.
  - a. Visitors to many national parks pay an entrance fee.
  - b. Local property taxes support elementary and secondary schools.
  - c. An airport trust fund collects a tax on each plane ticket sold and uses the money to improve airports and the air traffic control system.
12. Any income tax schedule embodies two types of tax rates—average tax rates and marginal tax rates.
  - a. The average tax rate is defined as total taxes paid divided by income. For the proportional tax system presented in Table 12-7, what are the average tax rates for people earning \$50,000, \$100,000, and \$200,000? What are the corresponding average tax rates in the regressive and progressive tax systems?
  - b. The marginal tax rate is defined as the extra taxes paid on additional income divided by the increase in income. Calculate the marginal tax rate for the proportional tax system as income rises from \$50,000 to \$100,000. Calculate the marginal tax rate as income rises from \$100,000 to \$200,000. Calculate the corresponding marginal tax rates for the regressive and progressive tax systems.
- c. Describe the relationship between average tax rates and marginal tax rates for each of these three systems. In general, which rate is relevant for someone deciding whether to accept a job that pays slightly more than her current job? Which rate is relevant for judging the vertical equity of a tax system?
13. What is the efficiency justification for taxing consumption rather than income? If the United States were to adopt a consumption tax, do you think that would make the U.S. tax system more or less progressive? Explain.
14. If a salesman takes a client to lunch, part of the cost of the lunch is a deductible business expense for his company. Some members of Congress have argued that this feature of the tax code benefits relatively wealthy businesspeople and should be eliminated. Yet their arguments have been met with greater opposition from eating and drinking establishments than from companies themselves. Explain.

rises as output increases further. The marginal-cost curve always crosses the average-total-cost curve at the minimum of average total cost.

- ◆ A firm’s costs often depend on the time horizon being considered. In particular, many costs are fixed in the

short run but variable in the long run. As a result, when the firm changes its level of production, average total cost may rise more in the short run than in the long run.

**Key Concepts**

total revenue, p. 270  
 total cost, p. 270  
 profit, p. 270  
 explicit costs, p. 271  
 implicit costs, p. 271  
 economic profit, p. 272  
 accounting profit, p. 272

production function, p. 273  
 marginal product, p. 273  
 diminishing marginal product, p. 273  
 fixed costs, p. 277  
 variable costs, p. 277  
 average total cost, p. 278  
 average fixed cost, p. 278

average variable cost, p. 278  
 marginal cost, p. 278  
 efficient scale, p. 280  
 economies of scale, p. 284  
 diseconomies of scale, p. 284  
 constant returns to scale, p. 284

**Questions for Review**

1. What is the relationship between a firm’s total revenue, profit, and total cost?
2. Give an example of an opportunity cost that an accountant might not count as a cost. Why would the accountant ignore this cost?
3. What is marginal product, and what does it mean if it is diminishing?
4. Draw a production function that exhibits diminishing marginal product of labor. Draw the associated total-cost curve. (In both cases, be sure to label the axes.) Explain the shapes of the two curves you have drawn.
5. Define total cost, average total cost, and marginal cost. How are they related?
6. Draw the marginal-cost and average-total-cost curves for a typical firm. Explain why the curves have the shapes that they do and why they cross where they do.
7. How and why does a firm’s average-total-cost curve differ in the short run and in the long run?
8. Define *economies of scale* and explain why they might arise. Define *diseconomies of scale* and explain why they might arise.

**Problems and Applications**

1. This chapter discusses many types of costs: opportunity cost, total cost, fixed cost, variable cost, average total cost, and marginal cost. Fill in the type of cost that best completes the phrases below:
  - a. The true cost of taking some action is its \_\_\_\_\_.
  - b. \_\_\_\_\_ is falling when marginal cost is below it, and rising when marginal cost is above it.
  - c. A cost that does not depend on the quantity produced is a \_\_\_\_\_.
  - d. In the ice-cream industry in the short run, \_\_\_\_\_ includes the cost of cream and sugar, but not the cost of the factory.
  - e. Profits equal total revenue less \_\_\_\_\_.
  - f. The cost of producing an extra unit of output is \_\_\_\_\_.
2. Your aunt is thinking about opening a hardware store. She estimates that it would cost \$500,000 per year to rent the location and buy the stock. In addition, she would have to quit her \$50,000 per year job as an accountant.
  - a. Define opportunity cost.
  - b. What is your aunt’s opportunity cost of running a hardware store for a year? If your aunt thought she could sell \$510,000 worth of merchandise in a year, should she open the store? Explain.

3. Suppose that your college charges you separately for tuition and for room and board.
  - a. What is a cost of attending college that is not an opportunity cost?
  - b. What is an explicit opportunity cost of attending college?
  - c. What is an implicit opportunity cost of attending college?
4. A commercial fisherman notices the following relationship between hours spent fishing and the quantity of fish caught:

HOURS	QUANTITY OF FISH (IN POUNDS)
0	0
1	10
2	18
3	24
4	28
5	30

- a. What is the marginal product of each hour spent fishing?
  - b. Use these data to graph the fisherman's production function. Explain its shape.
  - c. The fisherman has a fixed cost of \$10 (his pole). The opportunity cost of his time is \$5 per hour. Graph the fisherman's total-cost curve. Explain its shape.
5. Nimbus, Inc., makes brooms and then sells them door-to-door. Here is the relationship between the number of workers and Nimbus's output in a given day:

WORKERS	OUTPUT	MARGINAL PRODUCT	TOTAL COST	AVERAGE TOTAL COST	MARGINAL COST
0	0	_____	_____	_____	_____
1	20	_____	_____	_____	_____
2	50	_____	_____	_____	_____
3	90	_____	_____	_____	_____
4	120	_____	_____	_____	_____
5	140	_____	_____	_____	_____
6	150	_____	_____	_____	_____
7	155	_____	_____	_____	_____

- a. Fill in the column of marginal products. What pattern do you see? How might you explain it?
  - b. A worker costs \$100 a day, and the firm has fixed costs of \$200. Use this information to fill in the column for total cost.
  - c. Fill in the column for average total cost. (Recall that  $ATC = TC/Q$ .) What pattern do you see?
  - d. Now fill in the column for marginal cost. (Recall that  $MC = \Delta TC/\Delta Q$ .) What pattern do you see?
  - e. Compare the column for marginal product and the column for marginal cost. Explain the relationship.
  - f. Compare the column for average total cost and the column for marginal cost. Explain the relationship.
6. Suppose that you and your roommate have started a bagel delivery service on campus. List some of your fixed costs and describe why they are fixed. List some of your variable costs and describe why they are variable.
7. Consider the following cost information for a pizzeria:

Q (DOZENS)	TOTAL COST	VARIABLE COST
0	\$300	\$ 0
1	350	50
2	390	90
3	420	120
4	450	150
5	490	190
6	540	240

- a. What is the pizzeria's fixed cost?
  - b. Construct a table in which you calculate the marginal cost per dozen pizzas using the information on total cost. Also calculate the marginal cost per dozen pizzas using the information on variable cost. What is the relationship between these sets of numbers? Comment.
8. You are thinking about setting up a lemonade stand. The stand itself costs \$200. The ingredients for each cup of lemonade cost \$0.50.
- a. What is your fixed cost of doing business? What is your variable cost per cup?
  - b. Construct a table showing your total cost, average total cost, and marginal cost for output levels varying from zero to 10 gallons. (Hint: There are 16 cups in a gallon.) Draw the three cost curves.
9. Your cousin Vinnie owns a painting company with fixed costs of \$200 and the following schedule for variable costs:

	QUANTITY OF HOUSES PAINTED PER MONTH						
	1	2	3	4	5	6	7
Variable costs	\$10	\$20	\$40	\$80	\$160	\$320	\$640

Calculate average fixed cost, average variable cost, and average total cost for each quantity. What is the efficient scale of the painting company?

10. Healthy Harry’s Juice Bar has the following cost schedules:

Q (VATS)	VARIABLE COST	TOTAL COST
0	\$ 0	\$ 30
1	10	40
2	25	55
3	45	75
4	70	100
5	100	130
6	135	165

- Calculate average variable cost, average total cost, and marginal cost for each quantity.
  - Graph all three curves. What is the relationship between the marginal-cost curve and the average-total-cost curve? Between the marginal-cost curve and the average-variable-cost curve? Explain.
11. Consider the following table of long-run total cost for three different firms:

	QUANTITY						
	1	2	3	4	5	6	7
Firm A	\$60	\$70	\$80	\$90	\$100	\$110	\$120
Firm B	11	24	39	56	75	96	119
Firm C	21	34	49	66	85	106	129

Does each of these firms experience economies of scale or diseconomies of scale?

demand lowers prices and leads to losses. But if firms can freely enter and exit the market, then in the long run

the number of firms adjusts to drive the market back to the zero-profit equilibrium.

**Key Concepts**

competitive market, p. 292  
average revenue, p. 294

marginal revenue, p. 294

sunk cost, p. 298

**Questions for Review**

1. What is meant by a competitive firm?
2. Draw the cost curves for a typical firm. For a given price, explain how the firm chooses the level of output that maximizes profit.
3. Under what conditions will a firm shut down temporarily? Explain.
4. Under what conditions will a firm exit a market? Explain.
5. Does a firm’s price equal marginal cost in the short run, in the long run, or both? Explain.
6. Does a firm’s price equal the minimum of average total cost in the short run, in the long run, or both? Explain.
7. Are market supply curves typically more elastic in the short run or in the long run? Explain.

**Problems and Applications**

1. What are the characteristics of a competitive market? Which of the following drinks do you think is best described by these characteristics? Why aren’t the others?
  - a. tap water
  - b. bottled water
  - c. cola
  - d. beer
2. Your roommate’s long hours in Chem lab finally paid off—she discovered a secret formula that lets people do an hour’s worth of studying in 5 minutes. So far, she’s sold 200 doses, and faces the following average-total-cost schedule:

Q	AVERAGE TOTAL COST
199	\$199
200	200
201	201

If a new customer offers to pay your roommate \$300 for one dose, should she make one more? Explain.

3. The licorice industry is competitive. Each firm produces 2 million strings of licorice per year. The strings have an average total cost of \$0.20 each, and they sell for \$0.30.
  - a. What is the marginal cost of a string?

- b. Is this industry in long-run equilibrium? Why or why not?
4. You go out to the best restaurant in town and order a lobster dinner for \$40. After eating half of the lobster, you realize that you are quite full. Your date wants you to finish your dinner, because you can’t take it home and because “you’ve already paid for it.” What should you do? Relate your answer to the material in this chapter.
5. Bob’s lawn-mowing service is a profit-maximizing, competitive firm. Bob mows lawns for \$27 each. His total cost each day is \$280, of which \$30 is a fixed cost. He mows 10 lawns a day. What can you say about Bob’s short-run decision regarding shut down and his long-run decision regarding exit?
6. Consider total cost and total revenue given in the table below:

	QUANTITY							
	0	1	2	3	4	5	6	7
Total cost	\$8	\$9	\$10	\$11	\$13	\$19	\$27	\$37
Total revenue	0	8	16	24	32	40	48	56

- a. Calculate profit for each quantity. How much should the firm produce to maximize profit?



- b. Calculate marginal revenue and marginal cost for each quantity. Graph them. (Hint: Put the points between whole numbers. For example, the marginal cost between 2 and 3 should be graphed at  $2\frac{1}{2}$ .) At what quantity do these curves cross? How does this relate to your answer to part (a)?
- c. Can you tell whether this firm is in a competitive industry? If so, can you tell whether the industry is in a long-run equilibrium?
7. From *The Wall Street Journal* (July 23, 1991): "Since peaking in 1976, per capita beef consumption in the United States has fallen by 28.6 percent . . . [and] the size of the U.S. cattle herd has shrunk to a 30-year low."
- a. Using firm and industry diagrams, show the short-run effect of declining demand for beef. Label the diagram carefully and write out in words all of the changes you can identify.
- b. On a new diagram, show the long-run effect of declining demand for beef. Explain in words.
8. "High prices traditionally cause expansion in an industry, eventually bringing an end to high prices and manufacturers' prosperity." Explain, using appropriate diagrams.
9. Suppose the book-printing industry is competitive and begins in a long-run equilibrium.
- a. Draw a diagram describing the typical firm in the industry.
- b. Hi-Tech Printing Company invents a new process that sharply reduces the cost of printing books. What happens to Hi-Tech's profits and the price of books in the short run when Hi-Tech's patent prevents other firms from using the new technology?
- c. What happens in the long run when the patent expires and other firms are free to use the technology?
10. Many small boats are made of fiberglass, which is derived from crude oil. Suppose that the price of oil rises.
- a. Using diagrams, show what happens to the cost curves of an individual boat-making firm and to the market supply curve.
- b. What happens to the profits of boat makers in the short run? What happens to the number of boat makers in the long run?
11. Suppose that the U.S. textile industry is competitive, and there is no international trade in textiles. In long-run equilibrium, the price per unit of cloth is \$30.
- a. Describe the equilibrium using graphs for the entire market and for an individual producer.
- Now suppose that textile producers in other countries are willing to sell large quantities of cloth in the United States for only \$25 per unit.
- b. Assuming that U.S. textile producers have large fixed costs, what is the short-run effect of these imports on the quantity produced by an individual producer? What is the short-run effect on profits? Illustrate your answer with a graph.
- c. What is the long-run effect on the number of U.S. firms in the industry?
12. Suppose there are 1,000 hot pretzel stands operating in New York City. Each stand has the usual U-shaped average-total-cost curve. The market demand curve for pretzels slopes downward, and the market for pretzels is in long-run competitive equilibrium.
- a. Draw the current equilibrium, using graphs for the entire market and for an individual pretzel stand.
- b. Now the city decides to restrict the number of pretzel-stand licenses, reducing the number of stands to only 800. What effect will this action have on the market and on an individual stand that is still operating? Use graphs to illustrate your answer.
- c. Suppose that the city decides to charge a license fee for the 800 licenses. How will this affect the number of pretzels sold by an individual stand, and the stand's profit? The city wants to raise as much revenue as possible and also wants to ensure that 800 pretzel stands remain in the city. By how much should the city increase the license fee? Show the answer on your graph.
13. Assume that the gold-mining industry is competitive.
- a. Illustrate a long-run equilibrium using diagrams for the gold market and for a representative gold mine.
- b. Suppose that an increase in jewelry demand induces a surge in the demand for gold. Using your diagrams, show what happens in the short run to the gold market and to each existing gold mine.
- c. If the demand for gold remains high, what would happen to the price over time? Specifically, would the new long-run equilibrium price be above, below, or equal to the short-run equilibrium price in part (b)? Is it possible for the new long-run equilibrium price to be above the original long-run equilibrium price? Explain.
14. (This problem is challenging.) *The New York Times* (July 1, 1994) reported on a Clinton administration proposal to lift the ban on exporting oil from the North Slope of Alaska. According to the article, the administration said that "the chief effect of the ban has

been to provide California refiners with crude oil cheaper than oil on the world market. . . . The ban created a subsidy for California refiners that had not been passed on to consumers." Let's use our analysis of firm behavior to analyze these claims.

- a. Draw the cost curves for a California refiner and for a refiner in another part of the world. Assume that the California refiners have access to inexpensive Alaskan crude oil and that other refiners must buy more expensive crude oil from the Middle East.
- b. All of the refiners produce gasoline for the world gasoline market, which has a single price. In the long-run equilibrium, will this price depend on the costs faced by California producers or the costs faced by other producers? Explain. (Hint: California cannot itself supply the entire world market.) Draw new graphs that illustrate the profits earned by a California refiner and another refiner.
- c. In this model, is there a subsidy to California refiners? Is it passed on to consumers?

consumers who otherwise would not buy it. In the extreme case of perfect price discrimination, the deadweight losses of monopoly are completely

eliminated. More generally, when price discrimination is imperfect, it can either raise or lower welfare compared to the outcome with a single monopoly price.

**Key Concepts**

monopoly, p. 316

natural monopoly, p. 318

price discrimination, p. 336

**Questions for Review**

1. Give an example of a government-created monopoly. Is creating this monopoly necessarily bad public policy? Explain.
2. Define natural monopoly. What does the size of a market have to do with whether an industry is a natural monopoly?
3. Why is a monopolist's marginal revenue less than the price of its good? Can marginal revenue ever be negative? Explain.
4. Draw the demand, marginal-revenue, and marginal-cost curves for a monopolist. Show the profit-maximizing level of output. Show the profit-maximizing price.
5. In your diagram from the previous question, show the level of output that maximizes total surplus. Show the deadweight loss from the monopoly. Explain your answer.
6. What gives the government the power to regulate mergers between firms? From the standpoint of the welfare of society, give a good reason and a bad reason that two firms might want to merge.
7. Describe the two problems that arise when regulators tell a natural monopoly that it must set a price equal to marginal cost.
8. Give two examples of price discrimination. In each case, explain why the monopolist chooses to follow this business strategy.

**Problems and Applications**

1. A publisher faces the following demand schedule for the next novel by one of its popular authors:

PRICE	QUANTITY DEMANDED
\$100	0
90	100,000
80	200,000
70	300,000
60	400,000
50	500,000
40	600,000
30	700,000
20	800,000
10	900,000
0	1,000,000

The author is paid \$2 million to write the book, and the marginal cost of publishing the book is a constant \$10 per book.

- a. Compute total revenue, total cost, and profit at each quantity. What quantity would a profit-maximizing publisher choose? What price would it charge?
- b. Compute marginal revenue. (Recall that  $MR = \Delta TR / \Delta Q$ .) How does marginal revenue compare to the price? Explain.
- c. Graph the marginal-revenue, marginal-cost, and demand curves. At what quantity do the marginal-revenue and marginal-cost curves cross? What does this signify?
- d. In your graph, shade in the deadweight loss. Explain in words what this means.

- e. If the author were paid \$3 million instead of \$2 million to write the book, how would this affect the publisher’s decision regarding the price to charge? Explain.
  - f. Suppose the publisher were not profit-maximizing but were concerned with maximizing economic efficiency. What price would it charge for the book? How much profit would it make at this price?
2. Suppose that a natural monopolist were required by law to charge average total cost. On a diagram, label the price charged and the deadweight loss to society relative to marginal-cost pricing.
  3. Consider the delivery of mail. In general, what is the shape of the average-total-cost curve? How might the shape differ between isolated rural areas and densely populated urban areas? How might the shape have changed over time? Explain.
  4. Suppose the Clean Springs Water Company has a monopoly on bottled water sales in California. If the price of tap water increases, what is the change in Clean Springs’ profit-maximizing levels of output, price, and profit? Explain in words and with a graph.
  5. A small town is served by many competing supermarkets, which have constant marginal cost.
    - a. Using a diagram of the market for groceries, show the consumer surplus, producer surplus, and total surplus.
    - b. Now suppose that the independent supermarkets combine into one chain. Using a new diagram, show the new consumer surplus, producer surplus, and total surplus. Relative to the competitive market, what is the transfer from consumers to producers? What is the deadweight loss?
  6. Johnny Rockabilly has just finished recording his latest CD. His record company’s marketing department determines that the demand for the CD is as follows:

PRICE	NUMBER OF CDS
\$24	10,000
22	20,000
20	30,000
18	40,000
16	50,000
14	60,000

The company can produce the CD with no fixed cost and a variable cost of \$5 per CD.

- a. Find total revenue for quantity equal to 10,000, 20,000, and so on. What is the marginal revenue for each 10,000 increase in the quantity sold?
  - b. What quantity of CDs would maximize profit? What would the price be? What would the profit be?
  - c. If you were Johnny’s agent, what recording fee would you advise Johnny to demand from the record company? Why?
7. In 1969 the government charged IBM with monopolizing the computer market. The government argued (correctly) that a large share of all mainframe computers sold in the United States were produced by IBM. IBM argued (correctly) that a much smaller share of the market for *all* types of computers consisted of IBM products. Based on these facts, do you think that the government should have brought suit against IBM for violating the antitrust laws? Explain.
  8. A company is considering building a bridge across a river. The bridge would cost \$2 million to build and nothing to maintain. The following table shows the company’s anticipated demand over the lifetime of the bridge:
 

PRICE (PER CROSSING)	NUMBER OF CROSSINGS (IN THOUSANDS)
\$8	0
7	100
6	200
5	300
4	400
3	500
2	600
1	700
0	800

    - a. If the company were to build the bridge, what would be its profit-maximizing price? Would that be the efficient level of output? Why or why not?
    - b. If the company is interested in maximizing profit, should it build the bridge? What would be its profit or loss?
    - c. If the government were to build the bridge, what price should it charge?
    - d. Should the government build the bridge? Explain.
  9. The Placebo Drug Company holds a patent on one of its discoveries.

- a. Assuming that the production of the drug involves rising marginal cost, draw a diagram to illustrate Placebo's profit-maximizing price and quantity. Also show Placebo's profits.
  - b. Now suppose that the government imposes a tax on each bottle of the drug produced. On a new diagram, illustrate Placebo's new price and quantity. How does each compare to your answer in part (a)?
  - c. Although it is not easy to see in your diagrams, the tax reduces Placebo's profit. Explain why this must be true.
  - d. Instead of the tax per bottle, suppose that the government imposes a tax on Placebo of \$10,000 regardless of how many bottles are produced. How does this tax affect Placebo's price, quantity, and profits? Explain.
10. Larry, Curly, and Moe run the only saloon in town. Larry wants to sell as many drinks as possible without losing money. Curly wants the saloon to bring in as much revenue as possible. Moe wants to make the largest possible profits. Using a single diagram of the saloon's demand curve and its cost curves, show the price and quantity combinations favored by each of the three partners. Explain.
  11. For many years AT&T was a regulated monopoly, providing both local and long-distance telephone service.
    - a. Explain why long-distance phone service was originally a natural monopoly.
    - b. Over the past two decades, many companies have launched communication satellites, each of which can transmit a limited number of calls. How did the growing role of satellites change the cost structure of long-distance phone service?  
  
After a lengthy legal battle with the government, AT&T agreed to compete with other companies in the long-distance market. It also agreed to spin off its local phone service into the "Baby Bells," which remain highly regulated.
    - c. Why might it be efficient to have competition in long-distance phone service and regulated monopolies in local phone service?
  12. The Best Computer Company just developed a new computer chip, on which it immediately acquires a patent.
    - a. Draw a diagram that shows the consumer surplus, producer surplus, and total surplus in the market for this new chip.
      - b. What happens to these three measures of surplus if the firm can perfectly price discriminate? What is the change in deadweight loss? What transfers occur?
  13. Explain why a monopolist will always produce a quantity at which the demand curve is elastic. (Hint: If demand is inelastic and the firm raises its price, what happens to total revenue and total costs?)
  14. The "Big Three" American car companies are GM, Ford, and Chrysler. If these were the only car companies in the world, they would have much more monopoly power. What action could the U.S. government take to create monopoly power for these companies? (Hint: The government took such an action in the 1980s.)
  15. Singer Whitney Houston has a monopoly over a scarce resource: herself. She is the only person who can produce a Whitney Houston concert. Does this fact imply that the government should regulate the prices of her concerts? Why or why not?
  16. Many schemes for price discriminating involve some cost. For example, discount coupons take up time and resources from both the buyer and the seller. This question considers the implications of costly price discrimination. To keep things simple, let's assume that our monopolist's production costs are simply proportional to output, so that average total cost and marginal cost are constant and equal to each other.
    - a. Draw the cost, demand, and marginal-revenue curves for the monopolist. Show the price the monopolist would charge without price discrimination.
    - b. In your diagram, mark the area equal to the monopolist's profit and call it  $X$ . Mark the area equal to consumer surplus and call it  $Y$ . Mark the area equal to the deadweight loss and call it  $Z$ .
    - c. Now suppose that the monopolist can perfectly price discriminate. What is the monopolist's profit? (Give your answer in terms of  $X$ ,  $Y$ , and  $Z$ .)
    - d. What is the change in the monopolist's profit from price discrimination? What is the change in total surplus from price discrimination? Which change is larger? Explain. (Give your answer in terms of  $X$ ,  $Y$ , and  $Z$ .)
    - e. Now suppose that there is some cost of price discrimination. To model this cost, let's assume that the monopolist has to pay a fixed cost  $C$  in order to price discriminate. How would a monopolist make the decision whether to pay this fixed cost? (Give your answer in terms of  $X$ ,  $Y$ ,  $Z$ , and  $C$ .)

- f. How would a benevolent social planner, who cares about total surplus, decide whether the monopolist should price discriminate? (Give your answer in terms of  $X$ ,  $Y$ ,  $Z$ , and  $C$ .)
- g. Compare your answers to parts (e) and (f). How does the monopolist's incentive to price

discriminate differ from the social planner's? Is it possible that the monopolist will price discriminate even though it is not socially desirable?