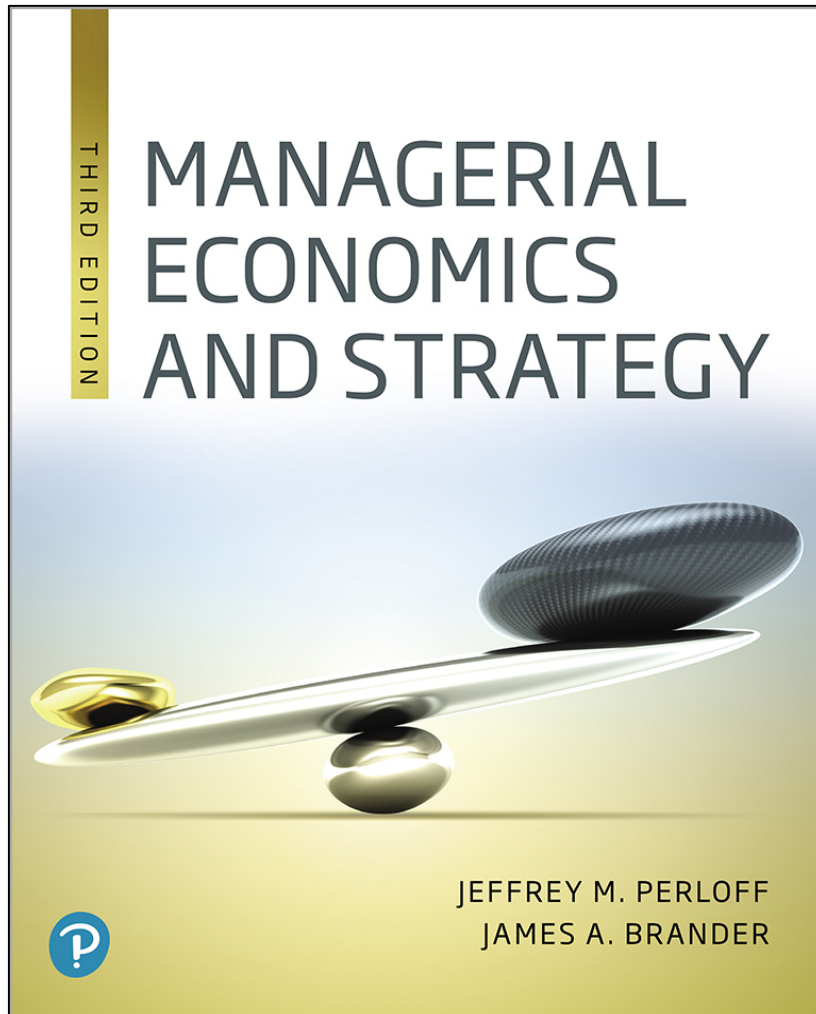


Managerial Economics and Strategy

Third Edition



Chapter 2

Supply and Demand

Managerial Problem

Carbon Taxes

- What will be the effect of imposing a carbon tax on the price of gasoline

Solution Approach

- Managers use the supply-and-demand model to answer this type of questions.

Model

- The supply-and-demand model provides a good description of many markets and applies particularly well to markets in which there are many buyers and many sellers.
- In markets where this model is applicable, it allows us to make clear, testable predictions about the effects of new taxes or other shocks on prices and other market outcomes.

Learning Objectives (1 of 2)

2.1 Demand

Explain how the quantity of a good or service that consumers want depends on its price and other factors

2.2 Supply

Describe how the quantity of a good or service that firms want to sell depends on its price and other factors

2.3 Market Equilibrium

Show how the interaction between consumers' demand and producers' supply determines the market price and quantity

Learning Objectives (2 of 2)

2.4 Shocks to the Equilibrium

Predict how an event that affects consumers or firms changes the market price and quantity

2.5 Effects of Government Interventions

Analyze the market effects of government policy using the supply-and-demand model

2.6 When to Use the Supply-and-Demand Model

Discuss when to use the supply-and-demand model

2.1 Demand (1 of 7)

- Consumers decide whether to buy a particular good or service.
 - If they decide to buy, **how much** is based on its **own price** and on **other factors**.
- Own Price
 - Economists focus most on how a good's **own price** affects the quantity demanded.
 - To determine how a change in price affects the quantity demanded, economists ask what happens to quantity when price changes and other factors are held constant.
- Other Factors
 - The list of other factors usually includes **income, price of related goods, tastes, information, government regulation**.
 - Go to next slide for more detail about these other factors of demand

2.1 Demand (2 of 7)

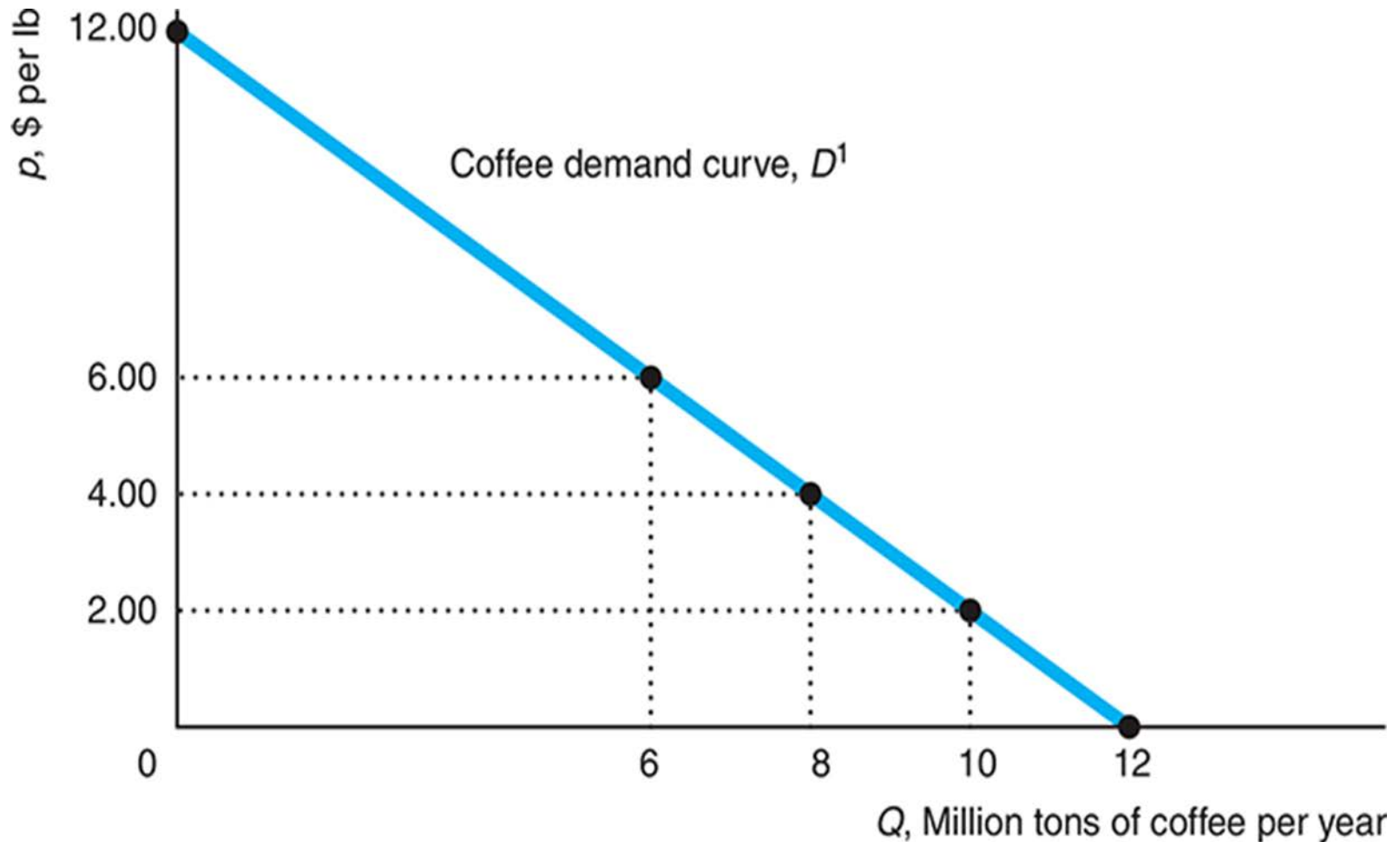
- Other factors of demand include the following:
 - Income
 - When a consumer's income rises that consumer will often buy more of many goods.
 - Price of related goods
 - **Substitute:** Different brands of essentially the same good are close substitutes.
 - **Complement:** is a good that is used with the good under consideration.
 - Information
 - Information about characteristics and the effects of a good has an impact on consumer decisions
 - Tastes
 - Consumers do not purchase goods they dislike. Firms devote significant resources to trying to change consumer tastes through advertising.
 - Government Regulations
 - Governments may ban, restrict, tax, or subsidize goods or services

2.1 Demand (3 of 7)

The Demand Curve

- A **demand curve** shows the quantity demanded at each possible price, holding constant the other factors that influence purchases.
- The **quantity demanded** is the amount of a good that consumers are willing to buy at a given price, holding constant the other factors that influence purchases.
- Graphical Presentation
 - In Figure 2.1, the demand curve hits the vertical axis at \$12, indicating that no quantity is demanded when the price is \$12 per lb or higher.
 - The demand curve hits the horizontal quantity axis at 12 million lbs, the quantity of avocados that consumers would want if the price were zero.
 - The quantity demanded at a price of \$2 per lb is 10 million lbs per year.

Figure 2.1 A Demand Curve



2.1 Demand (4 of 7)

Effects of a Price Change on the Quantity Demanded

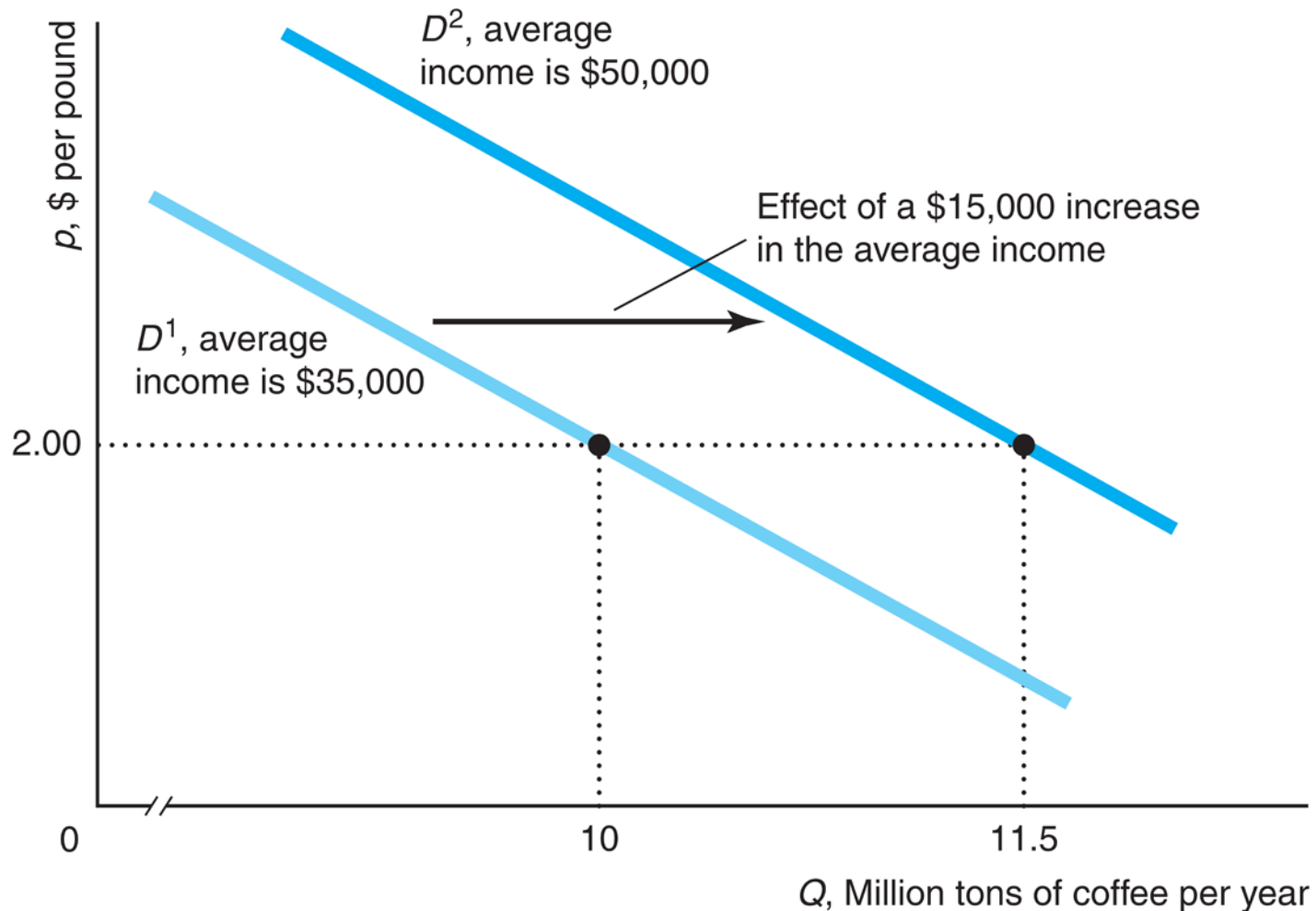
- The **Law of Demand** states that consumers demand more of a good if its price is lower or less when its price is higher.
 - The law of demand assumes income, the prices of other goods, tastes, and other factors that influence the amount they want to consume are **constant**.
 - The law of demand is an empirical claim—a claim about what actually happens.
 - According to the law of demand, **demand curves slope downward**, as in Figure 2.1.
- The **demand curve** is a concise summary of the answer to the question: What happens to the quantity demanded as the price changes, when all other factors are held constant?
 - **Changes in the quantity demanded** in response to changes in price are **movements along the demand curve**.

2.1 Demand (5 of 7)

Effects of Other Factors on Demand

- A change in any relevant factor other than the price of the good causes a **shift of the demand curve** rather than a movement along the demand curve.
- Example and Figure 2.2:
 - If average family income goes up from \$35,000 to \$50,000, the global demand for coffee shifts to the right from D^1 to D^2 .
 - The price remains at \$2 per pound, but the quantity demanded increases from 10 to 11.5 million pounds per year.
 - Verify the same shift of demand would occur if the price of a substitute of coffee, say tea, goes up.

Figure 2.2 A Shift of the Demand Curve



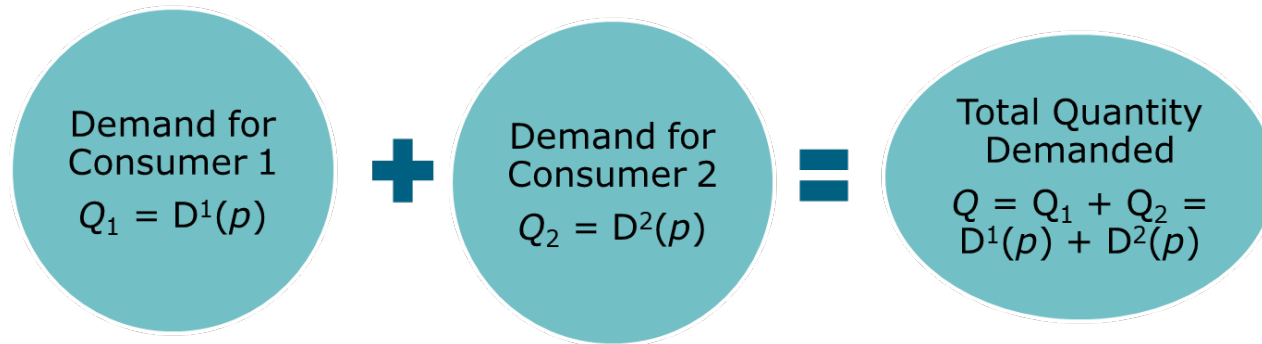
2.1 Demand (6 of 7)

The Demand Function: $Q = D(p, p_s, Y)$

- Q of coffee demanded is a function of its price p , **price of sugar** p_s and income Y . Other factors are constant.
- Estimated Demand Function: $Q = 8.56 - p - 0.3p_s + 0.1Y$
 - This specific linear form reflects empirical evidence; p **and** p_s are negative and Y is positive. The constant term, 8.56, represents all other factors.
- Demand Curve: $Q = 12 - p$
 - Straight-line demand curve D^1 in Figure 2.1 with $p_s = 0.20$, $Y = 35$. Notice that $\Delta Q = -\Delta p$. **So, if** $\Delta p = -\$2$, then $\Delta Q = -(-2) = 2$ million tons per year.
- **The Law of Demand and Calculus**
 - The Law of Demand states that the derivative of the demand function with respect to price is negative, $dQ/dp < 0$.
 - The demand function for coffee: $Q = 12 - p$. **So, the** derivative of the demand with respect to price: $dQ/dp = -1$.

2.1 Demand (7 of 7)

Summing Demand Curves



- The overall demand for coffee is composed of the demand of many individual consumers.
- The total quantity demanded at **a given price** is the sum of the quantity each consumer demands at that price.
- We can generalize this approach to look at the total demand for more than two consumers, or we can apply it to groups of consumers rather than just to individuals.

2.2 Supply (1 of 7)

- Firms determine how much of a good to **supply** on the basis of the **price** of that good and on **other factors**, including the costs of producing the good.
- Own Price
 - Usually, we expect firms to supply more quantity at a higher price.
- Other Factors
 - These other factors usually include **costs of production, technological change, government regulations**, and other factors.
 - Go to next slide for more detail about these other supply factors.

2.2 Supply (2 of 7)

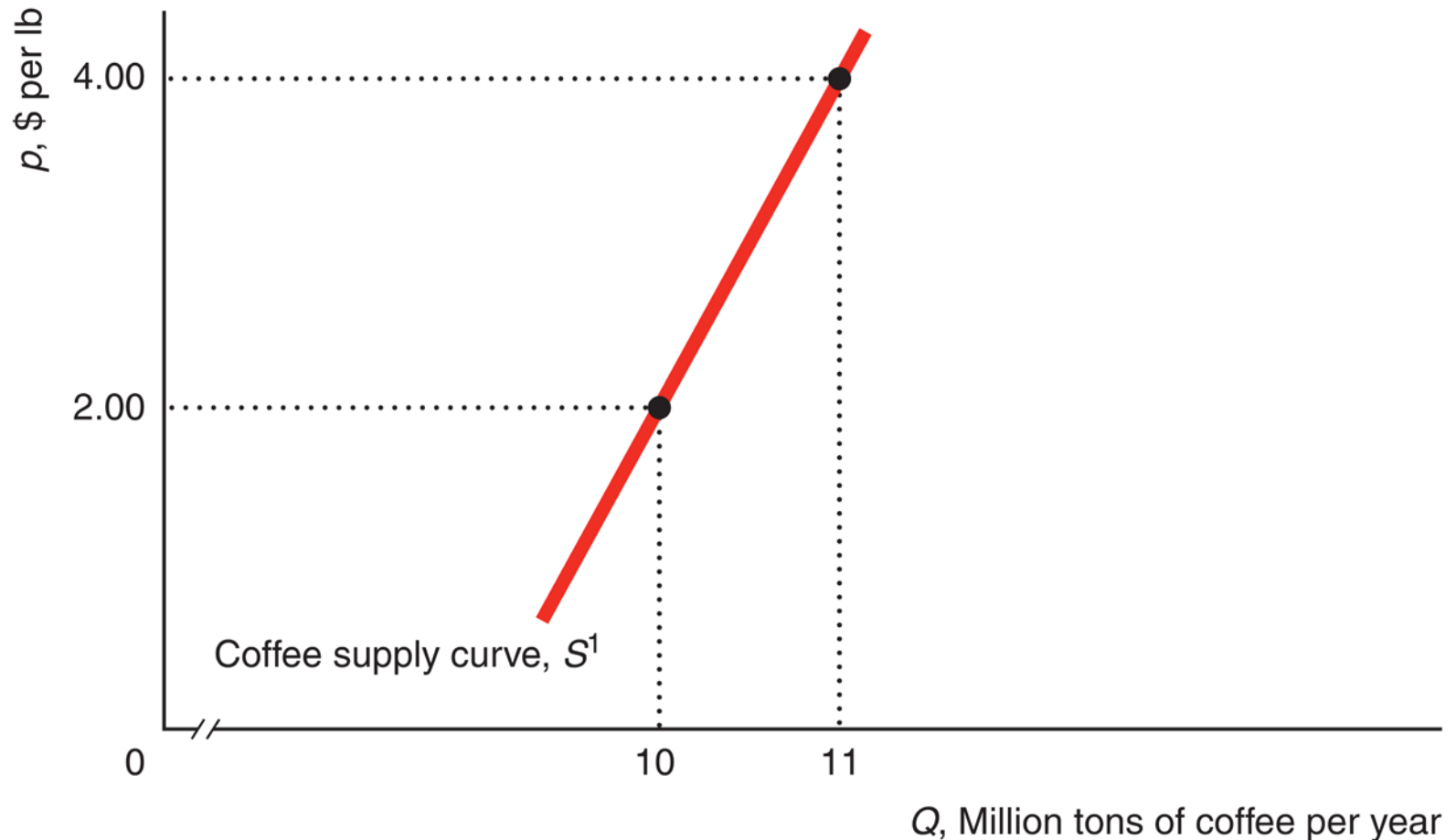
- Costs of Production
 - The costs of labor, machinery, fuel, and other costs affect how much of a product firms want to sell.
 - As a firm's cost falls, it is usually willing to supply more, holding price and other factors constant. Conversely, a cost increase will often reduce a firm's willingness to produce.
- Technological Change
 - If a **technological advance** allows a firm to produce its good at lower cost, the firm supplies more of that good at any given price, holding other factors constant.
- Government Regulations
 - **Government rules and regulations** can affect supply directly without working through costs.
 - For example, in some parts of the world, retailers may not sell most goods and services on particular days of religious significance.

2.2 Supply (3 of 7)

The Supply Curve

- A **supply curve** shows the quantity supplied at each possible price, holding constant the other factors that influence firms' supply decisions.
- The **quantity supplied** is the amount of a good that firms want to sell at a given price, holding constant other factors that influence firms' supply decisions, such as costs and government actions.
- Graphical Presentation
 - In Figure 2.3, the price on the vertical axis is measured in dollars per physical unit (dollars per lb), and the quantity on the horizontal axis is measured in physical units per time period (millions of tons per year).
 - The quantity supplied at a price of \$2 per lb is 10 million tons per year and 11 million tons per year when the price is \$4.

Figure 2.3 A Supply Curve



2.2 Supply (4 of 7)

Effects of Price on Supply

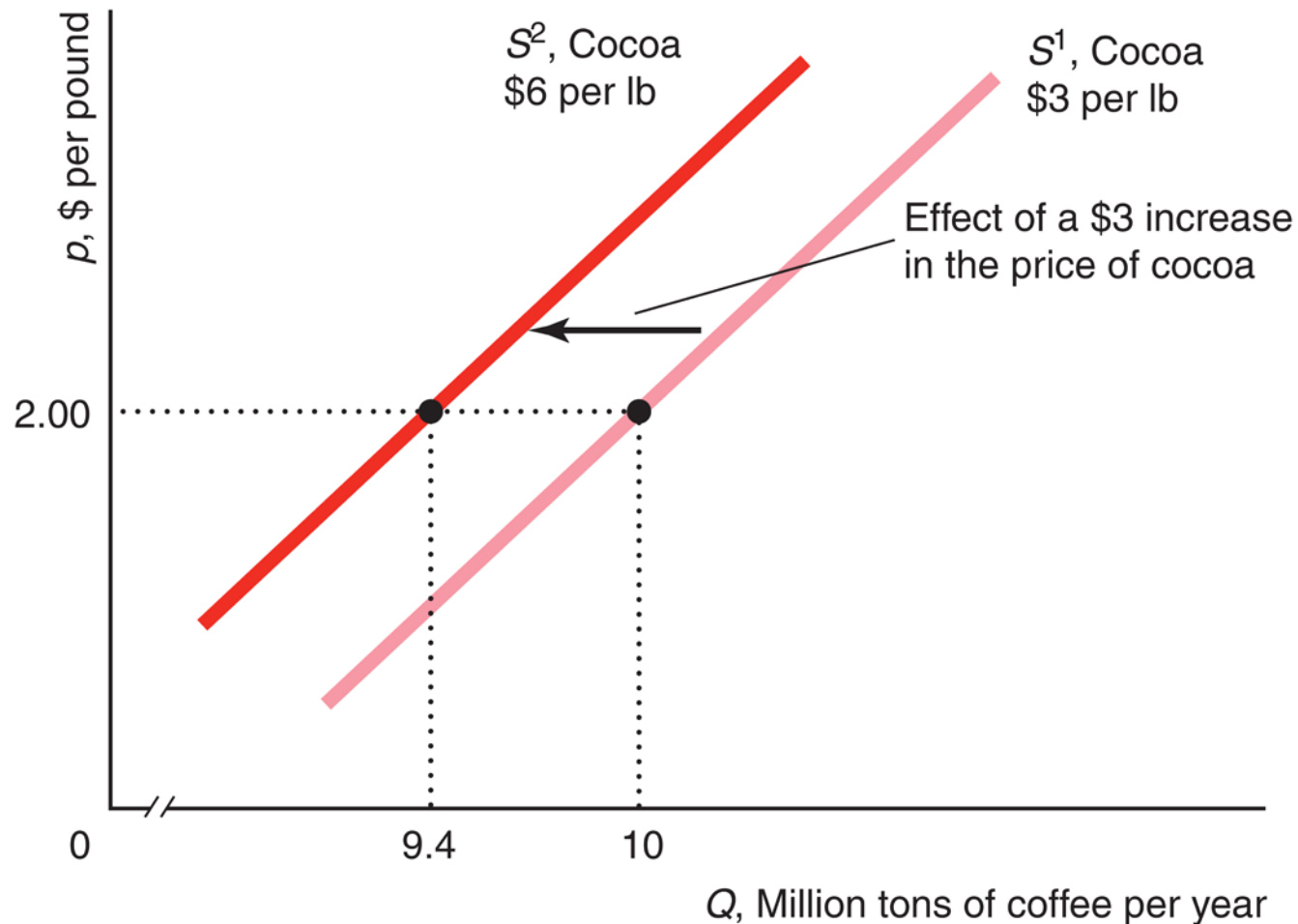
- The supply curve is usually upward sloping. **There is no “Law of Supply”** stating that the supply curve slopes upward.
- We observe supply curves that are vertical, horizontal, or downward sloping in particular situations. However, supply curves are commonly upward sloping.
- Along an upward-sloping supply curve, a higher price leads to more output being offered for sale, holding other factors constant.
- Changes in Quantity Supplied
 - An increase in the price of avocados causes a **movement along the supply curve**, resulting in more coffee being supplied.
 - As the price increases, firms supply more.
 - In Figure 2.3, if the price rises from \$2 per lb to \$4 per lb, the quantity supplied rises from 10 to 11 million tons per year.

2.2 Supply (5 of 7)

Effects of Other Variables on Supply

- A change in a relevant variable other than the good's own price causes the entire **supply curve to shift** rather than a movement along the supply curve.
- Example and Figure 2.4:
 - When the price of cocoa rises from \$3 per lb to \$6 per lb, many coffee farmers switch to producing cocoa. As a consequence, the supply curve for coffee shifts **leftward**, from S^1 to S^2 (Figure 2.4).
 - That is, firms want to supply less coffee at any given price than before the cocoa price increase. At a price of \$2 per lb for coffee, the quantity supplied falls from 10 million lbs on S^1 to 9.4 million tons on S^2 (after the cocoa price increase).

Figure 2.4 A Shift of a Supply Curve



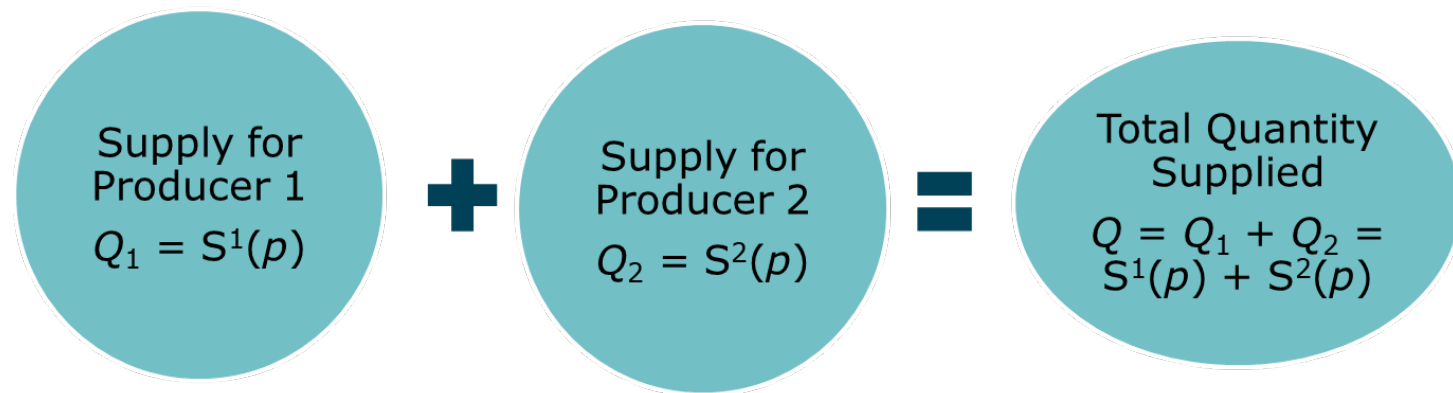
2.2 Supply (6 of 7)

The Supply Function: $Q = S(p, p_c)$

- Q of coffee demanded is a function of its price p and the price of cocoa p_c . Other factors are constant.
- Estimated Supply Function: $Q = 9.6 + 0.5p - 0.2p_c$
 - This specific linear form reflects empirical evidence; p is positive and p_c is negative. The constant term, 9.6, represents all other factors.
- Supply Curve: $Q = 9 + 0.5p$
 - Straight-line supply curve S^1 in Figure 2.3 with $p_c = \$3$. Notice that $\Delta S = 0.5\Delta p$. **So, if $\Delta p = \$1$, then $\Delta S = 0.5$ million tons per year.**
 - Thus, a \$1 increase in price causes the quantity supplied to increase by 0.5 million tons per year.
 - This change in q induced by a change in p is a **movement along the supply curve**.

2.2 Supply (7 of 7)

Summing Supply Curves



- The total supply curve shows the total quantity produced by all suppliers at each possible price.
- In the coffee case, for example, the overall market quantity supplied at any given price is the sum of the quantity supplied by Brazilian, Vietnamese, Colombian, and other producers in various countries.

2.3 Market Equilibrium (1 of 4)

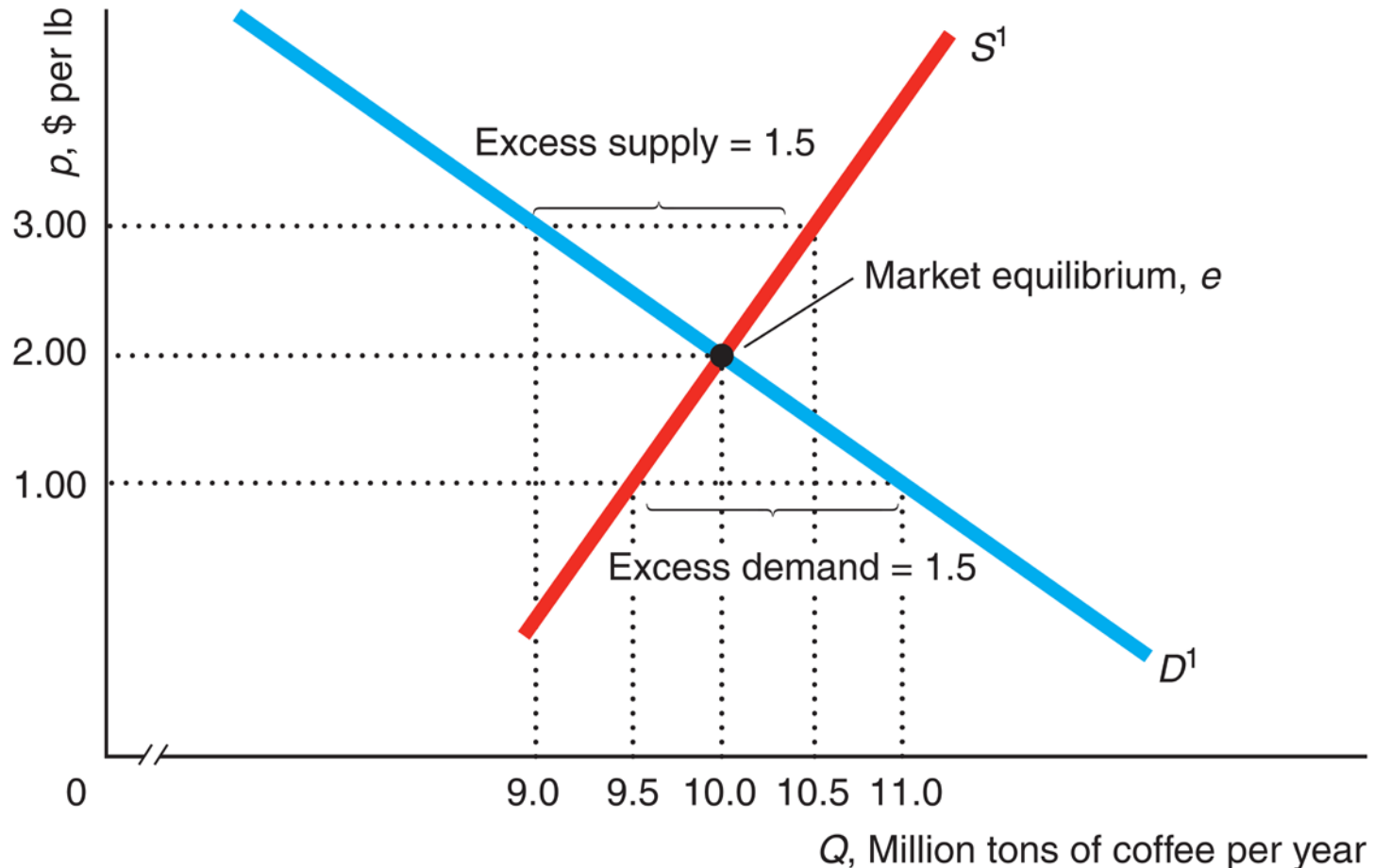
- The D curve shows the q consumers want to buy at various p
- The S curve shows the q firms want to sell at various p
 - The S and D curves jointly determine the p and q at which a good or service is bought and sold.
 - The **market is in equilibrium** when all market participants are able to buy or sell as much as they want (no participant wants to change its behavior).
 - The p at which consumers can buy as much as they want and sellers can sell as much as they want is an **equilibrium price**.
 - The resulting q is the **equilibrium quantity** because the quantity demanded equals the quantity supplied.

2.3 Market Equilibrium (2 of 4)

Using a Graph to Determine the Equilibrium

- In a graph, the market equilibrium is the point at which the demand and supply curves cross each other. This point gives the q and p of equilibrium.
- Graphical Presentation
 - Figure 2.5 shows the supply curve, S , and demand curve, D , for coffee.
 - The D and S curves intersect at point e , the market equilibrium.
 - The equilibrium price is \$2 per lb, and the equilibrium quantity is 10 million tons per year, which is the quantity firms want to sell **and** the quantity consumers want to buy.

Figure 2.5 Market Equilibrium



2.3 Market Equilibrium (3 of 4)

Using Math to Determine the Equilibrium

- D and S Curves: $Q_d = 12 - p$ and $Q_s = 9 + 0.5p$
 - We want to find the p at which $Q_d = Q_s = Q$, the equilibrium quantity. In equilibrium, it must be that $Q_s = Q_d$.
- In Equilibrium $Q_d = Q_s$: $12 - p = 9 + 0.5p$
 - We use algebra to find the **equilibrium price**: $3 = 1.5p$, so $p = \$2$. We can determine the equilibrium q by substituting this p into either Q_d or Q_s .
- Using the D Curve: $Q = 12 - 2 = 10$
 - We find that the **equilibrium quantity** is 10 million tons per year. We can obtain the same result if we use the S curve.

2.3 Market Equilibrium (4 of 4)

Forces That Drive the Market to Equilibrium

Excess Demand

- Figure 2.5 shows the supply curve, S , and demand curve, D , for coffee.
- If the price of coffee were \$1, firms are willing to supply 9.5 million tons per year but consumers demand 11 million tons. The market is in **disequilibrium**, and there is **excess demand**...but not for long.
- Frustrated consumers may offer to pay suppliers more than \$1 per lb and some suppliers might raise their prices. Such actions cause the market price to rise until it reaches the equilibrium price, \$2 (excess D eliminated).

Excess Supply

- If instead the price were \$3, firms are willing to supply 10.5 million tons per year but consumers demand 9 million tons. The market is in **disequilibrium** again, and there is **excess supply**...but not for long.
- To avoid unsold coffee to stale, firms lower the price to attract additional customers. The price falls until it reaches the equilibrium level, \$2 (excess S eliminated and no more pressure to lower the price further).

2.4 Shocks to the Equilibrium (1 of 5)

- The D curve shows the q consumers want to buy at various p
- The S curve shows the q firms want to sell at various p
 - The equilibrium changes only if a shock occurs that shifts the D curve or the S curve.
 - These curves shift if one of the variables we were holding constant changes.
 - If tastes, income, government policies, or costs of production change, the D curve or the S curve or both may shift, and the equilibrium changes.

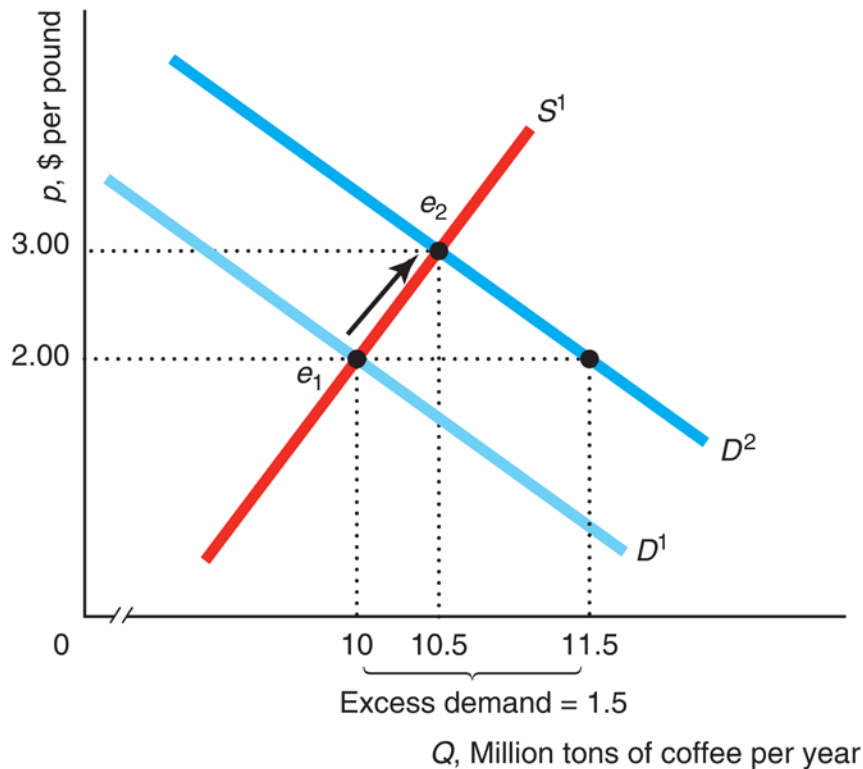
2.4 Shocks to the Equilibrium (2 of 5)

Effects of a Shift in the Demand Curve

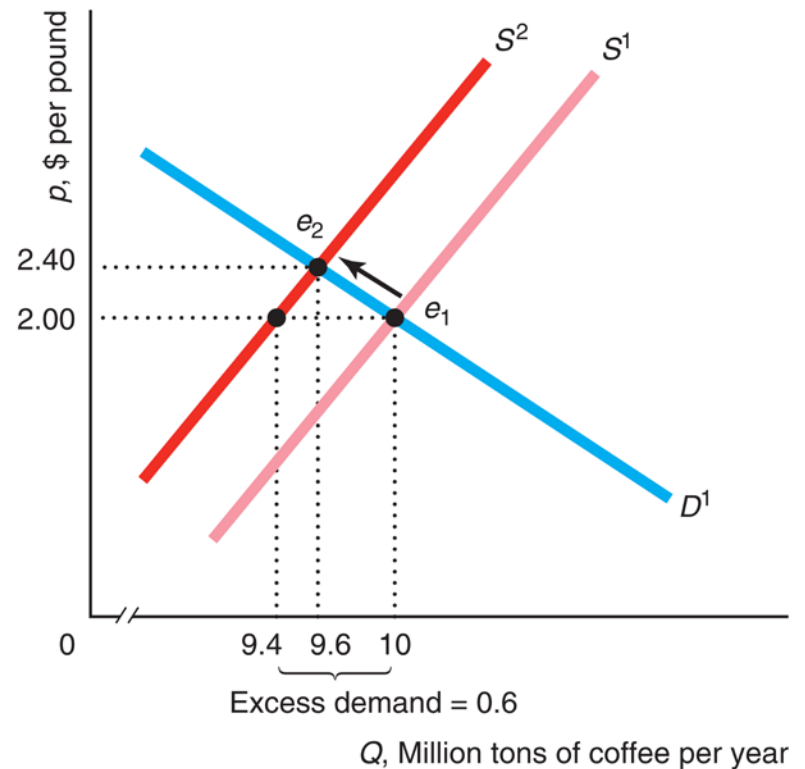
- Suppose that the average annual income in developed countries increases by \$15,000 from \$35,000 to \$50,000, so consumers can buy more coffee at any given price. As a result, the demand curve for coffee **shifts to the right** from D^1 to D^2 in Figure 2.6, panel (a).
 - At the **original equilibrium**, e_1 , price is \$2, and there is excess demand of 1.5 million lbs per month. Market pressures drive the price up until it reaches \$3 at the **new equilibrium**, e_2 .
 - Here the increase in income causes a **shift of the demand curve**, which in turn causes a **movement along the supply curve** from e_1 to e_2 .

Figure 2.6 Equilibrium Effects of a Shift of a Demand or Supply Curve

(a) Effect of a \$15,000 Increase in Income



(b) Effect of a \$3 Increase in the Price of Cocoa



2.4 Shocks to the Equilibrium (3 of 5)

Effects of a Shift in the Supply Curve



2.4 Shocks to the Equilibrium (4 of 5)

Effects of a Shift in the Supply Curve

- Assuming that income remains at its \$35,000 original level, an increase in the price of cocoa from \$3 to \$6 per lb causes some coffee producers to switch to cocoa production. So there are fewer suppliers and less coffee at every price. The supply curve for coffee **shifts to the left** from S^1 to S^2 , in Figure 2.6, panel (b).
 - At the **original equilibrium**, e_1 , price is \$2 per lb, and there is excess demand of 0.6 million tons per year. Market pressures drive the price up until it reaches \$2.40 at the **new equilibrium**, e_2 .
 - Here, a **shift of the supply curve** results in a **movement along the demand curve**.

2.4 Shocks to the Equilibrium (5 of 5)

Managerial Implication: Taking Advantage of Future Shocks

- Managers can use the supply-and-demand model to anticipate how shocks to supply or demand will affect future business conditions and can take advantage of that knowledge.
 - Mars is one of the world's largest chocolate producers and managers use a supply-and-demand model to make cocoa buying decisions.
 - If they expect prices to increase substantially, they immediately buy a great deal of cocoa at relatively low prices directly from suppliers in Africa.
 - Alternatively, if they expect prices to fall, they may hold off buying now and then buy later at a lower price from organized markets such as ICE Futures U.S. or the London International Financial Futures and Options Exchange.

2.5 Effects of Government Interventions (1 of 6)

Policies that Shift Curves

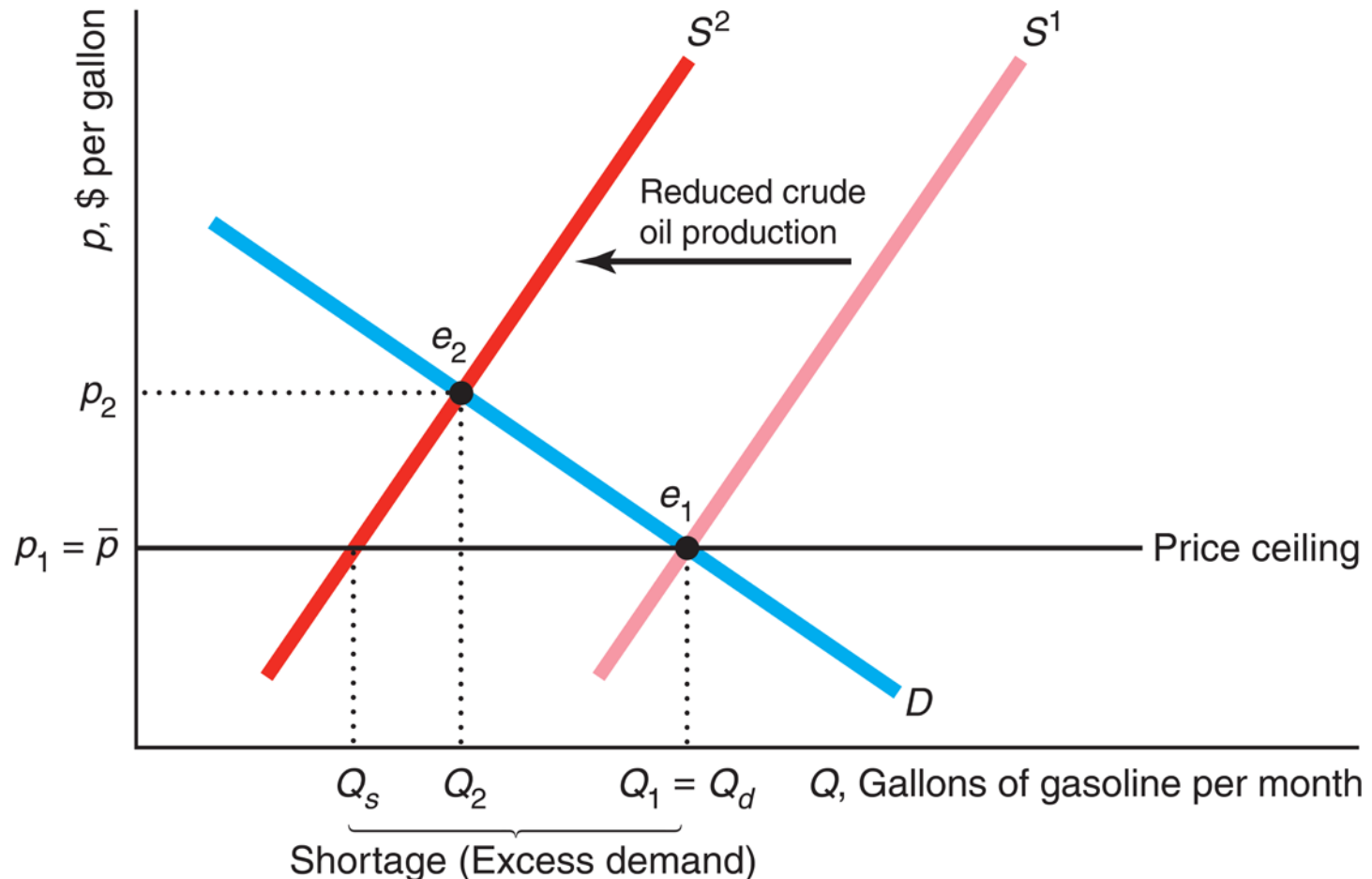
- Limits on Who can Buy
 - For example, governments usually forbid selling alcohol to young people. This decreases the quantity demanded at each price and thereby **shifts the demand curve to the left**.
- Restriction of Imports
 - The effect of this governmental restriction is to decrease the quantity supplied of imported goods at each price and **shifts the importing country's supply curve to the left**.
- Start buying a good
 - The effect of governments starting to buy goods is to increase the quantity demanded at each price for the good and **shifts the demand curve to the right**.

2.5 Effects of Government Interventions (2 of 6)

Price Controls—Price Ceilings

- When the government sets a price ceiling at $\bar{p}$ and the unregulated equilibrium price is above it, the price that is actually observed in the market is the price ceiling.
 - Price ceilings have no effect if they are set above the equilibrium price that would be observed in the absence of the price controls.
 - In Figure 2.7, the new equilibrium gasoline price would be p_2 but a price ceiling of p_1 is imposed, then the ceiling price of p_1 is charged.
- With a binding price ceiling, the supply-and-demand model predicts an **equilibrium with a shortage**: a persistent excess demand.
 - The new equilibrium with a shortage in Figure 2.7 occurs with a quantity Q_s and price p_1 (the excess demand is $Q_s - Q_1$). If the price ceiling were removed, the new equilibrium would be e_2 .
 - Deacon and Sonstelie (1989) found that for every dollar consumers saved during the 1980 gasoline price controls, they lost \$1.16 in waiting time and other factors.

Figure 2.7 A Price Ceiling on Gasoline

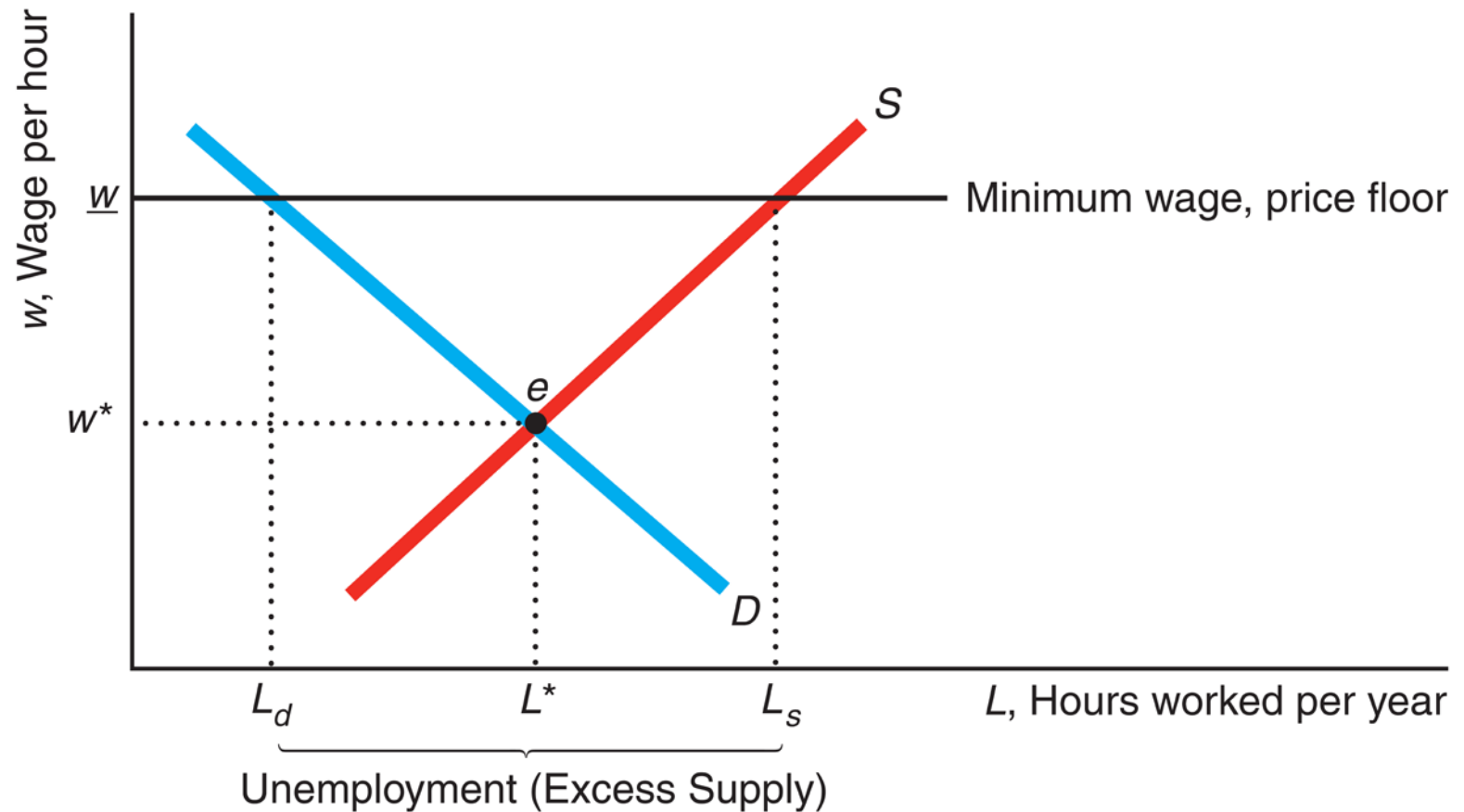


2.5 Effects of Government Interventions (3 of 6)

Price Controls—Price Floors

- When the government sets a price floor below the unregulated equilibrium price, the price that is actually observed in the market is the price floor.
 - A minimum wage law forbids employers from paying less than the minimum wage, w .
- With a binding price floor, the supply-and-demand model predicts an **equilibrium with a persistent excess supply**.
 - The minimum wage prevents market forces from eliminating this excess supply, so it leads to an equilibrium with unemployment.
 - The new equilibrium with unemployment in Figure 2.8 occurs with a quantity L_d and wage w (the excess supply is $L_s - L_d$). If the price ceiling were removed, the new equilibrium would be e_2

Figure 2.8 The Minimum Wage: A Price Floor



2.5 Effects of Government Interventions (4 of 6)

Why Supply Need Not Equal Demand

- The theory says that the price and quantity in a market are determined by the intersection of the supply curve and the demand curve and the market clears **if the government does not intervene**.
- However, the theory also tells us that government intervention can prevent market clearing.
 - The price ceiling and price floor examples show that the quantity supplied does not necessarily equal the quantity demanded in a supply-and-demand model.
 - The quantity that sellers want to sell and the quantity that buyers want to buy at a given price need not equal the **actual** quantity that is bought and sold.

2.5 Effects of Government Interventions (5 of 6)

Sales Taxes

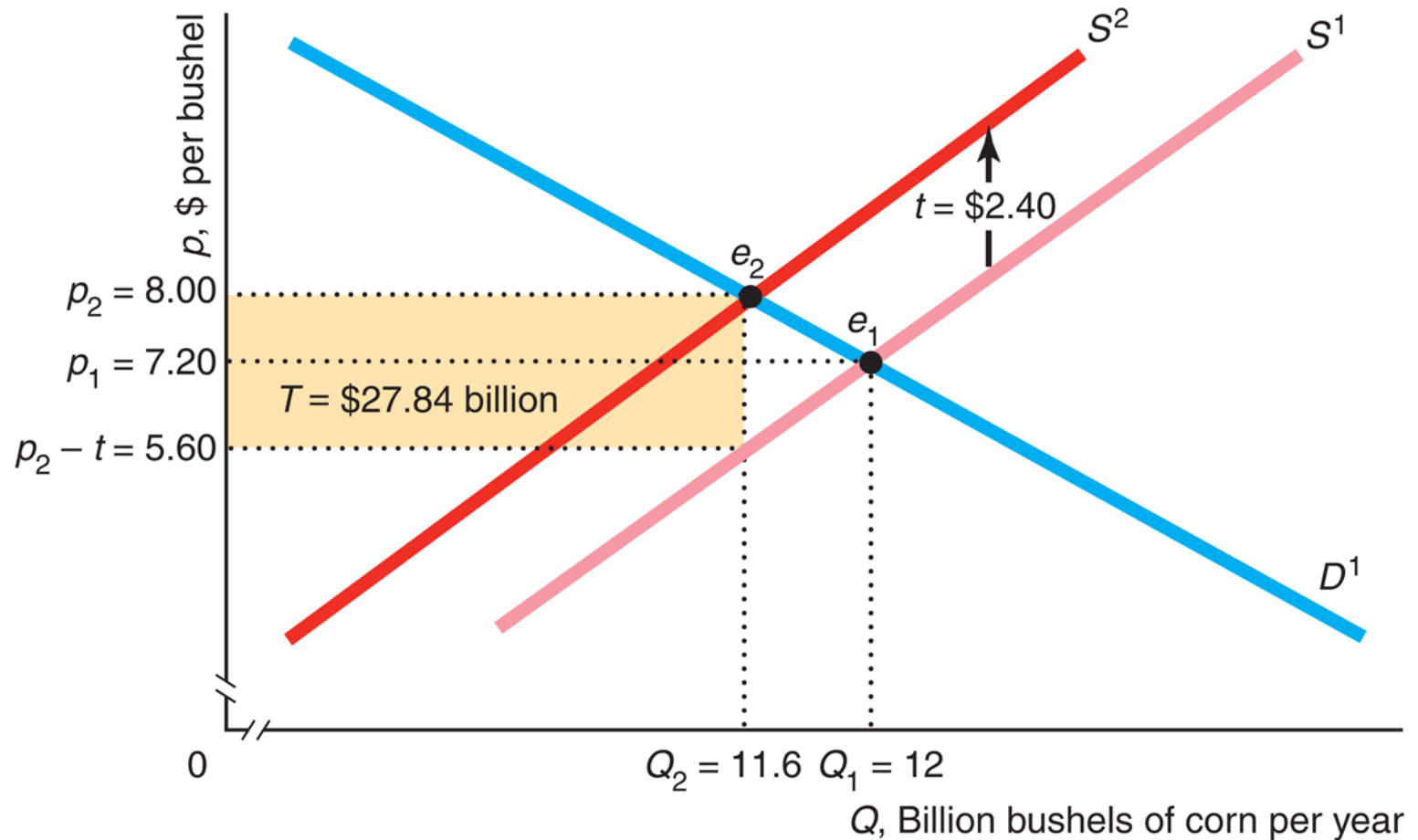
Equilibrium Effects of a Specific Tax

- The specific sales tax causes the equilibrium price consumers pay to rise, the equilibrium quantity that firms receive to fall, and the equilibrium quantity to fall (p_2 , Q_2 , and T in Figure 2.9)
- Although the consumers and producers are worse off because of the tax, the government acquires new tax revenue, \$27.84 billion in Figure 2.9.

Pass-Through

- **Common Confusion:** Businesses pass-through any sales tax to consumers, so that the price that consumers pay increases by the amount of the tax.
- This belief is not accurate in general. Full pass-through can occur, but partial pass-through is more common.
 - In Figure 2.9, after a \$2.40 specific tax is imposed on firms, the price consumers pay rises from \$7.20 to \$8.00. So, firms pass-through \$0.80 to consumers and absorb \$1.60 of the tax.
- The degree of the pass-through depends on the S and D shapes.

Figure 2.9 Effect of a \$2.40 Specific Tax on Corn Collected from Producers



2.5 Effects of Government Interventions (6 of 6)

Managerial Implication: Cost Pass-Through

- Managers should use pass-through analysis to predict the effect on their price and quantity from not just a new tax but from any per unit increase in costs.
 - Suppose that the cost of producing corn rises \$2.40 per bushel because of an increase in the cost of labor or other factors of production, rather than because of a tax.
 - Then, the same analysis as in Figure 2.9 would apply, so a manager would know that only 80¢ of this cost increase could be passed through to consumers.

2.6 When to Use the Supply-And-Demand Model (1 of 2)

- The Supply-and-Demand (S-D) model can help us to understand and predict real-world events in many markets. Like a map, it need not be perfect to be useful.
- The model is useful if the market to be analyzed is “competitive enough.”
- It is reliable in markets, such as those for agriculture, financial products, labor, construction, many services, real estate, wholesale trade, and retail trade.
- The S-D model is accurate for perfectly competitive markets.
 - It is precisely accurate in **perfectly competitive** markets, which are markets in which all firms and consumers are **price takers** (no market participant can affect the market price).
 - See next slide for characteristics of perfectly competitive markets.
- The S-D model is not accurate for noncompetitive markets.
- In markets with firms that are price setters, the market price is usually higher than that predicted by the S-D model.
 - Monopoly and oligopoly markets have few sellers that are price setters. These markets need a different model.

2.6 When to Use the Supply-And-Demand Model (2 of 2)

- **Five characteristics of a perfect competitive market:**
 - Many buyers and sellers, all relatively small with respect to the size of the market.
 - Consumers believe all firms produce identical products, so they only care about price.
 - All market participants have full information about price and product characteristics, so no participant can take advantage of each other.
 - Transaction costs (expenses over and above the price) are negligible.
 - Firms can easily enter and exit the market over time, so competition is very high.

Managerial Solution

Carbon Taxes

- What will be the effect of imposing a carbon tax on the price of gasoline?

Solution

- The degree to which a tax is passed through to consumers depends on the shapes of the demand-and-supply curves. Typically, short-run supply and demand curves differ from the long-run curves.
- In the long-run, the supply curve is upward sloping, as in our typical figure. However, the U.S. short-run supply curve of gasoline is very close to vertical.
- From empirical studies, we know that the U.S. federal gasoline specific tax of $t = 18.4\text{¢}$ per gallon is shared roughly equally between gasoline companies and consumers in the long run. However, based on what we learned, we expect that most of the tax will fall on firms that sell gasoline in the short run.
- Manufacturing and other firms that ship goods are consumers of gasoline. They can expect to absorb relatively little of a carbon tax when it is first imposed, but half of the tax in the long run.

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