

Managerial Economics

Chapter 2

Supply and Demand

Table of Contents

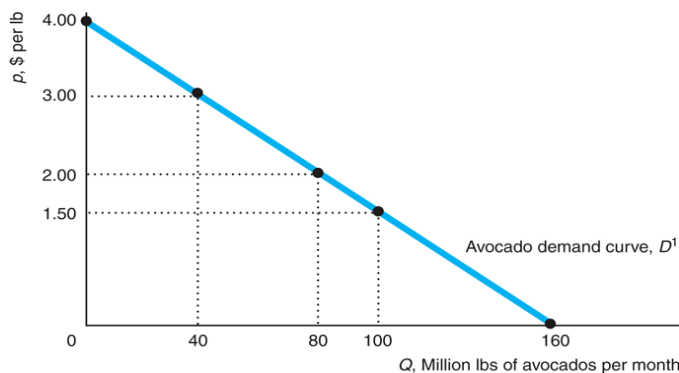
- 2.1 Demand
- 2.2 Supply
- 2.3 Market Equilibrium
- 2.4 Shocks to the Equilibrium
- 2.5 Effects of Government Interventions
- 2.6 When to Use the Supply-and-Demand Model

Introduction

- Managerial Problem
 - Carbon tax
 - 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 these types 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 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 market outcomes.
- **2.1 Demand**
- Demand
- Consumers decide whether to buy a particular good or service and, if so, how much to buy based on its own price and on other factors.
- Factors of Demand: 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.
- Factors of Demand: Income
- When a consumer's income rises that consumer will often buy more of many goods.
- Factors of Demand: Price of Related Goods
 - Substitute: different brands of essentially the same good are close substitutes
 - Complement: a good that is used with the good under consideration
- Factors of Demand: Tastes and Information
 - Consumers do not purchase goods they dislike. Firms devote significant resources to trying to change consumer tastes through advertising.
 - Information about characteristics and the effects of a good has an impact on consumer decisions
- Factors of Demand: Government Regulations
 - Governments may ban, restrict, tax, or subsidize goods or services.

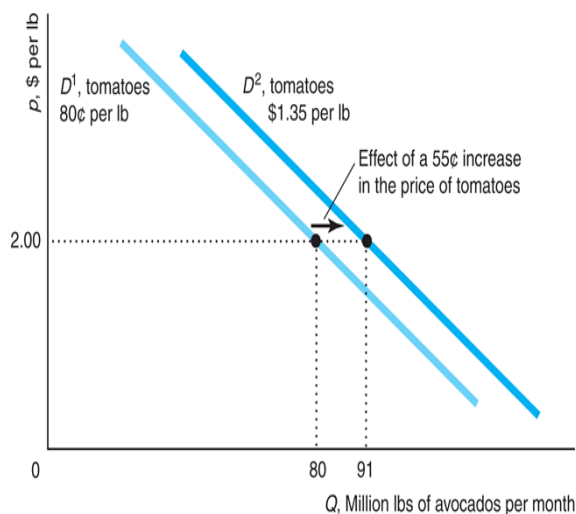
• **Figure 2.1 A Demand Curve**



- Effects of a Price Change on the Quantity Demanded
 - Law of Demand: 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.
- Changes in Quantity Demanded

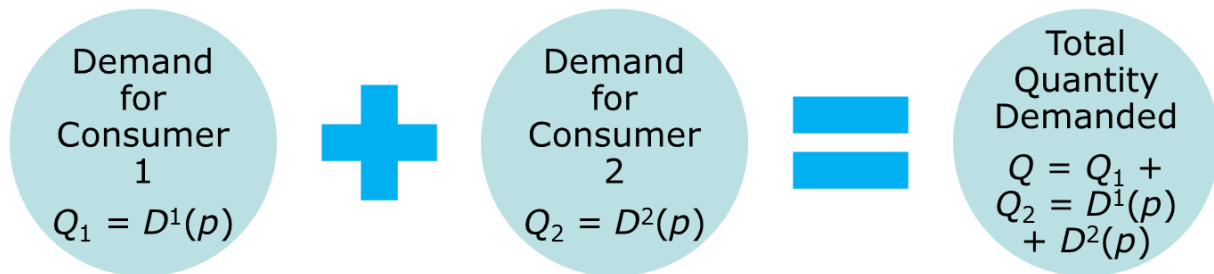
- The demand curve is a concise summary of the answer to the question: What happens to the quantity demanded as the price changes, when all other factors are held constant?
- Changes in the quantity demanded in response to changes in price are movements along the demand curve.
- Effects of Other Factors 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.
- Graphical Presentation
 - Assuming avocados and tomatoes are substitutes, if the price of tomatoes goes up, the demand for avocados shifts to the right from D^1 to D^2 , in Figure 2.2
 - Verify the same shift of demand would occur if income rises.

• **Figure 2.2 A Shift of the Demand Curve**



- Demand Function: $Q = D(p, p_t, Y)$
 - Demand for avocados: Quantity (Q) demanded in millions of lbs per month; price (p) in dollars per lb; price of tomatoes (p_t) in dollars per lb; monthly income (Y) in dollars. All other factors assumed irrelevant or constant.
- Estimated Demand Function: $Q = 104 - 40p + 20p_t + .01Y$
 - Based on previous general function and specific linear form: Q depends negatively on p ; positively on both p_t and Y .
 - Parameters for p , p_t and Y reflect empirical evidence. Value 104 captures all other factors.
 - If we hold p_t at \$0.80 per lb for tomatoes and Y at \$4,000 per month and substitute these values for p_t , and Y , we can draw a demand curve

- Demand Curve: $Q = 160 - 40p$
 - Based on the previous estimated demand (Figures 2.1 and 2.2)
 - How quantity demanded varies with a change in price? $\Delta Q = -40\Delta p$
 - For example, if $\Delta p = -\$0.50$, then $\Delta Q = -40\Delta p = -40(-0.50) = 20$ million lbs.
- Using Calculus: Deriving the Slope of a Demand Curve
 - The demand function for avocados: $Q = 160 - 40p$
 - The derivative of the demand function with respect to price: $dQ/dp = -40$.
- Calculus and the Law of Demand
 - More generally, the Law of Demand states that the derivative of the demand function with respect to price is negative, $dQ/dp < 0$.
 - Notice that this is true for the demand function for avocados.
- Summing Demand Curves



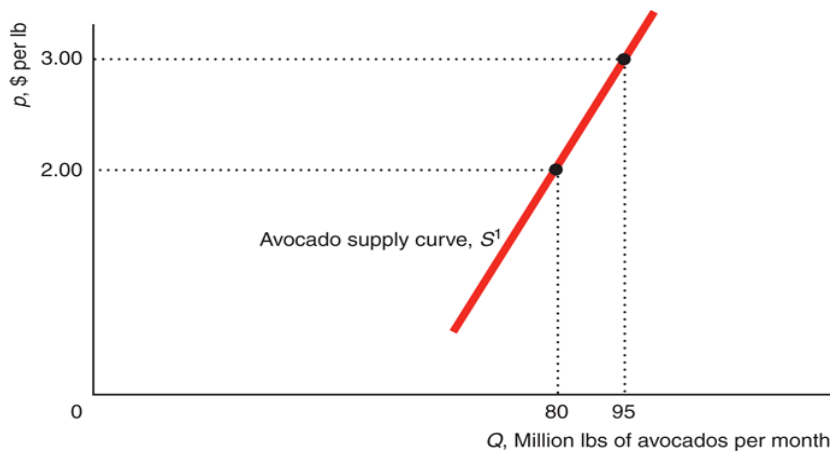
- The overall demand for avocados is composed of the demand of many individual consumers.
- The total quantity demanded at a given price is the sum of the quantity each consumer demands at that price.
- We can generalize this approach to look at the total demand for three or four or more consumers, or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

2.2 Supply

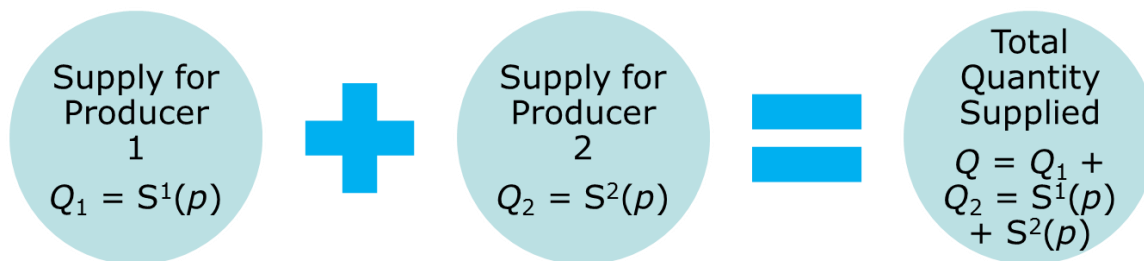
- Supply
 - Firms determine how much of a good to supply on the basis of the price of that good and on other factors.
- Factors of Supply: Own Price
 - Usually, we expect firms to supply more quantity at a higher price.

- Other Factors of Supply
 - These other factors include costs of production, technological change, government regulations, and other factors.
- Factors of Supply: 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.
- Factors of Supply: 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.
- Factors of Supply: 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.
- 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 lbs per month).
 - The quantity supplied at a price of \$2 per lb is 80 million lbs per month and 95 million lbs per month when the price is \$3.

- **Figure 2.3 A Supply Curve**



- Supply Function: $Q = S(p, p_f)$
 - Supply for avocados: Quantity (Q) supplied in millions of lbs per month; price (p) in dollars per lb; price of fertilizer (p_f) in dollars per lb. All other factors assumed irrelevant or constant.
- Estimated Supply Function: $Q = 58 + 15p - 20p_f$
 - Based on the previous general function and has a specific linear form
 - Q depends positively on p and negatively on p_f . The parameters for p and p_f reflect empirical evidence. Value 58 captures all other factors.
 - If we hold the fertilizer price fixed at 40¢ per lb and substitute this value for p_f , we can draw a supply curve (Figures 2.3 and 2.4).
- Supply Curve: $Q = 50 + 15p$
 - Based on the previous estimated supply (Figures 2.3 and 2.4)
 - How quantity supplied varies with a change in price? $\Delta Q = 15\Delta p$
 - For example, a \$1 increase in price ($\Delta p = \1) causes the quantity supplied to increase by $\Delta Q = 15$ million lbs per month.
- Summing Supply Curves

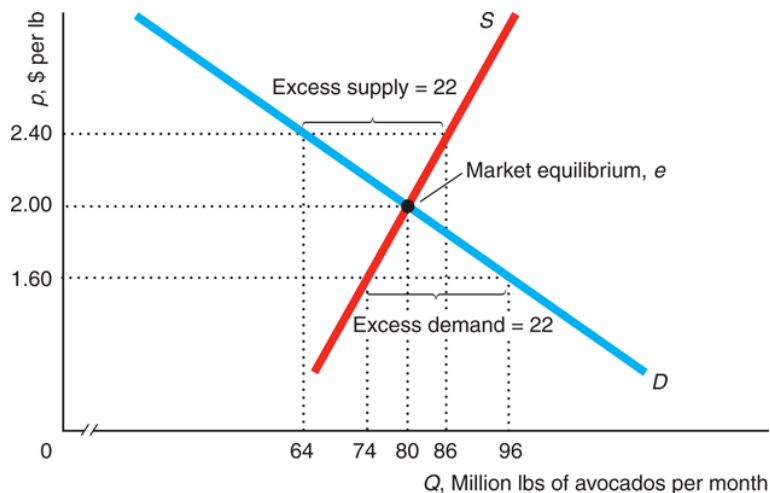


- The total supply curve shows the total quantity produced by all suppliers at each possible price.
- In the avocado case, for example, the overall market quantity supplied at any given price is the sum of the quantity supplied by Californian producers, the quantity supplied by Mexican producers, and the quantity supplied by producers elsewhere.

2.3 Market Equilibrium

- 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 avocados.
 - The D and S curves intersect at point e , the market equilibrium.
 - The equilibrium price is \$2 per lb, and the equilibrium quantity is 80 million lbs per month, which is the quantity firms want to sell and the quantity consumers want to buy.

• Figure 2.5 Market Equilibrium

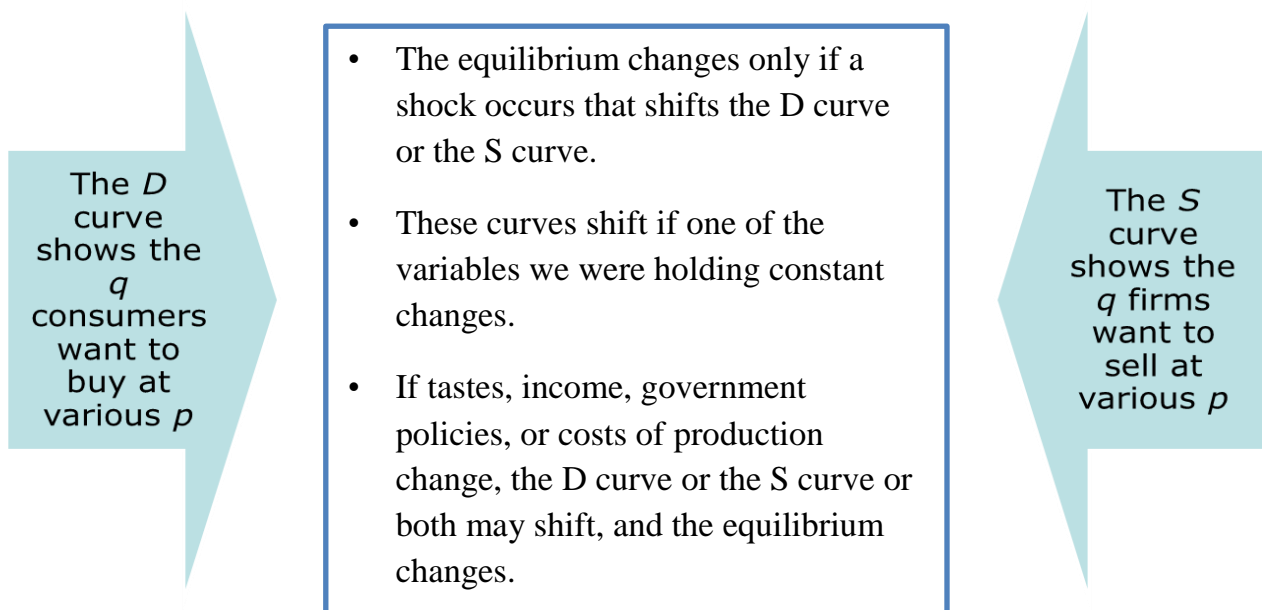


Using Algebra to Find the Equilibrium

- D and S Curves: $Q_d = 160 - 40p$ and $Q_s = 50 + 15p$
 - 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 $Q_d = Q_s$: $160 - 40p = 50 + 15p$
 - We use algebra to find the equilibrium price: $55p = 110$, so $p = \$2$
 - We can determine the equilibrium q by substituting this p into either Q_d or Q_s .

- Using the S Curve: $Q = 50 + (15 \times 2) = 80$
 - We find that the equilibrium quantity is 80 million lbs per month.
 - We can obtain the same result if we use the D curve.
- Forces That Drive the Market to Equilibrium: Excess D
 - In Figure 2.5, if the price of avocados were \$1.60, firms are willing to supply 74 million lbs per month but consumers demand 96 million lbs. The market is in disequilibrium and there is excess demand ... but not for long.
 - Frustrated consumers may offer to pay suppliers more than \$1.60 per lb and suppliers might raise their prices. Such actions cause the market price to rise until it reaches the equilibrium price, \$2, where there is no excess demand.
- Forces That Drive the Market to Equilibrium: Excess S
 - Figure 2.5 shows the supply curve, S , and demand curve, D , for avocados.
 - If instead the price were \$2.40, firms are willing to supply 86 million lbs per month but consumers demand 64 million lbs. The market is in disequilibrium and there is excess supply ... but not for long.
 - To avoid unsold avocados to spoil, firms lower the price to attract additional customers. The price falls until it reaches the equilibrium level, \$2, where there is no excess supply and hence no pressure to lower the price further.

2.4 Shocks to the Equilibrium

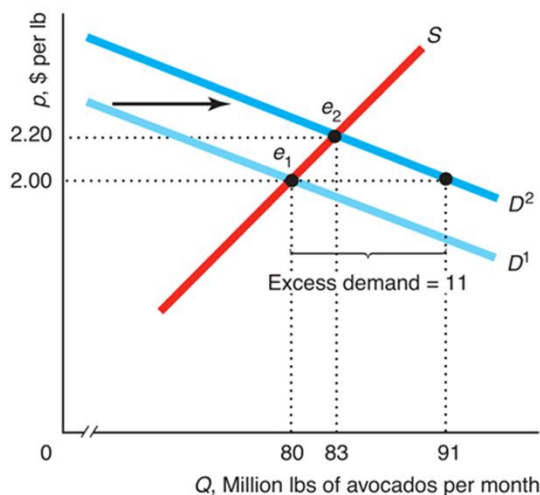


- Effects of a Shift in the Demand Curve

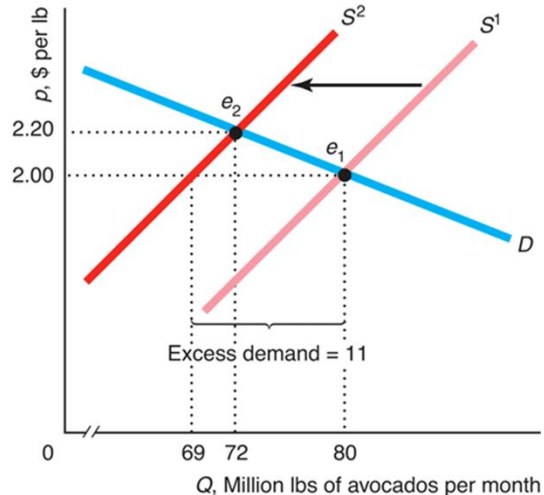
- Suppose that the price of fresh tomatoes increases by 55¢ per lb, so consumers substitute avocados for tomatoes. As a result, the demand curve for avocados shifts outward from D^1 to D^2 in panel a of Figure 2.6.
- At the original equilibrium, e_1 , price is \$2 and there is excess demand of 11 million lbs per month. Market pressures drive the price up until it reaches \$2.20 at the new equilibrium, e_2 .
- Here the increase in the price of tomatoes causes a shift of the demand curve, which in turn causes a movement along the supply curve.

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

(a) Effect of a 55¢ Increase in the Price of Tomatoes

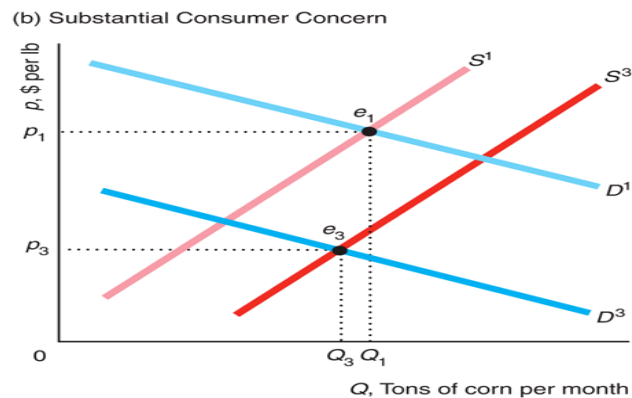
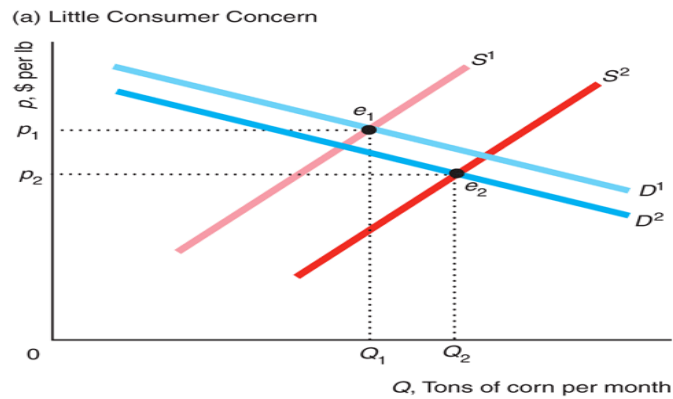


(b) Effect of a 55¢ Increase in the Price of Fertilizer



- Effects of a Shift in the Supply Curve

- An increase in the price of fertilizer by 55¢ causes producers' costs to rise and so they supply fewer avocados at every price. The supply curve for avocados shifts to the left from S^1 to S^2 , in panel b of Figure 2.6.
- At the original equilibrium, e_1 , price is \$2 and there is excess demand of 11 million lbs per month. Market pressures drive the price up until it reaches \$2.20 at the new equilibrium, e_2 .
- Here a shift of the supply curve results in a movement along the demand curve.



- Effects of Shifts in both Supply and Demand Curves
 - Some events cause both the supply curve and the demand curve to shift.
 - If both shift, then the qualitative effect on the equilibrium price and quantity may be difficult to predict, even if we know the direction in which each curve shifts.
 - Changes in the equilibrium price and quantity depend on exactly how much the curves shift.
 - Example: In the mini-case, Genetically Modified Foods, the new equilibrium depends on how big is the Demand shift. Panels a and b of the figure differ in the length of the demand shift.

2.5 Effects of Government Interventions

- Policies that Shift Curves: Limits on Who can Buy
 - For example, governments usually forbid selling cigarettes or alcohol to children. This decreases the quantity demanded for those goods at each price and thereby shifts their demand curves to the left.
- Policies that Shift Curves: 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.
- Policies that Shift Curves: 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.

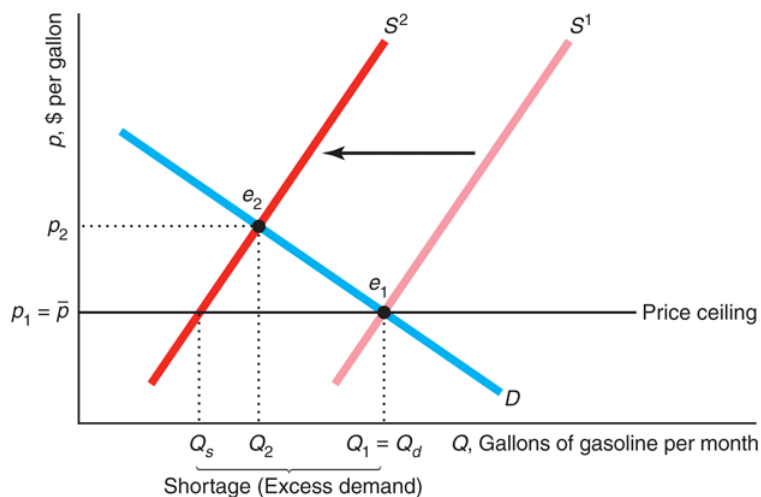
- Price Controls: Price Ceiling

- When the government sets a price ceiling at \bar{p} and the unregulated equilibrium price would be above the \bar{p} , 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.

- Shortage Effect

- With a binding price ceiling, the supply-and-demand model predicts an equilibrium with a shortage: a persistent excess demand.
- Deacon & 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.
- 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 .

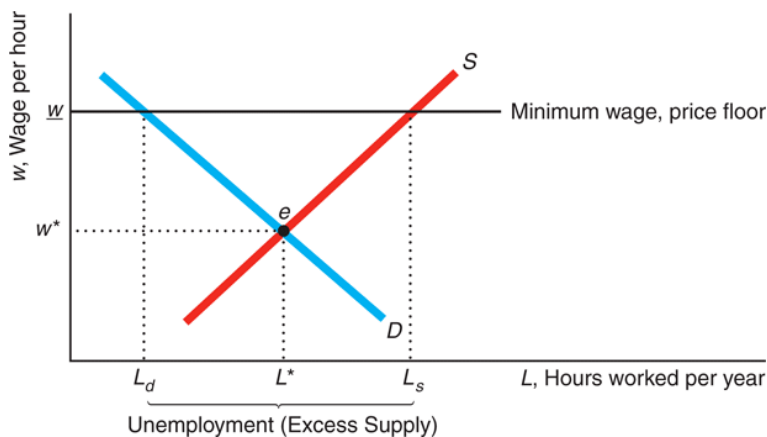
- **Figure 2.7 Price Ceiling on Gasoline**



- Price Controls: Price Floor
 - 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 .

- Excess Supply Effect
 - 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 Minimum Wage: A Price Floor**



- 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.
- Sales Taxes
 - 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.
 - Although the consumers and producers are worse off because of the tax, the government acquires new tax revenue.

- Tax Collected from Firms or Consumers
 - It doesn't matter whether the specific tax is collected from firms or consumers.
 - The market outcome is the same regardless of who is taxed.
- Common Belief: Taxes are Fully Passed to Consumers
 - This belief is not true in general. Full pass-through can occur but partial pass-through is more common.
 - The degree of the pass through depends on the shapes of the S and D curves.

2.6 When to Use the Supply-and-Demand Model

- S-D model and Real-World Events
 - The 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.
- 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).
- S-D Model not Accurate for Non-Competitive Markets
 - In markets with price setters, the market price is usually higher than that predicted by the S-D model.

Monopoly or oligopoly markets have one or very few sellers, respectively

- 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

- Managerial Problem
 - Carbon tax
 - 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.

Figure 2.9 Effect of a 55¢ Specific Tax on the Avocado Market Collected from Producers

