section 2

Supply and Demand

1. A survey indicated that chocolate ice cream is America's favorite ice-cream flavor. For each of the following, indicate the possible effects on the demand and/or supply, equilibrium price, and equilibrium quantity of chocolate ice cream.

a. A severe drought in the Midwest causes dairy farmers to reduce the number of milk-producing cows in their herds by a third. These dairy farmers supply cream that is used to manufacture chocolate ice cream.

b. A new report by the American Medical Association reveals that chocolate does, in fact, have significant health benefits.

c. The discovery of cheaper synthetic vanilla flavoring lowers the price of vanilla ice cream.

d. New technology for mixing and freezing ice cream lowers manufacturers' costs of producing chocolate ice cream.

Solution

1. **a.** By reducing their herds, dairy farmers reduce the supply of cream, a leftward shift of the supply curve for cream. As a result, the market price of cream rises, raising the cost of producing a unit of chocolate ice cream. This results in a leftward shift of the supply curve for chocolate ice cream as ice-cream producers reduce the quantity of chocolate ice cream supplied at any given price. Ultimately, this leads to a rise in the equilibrium price and a fall in the equilibrium quantity of chocolate ice cream.

b. Consumers will now demand more chocolate ice cream at any given price, represented by a rightward shift of the demand curve. As a result, both equilibrium price and quantity rise.

c. The price of a substitute (vanilla ice cream) has fallen, leading consumers to substitute it for chocolate ice cream. The demand for chocolate ice cream decreases, represented by a leftward shift of the demand curve. Both equilibrium price and quantity fall.

d. Because the cost of producing ice cream falls, manufacturers are willing to supply more units of chocolate ice cream at any given price. This is represented by a rightward shift of the supply curve and results in a fall in the equilibrium price and a rise in the equilibrium quantity of chocolate ice cream.

2. In a supply and demand diagram, draw the change in demand for hamburgers in your hometown due to the following events. In each case show the effect on equilibrium price and quantity.

a. The price of tacos increases.

b. All hamburger sellers raise the price of their french fries.

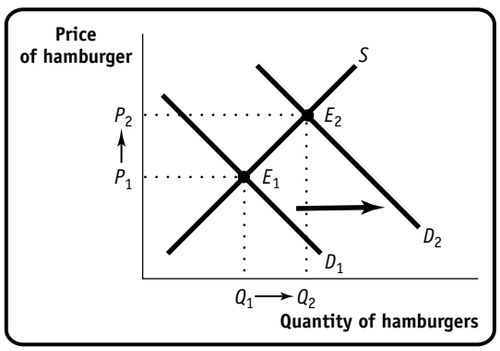
c. Income falls in town. Assume that hamburgers are a normal good for most people.

d. Income falls in town. Assume that hamburgers are an inferior good for most people.

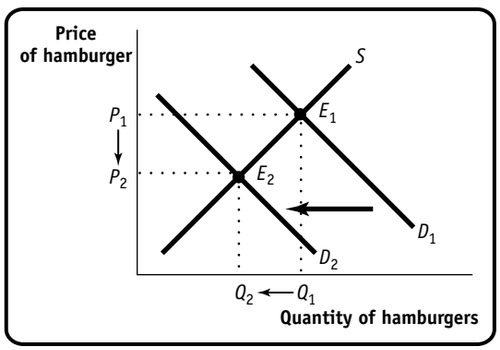
e. Hot dog stands cut the price of hot dogs.

Solution

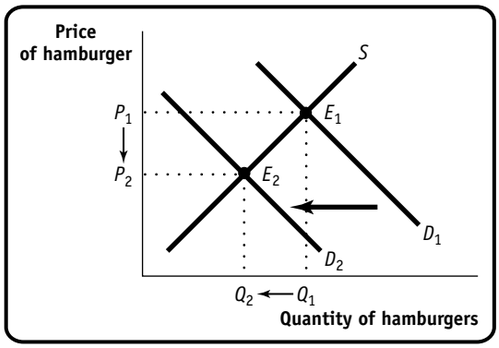
2. a. A rise in the price of a substitute (tacos) causes the demand for hamburgers to increase. This represents a rightward shift of the demand curve from D_1 to D_2 and results in a rise in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



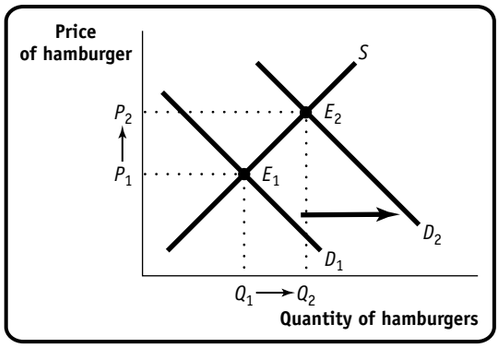
b. A rise in the price of a complement (french fries) causes the demand for hamburgers to decrease. This represents a leftward shift of the demand curve from D_1 to D_2 and results in a fall in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



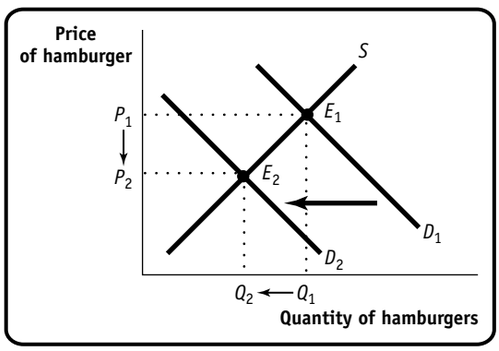
c. A fall in income causes the demand for a normal good (hamburgers) to decrease. This represents a leftward shift of the demand curve from D_1 to D_2 and results in a fall in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



d. A fall in income causes the demand for an inferior good (hamburgers) to increase. This represents a rightward shift of the demand curve from D_1 to D_2 and results in a rise in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



e. A fall in the price of a substitute (hot dogs) causes demand for hamburgers to decrease. This is represented by a leftward shift of the demand curve from D_1 to D_2 and results in a fall in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



3. The market for many goods changes in predictable ways according to the time of year, in response to events such as holidays, vacation times, seasonal changes in production, and so on. Using supply and demand, explain the change in price in each of the following cases. Note that supply and demand may shift simultaneously.

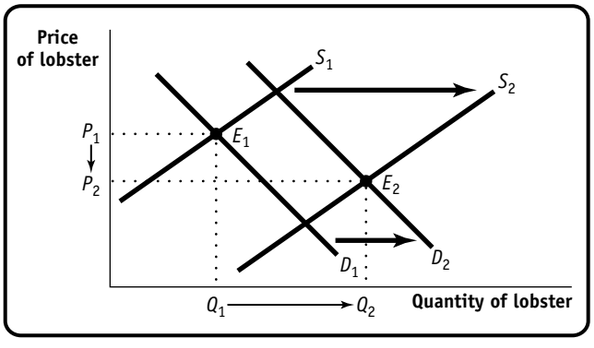
a. Lobster prices usually fall during the summer peak harvest season, despite the fact that people like to eat lobster during the summer months more than during any other time of year.

b. The price of a Christmas tree is lower after Christmas than before and fewer trees are sold.

c. The price of a round-trip ticket to Paris on Air France falls by more than $200 after the end of school vacation in September. This happens despite the fact that generally worsening weather increases the cost of operating flights to Paris, and Air France therefore reduces the number of flights to Paris at any given price.

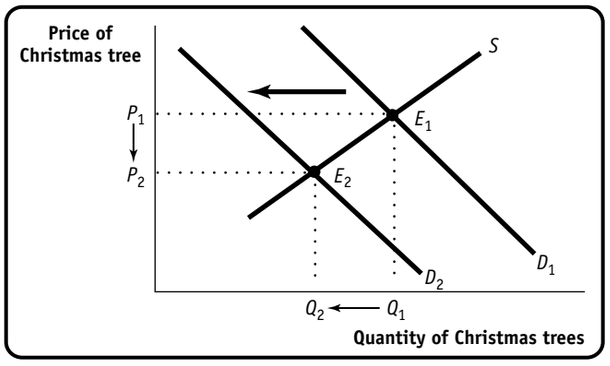
Solution

3. **a.** There is a rightward shift of the demand curve from D_1 to D_2 during the summer, as consumers prefer to eat more lobster during the summer than at other times of the year. All other things being equal, this leads to a rise in the price of lobster. Simultaneously, lobster fishermen produce more lobster during the summer peak harvest time, when it is cheaper to harvest lobster, representing a rightward shift of the supply curve of lobster from S_1 to S_2. All other things being equal, this leads to a fall in the price of lobster. Given the simultaneous rightward shifts of both the demand and supply curves, the equilibrium changes from E_1 to E_2. The fall in price indicates that the rightward shift of the supply curve exceeds the rightward shift of the demand curve.

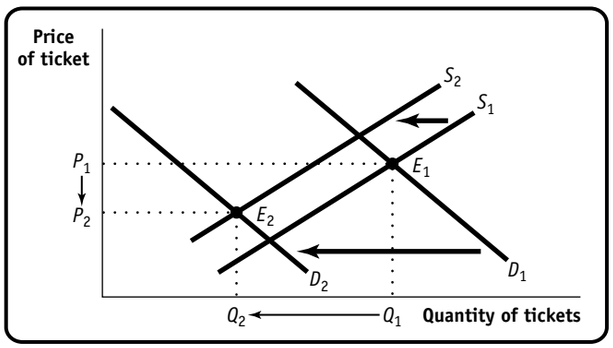


b. There is a leftward shift of the demand curve for Christmas trees after Christmas from D_1 to D_2, as fewer consumers want Christmas trees at any given price. The reduction in the quantity of trees supplied is a movement

along the supply curve. This leads to a fall in the equilibrium price and quantity, as the equilibrium changes from E_1 to E_2.



c. There is a leftward shift of the demand curve for tickets to Paris in September, after the end of school vacation, from D_1 to D_2. All other things being equal, this leads to a fall in the price of tickets. At the same time, as the cost of operating flights increases, Air France decreases the number of flights, shifting the supply curve leftward from S_1 to S_2. All other things being equal, this leads to a rise in price. Given the simultaneous leftward shifts of both the demand and supply curves, the equilibrium changes from E_1 to E_2. The fall in price indicates that the leftward shift of the demand curve exceeds the leftward shift of the supply curve.



4. Show in a diagram the effect on the demand curve, the supply curve, the equilibrium price, and the equilibrium quantity of each of the following events on the designated market.

a. the market for newspapers in your town

Case 1: The salaries of journalists go up.

Case 2: There is a big news event in your town, which is reported in the newspapers, and residents want to learn more about it.

b. the market for St. Louis Rams cotton T-shirts

Case 1: The Rams win the championship.

Case 2: The price of cotton increases.

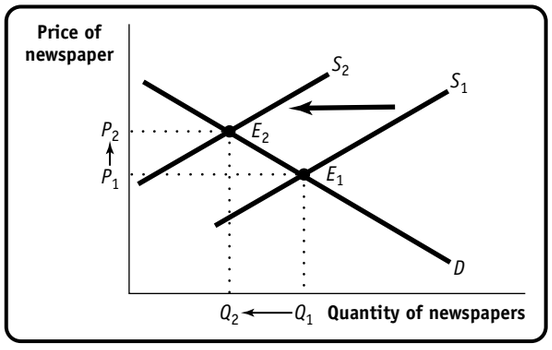
c. the market for bagels

Case 1: People realize how fattening bagels are.

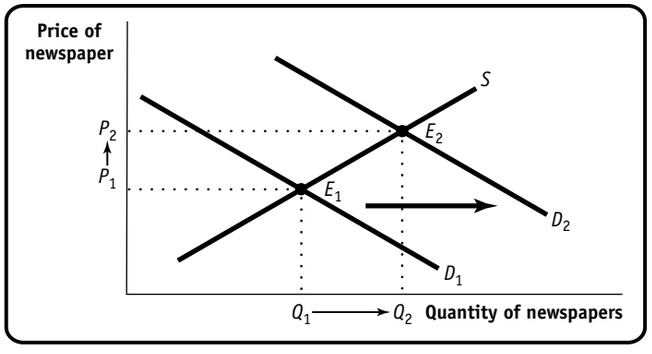
Case 2: People have less time to make themselves a cooked breakfast.

Solution

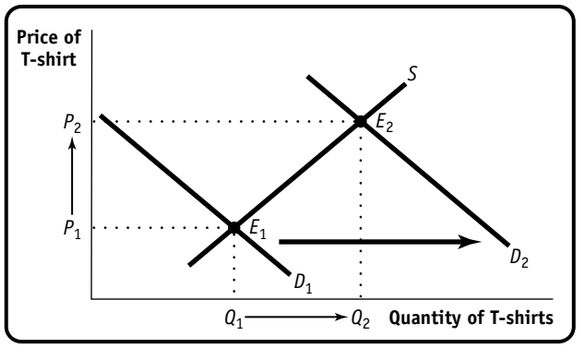
4. a. Case 1: Journalists are an input in the production of newspapers; an increase in their salaries will cause newspaper publishers to reduce the quantity supplied at any given price. This represents a leftward shift of the supply curve from S_1 to S_2 and results in a rise in the equilibrium price and a fall in the equilibrium quantity as the equilibrium changes from E_1 to E_2.



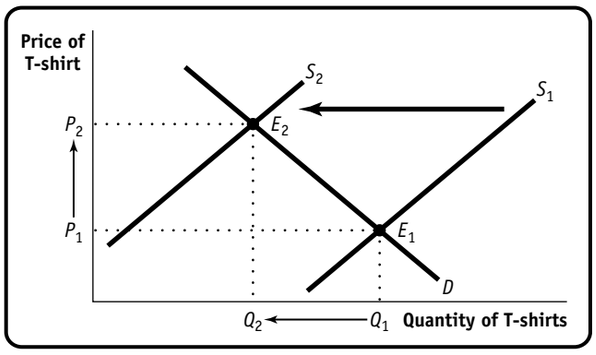
Case 2: Townspeople will wish to purchase more newspapers at any given price. This represents a rightward shift of the demand curve from D_1 to D_2 and leads to a rise in both the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



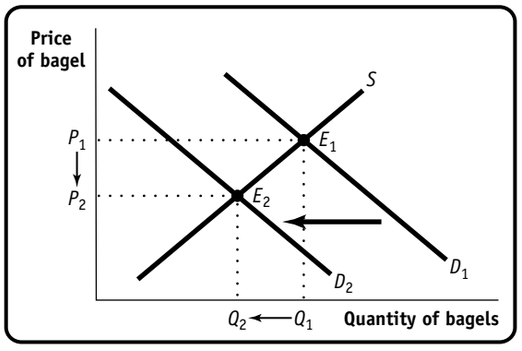
b. Case 1: Fans will demand more St. Louis Rams memorabilia at any given price. This represents a rightward shift of the demand curve from D_1 to D_2 and leads to a rise in both the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



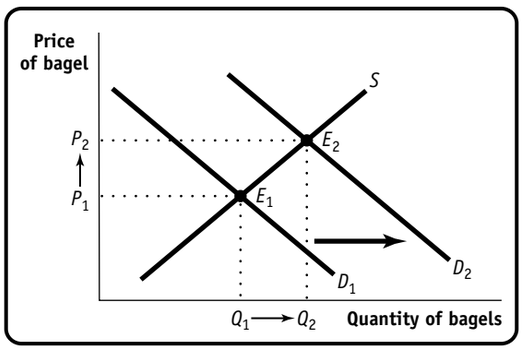
Case 2: Cotton is an input into T-shirts; an increase in its price will cause T-shirt manufacturers to reduce the quantity supplied at any given price, representing a leftward shift of the supply curve from S_1 to S_2. This leads to a rise in the equilibrium price and a fall in the equilibrium quantity as the equilibrium changes from E_1 to E_2.



c. Case 1: Consumers will demand fewer bagels at any given price. This represents a leftward shift of the demand curve from D_1 to D_2 and leads to a fall in both the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



Case 2: Consumers will demand more bagels (a substitute for cooked breakfasts) at any given price. This represents a rightward shift of the demand curve from D_1 to D_2 and leads to a rise in both the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



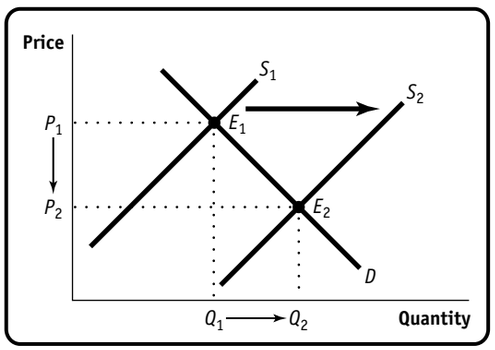
5. Find the flaws in reasoning in the following statements, paying particular attention to the distinction between changes in and movements along the supply and demand curves. Draw a diagram to illustrate what actually happens in each situation.

a. "A technological innovation that lowers the cost of producing a good might seem at first to result in a reduction in the price of the good to consumers. But a fall in price will increase demand for the good, and higher demand will send the price up again. It is not certain, therefore, that an innovation will really reduce price in the end."

b. "A study shows that eating a clove of garlic a day can help prevent heart disease, causing many consumers to demand more garlic. This increase in demand results in a rise in the price of garlic. Consumers, seeing that the price of garlic has gone up, reduce their demand for garlic. This causes the demand for garlic to decrease and the price of garlic to fall. Therefore, the ultimate effect of the study on the price of garlic is uncertain."

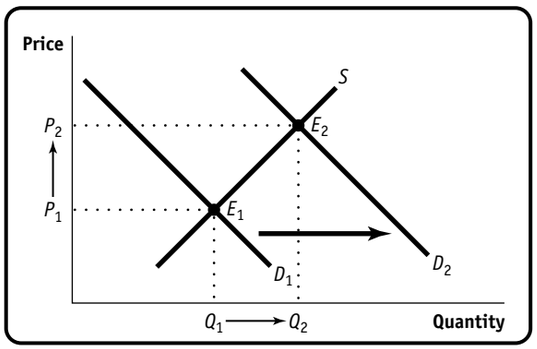
Solution

5. **a.** This statement confuses a shift of a curve with a movement along a curve. A technological innovation lowers the cost of producing the good, leading producers to offer more of the good at any given price. This is represented by a rightward shift of the supply curve from S_1 to S_2. As a result, the equilibrium price falls and the equilibrium quantity rises, as shown by the change from E_1 to E_2. The statement "but a fall in price will increase demand for the good, and higher demand will send the price up again" is wrong for the following reasons. A fall in price does increase the quantity demanded and leads to an increase in the equilibrium quantity as one moves down along the demand curve. But it does not lead to an increase in demand—a rightward shift of the demand curve—and therefore does not cause the price to go up again.



b. This statement also confuses a shift of a curve with a movement along a curve. The health report generates an increase in demand—a rightward shift of the demand curve from D_1 to D_2. This leads to a higher equilibrium price and quantity as we move up along the supply curve, and the equilibrium changes from E_1 to E_2. The following statements are wrong: "Consumers, seeing that

the price of garlic has gone up, reduce their demand for garlic. This causes the demand for garlic to decrease and the price of garlic to fall." They are wrong because they imply that the rise in the equilibrium price causes the demand for garlic to decrease—a leftward shift of the demand curve. But a rise in the equilibrium price via a movement along the supply curve does not cause the demand curve to shift leftward.



6. In *Rolling Stone* magazine, several fans and rock stars, including Pearl Jam, were bemoaning the high price of concert tickets. One superstar argued, "It just isn't worth $75 to see me play. No one should have to pay that much to go to a concert." Assume this star sold out arenas around the country at an average ticket price of $75.

a. How would you evaluate the argument that ticket prices are too high?

b. Suppose that due to this star's protests, ticket prices were lowered to $50. In what sense is this price too low? Draw a diagram using supply and demand curves to support your argument.

c. Suppose Pearl Jam really wanted to bring down ticket prices. Since the band controls the supply of its services, what do you recommend they do? Explain using a supply and demand diagram.

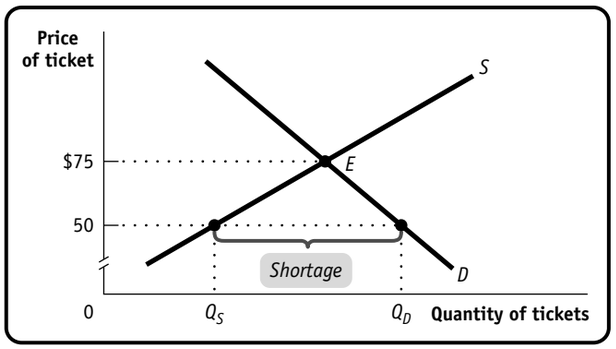
d. Suppose the band's next CD was a total dud. Do you think they would still have to worry about ticket prices being too high? Why or why not? Draw a supply and demand diagram to support your argument.

e. Suppose the group announced their next tour was going to be their last. What effect would this likely have on the demand for and price of tickets? Illustrate with a supply and demand diagram.

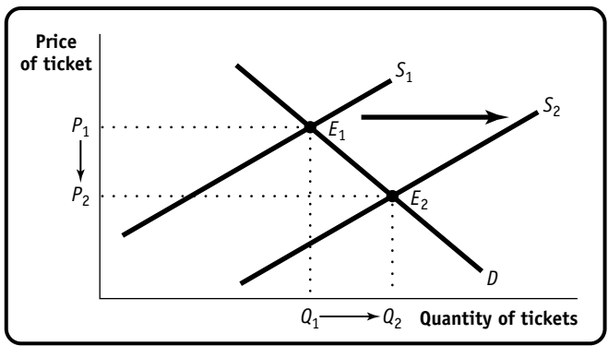
Solution

6. a. If markets are competitive, the ticket price is simply the equilibrium price: the price at which quantity supplied is equal to quantity demanded. No one is "made" to pay $75 to go to a concert: a potential concert-goer will pay $75 if going to the concert seems worth that amount and will choose to do something else if it isn't.

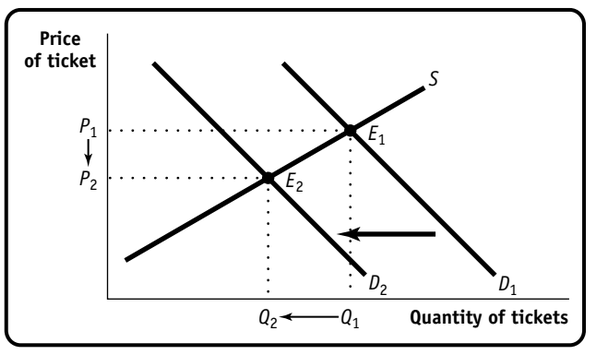
b. At \$50 each, the quantity of tickets demanded exceeds the quantity of tickets supplied. There is a shortage of tickets at this price, shown by the difference between the quantity demanded at this price, Q_D, and the quantity supplied at this price, Q_S.



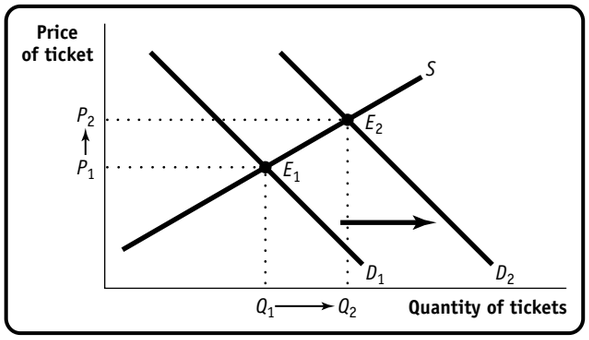
c. The band can lower the average price of a ticket by increasing supply: give more concerts. This is shown as a rightward shift of the supply curve from S_1 to S_2, resulting in a lower equilibrium price and a higher equilibrium quantity, shown by the change of the equilibrium from E_1 to E_2.



d. If the band's CD is a total dud, the demand for concert tickets is likely to decrease. This represents a leftward shift of the demand curve from D_1 to D_2, resulting in a lower equilibrium price and quantity as the equilibrium changes from E_1 to E_2. This is likely to eliminate the worry that ticket prices are "too high."



e. The announcement that this is the group's last tour causes the demand for tickets to increase. This is represented by a rightward shift of the demand curve from D_1 to D_2, resulting in an increase in both the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



7. After several years of decline, the market for handmade acoustic guitars is making a comeback. These guitars, which are normal goods, are usually made in small workshops employing relatively few highly skilled luthiers. Assess the impact on the equilibrium price and quantity of handmade acoustic guitars as a result of each of the following events. In your answers, indicate which curve(s) shift(s) and in which direction.

a. Environmentalists succeed in having the use of Brazilian rosewood banned in the United States, forcing luthiers to seek out alternative, more costly woods.

b. A foreign producer reengineers the guitar-making process and floods the market with identical guitars.

c. Music featuring handmade acoustic guitars makes a comeback as audiences tire of heavy metal and grunge music.

d. The country goes into a deep recession and the income of the average American falls sharply.

Solution

7. **a.** The cost of producing handmade acoustic guitars rises as more costly woods are used to construct them. This reduces supply, as luthiers offer fewer guitars at any given price. This is represented by a leftward shift of the supply curve and results in a rise in the equilibrium price and a fall in the equilibrium quantity.

b. This represents a rightward shift of the supply curve, resulting in a fall in the equilibrium price and a rise in the equilibrium quantity.

c. As more people demand music played on acoustic guitars, the demand for these guitars by musicians increases as well. (Acoustic guitars are an input into the production of this music.) This represents a rightward shift of the demand curve, leading to a higher equilibrium price and quantity.

d. If average American income falls sharply, then the demand for handmade acoustic guitars will decrease sharply as well because they are a normal good. This is represented by a leftward shift of the demand curve, leading to a lower equilibrium price and quantity.

8. Will Shakespeare is a struggling playwright in sixteenth-century London. As the price he receives for writing a play increases, he is willing to write more plays. For the following situations, use a diagram to illustrate how each event affects the equilibrium price and quantity in the market for Shakespeare's plays.

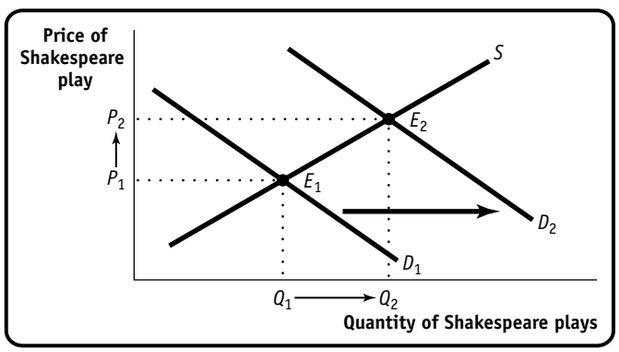
a. The playwright Christopher Marlowe, Shakespeare's chief rival, is killed in a bar brawl.

b. The bubonic plague, a deadly infectious disease, breaks out in London.

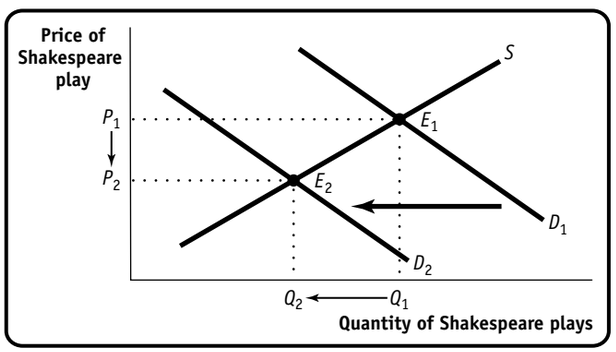
c. To celebrate the defeat of the Spanish Armada, Queen Elizabeth declares several weeks of festivities, which involves commissioning new plays.

Solution

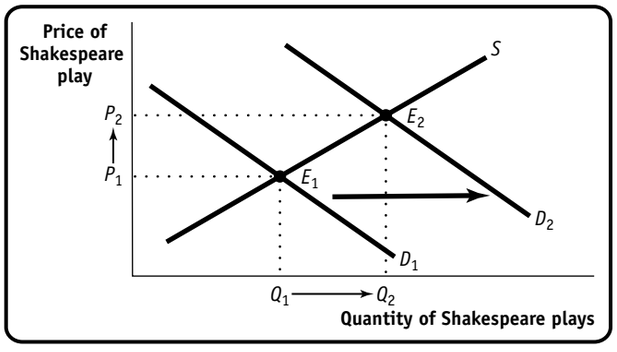
8. **a.** The death of Marlowe means that the supply of a substitute good (Marlowe's plays) has decreased, and so the price of Marlowe's plays will rise. As a result, the demand for Shakespeare's plays will increase, inducing a rightward shift of the demand curve in the market for Shakespeare's plays from D_1 to D_2. As a result, equilibrium price and quantity will rise as the equilibrium changes from E_1 to E_2.



b. After the outbreak of the plague, fewer Londoners will wish to see Shakespeare's plays to avoid contracting the illness, inducing a leftward shift of the demand curve from D_1 to D_2. Equilibrium price and quantity will fall as the equilibrium changes from E_1 to E_2.



c. Queen Elizabeth's commissions result in a greater quantity of Shakespeare's plays demanded at any given price. This represents a rightward shift of the demand curve from D_1 to D_2, resulting in a higher equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



9. The small town of Middling experiences a sudden doubling of the birth rate. After three years, the birth rate returns to normal. Use a diagram to illustrate the effect of these events on the following:

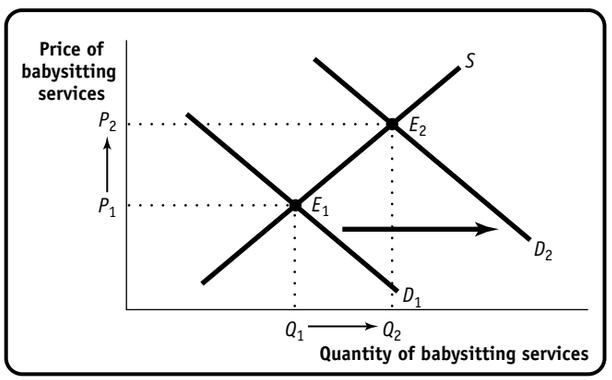
a. the market for an hour of babysitting services in Middling today

b. the market for an hour of babysitting services 14 years into the future, after the birth rate has returned to normal, by which time children born today are old enough to work as babysitters

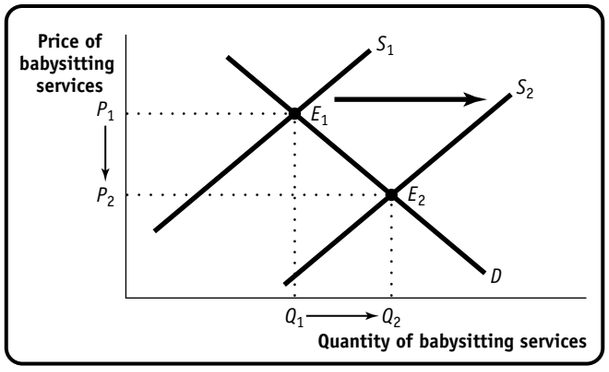
c. the market for an hour of babysitting services 30 years into the future, when children born today are likely to be having children of their own

Solution

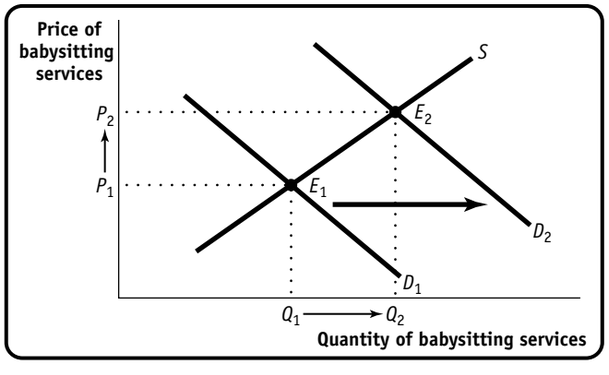
9. a. There are more babies today, so the demand for an hour of babysitting services has increased. This produces a rightward shift of the demand curve for babysitting services from D_1 to D_2, resulting in a rise in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



b. The children born today will cause an increase in the supply of babysitters available 14 years from now, when there will be a rightward shift of the supply curve for babysitting services from S_1 to S_2. This will result in a lower equilibrium price and a higher equilibrium quantity as the equilibrium changes from E_1 to E_2.



c. It is likely that there will be an increase in the birth rate 30 years from now. Therefore, there will be an increase in the demand for babysitting services, shifting the demand curve rightward from D_1 to D_2. This will result in a higher equilibrium quantity and price as the equilibrium changes from E_1 to E_2.



10. Use a diagram to illustrate how each of the following events affects the equilibrium price and quantity of pizza.

a. The price of mozzarella cheese rises.

b. The health hazards of hamburgers are widely publicized.

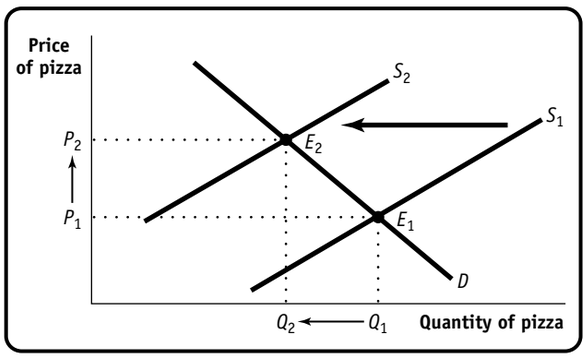
c. The price of tomato sauce falls.

d. The incomes of consumers rise and pizza is an inferior good.

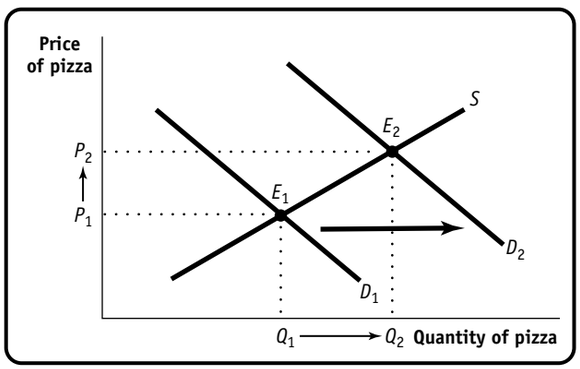
e. Consumers expect the price of pizza to fall next week.

Solution

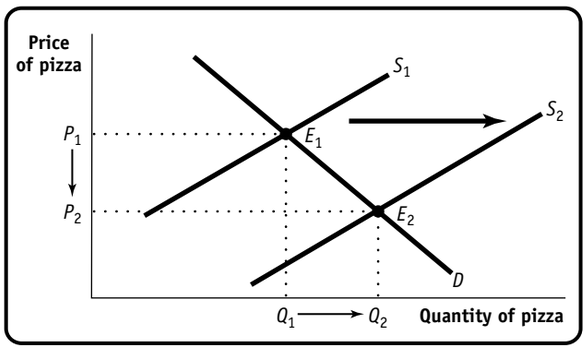
10. **a.** Mozzarella is an input in the production of pizza. Since the cost of an input has risen, pizza producers will reduce the quantity supplied at any given price, a leftward shift of the supply curve from S_1 to S_2. As a result, the equilibrium price of pizza will rise and the equilibrium quantity will fall as the equilibrium changes from E_1 to E_2.



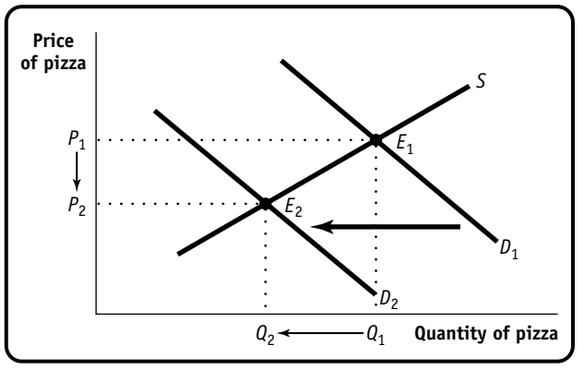
b. Consumers will substitute pizza in place of hamburgers, resulting in an increased demand for pizza at any given price. This generates a rightward shift of the demand curve from D_1 to D_2, leading to a rise in the equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



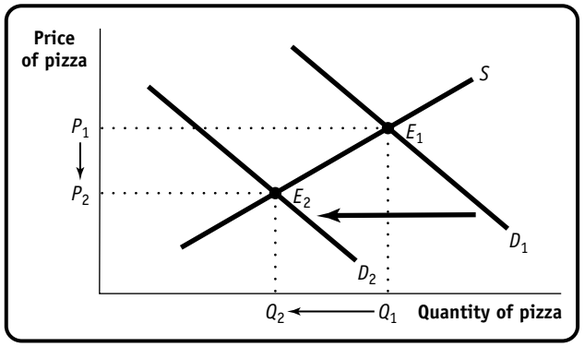
c. Tomato sauce is an input in the production of pizza. Since the cost of an input has fallen, pizza producers will increase the quantity supplied at any given price, a rightward shift of the supply curve from S_1 to S_2. As a result, the equilibrium price of pizza will fall and the equilibrium quantity will rise as the equilibrium changes from E_1 to E_2.



d. The demand for an inferior good decreases when the incomes of consumers rise. So a rise in consumer incomes produces a leftward shift of the demand curve from D_1 to D_2, resulting in a lower equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



e. Consumers will delay their purchases of pizza today in anticipation of consuming more pizza next week. As a result, the demand curve shifts leftward from D_1 to D_2, resulting in a lower equilibrium price and quantity as the equilibrium changes from E_1 to E_2.



11. Although he was a prolific artist, Pablo Picasso painted only 1,000 canvases during his "Blue Period." Picasso is now dead, and all of his Blue Period works are currently on display in museums and private galleries throughout Europe and the United States.

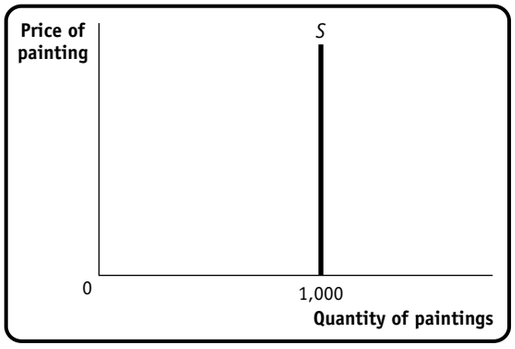
a. Draw a supply curve for Picasso Blue Period works. Why is this supply curve different from ones you have seen?

b. Given the supply curve from part a, the price of a Picasso Blue Period work will be entirely dependent on what factor(s)? Draw a diagram showing how the equilibrium price of such a work is determined.

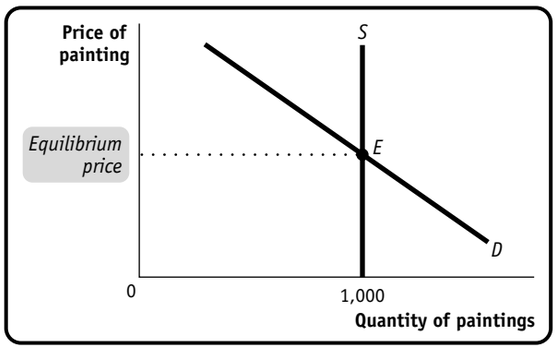
c. Suppose that rich art collectors decide that it is essential to acquire Picasso Blue Period art for their collections. Show the impact of this on the market for these paintings.

Solution

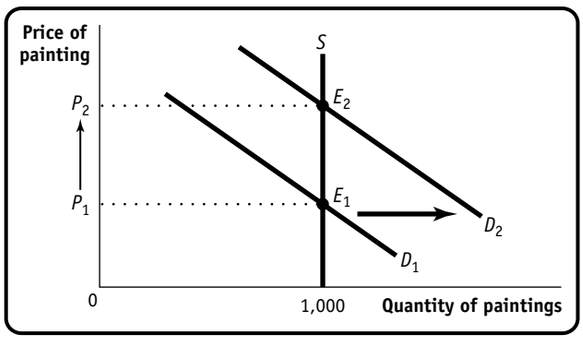
11. **a.** There are no more Picasso Blue Period works available. Hence the supply curve is a vertical line at the quantity 1,000.



b. Since supply is fixed, the price of a Picasso Blue Period work is entirely determined by demand. Any change in demand is fully reflected in a change in price.



c. This results in a rightward shift of the demand curve for these works from D_1 to D_2, and the equilibrium changes from E_1 to E_2. But since no more works are available, this increase in demand simply results in an increase in the equilibrium price.



12. Suppose it is decided that rent control in New York City will be abolished and that market rents will now prevail. Assume that all rental units are identical and are therefore offered at the same rent. To address the plight of residents who may be unable to pay the market rent, an income supplement will be paid to all low-income households equal to the difference between the old controlled rent and the new market rent.

a. Use a diagram to show the effect on the rental market of the elimination of rent control. What will happen to the quality and quantity of rental housing supplied?

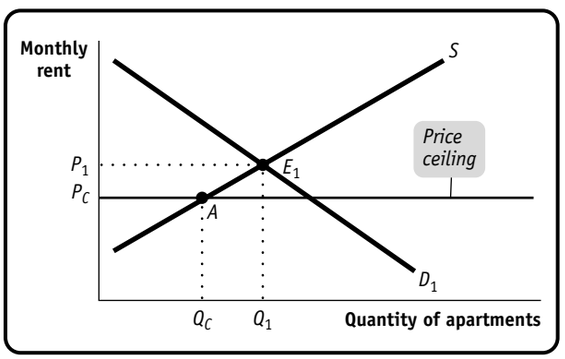
b. Now use a second diagram to show the additional effect of the income-supplement policy on the market, namely the resulting increase in demand. What effect does it have on the market rent and quantity of rental housing supplied in comparison to your answers to part a?

c. Are tenants better or worse off as a result of these policies? Are landlords better or worse off?

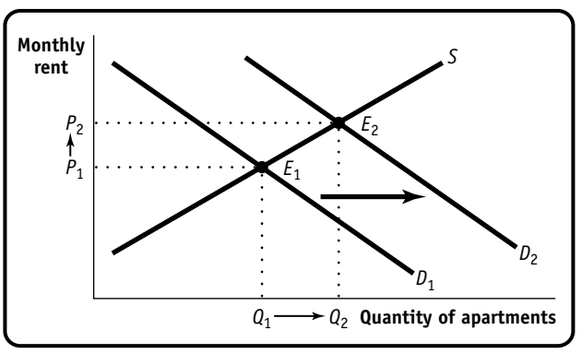
d. From a political standpoint, why do you think cities have been more likely to resort to rent control rather than a policy of income supplements to help low-income people pay for housing?

Solution

12. **a.** With a price ceiling at P_C, the quantity bought and sold is Q_C, indicated by point A. The ceiling at P_C is eliminated and the rent returns to the market equilibrium E_1, with an equilibrium rent of P_1. The quantity supplied increases from Q_C to the equilibrium quantity Q_1. At the same time, one should expect the quality of rental housing to improve. As we learned, one of the inefficiencies caused by price ceilings is inefficiently low quality. As the rent returns to the equilibrium rent, landlords again have the incentive to invest in the quality of their apartments in order to attract renters.



b. The income-supplement policy causes a rightward shift of the demand curve from D_1 to D_2. This results in an increase in the equilibrium rent, from P_1 to P_2, and an increase in the equilibrium quantity, from Q_1 to Q_2, as the equilibrium changes from E_1 to E_2.



c. Landlords are clearly better off as a result of these two policies: more landlords rent out apartments, and at a higher monthly rent. It is not clear whether tenants are better or worse off. Some tenants who previously could not get apartments can now do so, but at a higher rent. In particular, those tenants who do not receive the income supplement and who used to rent cheap apartments under the price ceiling are now worse off. Society as a whole is better off because the deadweight loss caused by a price ceiling has been eliminated: there are now no missed gains from trade.

d. It is likely that tenants who currently live in rent-controlled housing are better organized than people who cannot currently find rental housing. And more organized groups can generally exert greater influence over city policy.

13. In the late eighteenth century, the price of bread in New York City was controlled, set at a predetermined price above the market price.

a. Draw a diagram showing the effect of the policy. Did the policy act as a price ceiling or a price floor?

b. What kinds of inefficiencies were likely to have arisen when the controlled price of bread was above the market price? Explain in detail.

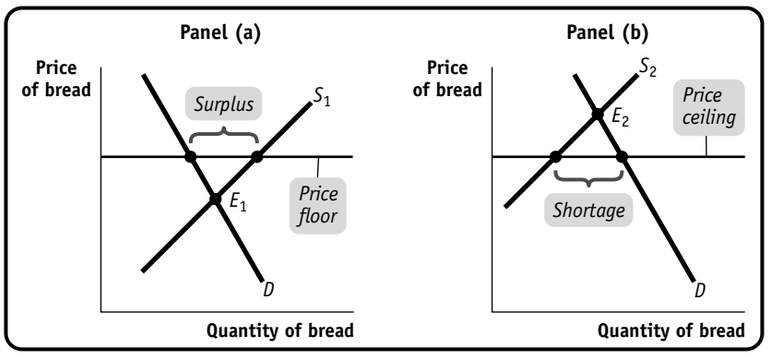
One year during this period, a poor wheat harvest caused a leftward shift in the supply of bread and therefore an increase in its market price. New York bakers found that the controlled price of bread in New York was below the market price.

c. Draw a diagram showing the effect of the price control on the market for bread during this one-year period. Did the policy act as a price ceiling or a price floor?

d. What kinds of inefficiencies do you think occurred during this period? Explain in detail.

Solution

13. **a.** Panel (a) of the accompanying diagram illustrates the effect of this policy. Since the price is set above the market equilibrium price, this policy acts as a price floor: it raises the price artificially above the equilibrium. As a result, too much bread is produced: there is a surplus.

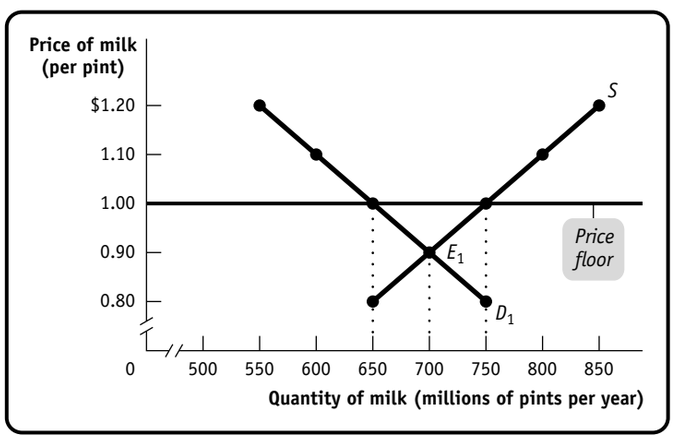


b. As with all price floors above the equilibrium price, there are several associated inefficiencies. First, there is deadweight loss from inefficiently low quantity. Some transactions that would have occurred at the unregulated market price no longer occur. Second, there is inefficient allocation of sales among bakers. Some bakers who have higher cost get to operate, while some who have lower cost do not. Third, there are wasted resources from surplus production of bread that must be given or thrown away. Fourth, there is inefficiently high quality as bakers produce bread of higher quality than consumers want. Consumers would instead prefer a lower price.

c. Panel (b) illustrates the effect of the price control if the market equilibrium is above that price. The set price now acts like a price ceiling, preventing the price from rising to the equilibrium. There is a shortage, as occurs with every price ceiling below the equilibrium price.

d. As with all price ceilings below the equilibrium price, there are several associated inefficiencies. First, there is deadweight loss from inefficiently low quantity. There is a persistent shortage of bread, and some transactions that would have occurred at the equilibrium price no longer occur. Second, there is inefficient allocation to consumers, as some who want bread very much are not able to find any, while those who value bread less are able to purchase some. Third, there are wasted resources as consumers expend resources to find bread. Fourth, there is inefficiently low quality of bread that is offered for sale.

14. Suppose the U.S. government decides that the incomes of dairy farmers should be maintained at a level that allows the traditional family dairy farm to survive. It therefore implements a price floor of $1 per pint by buying surplus milk until the market price is $1 per pint. Use the accompanying diagram to answer the following questions.



a. How much surplus milk will be produced as a result of this policy?

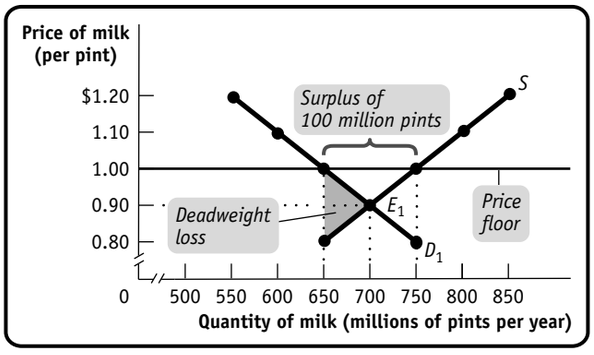
b. What will be the cost to the government of this policy?

c. Since milk is an important source of protein and calcium, the government decides to provide the surplus milk it purchases to elementary schools at a price of only $0.60 per pint. Assume that schools will buy any amount of milk available at this low price. But parents now reduce their purchases of milk at any price by 50 million pints per year because they know their children are getting milk at school. How much will the dairy program now cost the government?

d. Give two examples of inefficiencies arising from wasted resources that are likely to result from this policy. What is the missed opportunity in each case?

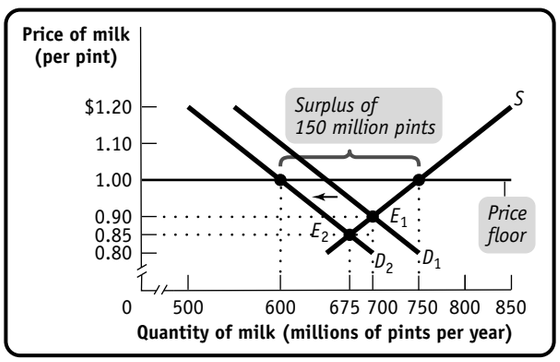
Solution

14. **a.** With demand of D_1 and supply of S, the equilibrium would be at point E_1 in the accompanying diagram. However, with a price floor at \$1, the quantity supplied is 750 million pints and the quantity demanded is 650 million pints. So the policy causes a surplus of milk of 100 million pints per year.



b. In order to sustain this price floor (to prevent black market sales of surplus milk below the price floor), the government has to buy up the surplus of milk. Buying 100 million pints of milk at a price of \$1 each costs the government \$100 million.

c. As a result of sales of cheap milk to schools, the quantity demanded falls by 50 million pints per year at any price: the demand curve shifts leftward to the new demand curve D_2. Without the price floor, the equilibrium would now be at point E_2. However, with the price floor at \$1, there is now a surplus of 150 million pints. In order to sustain the price floor of \$1, the government must buy up 150 million pints at \$1 each; that is, it must spend \$150 million. It does, however, sell those 150 million pints to schools at \$0.60 each (and from those sales makes \$0.60 × 150 million = \$90 million), so that the policy costs the government \$150 million − \$90 million = \$60 million.



d. One inefficiency arising from wasted resources is the government's cost of purchasing and selling surplus milk. This effort which could be used for other productive purposes represents a missed opportunity. Another inefficiency is the higher cost incurred by farmers of producing more than the market equilibrium quantity of milk using scarce resources. The inability to use these resources for other more productive uses represents a missed opportunity.

15. European governments tend to make greater use of price controls than the U.S. government. For example, the French government sets minimum starting yearly wages for new hires who have completed *le bac,* certification roughly equivalent to a high school diploma. The demand schedule for new hires with *le bac* and the supply schedule for similarly credentialed new job seekers are given in the accompanying table. The price here—given in euros, the currency used in France—is the same as the yearly wage.

Wage (per year)	Quantity demanded (new job offers per year)	Quantity supplied (new job seekers per year)
€45,000	200,000	325,000
40,000	220,000	320,000
35,000	250,000	310,000
30,000	290,000	290,000
25,000	370,000	200,000

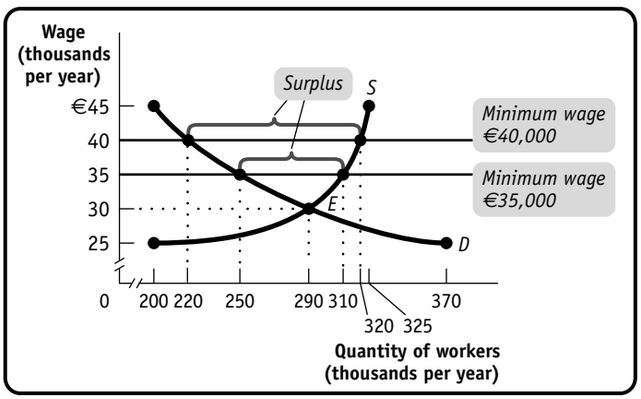
a. In the absence of government interference, what is the equilibrium wage and number of graduates hired per year? Illustrate with a diagram. Will there be anyone seeking a job at the equilibrium wage who is unable to find one—that is, will there be anyone who is involuntarily unemployed?

b. Suppose the French government sets a minimum yearly wage of 35,000 euros. Is there any involuntary unemployment at this wage? If so, how much? Illustrate with a diagram. What if the minimum wage is set at 40,000 euros? Also illustrate with a diagram.

c. Given your answer to part b and the information in the table, what do you think is the relationship between the level of involuntary unemployment and the level of the minimum wage? Who benefits from such a policy? Who loses? What is the missed opportunity here?

Solution

15. a. The equilibrium wage is €30,000, and 290,000 workers are hired. There is full employment: nobody is involuntarily unemployed. The equilibrium is at point *E*.



b. With a minimum yearly wage of 35,000 euros, employers would demand 250,000 workers, while 310,000 workers want jobs. This results in a surplus of 60,000 workers, which represents involuntary unemployment. At a minimum yearly wage of 40,000 euros, employers would demand 220,000 workers, while 320,000 workers want jobs. Involuntary unemployment increases to 100,000 workers.

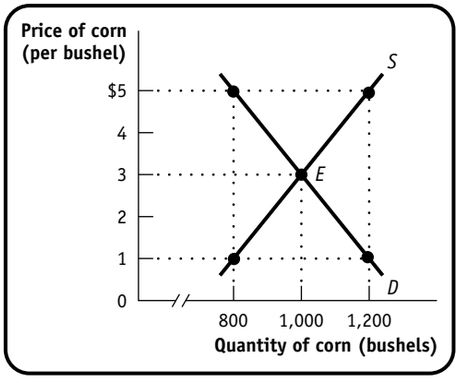
c. The higher the minimum wage, the larger the amount of involuntary unemployment. The people who benefit from this policy are those workers who succeed in getting hired: they now enjoy a higher wage. Those workers who do not get hired, however, lose: if the market were allowed to reach equilibrium, more workers would be employed. Employers also lose: fewer employers can now afford to hire workers, and they need to pay higher wages. The missed opportunity is that there are workers who want to work even at a wage lower than the minimum wage and firms that would willingly hire them at a lower wage; but because the wage is not allowed to fall below the minimum wage, these hires are not made.

16. Until recently, the standard number of hours worked per week for a full-time job in France was 39 hours, similar to that in the United States. But in response to social unrest over high levels of involuntary unemployment, the French government instituted a 35-hour workweek—a worker could not work more than 35 hours per week even if both the worker and employer wanted it. The motivation behind this policy was that if current employees worked fewer hours, employers would be forced to hire more new workers. Assume that it is costly for employers to train new workers. French employers were greatly opposed to this policy and threatened to move their operations to neighboring countries that did not have such employment restrictions. Can you explain their attitude? Give an example of both an inefficiency and an illegal activity that are likely to arise from this policy.

Solution

16. The introduction of a quota limit—limiting the workweek to 35 hours, below the current equilibrium quantity—implies that there is quota rent earned by the suppliers of labor. So it should not come as a surprise that workers who expected to keep their jobs under the new policy were in favor of the policy. The demand price (the price paid by the demanders of labor, that is, firms), compared to what the wage had been before the introduction of the policy, had risen. Furthermore, since it is costly to train new workers, firms could not use new hires to completely make up for the shortfall in the hours that their current employees were working. As a result, firms had to produce less output and earn lower revenue than before the policy. Like every quota that is below the equilibrium quantity, this quota introduced inefficiency: even if workers wanted to work longer hours and firms agreed to this arrangement, such trades were no longer legally possible. You should expect some black market activity to occur: workers working longer hours off the books.

17. For the last 70 years, the U.S. government has used price supports to provide income assistance to U.S. farmers. At times the government has used price floors, which it maintains by buying up the surplus farm products. At other times, it has used target prices, giving the farmer an amount equal to the difference between the market price and the target price for each unit sold. Use the accompanying diagram to answer the following questions.



a. If the government sets a price floor of $5 per bushel, how many bushels of corn are produced? How many are purchased by consumers? by the government? How much does the program cost the government? How much revenue do corn farmers receive?

b. Suppose the government sets a target price of $5 per bushel for any quantity supplied up to 1,000 bushels. How many bushels of corn are purchased by consumers and at what price? by the government? How much does the program cost the government? How much revenue do corn farmers receive?

c. Which of these programs (in parts a and b) costs corn consumers more? Which program costs the government more? Explain.

d. What are the inefficiencies that arise in each of these cases (parts a and b)?

Solution

17. **a.** With a price floor of $5, the quantity of corn supplied is 1,200 bushels. The quantity demanded is only 800 bushels: there is a surplus of 400 bushels. The government therefore has to buy up the surplus of 400 bushels, at a price of $5 each: the program costs the government 400 × $5 = $2,000. Corn farmers sell 1,200 bushels (800 to consumers and 400 to the government) and therefore make 1,200 × $5 = $6,000 in revenue.

b. If the government sets a target price of $5, the market reaches equilibrium at a price of $3 and a quantity of 1,000 bushels. There is no surplus (or shortage). The government does not buy any corn under this policy. For each bushel sold the government pays farmers $2 (to make up the difference between the market price of $3 and the target price of $5), so the government pays a total of 1,000 × $2 = $2,000. Corn farmers sell 1,000 bushels and make $5 for each bushel ($3 come from consumers and $2 from the government), for a total of $5,000 of revenue.

c. The price-floor policy is more expensive for consumers: they pay $5 per bushel (compared to the $3 under the target-price policy). Both policies are equally expensive for the government.

d. In part a, the inefficiency arises from the wasted resources of farmers in producing a quantity greater than the market equilibrium, as well as the government resources used to buy the surplus. In part b, the farmers produce an efficient quantity; however, there is still inefficiency caused by the government's use of resources that could be used for more productive activities.

18. The waters off the north Atlantic coast were once teeming with fish. Now, due to overfishing by the commercial fishing industry, the stocks of fish are seriously depleted. In 1991, the National Marine Fishery Service of the U.S. government implemented a quota to allow fish stocks to recover. The quota limited the amount of swordfish caught per year by all U.S.-licensed fishing boats to 7 million pounds. As soon as the U.S. fishing fleet had met the quota, the swordfish catch was closed down for the rest of the year. The accompanying table gives the hypothetical demand and supply schedules for swordfish caught in the United States per year.

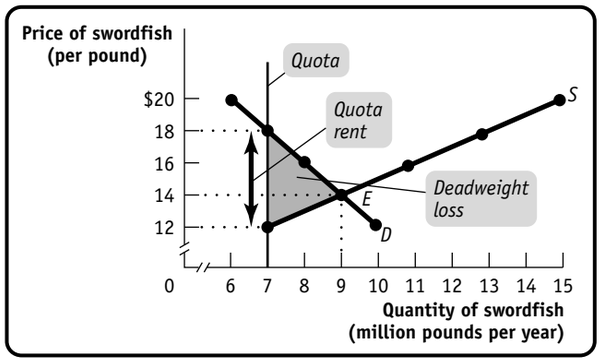
Price of swordfish (per pound)	Quantity of swordfish (millions of pounds per year)	
	Quantity demanded	Quantity supplied
$20	6	15
18	7	13
16	8	11
14	9	9
12	10	7

a. Use a diagram to show the effect of the quota on the market for swordfish in 1991.

b. How do you think fishermen will change how they fish in response to this policy?

Solution

18. **a.** The quantity sold is 7 million pounds, at a price of $18 per pound. On each pound of fish caught, each fisherman earns quota rent of $6, as shown in the accompanying diagram. The shaded triangle shows the deadweight loss.



b. Because each pound of swordfish gives a fisherman $6 quota rent, each fisherman will attempt to fish as much as possible as soon as the swordfish catch opens. You should therefore see fishermen scramble to fish right at the beginning of the season, and you should see the catch being closed down very soon thereafter. (Which is exactly what happens.)

19. The accompanying table indicates the U.S. domestic demand schedule and domestic supply schedule for commercial jet airplanes. Suppose that the world price of a commercial jet airplane is $100 million.

Price of jet (millions)	Quantity of jets demanded	Quantity of jets supplied
$120	100	1,000
110	150	900
100	200	800
90	250	700
80	300	600
70	350	500
60	400	400
50	450	300
40	500	200

a. In autarky, how many commercial jet airplanes does the United States produce, and at what price are they bought and sold?

b. With trade, what will the price for commercial jet airplanes be? Will the United States import or export airplanes? How many?

Solution

19. **a.** In autarky, the equilibrium price will be $60 million, and 400 airplanes will be bought and sold at that price.

b. When there is trade, the price rises to the world price of $100 million. At that price, the domestic quantity supplied is 800, and the domestic quantity demanded is 200. So 600 airplanes are exported.

20. The accompanying table shows the U.S. domestic demand schedule and domestic supply schedule for oranges. Suppose that the world price of oranges is $0.30 per orange.

Price of orange	Quantity of oranges demanded (thousands)	Quantity of oranges supplied (thousands)
$1.00	2	11
0.90	4	10
0.80	6	9
0.70	8	8
0.60	10	7
0.50	12	6
0.40	14	5
0.30	16	4
0.20	18	3

a. Draw the U.S. domestic supply curve and domestic demand curve.

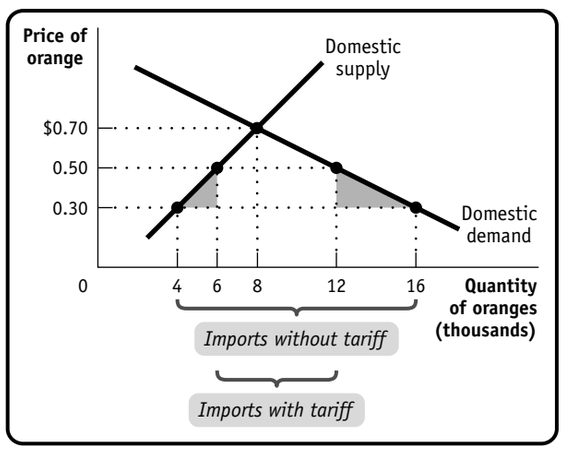
b. With free trade, how many oranges will the United States import or export?

Suppose that the U.S. government imposes a tariff on oranges of $0.20 per orange.

c. How many oranges will the United States import or export after introduction of the tariff?

Solution

20. **a.** The U.S. domestic supply and demand curves are illustrated in the accompanying diagram.



b. With free trade, the price will be the world price, $0.30, the domestic quantity demanded will be 16,000 oranges, and the domestic quantity supplied will be 4,000 oranges. So the United States will import 12,000 oranges.

c. With the tariff, the domestic price will rise to $0.50. At that price, the domestic quantity demanded will exceed the domestic quantity supplied by 6,000. So the United States will import 6,000 oranges.

21. The U.S. domestic demand schedule and domestic supply schedule for oranges was given in Problem 20. Suppose that the world price of oranges is $0.30. The United States introduces an import quota of 3,000 oranges and assigns the quota rents to foreign orange exporters.

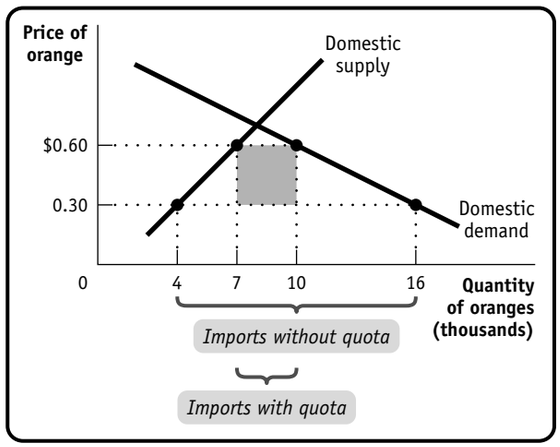
a. Draw the domestic demand and supply curves.

b. What will the domestic price of oranges be after introduction of the quota?

c. What is the value of the quota rents that foreign exporters of oranges receive?

Solution

21. **a.** The domestic demand and domestic supply curves are shown in the accompanying diagram.



b. After introduction of the quota, instead of importing 16,000 – 4,000 = 12,000 oranges, the United States will import only 3,000 oranges. The price will rise to $0.60, the price at which the domestic quantity demanded exceeds the domestic quantity supplied by exactly 3,000 oranges.

c. The foreign exporters of oranges receive quota rent of $0.30 × 3,000 = $900.

22. As the United States has opened up to trade, it has lost many of its low-skill manufacturing jobs, but it has gained jobs in high-skill industries, such as the software industry. Explain whether the United States as a whole has been made better off by trade.

Solution

22. As the United States has opened up to trade, it has specialized in producing goods that use high-skill labor (such as software design) in which it has a comparative advantage, and it has allowed other countries to specialize in producing low-skill manufactured goods in which they have the comparative advantage. As a result, the country has lost low-skill manufacturing jobs (and the wage to low-skill workers has fallen), and it has gained jobs in high-skill industries (and the wage to high-skill workers has risen). That is, demand for labor in exporting industries has risen, and demand for labor in import-competing industries has fallen. But as a result of trade, the United States can now consume more of all goods than before. That is, overall the economy is better off, so the gains to high-skill workers outweigh the losses to low-skill workers.

Module 2

The Production Possibility Frontier Model

Module Objectives

What students will learn:

- The importance of trade-offs in economic analysis
- What the production possibility frontier model tells us about efficiency, opportunity cost, and economic growth
- The two sources of economic growth—increases in the availability of resources and improvements in technology

Module Outline

I. Trade-offs: The Production Possibility Frontier

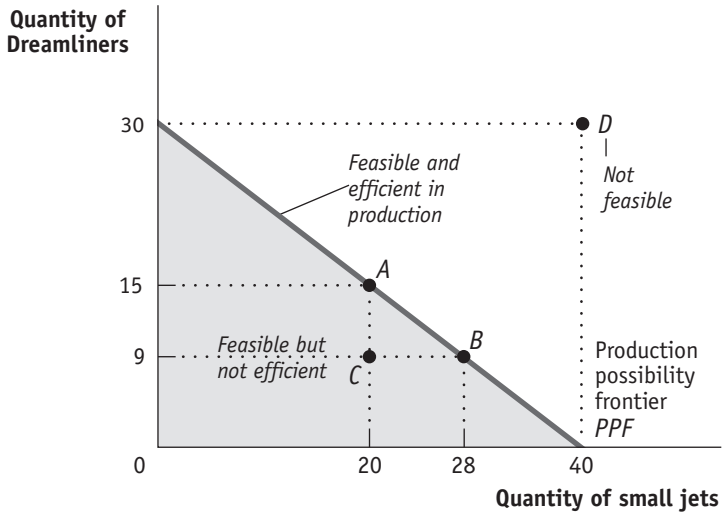
A. *Definition:* You make a **trade-off** when you give up something to have something else.

B. *Definition:* The **production possibility frontier** illustrates the trade-offs facing an economy that produces only two goods. It shows the maximum quantity of one good that can be produced with available resources and technology for any given production of the other.

C. A point inside the curve is a feasible combination of two goods that can be produced but does not use all resources fully, and a point outside the curve is not feasible given the current amount of resources. See text Figure 2-1, shown on the next page.

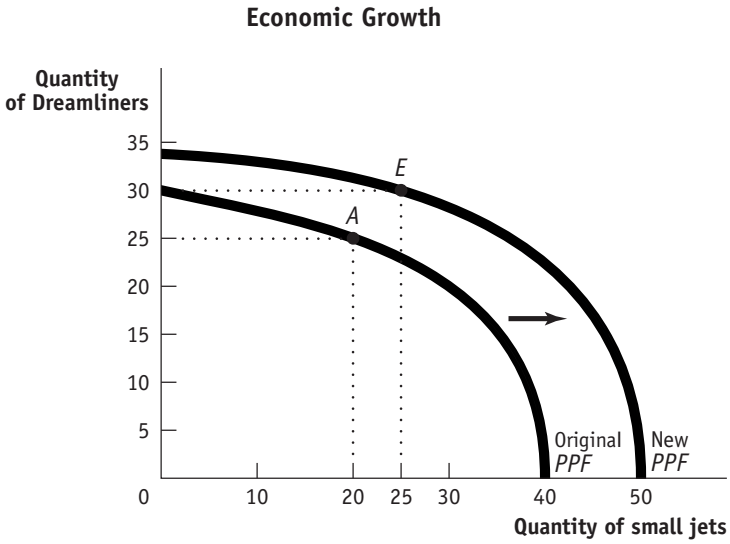
D. The slope of the production possibility curve is equal to the opportunity cost of producing one more unit of the good on the horizontal axis.

The Production Possibility Frontier



E. The production possibility model illustrates these concepts:

1. *Efficiency:* Any point on the production possibility curve represents an efficient use of resources, and any combination of goods inside the curve represents a point of inefficiency.
   - **a.** *Definition:* An economy is **efficient** if there is no way to make anyone better off without making at least one person worse off.
   - **b.** If an economy produces on its production possibilities curve, it is *efficient in production*.
   - **c.** An economy is *efficient in allocation* if it allocates resources so that consumers are as well off as possible.
2. *Opportunity costs:* The negative slope of the curve means that an increase in the production of one good must require a sacrifice of some quantity of the other good.
   - **a.** Opportunity cost is constant along a straight-line production possibility curve.
   - **b.** If the curve is bowed out, the opportunity cost increases as more of one good is produced because resources are not easily transferable from the production of one good to another.
   - **c.** In reality, the opportunity cost of producing one more unit of a good is typically increasing.
3. *Economic growth:* Over time, as a society gains more resources, the production possibility curve shifts outward. See text Figure 2-3, shown on the next page.
   - **a.** Economic growth comes from two basic sources: technology and an increase in factors of production.
   - **b.** *Definition:* **Factors of production** are resources used to produce goods and services.
   - **c.** *Definition:* **Technology** is the technical means for producing goods and services.



Teaching Tips

Trade-offs: The Production Possibilities Frontier

Creating Student Interest

Introduce the production possibilities model by evoking the image of a person (or people) stranded on an island. This could be Robinson Crusoe, Gilligan, Tom Hanks in *Cast Away,* contestants on *Survivor*—have your students select the image that they can relate to the most. Present that as an example of the simplest economy you can imagine. Explain to students that you are going to build a model of the economy on the island. Have students list the limited resources available on the island (for example, trees, sand, water, fish, labor, entrepreneurship). Then have the class consider the immediate needs that must be met using these resources (water, food, shelter). Explain that the model will represent production in the island economy.

Presenting the Material

Use grades as a simple example of a production possibility frontier. Put economics on the vertical axis of a graph and accounting on the horizontal axis. Students' time and energy are fixed for the moment, and putting more time into one subject will yield a lower grade in the other subject. (Assuming that the student is equally proficient in both subjects, the production possibilities graph is a straight line.) Points on the frontier show the possible combinations of grades that the student can achieve.

Use an example of a country that can produce wheat or airplanes. Here are the points on the production possibility frontier:

Maximum annual output Options	Wheat	Airplanes
A	1,000	0
B	800	150
C	600	250
D	400	325
E	200	375
F	0	400

Ask students: What is the opportunity cost of expanding production from 150 airplanes to 250 airplanes? (200 wheat.) Why is the production possibility graph negatively sloped? (Given scarcity, producing more of one good means producing less of the other.) Why is it bowed out from the origin? (Because of increasing opportunity cost.)

Common Student Pitfalls

- **The meaning of efficiency.** It is important that students have a solid understanding of efficiency, because it is a central economic concept. Prepare students for the fact that though they will see "efficiency" used in slightly different ways, the general concept is always the same. Efficiency in general is the idea of no waste. Efficiency is achieved when opportunities to make anyone better off have been fully exploited. No one can be made better off without making someone worse off. For example, a box of doughnuts is distributed efficiently if each of the doughnuts is eaten. However, if 11 doughnuts are eaten and one is left in the box, then the doughnuts were not distributed efficiently—one was wasted. Someone could have been made better off (by getting to eat a doughnut) without taking a doughnut away from anyone else.

Activities

Generating A Production Possibilities Curve (15–25 minutes)

For this activity you will need two desks, paper (this can be in half-sheets), and two staplers—capital. You will also need four or six volunteers to participate in the activity—labor. Have another student take responsibility for graphing results of the activity on the board. This activity identifies the alternative combinations of output (called widgets and whatsits) that can be produced given the available resources (capital–desks, paper, and staplers– and labor–students). That is, the students will generate a production possibilities frontier. Have the nonlabor students draw a production possibilities graph and label the axes. Then have the student grapher draw the graph.

Explain to students that the capital and labor will be used to produce widgets or whatsits. A widget is a piece of paper folded twice into a square and stapled. A whatsit is a piece of paper of paper folded three times. Start by having the students use all of their resources to produce widgets for 30 seconds. Count the number of widgets and whatsits produced (whatsits will equal 0). Have the students graph the data point. Next have the students use all of their resources to produce whatsits. Count the production and graph the data point. Finally, have the students divide the resources in half. Have half produce widgets and the other produce whatsits. Graph this third data point. Connect the points to show the production possibilities frontier.

Increasing Your Productivity (3–5 minutes)

Pair students. After presenting the production possibility frontier for an economics and an accounting class, ask students to brainstorm what will cause the frontier to shift outward. (They might become better organized and study more efficiently, or they might purchase high-speed Internet access to speed up their research time, a technological innovation that would boost productivity.) Ask a few pairs to report.

From Depression to War (3–5 minutes)

Pair students and have them place three historic points on a production possibility frontier for the U.S. economy: 1932, economic depression; 1942, full war mobilization; and 1944, consumer goods are sacrificed for the production of military goods. Have them put military goods on the vertical axis and consumer goods on the horizontal axis. (Of course, 1932 is inside the PPF, 1942 is on the PPF, and 1944 is a movement upward on the PPF.)

SUGGESTED SOLUTIONS FOR BUSINESS CASE *QUESTIONS FOR THOUGHT*

These are suggested answers to the "Questions for Thought" that conclude each business case near the end of sections.

Section 1

1. What is the opportunity cost associated with having a worker wander across the factory floor from task to task or in search of tools and parts?

Suggested Solution

1. The opportunity cost of a worker wandering across the factory floor is forgone output—the output that worker could have produced in the time spent wandering around.

2. How does lean manufacturing improve the economy's efficiency in allocation?

Suggested Solution

2. Lean manufacturing improves the economy's efficiency in allocation because, for example, an automaker can more quickly switch to producing more of the types of cars that more consumers want and fewer of the types of cars that fewer consumers want.

3. How will the shift in the location of Toyota's production from Japan to the United States alter the pattern of comparative advantage in automaking between the two countries?

Suggested Solution

3. The shift in the location of Toyota's production from Japan to the United States means that it is likely that Japan will no longer have a clear comparative advantage in automaking vis-à-vis the United States.

Section 2

1. Why do you think it was profitable for Li & Fung to go beyond brokering exports to becoming a supply chain manager, breaking down the production process and sourcing the inputs from various suppliers across many countries?

Suggested Solution

1. By sourcing inputs from various suppliers across many countries, Li & Fung was able to allocate production to where it is most cost effective, namely to those economies that have a comparative advantage in producing a given input.

2. What principle do you think underlies Li & Fung's decisions on how to allocate production of a good's inputs and its final assembly among various countries?

Suggested Solution

2. Comparative advantage is the principle that underlies Li & Fung's decisions. Inputs that require more skill or are more capital-intensive can be produced in countries that have relatively higher-skilled workers or are relatively more abundant in capital, such as Hong Kong and Japan. Similarly, inputs that are more labor-intensive can be produced in countries that are relatively more abundant in labor, like mainland China and Thailand.

3. Why do you think a retailer prefers to have Li & Fung arrange international production of its jeans rather than purchase them directly from a jeans manufacturer in mainland China?

Suggested Solution

3. A retailer that purchased jeans directly from a manufacturer in mainland China would not benefit from the gains from trade that arise from sourcing inputs from different countries according to those countries' comparative advantage.

4. What is the source of Li & Fung's success? Is it based on human capital, on ownership of a natural resource, or on ownership of capital?

Suggested Solution

4. The source of Li & Fung's success is human capital. The company understands how to use the principle of comparative advantage to exploit gains from trade in the production process. In addition, it is skilled in providing quality control and logistics.

Section 3

1. Why do businesses care about GDP to such an extent that they want early estimates?

Suggested Solution

1. Businesses care about GDP because it's our prime indicator of the overall state of the economy. Macroeconomics tells us that the overall state of the economy matters a lot to individual firms: what's good or bad for the U.S. economy as a whole is generally good or bad for each individual company, too.

2. How do the methods of Macroeconomic Advisers and the Institute of Supply Management fit into the three different ways to calculate GDP?

Suggested Solution

2. Macroeconomic Advisers looks at purchases to estimate GDP; in effect, it's using the method of calculating GDP that derives the total value of output by adding up total spending on domestically produced goods and services. The Institute of Supply Management, by contrast, surveys producers to find out how much they're producing; it is, in