

Price Controls and Quotas: Meddling with Markets

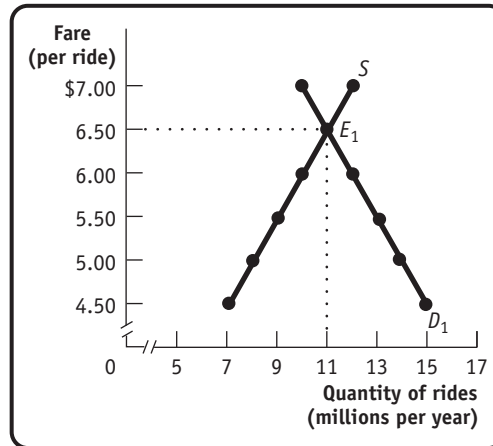
1. In order to ingratiate himself with voters, the mayor of Gotham City decides to lower the price of taxi rides. Assume, for simplicity, that all taxi rides are the same distance and therefore cost the same. The accompanying table shows the demand and supply schedules for taxi rides.

Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
\$7.00	10	12
6.50	11	11
6.00	12	10
5.50	13	9
5.00	14	8
4.50	15	7

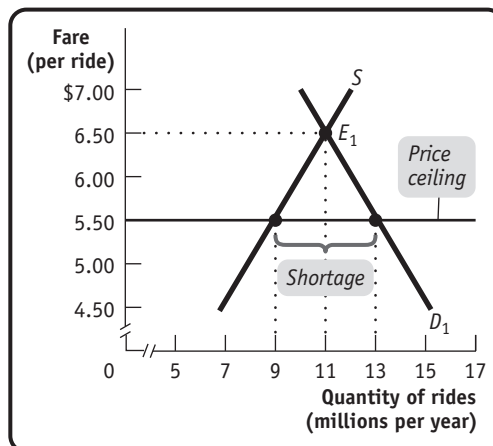
- Assume that there are no restrictions on the number of taxi rides that can be supplied (there is no medallion system). Find the equilibrium price and quantity.
- Suppose that the mayor sets a price ceiling at \$5.50. How large is the shortage of rides? Illustrate with a diagram. Who loses and who benefits from this policy?
- Suppose that the stock market crashes and, as a result, people in Gotham City are poorer. This reduces the quantity of taxi rides demanded by 6 million rides per year at any given price. What effect will the mayor's new policy have now? Illustrate with a diagram.
- Suppose that the stock market rises and the demand for taxi rides returns to normal (that is, returns to the demand schedule given in the table). The mayor now decides to ingratiate himself with taxi drivers. He announces a policy in which operating licenses are given to existing taxi drivers; the number of licenses is restricted such that only 10 million rides per year can be given. Illustrate the effect of this policy on the market, and indicate the resulting price and quantity transacted. What is the quota rent per ride?

Solution

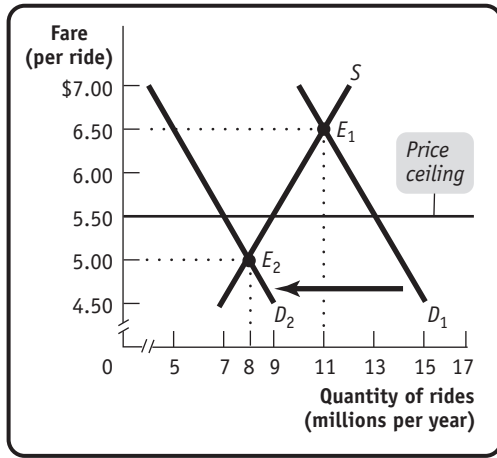
1. a. The equilibrium in the market for taxi rides is shown by E_1 in the accompanying diagram. The equilibrium price is \$6.50; at that price, the quantity demanded equals the quantity supplied—11 million taxi rides per year. The demand and supply curves (D_1 and S) illustrate this initial situation.



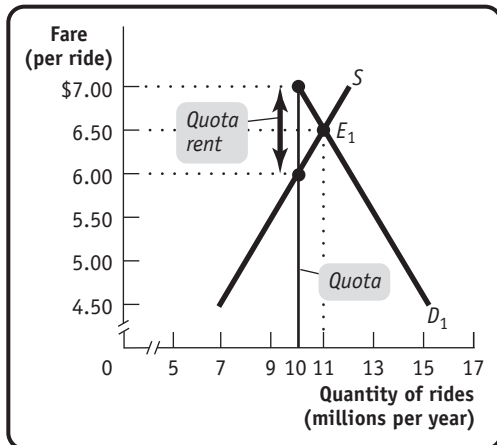
- b. With a price ceiling of \$5.50, the quantity supplied is 9 million taxi rides and the quantity demanded is 13 million. So the shortage is 13 million – 9 million = 4 million. Taxi drivers clearly lose out: there are fewer taxi rides supplied than before, and at a lower price. The impact on consumers is unclear: fewer people now manage to get rides, but those who do, get them at a lower price.



- c. The new demand curve is D_2 . Now the price ceiling has no effect: the equilibrium is point E_2 and the market price settles at \$5, which is below the mandated price ceiling of \$5.50. There will be 8 million taxi rides demanded and supplied, at a price of \$5 each.



- d. The accompanying diagram illustrates the effect of the quota of 10 million taxi rides. The quantity of taxi rides is now 10 million, at a price of \$7. The quota rent per ride is \$1.



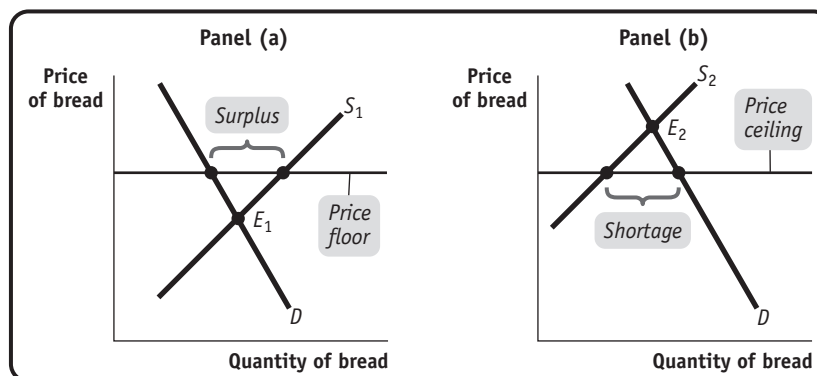
2. In the late eighteenth century, the price of bread in New York City was controlled, set at a predetermined price above the market price.
- Draw a diagram showing the effect of the policy. Did the policy act as a price ceiling or a price floor?
 - What kinds of inefficiencies were likely to have arisen 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.

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

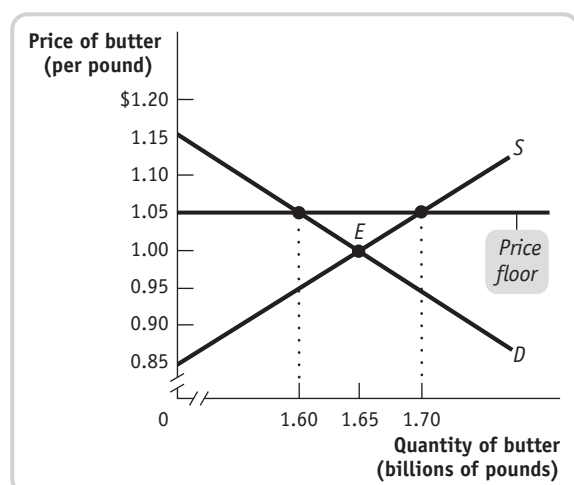
Solution

2. 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.



- As with all price floors above the equilibrium price, there are several associated inefficiencies. First, 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 are willing to sell at a lower price don't get to operate, while bakers who will only operate by selling at a higher price do get to operate. 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.
- Panel (b) illustrates the effect of the fixed price 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.
- As with all price ceilings below the equilibrium price, there are several associated inefficiencies. First, there is inefficiently low quantity transacted. 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.

3. The U.S. Department of Agriculture (USDA) administers the price floor for butter, which the 2008 Farm Bill set at \$1.05 per pound. At that price, according to data from the USDA, the quantity of butter supplied in 2010 was 1.7 billion pounds, and the quantity demanded was 1.6 billion pounds. To support the price of butter at the price floor, the USDA therefore had to buy up 100 million pounds of butter. The accompanying diagram shows supply and demand curves illustrating the market for butter.



- In the absence of a price floor, how much consumer surplus is created? How much producer surplus? What is the total surplus?
- With the price floor at \$1.05 per pound of butter, consumers buy 1.6 billion pounds of butter. How much consumer surplus is created now?
- With the price floor at \$1.05 per pound of butter, producers sell 1.7 billion pounds of butter (some to consumers and some to the USDA). How much producer surplus is created now?
- How much money does the USDA spend on buying up surplus butter?
- Taxes must be collected to pay for the purchases of surplus butter by the USDA. As a result, total surplus (producer plus consumer) is reduced by the amount the USDA spent on buying surplus butter. Using your answers for parts b–d, what is the total surplus when there is a price floor? How does this compare to the total surplus without a price floor from part a?

Solution

3. a. In the absence of a price floor, consumer surplus is the area below the demand curve but above the equilibrium price of \$1.00: it is $((\$1.15 - \$1.00) \times 1.65 \text{ billion})/2 = \123.75 million . Producer surplus is the area above the supply curve but below the equilibrium price of \$1.00: it is $((\$1.00 - \$0.85) \times 1.65 \text{ billion})/2 = \123.75 million . Total surplus therefore is $\$123.75 \text{ million} + \$123.75 \text{ million} = \247.5 million .
- b. With the price floor at \$1.05 per pound, consumer surplus is the area below the demand curve but above the price of \$1.05: it is $((\$1.15 - \$1.05) \times 1.6 \text{ billion})/2 = \80 million .
- c. With the price floor at \$1.05 per pound, producer surplus is the area above the supply curve but below the price of \$1.05: it is $((\$1.05 - \$0.85) \times 1.7 \text{ billion})/2 = \170 million .

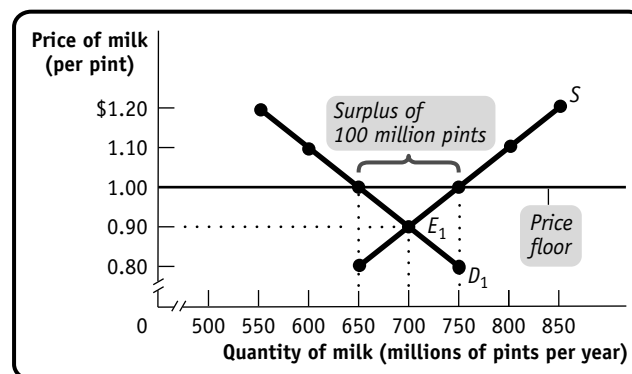
- d. The USDA buys 100 million pounds of butter at a price of \$1.05 per pound, for a total of $\$1.05 \times 100 \text{ million} = \105 million .
- e. Total surplus when there is a price floor is consumer surplus plus producer surplus minus the money spent by the USDA. It is \$80 million + \$170 million – \$105 million = \$145 million. This is less than the \$247.5 million total surplus without any price support.
4. The accompanying table shows hypothetical demand and supply schedules for milk per year. 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. So it implements a price floor of \$1 per pint by buying surplus milk until the market price is \$1 per pint.

Price of milk (per pint)	Quantity of milk (millions of pints per year)	
	Quantity demanded	Quantity supplied
\$1.20	550	850
1.10	600	800
1.00	650	750
0.90	700	700
0.80	750	650

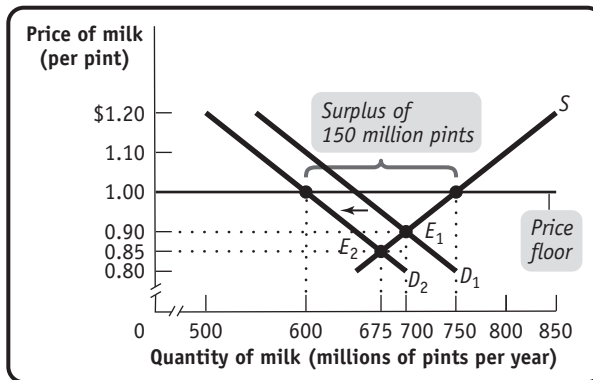
- a. How much surplus milk will be produced as a result of this policy?
- b. What will be the cost to the government of this policy?
- c. Since milk is an important source of protein and calcium, the government decides to provide the surplus milk it purchases to elementary schools at a price of only \$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. Explain how inefficiencies in the form of inefficient allocation to sellers and wasted resources arise from this policy.

Solution

4. 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 \times 150 \text{ million} = \90 million), so that the policy costs the government $\$150 \text{ million} - \$90 \text{ million} = \$60 \text{ million}$.



- d. Some milk producers are inefficient: if the price was allowed to reach equilibrium, they would find it too costly to produce. In their absence, milk would be produced only by the most efficient producers. Furthermore, resources are being wasted: although no milk is poured away outright, the government spends significant amounts of money on purchases of milk. This is money that might be used more effectively for purposes other than providing cheap milk to schoolchildren, such as improving the quality of public schools.

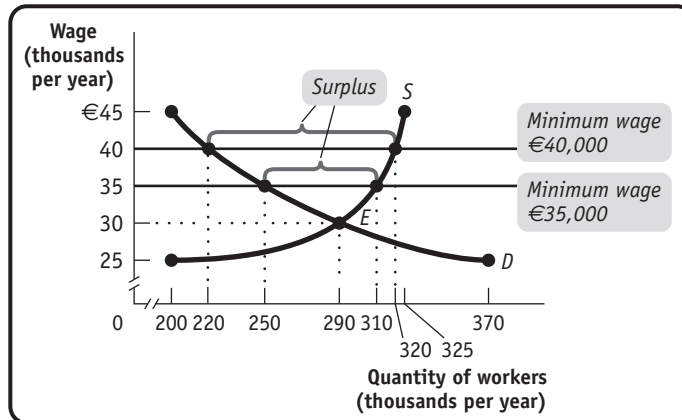
5. European governments tend to make greater use of price controls than does the U.S. government. For example, the French government sets minimum starting yearly wages for new hires who have completed *le bac*, certification roughly equivalent to a high school diploma. The demand schedule for new hires 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 are 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. 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? 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?

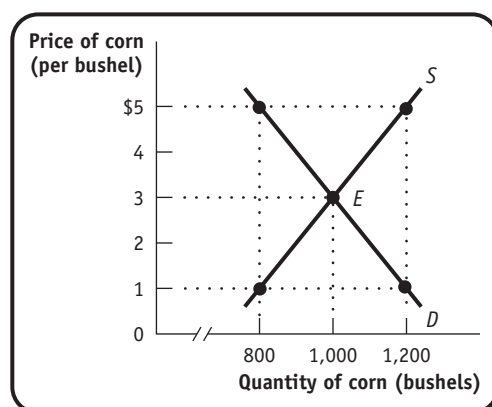
Solution

5. 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 wage of €35,000, there is a surplus of workers of 60,000 (the quantity supplied is 310,000 and the quantity demanded is 250,000). That is, there are 60,000 workers who are involuntarily unemployed. At a minimum wage of €40,000, there is a surplus of workers of 100,000: this is the number of involuntarily unemployed 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 was 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.

6. For the last 80 years the U.S. government has used price supports to provide income assistance to American farmers. To implement these price supports, 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, a policy by which the government gives the farmer an amount equal to the difference between the market price and the target price for each unit sold. Consider the market for corn depicted in the accompanying diagram.



- 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?
- 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?
- Which of these programs (in parts a and b) costs corn consumers more? Which program costs the government more? Explain.
- Is one of these policies less inefficient than the other? Explain.

Solution

6. 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 $400 \times \$5 = \$2,000$. Corn farmers sell 1,200 bushels (800 to consumers and 400 to the government) and therefore make $1,200 \times \$5 = \$6,000$ 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 $1,000 \times \$2 = \$2,000$. 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. The target-price policy avoids the inefficiency of wasted resources: surplus corn bought by the government and either given or thrown away. It is less inefficient than the price-floor policy.

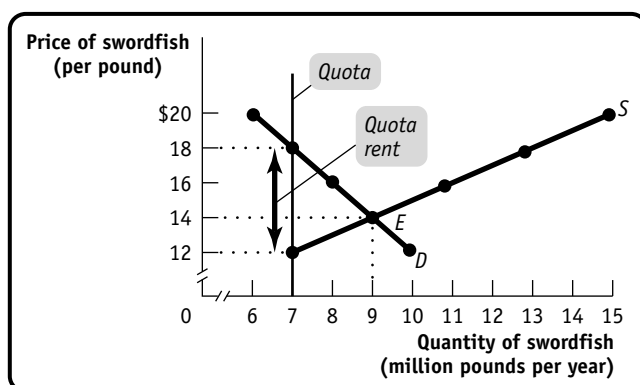
7. The waters off the North Atlantic coast were once teeming with fish. But due to overfishing by the commercial fishing industry, the stocks of fish became seriously depleted. In 1991, the National Marine Fishery Service of the U.S. government implemented a quota to allow fish stocks to recover. The 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 limit, 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?

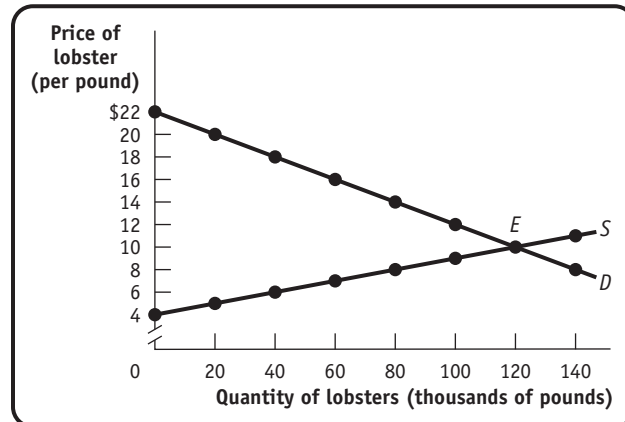
Solution

7. 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.



- 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.)

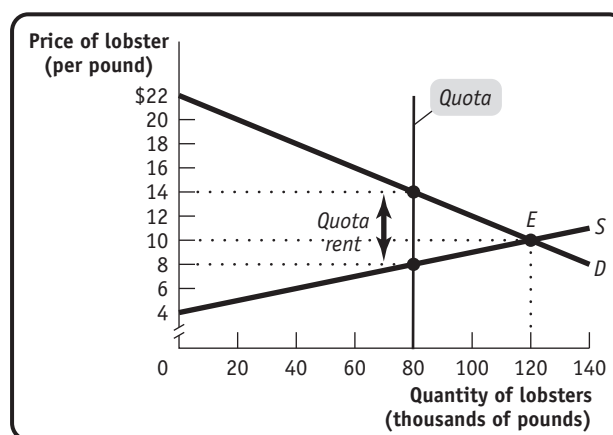
8. In Maine, you must have a license to harvest lobster commercially; these licenses are issued yearly. The state of Maine is concerned about the dwindling supplies of lobsters found off its coast. The state fishery department has decided to place a yearly quota of 80,000 pounds of lobsters harvested in all Maine waters. It has also decided to give licenses this year only to those fishermen who had licenses last year. The accompanying diagram shows the demand and supply curves for Maine lobsters.



- In the absence of government restrictions, what are the equilibrium price and quantity?
- What is the *demand price* at which consumers wish to purchase 80,000 pounds of lobsters?
- What is the *supply price* at which suppliers are willing to supply 80,000 pounds of lobsters?
- What is the *quota rent* per pound of lobster when 80,000 pounds are sold?
- Explain a transaction that benefits both buyer and seller but is prevented by the quota restriction.

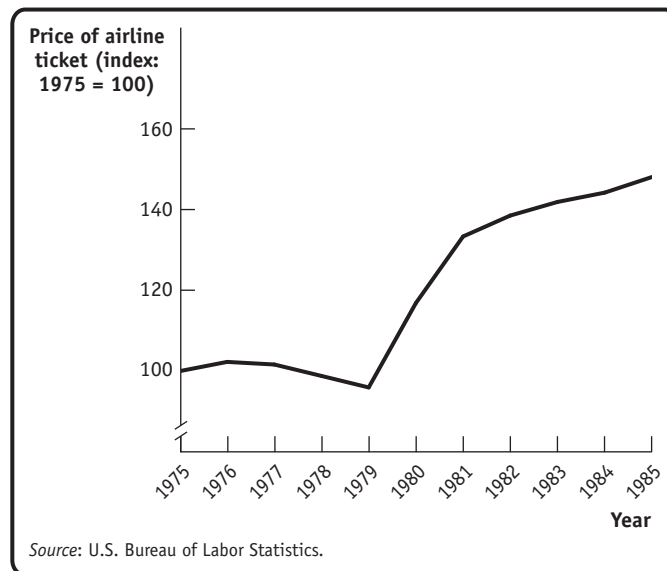
Solution

8. a. Without government restrictions, the equilibrium in the market for lobsters is at point E. The equilibrium price for lobsters is \$10 per pound. At that price, the quantity demanded and the quantity supplied are 120,000 pounds of lobsters.



- b. The demand price of 80,000 pounds of lobsters is \$14.
- c. The supply price of 80,000 pounds of lobsters is \$8.
- d. The quota rent per pound of lobster is $\$14 - \$8 = \$6$.
- e. Under the quota policy, the producer and consumer of the 80,001st pound of lobster could both be better off: the producer would be willing to sell for just a little more than \$8, and the consumer would be willing to buy for just a little less than \$14. The quota, however, prevents this trade.

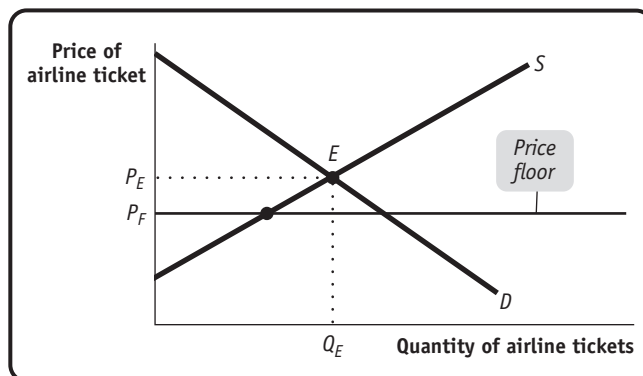
9. The accompanying diagram shows data from the U.S. Bureau of Labor Statistics on the average price of an airline ticket in the United States from 1975 until 1985, adjusted to eliminate the effect of *inflation* (the general increase in the prices of all goods over time). In 1978, the United States Airline Deregulation Act removed the price floor on airline fares, and it also allowed the airlines greater flexibility to offer new routes.



- a. Looking at the data on airline ticket prices in the diagram, do you think the price floor that existed before 1978 was binding or nonbinding? That is, do you think it was set above or below the equilibrium price? Draw a supply and demand diagram, showing where the price floor that existed before 1978 was in relation to the equilibrium price.
- b. Most economists agree that the average airline ticket price per mile traveled actually *fell* as a result of the Airline Deregulation Act. How might you reconcile that view with what you see in the diagram?

Solution

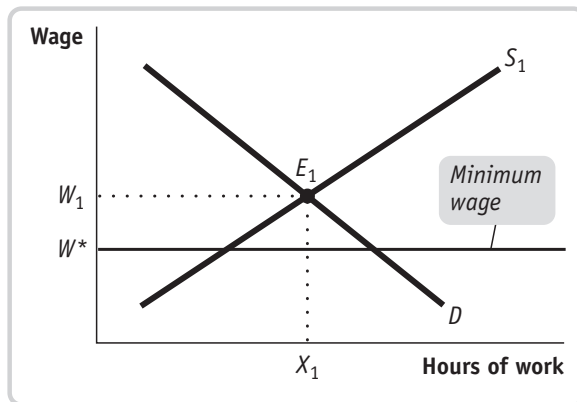
9. a. When a binding price floor—one that is set above the equilibrium price—is removed, you should expect the price of the good to fall. From looking at the data in the figure, you should think that the pre-1978 price floor was ineffective, since the price of an airline ticket actually rose after 1978. In the accompanying diagram, the price floor, P_F , is nonbinding: it is set below the equilibrium price, P_E . In that case, removing the price floor would not lead to a decrease in price.



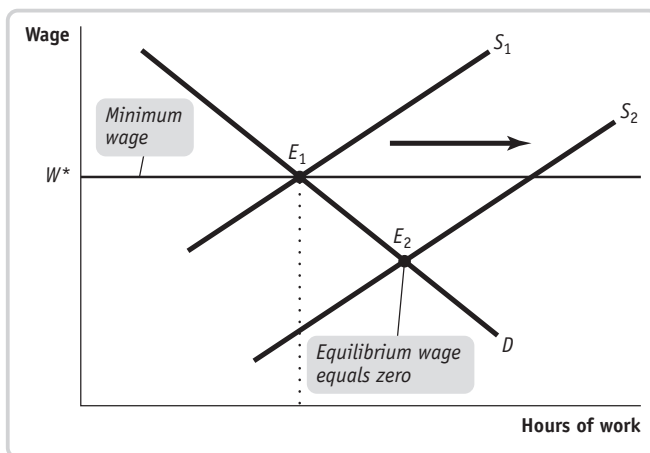
- b. Many things that determine the price of an average airline ticket changed in 1978; the removal of the price floor on airline tickets was just one of them. What also changed was that airlines now could—and did—offer longer-range flights. So although the average ticket price increased, so did the distance of the average airline flight. As a result, the cost *per mile traveled* actually fell—leading most economists to claim that the Airline Deregulation Act resulted in lower airfares. Remember that when you want to analyze the effect of one change, you have to hold *other things equal*. And in this case, many other things changed at the same time.
10. Many college students attempt to land internships before graduation to burnish their resumes, gain experience in a chosen field, or try out possible careers. The hope shared by all of these prospective interns is that they will find internships that pay more than typical summer jobs, such as waiting tables or flipping burgers.
- a. With wage measured on the vertical axis and number of hours of work on the horizontal axis, draw a supply and demand diagram for the market for interns in which the minimum wage is non-binding at the market equilibrium.
- b. Assume that a market downturn reduces the demand for interns by employers. However, many students are willing and eager to work in unpaid internships. As a result, the new market equilibrium wage is equal to zero. Draw another supply and demand diagram to illustrate this new market equilibrium.

Solution

10. a. Here the market-clearing wage, W_1 , is non-binding because it is above the minimum wage. In this case the minimum wage has no effect on the market for interns: the number of hours transacted in the market equilibrium, X_1 , is the same as if there had been no minimum wage.



- b. The economic downturn will result in an increase in the supply of interns. The supply curve will shift outward to its new position at S_2 and result in a new equilibrium wage of zero. The minimum wage is now binding.



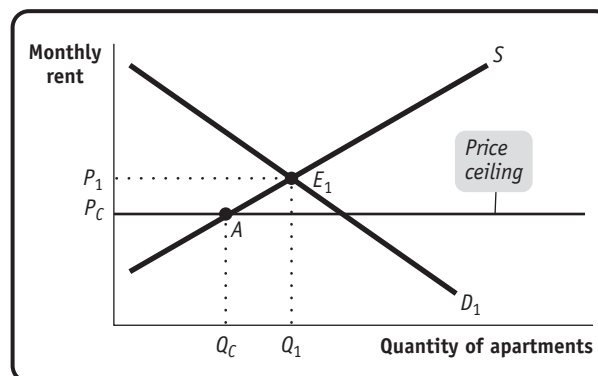
WORK IT OUT

Interactive, step-by-step help solving this problem is available to your students via

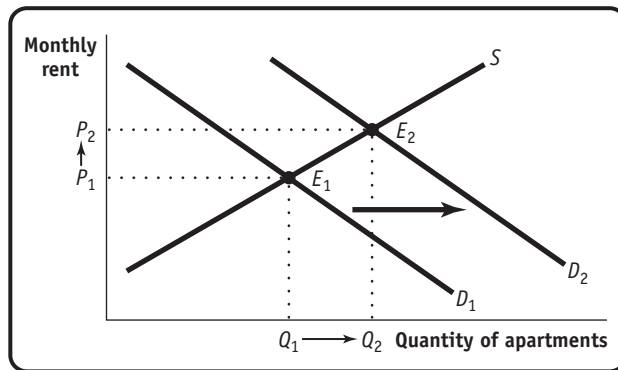


- 11.** Suppose it is decided that rent control in New York City will be abolished and that market rents will now prevail. Assume that all rental units are identical and so are offered at the same rent. To address the plight of residents who may be unable to pay the market rent, an income supplement will be paid to all low-income households equal to the difference between the old controlled rent and the new market rent.
- 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?
 - Use a second diagram to show the additional effect of the income-supplement policy on the market. What effect does it have on the market rent and quantity of rental housing supplied in comparison to your answers to part a?
 - Are tenants better or worse off as a result of these policies? Are landlords better or worse off? Is society as a whole better or worse off?
 - 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?

- 11. 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, you should expect the quality of rental housing to improve. As you learned in this chapter, 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 inefficiency 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.

