



## What you will learn in this Module:

- The meaning of quantity controls, another way government intervenes in markets
- How quantity controls create problems and can make a market inefficient
- Who benefits and who loses from quantity controls, and why they are used despite their well-known problems

# Module 9

## Supply and Demand: Quantity Controls

### Controlling Quantities

In the 1930s, New York City instituted a system of licensing for taxicabs: only taxis with a “medallion” were allowed to pick up passengers. Because this system was intended to ensure quality, medallion owners were supposed to maintain certain standards, including safety and cleanliness. A total of 11,787 medallions were issued, with taxi owners paying \$10 for each medallion.

In 1995, there were still only 11,787 licensed taxicabs in New York, even though the city had meanwhile become the financial capital of the world, a place where hundreds of thousands of people in a hurry tried to hail a cab every day. (An additional 400 medallions were issued in 1995, and after several rounds of sales of additional medallions, today there are 13,257 medallions.)

The result of this restriction on the number of taxis was that a New York City taxi medallion became very valuable: if you wanted to operate a taxi in New York, you had to lease a medallion from someone else or buy one for a going price of several hundred thousand dollars.

It turns out that this story is not unique; other cities introduced similar medallion systems in the 1930s and, like New York, have issued few new medallions since. In San Francisco and Boston, as in New York, taxi medallions trade for six-figure prices.

A taxi medallion system is a form of **quantity control**, or **quota**, by which the government regulates the quantity of a good that can be bought and sold rather than regulating the price. Typically, the government limits quantity in a market by issuing **licenses**; only people with a license can legally supply the good. A taxi medallion is just such a license. The government of New York City limits the number of taxi rides that can be sold by limiting the number of taxis to only those who hold medallions. There are many other cases of quantity controls, ranging from limits on how much foreign currency (for instance, British pounds or Mexican pesos) people are allowed to buy to the quantity of clams New Jersey fishing boats are allowed to catch.

A **quantity control**, or **quota**, is an upper limit on the quantity of some good that can be bought or sold.

A **license** gives its owner the right to supply a good or service.

Some attempts to control quantities are undertaken for good economic reasons, some for bad ones. In many cases, as we will see, quantity controls introduced to address a temporary problem become politically hard to remove later because the beneficiaries don't want them abolished, even after the original reason for their existence is long gone. But whatever the reasons for such controls, they have certain predictable—and usually undesirable—economic consequences.

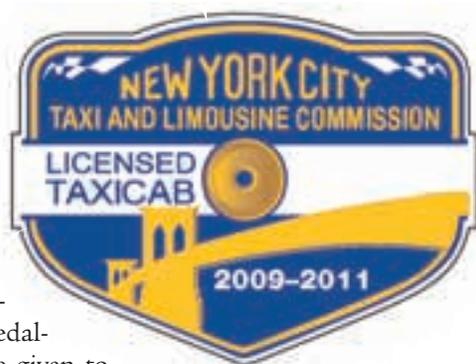
The **demand price** of a given quantity is the price at which consumers will demand that quantity.

## The Anatomy of Quantity Controls

To understand why a New York taxi medallion is worth so much money, we consider a simplified version of the market for taxi rides, shown in Figure 9.1. Just as we assumed in the analysis of rent control that all apartments were the same, we now suppose that all taxi rides are the same—ignoring the real-world complication that some taxi rides are longer, and so more expensive, than others. The table in the figure shows supply and demand schedules. The equilibrium—indicated by point *E* in the figure and by the shaded entries in the table—is a fare of \$5 per ride, with 10 million rides taken per year. (You'll see in a minute why we present the equilibrium this way.)

The New York medallion system limits the number of taxis, but each taxi driver can offer as many rides as he or she can manage. (Now you know why New York taxi drivers are so aggressive!) To simplify our analysis, however, we will assume that a medallion system limits the number of taxi rides that can legally be given to 8 million per year.

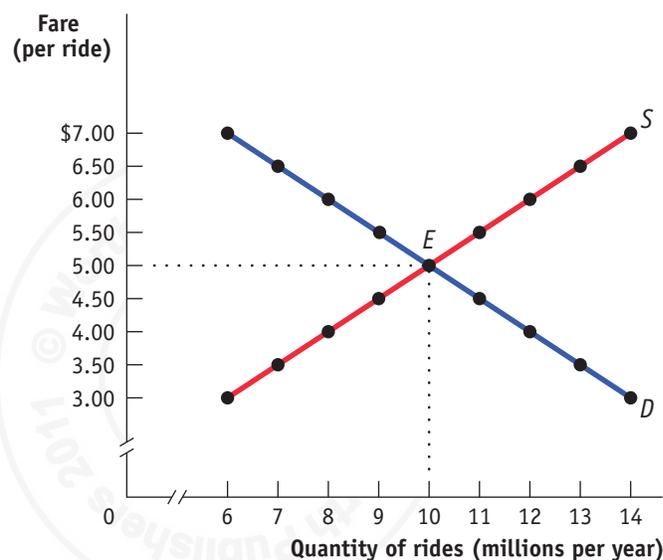
Until now, we have derived the demand curve by answering questions of the form: “How many taxi rides will passengers want to take if the price is \$5 per ride?” But it is possible to reverse the question and ask instead: “At what price will consumers want to buy 10 million rides per year?” The price at which consumers want to buy a given quantity—in this case, 10 million rides at \$5 per ride—is the **demand price** of that



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**figure 9.1**

The Market for Taxi Rides in the Absence of Government Controls



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
\$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

Without government intervention, the market reaches equilibrium with 10 million rides taken per year at a fare of \$5 per ride.

The **supply price** of a given quantity is the price at which producers will supply that quantity.

quantity. You can see from the demand schedule in Figure 9.1 that the demand price of 6 million rides is \$7 per ride, the demand price of 7 million rides is \$6.50 per ride, and so on.

Similarly, the supply curve represents the answer to questions of the form: “How many taxi rides would taxi drivers supply at a price of \$5 each?” But we can also reverse this question to ask: “At what price will producers be willing to supply 10 million rides per year?” The price at which producers will supply a given quantity—in this case, 10 million rides at \$5 per ride—is the **supply price** of that quantity. We can see from the supply schedule in Figure 9.1 that the supply price of 6 million rides is \$3 per ride, the supply price of 7 million rides is \$3.50 per ride, and so on.

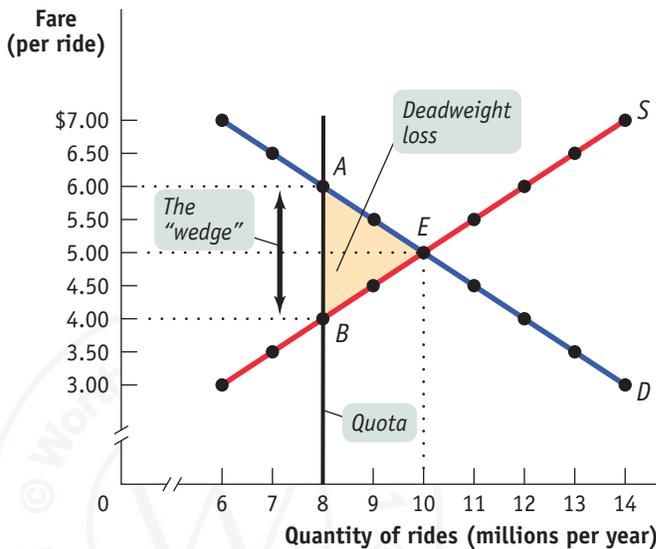
Now we are ready to analyze a quota. We have assumed that the city government limits the quantity of taxi rides to 8 million per year. Medallions, each of which carries the right to provide a certain number of taxi rides per year, are made available to selected people in such a way that a total of 8 million rides will be provided. Medallion holders may then either drive their own taxis or rent their medallions to others for a fee.

Figure 9.2 shows the resulting market for taxi rides, with the black vertical line at 8 million rides per year representing the quota. Because the quantity of rides is limited to 8 million, consumers must be at point *A* on the demand curve, corresponding to the shaded entry in the demand schedule: the demand price of 8 million rides is \$6 per ride. Meanwhile, taxi drivers must be at point *B* on the supply curve, corresponding to the shaded entry in the supply schedule: the supply price of 8 million rides is \$4 per ride.

But how can the price received by taxi drivers be \$4 when the price paid by taxi riders is \$6? The answer is that in addition to the market in taxi rides, there is also a market in medallions. Medallion-holders may not always want to drive their taxis: they

**figure 9.2**

**Effect of a Quota on the Market for Taxi Rides**



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
\$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

The table shows the demand price and the supply price corresponding to each quantity: the price at which that quantity would be demanded and supplied, respectively. The city government imposes a quota of 8 million rides by selling enough medallions for only 8 million rides, represented by the black vertical line. The price paid by consumers rises to \$6 per ride, the demand price of 8 million rides, shown by point *A*. The sup-

ply price of 8 million rides is only \$4 per ride, shown by point *B*. The difference between these two prices is the quota rent per ride, the earnings that accrue to the owner of a medallion. The quota rent drives a wedge between the demand price and the supply price. Because the quota discourages mutually beneficial transactions, it creates a deadweight loss equal to the shaded triangle.

may be ill or on vacation. Those who do not want to drive their own taxis will sell the right to use the medallion to someone else. So we need to consider two sets of transactions here, and so two prices: (1) the transactions in taxi rides and the price at which these will occur and (2) the transactions in medallions and the price at which these will occur. It turns out that since we are looking at two markets, the \$4 and \$6 prices will both be right.

To see how this all works, consider two imaginary New York taxi drivers, Sunil and Harriet. Sunil has a medallion but can't use it because he's recovering from a severely sprained wrist. So he's looking to rent his medallion out to someone else. Harriet doesn't have a medallion but would like to rent one. Furthermore, at any point in time there are many other people like Harriet who would like to rent a medallion. Suppose Sunil agrees to rent his medallion to Harriet. To make things simple, assume that any driver can give only one ride per day and that Sunil is renting his medallion to Harriet for one day. What rental price will they agree on?

To answer this question, we need to look at the transactions from the viewpoints of both drivers. Once she has the medallion, Harriet knows she can make \$6 per day—the demand price of a ride under the quota. And she is willing to rent the medallion only if she makes at least \$4 per day—the supply price of a ride under the quota. So Sunil cannot demand a rent of more than \$2—the difference between \$6 and \$4. And if Harriet offered Sunil less than \$2—say, \$1.50—there would be other eager drivers willing to offer him more, up to \$2. So, in order to get the medallion, Harriet must offer Sunil at least \$2. Since the rent can be no more than \$2 and no less than \$2, it must be exactly \$2.

It is no coincidence that \$2 is exactly the difference between \$6, the demand price of 8 million rides, and \$4, the supply price of 8 million rides. In every case in which the supply of a good is legally restricted, there is a **wedge** between the demand price of the quantity transacted and the supply price of the quantity transacted. This wedge, illustrated by the double-headed arrow in Figure 9.2, has a special name: the **quota rent**. It is the earnings that accrue to the medallion holder from ownership of a valuable commodity, the medallion. In the case of Sunil and Harriet, the quota rent of \$2 goes to Sunil because he owns the medallion, and the remaining \$4 from the total fare of \$6 goes to Harriet.

So Figure 9.2 also illustrates the quota rent in the market for New York taxi rides. The quota limits the quantity of rides to 8 million per year, a quantity at which the demand price of \$6 exceeds the supply price of \$4. The wedge between these two prices, \$2, is the quota rent that results from the restrictions placed on the quantity of taxi rides in this market.

But wait a second. What if Sunil doesn't rent out his medallion? What if he uses it himself? Doesn't this mean that he gets a price of \$6? No, not really. Even if Sunil doesn't rent out his medallion, he could have rented it out, which means that the medallion has an *opportunity cost* of \$2: if Sunil decides to use his own medallion and drive his own taxi rather than renting his medallion to Harriet, the \$2 represents his opportunity cost of not renting out his medallion. That is, the \$2 quota rent is now the rental income he forgoes by driving his own taxi. In effect, Sunil is in two businesses—the taxi-driving business and the medallion-renting business. He makes \$4 per ride from driving his taxi and \$2 per ride from renting out his medallion. It doesn't make any difference that in this particular case he has rented his medallion to himself! So regardless of whether the medallion owner uses the medallion himself or herself, or rents it to others, it is a valuable asset. And this is represented in the going price for a New York City taxi medallion. Notice, by the way, that quotas—like price ceilings and price floors—don't always have a real effect. If the quota were set at 12 million rides—that is, above the equilibrium quantity in an unregulated market—it would have no effect because it would not be binding.

A quantity control, or quota, drives a **wedge** between the demand price and the supply price of a good; that is, the price paid by buyers ends up being higher than that received by sellers. The difference between the demand and supply price at the quota amount is the **quota rent**, the earnings that accrue to the license-holder from ownership of the right to sell the good. It is equal to the market price of the license when the licenses are traded.



New York City: An empty cab is hard to find.

**Deadweight loss** is the lost gains associated with transactions that do not occur due to market intervention.

## The Costs of Quantity Controls

Like price controls, quantity controls can have some predictable and undesirable side effects. The first is the by-now-familiar problem of inefficiency due to missed opportunities: quantity controls prevent mutually beneficial transactions from occurring, transactions that would benefit both buyers and sellers. Looking back at Figure 9.2, you can see that starting at the quota of 8 million rides, New Yorkers would be willing to pay at least \$5.50 per ride for an additional 1 million rides and that taxi drivers would be willing to provide those rides as long as they got at least \$4.50 per ride. These are rides that would have taken place if there had been no quota. The same is true for the next 1 million rides: New Yorkers would be willing to pay at least \$5 per ride when the quantity of rides is increased from 9 to 10 million, and taxi drivers would be willing to provide those rides as long as they got at least \$5 per ride. Again, these rides would have occurred without the quota. Only when the market has reached the unregulated market equilibrium quantity of 10 million rides are there no “missed-opportunity rides”—the quota of 8 million rides has caused 2 million “missed-opportunity rides.” A buyer would be willing to buy the good at a price that the seller would be willing to accept, but such a transaction does not occur because it is forbidden by the quota. Economists have a special term for the lost gains from missed opportunities such as these: **deadweight loss**. Generally, when the demand price exceeds the supply price, there is a deadweight loss. Figure 9.2 illustrates the deadweight loss with a shaded triangle between the demand and supply curves. This triangle represents the missed gains from taxi rides prevented by the quota, a loss that is experienced by both disappointed would-be riders and frustrated would-be drivers.

Because there are transactions that people would like to make but are not allowed to, quantity controls generate an incentive to evade them or even to break the law. New York’s taxi industry again provides clear examples. Taxi regulation applies only to those drivers who are hailed by passengers on the street. A car service that makes pre-arranged pickups does not need a medallion. As a result, such hired cars provide much of the service that might otherwise be provided by taxis, as in other cities. In addition, there are substantial numbers of unlicensed cabs that simply defy the law by picking up passengers without a medallion. Because these cabs are illegal, their drivers are completely unregulated, and they generate a disproportionately large share of traffic accidents in New York City.

### in real life

#### The Clams of New Jersey

Forget the refineries along the Jersey Turnpike; one industry that New Jersey *really* dominates is clam fishing. In 2005 the Garden State supplied 71% of the country’s surf clams, whose tongues are used in fried-clam dinners, and 92% of the quahogs, which are used to make clam chowder.

In the 1980s, however, excessive fishing threatened to wipe out New Jersey’s clam beds. To save the resource, the U.S. government introduced a clam quota, which sets an overall limit on the number of bushels of clams that may be caught and allocates licenses to owners of fishing boats based on their historical catches.



A fried clam feast is a favorite on the Jersey shore.

Notice, by the way, that this is an example of a quota that is probably justified by broader economic and environmental considerations—

unlike the New York taxicab quota, which has long since lost any economic rationale. Still, whatever its rationale, the New Jersey clam quota works the same way as any other quota.

Once the quota system was established, many boat owners stopped fishing for clams. They realized that rather than operate a boat part time, it was more profitable to sell or rent their licenses to someone else, who could then assemble enough licenses to operate a boat full time. Today, there are about 50 New Jersey boats fishing for clams; the license required to operate one is worth more than the boat itself.

In fact, in 2004 the hardships caused by the limited number of New York taxis led city leaders to authorize an increase in the number of licensed taxis. In a series of sales, the city sold more than 1,000 new medallions, to bring the total number up to the current 13,257 medallions—a move that certainly cheered New York riders. But those who already owned medallions were less happy with the increase; they understood that the nearly 1,000 new taxis would reduce or eliminate the shortage of taxis. As a result, taxi drivers anticipated a decline in their revenues as they would no longer always be assured of finding willing customers. And, in turn, the value of a medallion would fall. So to placate the medallion owners, city officials also raised taxi fares: by 25% in 2004, and again—by a smaller percentage—in 2006. Although taxis are now easier to find, a ride now costs more—and that price increase slightly diminished the newfound cheer of New York taxi riders.

## Module 9 Review

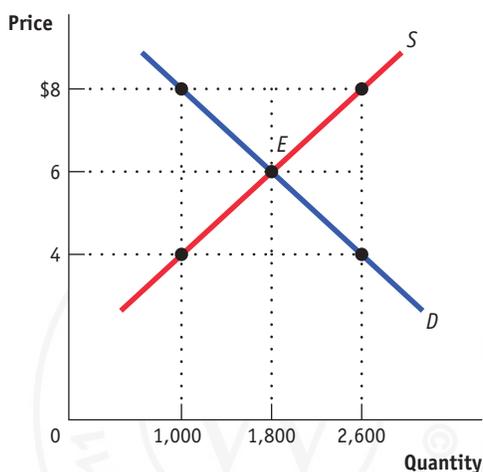
Solutions appear at the back of the book.

### Check Your Understanding

- Suppose that the supply and demand for taxi rides is given by Figure 9.1 and a quota is set at 6 million rides. Replicate the graph from Figure 9.1, and identify each of the following on your graph:
  - the price of a ride
  - the quota rent
  - the deadweight loss resulting from the quota
- Suppose the quota on taxi rides is increased to 9 million.
  - What happens to the quota rent and the deadweight loss?
- Again replicate the graph from Figure 9.1. Suppose that the quota is 8 million rides and that demand decreases due to a decline in tourism. Show on your graph the smallest parallel leftward shift in demand that would result in the quota no longer having an effect on the market.

### Multiple-Choice Questions

Refer to the graph provided for questions 1–3.



- If the government established a quota of 1,000 in this market, the demand price would be
  - less than \$4.
  - \$4.
  - \$6.
  - \$8.
  - more than \$8.
- If the government established a quota of 1,000 in this market, the supply price would be
  - less than \$4.
  - \$4.
  - \$6.
  - \$8.
  - more than \$8.
- If the government established a quota of 1,000 in this market, the quota rent would be
  - \$2.
  - \$4.
  - \$6.
  - \$8.
  - more than \$8.
- Quotas lead to which of the following?
  - inefficiency due to missed opportunities
  - incentives to evade or break the law
  - a surplus in the market
  - I
  - II
  - III
  - I and II
  - I, II, and III

5. Which of the following would decrease the effect of a quota on a market? A(n)
- a. decrease in demand
  - b. increase in supply
  - c. increase in demand
  - d. price ceiling above the equilibrium price
  - e. none of the above

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## Critical-Thinking Question

Draw a correctly labeled graph of the market for taxicab rides. On the graph, draw and label a vertical line showing the level of an effective quota. Label the demand price, the supply price, and the quota rent.

## Section 2 Review

### Summary

#### Introduction and Demand

1. The **supply and demand model** illustrates how a **competitive market**, one with many buyers and sellers of the same product, works.
2. The **demand schedule** shows the **quantity demanded** at each price and is represented graphically by a **demand curve**. The **law of demand** says that demand curves slope downward, meaning that as price decreases, the quantity demanded increases.
3. A **movement along the demand curve** occurs when the price changes and causes a change in the quantity demanded. When economists talk of **changes in demand**, they mean shifts of the demand curve—a change in the quantity demanded at any given price. An increase in demand causes a rightward shift of the demand curve. A decrease in demand causes a leftward shift.

- There are five main factors that shift the demand curve:
  - A change in the prices of related goods, such as **substitutes** or **complements**
  - A change in income: when income rises, the demand for **normal goods** increases and the demand for **inferior goods** decreases
  - A change in tastes
  - A change in expectations
  - A change in the number of consumers

### Supply and Equilibrium

- The **supply schedule** shows the **quantity supplied** at each price and is represented graphically by a **supply curve**. Supply curves usually slope upward.
- A **movement along the supply curve** occurs when the price changes and causes a change in the quantity supplied. When economists talk of **changes in supply**, they mean shifts of the supply curve—a change in the quantity supplied at any given price. An increase in supply causes a rightward shift of the supply curve. A decrease in supply causes a leftward shift.
- There are five main factors that shift the supply curve:
  - A change in **input** prices
  - A change in the prices of related goods and services
  - A change in technology
  - A change in expectations
  - A change in the number of producers
- The supply and demand model is based on the principle that the price in a market moves to its **equilibrium price**, or **market-clearing price**, the price at which the quantity demanded is equal to the quantity supplied. This quantity is the **equilibrium quantity**. When the price is above its market-clearing level, there is a **surplus** that pushes the price down. When the price is below its market-clearing level, there is a **shortage** that pushes the price up.

### Changes in Equilibrium

- An increase in demand increases both the equilibrium price and the equilibrium quantity; a decrease in demand has the opposite effect. An increase in supply reduces the equilibrium price and increases the equilibrium quantity; a decrease in supply has the opposite effect.
- Shifts of the demand curve and the supply curve can happen simultaneously. When they shift in opposite directions, the change in price is predictable but the change in quantity is not. When they shift in the same direction, the change in quantity is predictable but the change in price is not. In general, the curve that shifts the greater distance has a greater effect on the changes in price and quantity.

### Price Controls: Ceilings and Floors

- Even when a market is efficient, governments often intervene to pursue greater fairness or to please a powerful interest group. Interventions can take the form of **price controls** or **quantity controls**, both of which generate predictable and undesirable side effects, consisting of various forms of inefficiency and illegal activity.
- A **price ceiling**, a maximum market price below the equilibrium price, benefits successful buyers but creates persistent shortages. Because the price is maintained below the equilibrium price, the quantity demanded is increased and the quantity supplied is decreased compared to the equilibrium quantity. This leads to predictable problems including **inefficient allocation to consumers**, **wasted resources**, and **inefficiently low quality**. It also encourages illegal activity as people turn to **black markets** to get the good. Because of these problems, price ceilings have generally lost favor as an economic policy tool. But some governments continue to impose them either because they don't understand the effects or because the price ceilings benefit some influential group.
- A **price floor**, a minimum market price above the equilibrium price, benefits successful sellers but creates a persistent surplus: because the price is maintained above the equilibrium price, the quantity demanded is decreased and the quantity supplied is increased compared to the equilibrium quantity. This leads to predictable problems: inefficiencies in the form of **inefficient allocation of sales among sellers**, **wasted resources**, and **inefficiently high quality**. It also encourages illegal activity and black markets. The most well known kind of price floor is the **minimum wage**, but price floors are also commonly applied to agricultural products.

### Quantity Controls

- Quantity controls, or **quotas**, limit the quantity of a good that can be bought or sold. The government issues **licenses** to individuals, the right to sell a given quantity of the good. The owner of a license earns a **quota rent**, earnings that accrue from ownership of the right to sell the good. It is equal to the difference between the **demand price** at the quota amount, what consumers are willing to pay for that amount, and the **supply price** at the quota amount, what suppliers are willing to accept for that amount. Economists say that a quota drives a **wedge** between the demand price and the supply price; this wedge is equal to the quota rent. By limiting mutually beneficial transactions, quantity controls generate inefficiency. Like price controls, quantity controls lead to **deadweight loss** and encourage illegal activity.

## Key Terms

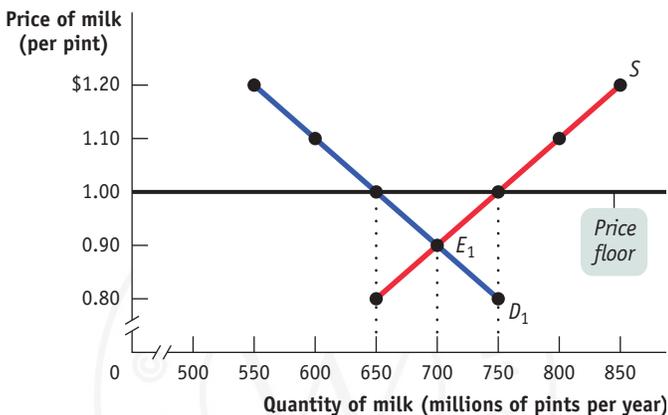
Competitive market, p. 48	Supply curve, p. 59	Inefficient allocation to consumers, p. 80
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## Problems

- 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 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.
  - A new report by the American Medical Association reveals that chocolate does, in fact, have significant health benefits.
  - The discovery of cheaper synthetic vanilla flavoring lowers the price of vanilla ice cream.
  - New technology for mixing and freezing ice cream lowers manufacturers' costs of producing chocolate ice cream.
- 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.
  - The price of tacos increases.
  - All hamburger sellers raise the price of their french fries.
  - Income falls in town. Assume that hamburgers are a normal good for most people.
  - Income falls in town. Assume that hamburgers are an inferior good for most people.
  - Hot dog stands cut the price of hot dogs.
- 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.
  - 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.
  - The price of a Christmas tree is lower after Christmas than before and fewer trees are sold.
  - 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.
- 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.
  - 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.
  - the market for St. Louis Rams cotton T-shirts
    - Case 1: The Rams win the national championship.
    - Case 2: The price of cotton increases.
  - the market for bagels
    - Case 1: People realize how fattening bagels are.
    - Case 2: People have less time to make themselves a cooked breakfast.
- 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 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.”
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.
- How would you evaluate the arguments that ticket prices are too high?
  - 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.
  - 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.
  - 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.
  - 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.
7. After several years of decline, the market for handmade acoustic guitars is making a comeback. These guitars 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.
- Environmentalists succeed in having the use of Brazilian rosewood banned in the United States, forcing luthiers to seek out alternative, more costly woods.
  - A foreign producer reengineers the guitar-making process and floods the market with identical guitars.
  - Music featuring handmade acoustic guitars makes a comeback as audiences tire of heavy metal and grunge music.
  - The country goes into a deep recession and the income of the average American falls sharply.
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.
- The playwright Christopher Marlowe, Shakespeare’s chief rival, is killed in a bar brawl.
  - The bubonic plague, a deadly infectious disease, breaks out in London.
  - To celebrate the defeat of the Spanish Armada, Queen Elizabeth declares several weeks of festivities, which involves commissioning new plays.
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:
- the market for an hour of babysitting services in Middling today
  - 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
  - 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
10. Use a diagram to illustrate how each of the following events affects the equilibrium price and quantity of pizza.
- The price of mozzarella cheese rises.
  - The health hazards of hamburgers are widely publicized.
  - The price of tomato sauce falls.
  - The incomes of consumers rise and pizza is an inferior good.
  - Consumers expect the price of pizza to fall next week.
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.
- Draw a supply curve for Picasso Blue Period works. Why is this supply curve different from ones you have seen?
  - 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.
  - 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.
12. Draw the appropriate curve in each of the following cases. Is it like or unlike the curves you have seen so far? Explain.
- the demand for cardiac bypass surgery, given that the government pays the full cost for any patient
  - the demand for elective cosmetic plastic surgery, given that the patient pays the full cost
  - the supply of Rembrandt paintings
  - the supply of reproductions of Rembrandt paintings
13. 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.
- 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. 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?
14. 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.
15. 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

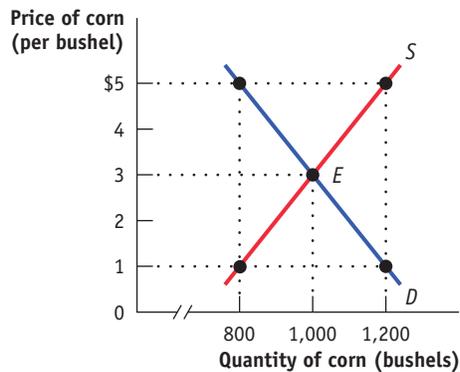
know their children are getting milk at school. How much will the dairy program now cost the government?

- 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?
16. As noted in the text, European governments tend to make greater use of price controls than does the U.S. government. For example, the French government sets minimum starting 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?
17. Until recently, the standard number of hours worked per week for a full-time job in France was 39 hours, similar to 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.
18. 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.



- 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.

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

19. 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

- Use a diagram to show the effect of the quota on the market for swordfish in 1991.
- How do you think fishermen will change how they fish in response to this policy?



