CHAPTER

2

SUPPLY AND DEMAND

In 1979 I was working for the federal government and living in Washington, D.C. Outside my apartment window stood a gas station. With 16 pumps, it was larger than most, but otherwise typical of the modern urban self-serve station.

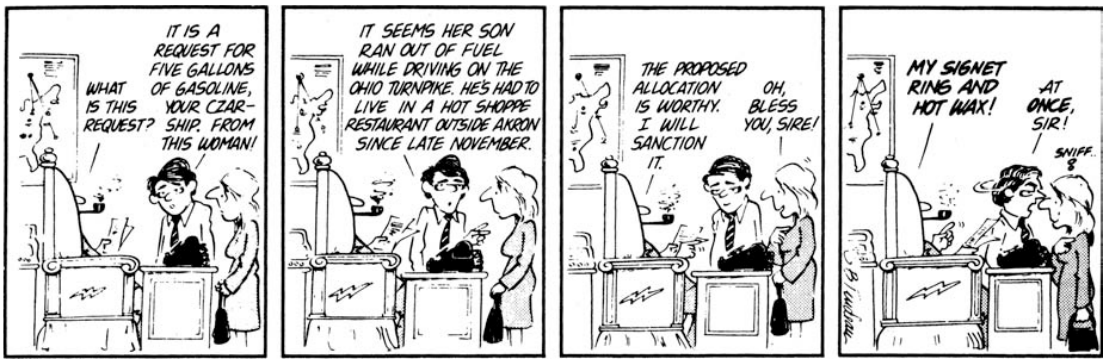
In April of that year, a major oil supply interruption occurred in the Mideast, which sent gasoline prices skyrocketing. To keep prices from rising further, the Carter administration implemented a complex system of fuel allocations and price controls. One result was that many urban markets got substantially less gasoline than motorists wanted to buy at the regulated prices. At the station outside my window, a line of cars regularly stretched for several blocks.

Quarrels over position in such queues were common, and many motorists got into fistfights and shouting matches. One was shot and killed for butting into line. Tensions continued until the gasoline lines dwindled with the passing of the summer travel months.

The government's system of price controls and allocations tried to accomplish a task we usually relegate to markets. The Washington experience was typical of similar interventions in other times and places. These programs typically produce confusion and conflict. Of course, the unfettered market can itself produce outcomes we don't like. But rarely does it fail to allocate available supplies in a smooth, efficient manner.

CHAPTER PREVIEW

In this chapter we will explore why markets function so smoothly most of the time and why attempts at direct allocation are so often problematic. The early part of the chapter will look at basic supply and demand analysis. First, we'll review the usual descriptive features of supply and demand analysis covered in the



introductory course. Next, we'll see that, for given attributes of buyers and sellers, the unregulated competitive market yields the best attainable outcome, in the sense that any other combination of price and quantity would be worse for at least some buyers or sellers.

Despite this attractive feature, market outcomes often do not command society's approval. Concern for the well-being of the poor has motivated the governments of every Western society to intervene in a variety of ways—for instance, by adopting laws that peg prices above or below their equilibrium levels. Such laws, we will see, almost always generate harmful, if unintended, consequences.

A generally more efficient solution to the problems of the poor is to boost their incomes directly. The law of supply and demand cannot be repealed by the legislature. But legislatures can alter the underlying forces that govern the shape and position of supply and demand schedules.

Finally, we will explore supply and demand analysis as a useful device for understanding how taxes affect equilibrium prices and quantities. In particular, it helps dispel the myth that a tax is paid primarily by the party on whom it is directly levied; rather, the burden of a tax falls most heavily on whichever side of the market is least able to avoid it.

SUPPLY AND DEMAND CURVES

Our basic tool for analyzing market outcomes is supply and demand analysis, already familiar to most of you from your introductory course. Let us begin with the following working definition of a market.

> **Definition:** A market consists of the buyers and sellers of a good or service.

Some markets are confined to a single specific time and location. For example, all the participating buyers and sellers (or at least their designated representatives) gather together in the same place for an antiques auction. Other markets span vast geographic territory, and most participants in them never meet or even see one another. The New York Stock Exchange is such a market. The Internet provides access to markets of this type for many goods.

Sometimes the choice of market definition will depend on the bias of the observer. In antitrust cases, for example, current policy prohibits mergers between companies whose combined share of the market would exceed a given threshold. Accordingly, government prosecutors who oppose a merger will often try to define markets as narrowly as possible, thereby making the combined market share as large as possible. The merging companies, by contrast, tend to view their markets in much broader terms, which naturally makes their combined market share smaller. The Stouffer's Corporation, when it wanted to merge with Nestlé, told the

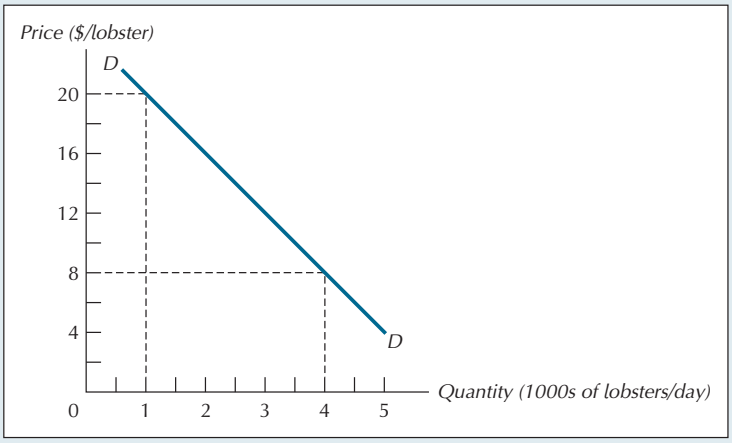


FIGURE 2.1
The Demand Curve for Lobsters in Hyannis Mass., July 20, 2009
The demand curve tells the quantities buyers will wish to purchase at various prices. Its key property is its downward slope; when price falls, the quantity demanded increases. This property is called the law of demand.

court that both firms were in the business of selling "frozen dinners." The Justice Department argued to the same court that the two companies were in the business of selling "high-priced ethnic entrees." In general, as in this particular instance, the best market definition will depend on the purpose at hand.

Over the years, economists have increasingly recognized that even subtle product differences matter a great deal to some consumers, and the trend in analysis has been toward ever narrower definitions of goods and markets. Two otherwise identical products are often classified as separate if they differ only with respect to the times or places they are available. An umbrella on a sunny day, for example, is in this sense a very different product from an umbrella during a downpour. And the markets for these two products behave very differently indeed. (My editor tells me that low-quality umbrellas in Manhattan sell for $10 on rainy days, only $5 on sunny days.)

To make our discussion concrete, let us consider the workings of a specific market—say, the one for $1\frac{1}{2}$-pound lobsters in Hyannis, Massachusetts, on July 20, 2009. For this market, our task is to explain both the price of lobsters and the quantity traded. We begin with the basic *demand curve,* a simple mathematical relationship that tells how many lobsters buyers wish to purchase at various possible prices (holding all else constant). The curve *DD* depicted in Figure 2.1, for example, tells us that 4000 lobsters will be demanded at a price of $8 each, 1000 at a price of $20, and so on.

If a visitor from Mars were told only that lobsters sell for $8 each, he would have no way of knowing whether they were cheap or expensive. In 1900, an $8 lobster would have been out of reach of all but the wealthiest consumers. In 2009, by contrast, lobsters would have been considered an incredible bargain at that price. Unless otherwise stated, the price on the vertical axis of the demand curve diagram will refer to the **real price** of the good, which means its price relative to the prices of all other goods and services. Thus, the prices on the vertical axis of Figure 2.1 represent lobster prices on July 20, 2009, and the context within which those prices are interpreted by buyers is the set of prices of all other goods on that same date.

real price of a product its price relative to the prices of other goods and services.

The discussion above describes the demand curve as a schedule telling how much of a product consumers wish to purchase at various prices. This is called the *horizontal interpretation* of the demand curve. Under this interpretation, we start with price on the vertical axis and read the corresponding quantity demanded on the horizontal axis. For instance, at a price of $20 per lobster, the demand curve in Figure 2.1 tells us that the quantity demanded will be 1000 lobsters per day.

A second interpretation of the demand curve is to start with quantity on the horizontal axis and then read the marginal buyer's reservation price on the vertical axis. Thus when the quantity of lobsters sold is 4000 per day, the demand curve in

Figure 2.1 tells us that the marginal buyer's reservation price is $8 per lobster. This second way of reading the demand curve is called the *vertical interpretation*.

The demand curve shown in Figure 2.1 happens to be linear, but demand curves in general need not be. The key property assumed of them is that they are downward sloping: the quantity demanded rises as the price of the product falls. This property is often called the **law of demand.** Although we will see in Chapter 4 that it is theoretically possible for a demand curve to be upward sloping, such exceptions are virtually never encountered in practice. To be sure, the negative slope of the demand curve accords in every way with our intuitions about how people respond to rising prices.

law of demand the empirical observation that when the price of a product falls, people demand larger quantities of it.

As we will see in more detail in Chapter 4, there are normally two independent reasons for the quantity demanded to fall when price rises. One is that many people switch to a close substitute. Thus, when lobster gets more expensive, some consumers may switch to crab, others to meat or poultry. A second reason is that people are not *able* to buy as much as before. Incomes, after all, go only so far. When price goes up, it is not possible to buy as much as before unless we purchase less of something else.

The demand curve for a good is a summary of the various cost-benefit calculations that buyers make with respect to the good, as we will see in greater detail in the next chapter. The question each person faces is, "Should I buy the product?" (and usually, "If so, how much of it?"). The cost side of the calculation is simply the price of the product (and implicitly, the other goods or services that could be bought with the same money). The benefit side is the satisfaction provided by the product. The negative slope of the demand schedule tells us that the cost-benefit criterion will be met for fewer and fewer potential buyers as the price of the product rises.

On the seller's side of the market, the corresponding analytical tool is the supply schedule. A hypothetical schedule for our lobster market is shown as line *SS* in Figure 2.2. Again, the linear form of this particular schedule is not a characteristic feature of supply schedules generally. What these schedules do tend to have in common is their upward slope: The quantity supplied rises as the price of a product rises. This property can be called the **law of supply.** For a supplier to be willing to sell a product, its price must cover the marginal cost of producing or acquiring it. As we will see in detail in Chapter 9, the cost of producing additional units often tends to rise as more units are produced, especially in the short run. When this is the case, increased production is profitable only at higher prices.

law of supply the empirical observation that when the price of a product rises, firms offer more of it for sale.

In our lobster market, the reasons for this are clear. Suppliers harvest the lobsters closest to shore first, and then work their way farther offshore as they try to enlarge their catch. The more lobsters they try to harvest, the farther they have to go, and hence the more it costs.

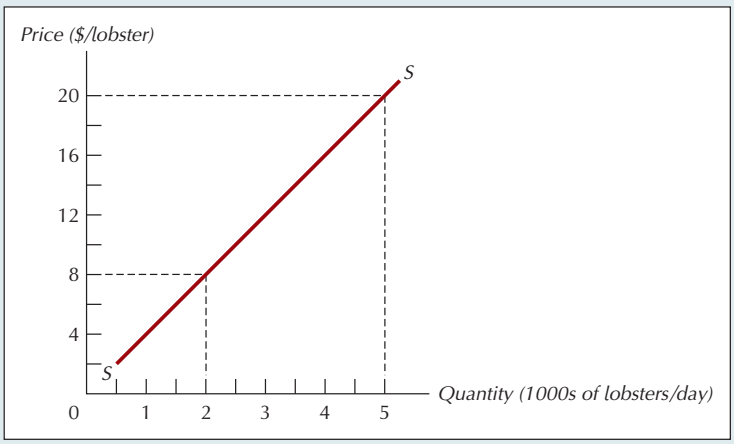


FIGURE 2.2
A Supply Schedule for Lobsters in Hyannis, Mass., July 20, 2006
The upward slope of the supply schedule reflects the fact that costs tend to rise when producers expand production in the short run.

Another factor contributing to the upward slope of the supply curve is substitution on the part of fishermen. As the price of lobsters increases, more producers switch to lobsters, rather than continue to fish for, say, cod.

Like demand curves, supply curves can be interpreted either horizontally or vertically. Under the horizontal interpretation, we begin with a price, then go over to the supply curve to read the quantity that sellers wish to sell at that price on the horizontal axis. For instance, at a price of $8 per lobster, sellers in Figure 2.2 wish to sell 2000 lobsters per day.

Under the vertical interpretation, we begin with a quantity, then go up to the supply curve to read the corresponding marginal cost on the vertical axis. For example, if sellers in Figure 2.2 are currently supplying 5000 lobsters per day, the opportunity cost of the last lobster supplied by the marginal seller would be $20. In other words, the supply curve tells us that the marginal cost of delivering the 5000th lobster is $20. If someone could deliver a 5001st lobster for less than $20, she would have had an incentive to do so, in which case the quantity of lobster supplied at a price of $20 would not have been 5000 per day to begin with. By similar reasoning, when the quantity of lobster supplied is 2000 per day, the marginal cost of delivering another lobster must be $8.

An alternative way of describing the supply schedule is to call it the set of price-quantity pairs for which suppliers are satisfied. The term "satisfied" has a technical meaning here, which is that any point on the supply schedule represents the quantity that suppliers want to sell, *given the price they face*. They would obviously be happy to get even higher prices for their offerings. But for any given price, suppliers would consider themselves worse off if forced to sell either more or less than the corresponding quantity on the supply schedule. If, for example, the price of lobsters in Figure 2.2 were $8, suppliers would not be satisfied selling either more or fewer than 2000 lobsters a day.

The demand schedule may be given a parallel description. It is the set of price-quantity pairs for which buyers are satisfied in precisely the same sense. At any given price, they would consider themselves worse off if forced to purchase either more or less than the corresponding quantity on the demand schedule.

EQUILIBRIUM QUANTITY AND PRICE

With both the supply and demand schedules in hand, we can describe the *equilibrium quantity and price* of lobsters. It is the price-quantity pair at which both buyers and sellers are satisfied. Put another way, it is the price-quantity pair at which the supply and demand schedules intersect. Figure 2.3 depicts the equilibrium in our lobster market, at which a total of 3000 lobsters is traded at a price of $12 each.

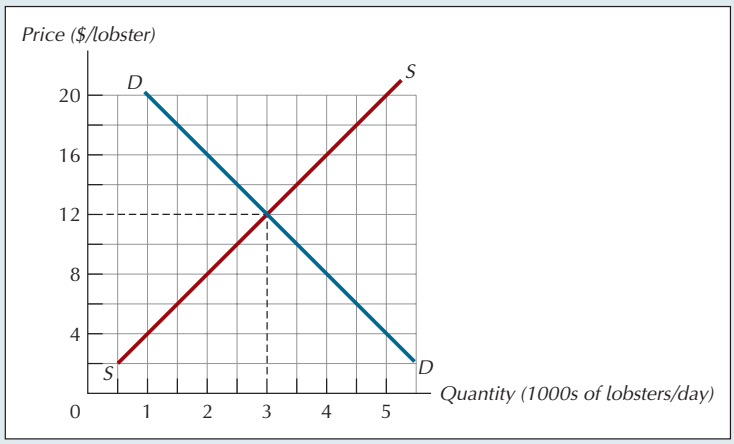
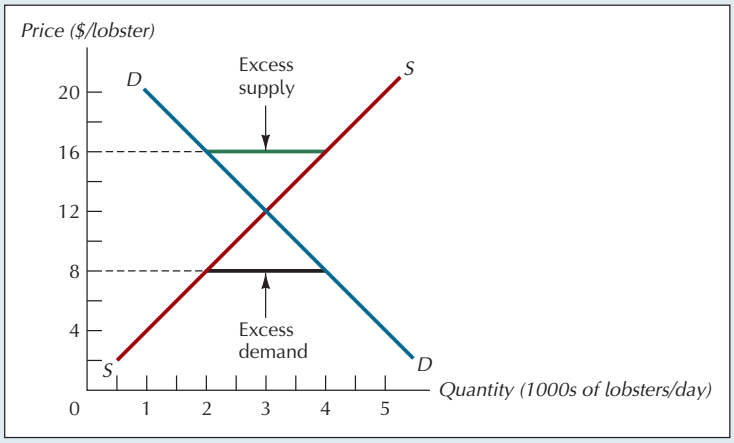


FIGURE 2.3
Equilibrium in the Lobster Market
The intersection of the supply and demand curves represents the price-quantity pair at which all participants in the market are "satisfied": Buyers are buying the amount they want to buy at that price, and sellers are selling the amount they want to sell.

FIGURE 2.4
Excess Supply and Excess Demand
When price exceeds the equilibrium level, there is excess supply, or surplus. When price is below the equilibrium level, there is excess demand, or shortage.



If we were at any price-quantity pair other than the one in Figure 2.3, either buyers or sellers, or both, would be dissatisfied in the sense described above. If the price happened for some reason to lie above the $12 equilibrium level, sellers would tend to be the ones who are frustrated. At a price of $16, for example, buyers would purchase only 2000 lobsters, whereas sellers would offer 4000. (See Figure 2.4.) Buyers would be satisfied at a price of $16, but sellers would not. A situation in which price exceeds its equilibrium value is called one of **excess supply,** or *surplus*. At $16, there is an excess supply of 2000 lobsters.

excess supply the amount by which quantity supplied exceeds quantity demanded.

If, by contrast, the price happened to lie below the equilibrium price of $12, then buyers would be the ones dissatisfied. At a price of $8, for example, they would want to purchase 4000 lobsters, whereas suppliers would be willing to sell only 2000. A situation in which price lies below its equilibrium value is referred to as one of **excess demand,** or *shortage*. At a price of $8 in this lobster market, there is an excess demand of 2000 lobsters. At the market equilibrium price of $12, both excess demand and excess supply are exactly zero.

excess demand the amount by which quantity demanded exceeds quantity supplied.

EXERCISE 2.1

At a price of $4 in this hypothetical lobster market, how much excess demand for lobsters will there be? How much excess supply will there be at a price of $20?

ADJUSTMENT TO EQUILIBRIUM

When price differs from the equilibrium price, trading in the marketplace will be constrained—by the behavior of buyers if the price lies above equilibrium, by the behavior of sellers if below. At any price other than the equilibrium price, one side or the other of the market is dissatisfied. At prices above equilibrium, for example, sellers are not selling as much as they want to. The impulse of a dissatisfied seller is to reduce the price. In the seafood business, after all, the rule of thumb is "sell it or smell it." At a price of $16 each, 2000 lobsters are being sold, but another 2000 go unclaimed. Each seller reasons, correctly, that if he were to cut his price slightly, while others remained at $16, he could move all his unsold lobsters. Buyers will abandon sellers who charge $16 in favor of those who charge only $15.95. But then the deserted sellers themselves have a motive for cutting price. And if all sellers cut price to $15.95, each will again have a large quantity of unsold lobsters. Downward

pressure on price will persist as long as there remain any dissatisfied sellers—that is, until price falls to its equilibrium value.

When price is below $12, buyers are dissatisfied. Under these conditions, sellers will realize that they can increase their prices and still sell as much as they wish to. This upward pressure on price will persist until price reaches its equilibrium value. Put another way, consumers will start bidding against each other in the hope of seeing their demands satisfied.

An extraordinary feature of this equilibrating process is that no one consciously plans or directs it. The actual steps that consumers and producers must take to move toward equilibrium are often indescribably complex. Suppliers looking to expand their operations, for example, must choose from a bewilderingly large menu of equipment options. Buyers, for their part, face literally millions of choices about how to spend their money. And yet the adjustment toward equilibrium results more or less automatically from the natural reactions of self-interested individuals facing either surpluses or shortages.

SOME WELFARE PROPERTIES OF EQUILIBRIUM

Given the attributes—tastes, abilities, knowledge, incomes, and so on—of buyers and sellers, the equilibrium outcome has some attractive properties. Specifically, we can say that no reallocation can improve some people's position without harming the position of at least some others. *If price and quantity take anything other than their equilibrium values, however, it will always be possible to reallocate so as to make at least some people better off without harming others.*

Sticking with the lobster example, suppose price is $8, with suppliers therefore offering only 2000 lobsters. As indicated in Figure 2.5, the vertical interpretation of the demand curve tells us that when only 2000 lobsters are available, buyers are willing to pay $16. Similarly, the vertical interpretation of the supply curve tells us that when 2000 lobsters a day are supplied, the marginal cost of delivering another lobster is only $8. When the value to the buyer of the last lobster caught ($16) is higher than the cost of harvesting it ($8), there is room to cut a deal.

Suppose, for example, a dissatisfied buyer were to offer a supplier $10 for a lobster. The supplier would gladly sell an additional lobster at this price (since, at 2000 lobsters, an additional lobster costs only $8 to harvest). This transaction would improve the buyer's position by $6 (the difference between the $16 value he attaches to the lobster and the $10 he paid for it). It would also improve the seller's

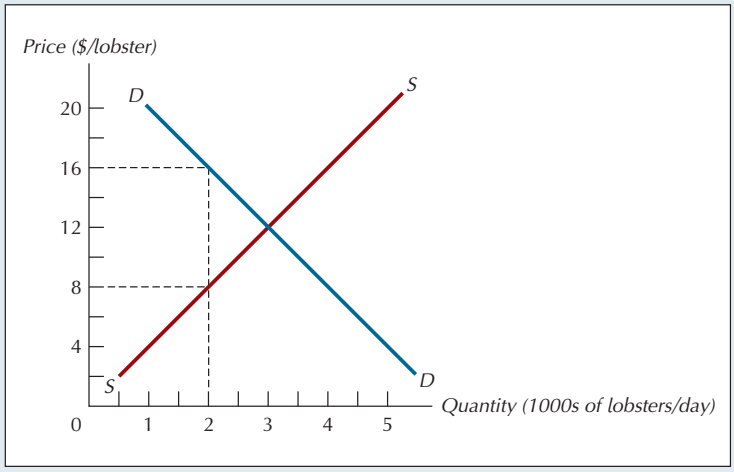


FIGURE 2.5
An Opportunity for Improvement in the Lobster Market
When the quantity traded in the market is below (or above) the equilibrium quantity, it is always possible to reallocate resources in such a way that some people are made better off without harming others. Here, a dissatisfied buyer can pay a seller $10 for an additional lobster, thus making both parties better off.

position by $2 (the difference between the $10 she got and the $8 cost of harvesting the extra lobster). No one suffers any harm from this transaction (except the extra lobster!), and the participants reap $8 of additional benefit from it ($6 for the buyer, $2 for the seller). A similar argument can be made concerning any price below the equilibrium value. For any such price, it is always possible to make some people better off without hurting others.

What if the price had been higher than the equilibrium price to begin with? Suppose price is $16 with trading therefore limited by buyers' demands for 2000 lobsters. (Again, see Figure 2.5.) Now a dissatisfied seller can propose a transaction that will make both the seller and some buyers better off. Suppose, for example, a seller offers an additional lobster for sale for $14. Since buyers value additional lobsters at $16, whoever buys it will be better off by $2. And since lobsters cost only $8 to harvest, the seller will be better off by $6. Again, no one is injured by this transaction, and again the two parties gain a total of $8.

Thus, no matter whether price starts out above or below its equilibrium value, a mutually beneficial transaction will always be possible. We'll examine the welfare properties of the market system in much greater detail in later chapters. But for now, suffice it to say that the equilibrium price and quantity constitute the best outcome attainable, given the initial attributes and endowments of buyers and sellers.

FREE MARKETS AND THE POOR

The fact that market equilibrium is efficient in the sense just described does not mean that it is necessarily desirable in any absolute sense. All markets may be in perfect equilibrium, for example, and yet many people may lack sufficient incomes to purchase even the bare necessities of life. Saying market equilibrium is efficient does not challenge the notion that being poor is difficult, often even painful. Efficiency says merely that, *given the low incomes of the poor,* free exchange enables them to do the best they can. One can hold this view and still believe it desirable to provide public assistance to poor people.

Concern for the well-being of the poor motivates most societies to try to intervene, as in the gasoline price control example mentioned earlier. The difficulty, as in that example, is that these interventions often produce unintended harmful consequences. Indeed, many clearly do more harm than good. As we will see, a more thorough understanding of the workings of the market mechanism would prevent many of the most costly consequences of our current approach.

EXAMPLE 2.1 **Denied boarding compensation.**

What are the efficiency and distributional implications of handling excess demand for seats on overbooked flights through a first-come, first-served policy as opposed to an auction mechanism?

Commercial airlines frequently issue more reservations than there are seats on a flight. Because many reservation holders fail to show up for their flights, this practice seldom causes difficulty. Occasionally, however, 160 passengers will show up for a flight on which there are only, say, 150 seats. Before the late 1970s, airlines dealt with overbooked flights by boarding passengers on a first-come, first-served basis.

This solution gives insufficient weight to the interests of passengers with pressing needs who may be a bit late to arrive at their final destinations on time. With this problem clearly in mind, the Civil Aeronautics Board (CAB), the government agency that used to regulate the commercial aviation industry, proposed a simple regulation. When too many people showed up for a flight, the airline would be required to call

for volunteers to abandon their seats in return for either a cash payment or an in-kind payment, such as a free air ticket. The airline would be required to keep increasing its offer until it got enough volunteers.

The advantage of the CAB proposal was that it would allow passengers to decide for themselves how pressing their schedules were. People with important meetings could simply refuse to volunteer. Others could agree to wait a few hours, often in return for several hundred dollars or a free trip to Hawaii. By comparison with the first-come, first-served solution, the CAB proposal promised a better outcome for all passengers.

Or at any rate, so it seemed. A consumer-action group immediately objected to the CAB's proposal on the grounds that it was unfair to low-income passengers. The group's complaint was that the auction method of soliciting volunteers would almost always result in the poorest ticket holders being the ones to wait for the next flight.

Why is an auction a better way to allocate seats on an over-booked flight than first-come, first-served?

Now, a poor person will surely be more likely to find a cash payment a compelling reason to volunteer. But by volunteering, a person says that the cash payment is *worth* the wait. The world would indeed be a better place if poor people had higher incomes and were not tempted by their poverty to give up their seats on airplanes. But the consumer group was not proposing to give the poor higher incomes. Rather, it wanted the industry to stick with a system that bumped passengers from overbooked flights irrespective of the value they attached to remaining on board.

It is hard to see how poor people's interests would be served by preventing them from earning extra cash by volunteering to wait for the next flight. And in the end, the CAB adopted its denied-boarding-compensation proposal, to the benefit of air travelers at all income levels.

Many critics of the market system complain that it is unfair to ration goods and services by asking how much people are willing to pay for them. This criterion, they point out, gives short shrift to the interests of the poor. But as Example 2.1 clearly illustrates, serious contradictions plague alternative schemes of allocation. Consider again our hypothetical lobster market. Suppose we are concerned that the equilibrium price of $12 will exclude many deserving poor persons from experiencing the pleasure of a lobster dinner. And suppose that, with this in mind, we adopt a system that periodically gives free lobsters to the poor. Wouldn't such a system represent a clear improvement in the eyes of any person who feels compassion for the poor?

The answer, as in Example 2.1, is that for the same cost we can do even better. When a poor person, or indeed even a rich person, does not buy lobster because the price is too high, she is saying, in effect, that she would prefer to spend her money on other things. If we gave her a lobster, what would she want to do with it? In an ideal world, she would immediately sell it to someone willing to pay the $12 equilibrium price for it. We know there will be such persons because some of the lobsters that would have been bought for $12 were instead given to the poor. The poor person's sale of the lobster to one of these people will bring about a clear improvement for both parties—for the buyer, or else he would not have bought it, and for the seller because the lobster is worth less than $12 to her.

The practical difficulty, as we will see in detail in later chapters, is that it would take time and effort for our hypothetical poor person to find a buyer for the lobster. In the end, she would probably eat it herself. True enough, she might enjoy her lobster dinner. But by her own reckoning, she would have enjoyed the $12 even more.

The problem is the same with gasoline price controls. The controls were implemented in the sincere belief they were needed to protect the poor from sharply higher gasoline prices. Their effect, however, was to induce a host of behaviors that helped neither rich nor poor.

Despite statements to the contrary by critics of the market system, people are highly responsive to energy prices when they make decisions about how to spend their incomes. If gasoline costs $3.00/gal, for example, many people will form car pools or purchase fuel-efficient cars, even though they would do neither if price were only $1.50/gal. Whether a long trip is considered worth taking also clearly depends on the price of gasoline.

Regardless of whether fuel is in short supply, it is in everyone's interest—rich or poor—to use it for the activities people value most. But the costs of a policy that does not do this are particularly high when fuel is scarce. Selling gasoline for less than the equilibrium price is just such a policy. It encourages people to use gasoline in wasteful ways.

RENT CONTROLS

It has been said that the surest way to destroy a city, short of dropping a nuclear bomb on it, is to pass a rent control law. Such laws, like so many others, are motivated by an honest concern for the well-being of low-income citizens. But their economic consequences are no less damaging for being unintended.

Basic supply and demand analysis is again all we need to see clearly the nature of the difficulties. Figure 2.6 depicts the supply and demand schedules for a hypothetical urban apartment market. The equilibrium rent in this market would be $600/month, and at this level there would be 60,000 apartments rented. The city council, however, has passed a law that holds rents at R_c = $400/month, or $200 below the market-clearing value. R_c in this example constitutes a **price ceiling** for rents, a level beyond which rents are not permitted to rise. At $400/month, buyers would like to rent 80,000 apartments, but suppliers are willing to offer only 40,000. There is an excess demand of 40,000 units. And if the rent control level remains fixed at $400/month, excess demand will grow over time as population grows and inflation reduces the value of money.

Why are rent-controlled apartments less well maintained than unregulated units?

In an unregulated market, the immediate response would be for rents to rise sharply. But here the law prevents them from rising above R_c. Yet there are other ways the pressures of excess demand can make themselves felt. One is for owners to spend less on maintaining their rental units. If there are two renters knocking at the door of each vacant apartment, clogged drains, peeling paint, broken thermostats, and the like are not apt to receive prompt attention.

price ceiling level above which the price of a good is not permitted by law to rise.

Nor are these the most serious difficulties. With an offering of only 40,000 apartments per month, we see in Figure 2.6 that renters would be willing to pay as much as $800/month for an apartment (again, the vertical interpretation of the

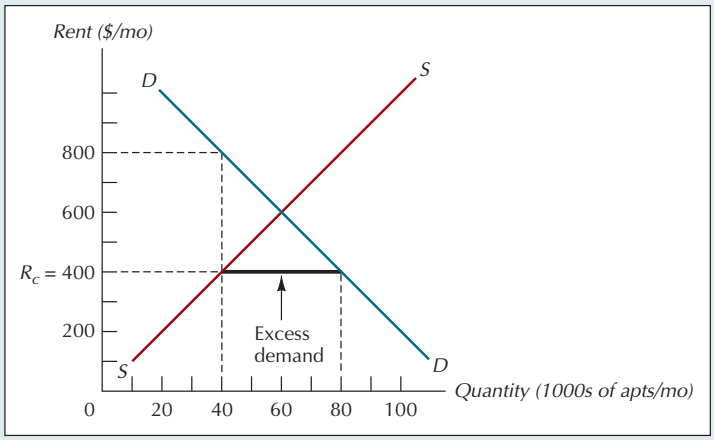


FIGURE 2.6
Rent Controls
With the rent control level set at $400 a month, there is an excess demand of 40,000 apartments a month.

demand curve). This pressure almost always finds ways, legal or illegal, of expressing itself. In New York City, for example, it is not uncommon to see "finder's fees" or "key deposits" as high as several thousand dollars. Owners who cannot charge a market-clearing rent for an apartment also have the option of converting it to a condominium or co-op, which enables them to sell their asset for a price much closer to its true economic value.

Even when rent-controlled apartment owners do not hike their prices in these various ways, serious misallocations result. A widow steadfastly remains in her seven-room apartment even after her children have left home because it is cheaper than alternative dwellings not covered by rent control. It would be better for all concerned if she relinquished that space to a larger family. But under rent controls, she has no economic incentive to do so.

EXAMPLE 2.2

Suppose the rent control is lowered (strengthened) to $200/month. What is the excess demand, and how does it compare with the excess demand when rents were limited (more loosely) to $400/month?

At $200/month, buyers would like to rent 100,000 apartments, but suppliers are willing to offer only 20,000. Thus there is an excess demand of 80,000 units. The excess demand is greater than the excess demand of 40,000 units at the $400/month rent control.

EXERCISE 2.2

In the market for apartments described in Figure 2.6, what would happen if the rent control level were set at $625/mo?

In response to the kinds of problems described above, some rent-control programs have been modified to allow landlords to raise rents when a tenant moves out of an apartment. Such changes reduce, but do not eliminate, misallocations. And they may even create new problems. For example, a landlord who knows that a tenant's departure would permit a rent increase may take any available lawful steps to make the tenant's life unpleasant if he remains.

There are much more effective ways to help poor people than to give them cheap gasoline, rent-controlled apartments, or free lobsters. One would be to give them additional income and let them decide for themselves how to spend it.

Chapter 18 examines some of the practical difficulties involved in transferring additional purchasing power into the hands of the poor. In brief, the most pressing problem is that it is hard to target cash to the genuinely needy without attracting others who could fend for themselves. But as we will see, economic reasoning also suggests practical ways to overcome this difficulty. There are no simple or easy solutions. But given the enormous losses caused by policies that keep prices below their equilibrium levels, these issues deserve our most serious attention.

PRICE SUPPORTS

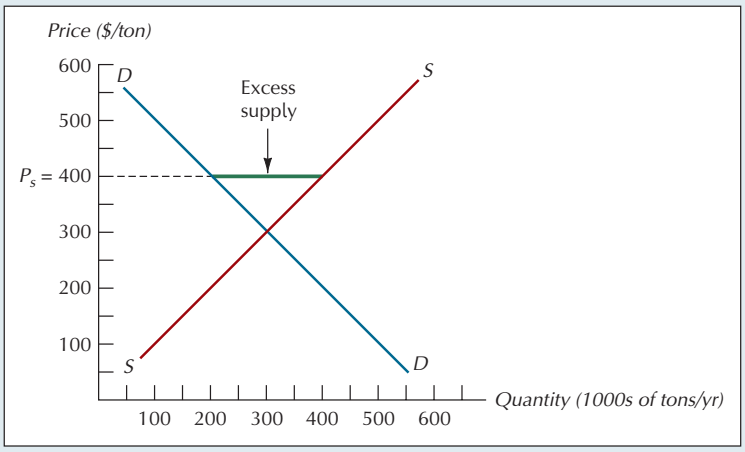
price floor a minimum price for a good, established by law, and supported by government's offer to buy the good at that price.

Rent controls are an example of a price ceiling that prevents the price from rising to its equilibrium level. For many agricultural products, the government's policy has been to impose not ceilings but *price supports,* or **price floors,** which keep prices above their equilibrium levels. By contrast to price ceilings, which required merely the announcement of a level beyond which prices could not rise, price supports require the government to become an active buyer in the market.

Figure 2.7, for example, depicts a price support level of P_s in the market for soybeans. Because P_s is above the equilibrium price, there is an excess supply of 200,000 tons/yr. To maintain the price at P_s = \$400/ton, the government must purchase 200,000 tons/yr of soybeans. Otherwise farmers would face powerful incentives to cut their prices.

An important purpose of farm price supports is to ensure prices high enough to provide adequate incomes for farm families. In practice, however, the supports have proved a costly and inefficient instrument. One problem is the disposition of the surplus bought by the government. To produce this surplus requires valuable labor, capital, fertilizer, and other inputs. Yet often it is simply left to decay in government storage bins. Another difficulty is that much of the surplus is produced by large corporate farms, whose owners have no need for support. For every dollar that price supports put into the hands of a needy family farmer, several more go into the coffers of prosperous agribusinesses. Price supports also raise the food bills of all families, and often raise prices of goods not directly supported. (See Example 2.3 later in this chapter.) If society wants to subsidize small family farms, there are more efficient and direct means than agricultural price supports.

FIGURE 2.7
A Price Support in the Soybean Market
For a price support to have any impact, it must be set above the market-clearing price. Its effect is to create excess supply, which the government then purchases.



THE RATIONING AND ALLOCATIVE FUNCTIONS OF PRICES

Prices serve two important and distinct functions. First, they ration existing supplies of goods. Scarcity is the universal feature of economic life. People want more of virtually everything than could be supplied at a price of zero. Equilibrium prices curtail these excessive claims by rationing scarce supplies to the users who place the highest value on them. This is the **rationing function of price.** It is a short-run function, in the sense that its focus is the distribution of output that already exists.

rationing function of price the process whereby price directs existing supplies of a product to the users who value it most highly.

The second function of price is that of a signal to direct productive resources among the different sectors of the economy. In industries in which there is excess demand, firms are able to charge more than they need to cover their costs of production. The resulting profits act as a carrot that lures additional resources into these industries. The other side of this coin is that losses act as the stick that drives resources out of those industries in which there is excess supply. This is the so-called **allocative function of price,** the driving force behind Adam Smith's invisible hand. It is a long-run function in the sense that its focus is to induce resources to migrate from industries with excess supply to those with excess demand.

allocative function of price the process whereby price acts as a signal that guides resources away from the production of goods whose prices lie below cost toward the production of goods whose prices exceed cost.

Rent controls subvert both functions of the price mechanism. The rationing function is undercut by the alternative mechanisms that distribute housing with little regard to the value people place on it. The underlying needs of renters are relegated to secondary status. Both luck and the people you happen to know are often decisive. Artificially low rents undercut the allocative function of price by sending a false signal to investors about the need for additional housing. Under rent controls, apartment builders earn less than they could by investing their money elsewhere. The cruel irony is that the pressing need in many communities with rent controls is for more low-income housing units, not fewer—which is precisely what the market would produce on its own if the poor were given more money.

DETERMINANTS OF SUPPLY AND DEMAND

Supply and demand analysis is useful not only for the normative insight it offers into questions of public policy but also for a rich variety of descriptive purposes. Most important, it predicts how equilibrium prices and quantities will respond to changes in market forces. Because supply and demand curves intersect to determine equilibrium prices and quantities, anything that shifts these curves will alter equilibrium values in a predictable way. In the next several chapters, we investigate in detail the forces that determine the shape and position of market demand curves. For the moment, let's discuss a few whose roles are intuitively clear.

DETERMINANTS OF DEMAND

Incomes

For most goods, the quantity demanded at any price rises with income. Goods that have this property are called *normal goods*. So-called *inferior goods* (such as ground beef with high fat content) are the exception. For such goods, the quantity demanded at any price falls with income. The idea is that consumers abandon these goods in favor of higher-quality substitutes (such as leaner grades of meat in the ground beef case) as soon as they can afford to.

Tastes

Tastes vary across people and over time. In Western societies, culture instills a taste for sitting on padded furniture, whereas in many Eastern societies, people are conditioned to favor sitting cross-legged on the floor. The demand for armchairs thus tends to be larger in the West than in the East. By the same token, the demand for skirts with hemlines above the knee tends to vary sharply from one decade to another.

Prices of Substitutes and Complements

Bacon and eggs play a complementary role in the diets of some people. For them, a sharp increase in the price of bacon leads not only to a reduction in the quantity of bacon demanded but also to a reduction in the demand for eggs. Such goods are considered *complements:* An increase in the price of one good decreases demand for the other good. In the case of close *substitutes,* such as coffee and tea, an increase in the price of one will tend to increase the demand for the other.

Expectations

Expectations about future income and price levels also affect current purchase decisions. For example, someone who expects higher future income is likely to spend more today than an otherwise identical person who expects lower future income. (After all, with higher expected future income, the need to save diminishes.) Similarly, people will often accelerate their current purchases of goods whose prices are expected to rise in the months to come.

Population

In general, the number of people who buy a product grows as the number of potential buyers grows. Thus, in cities with growing populations, the demand for housing increases from year to year, whereas it tends to fall in cities with declining populations.

Figure 2.8 graphically displays some factors that shift demand curves. We will revisit these factors in more detail in Chapters 4 and 10.

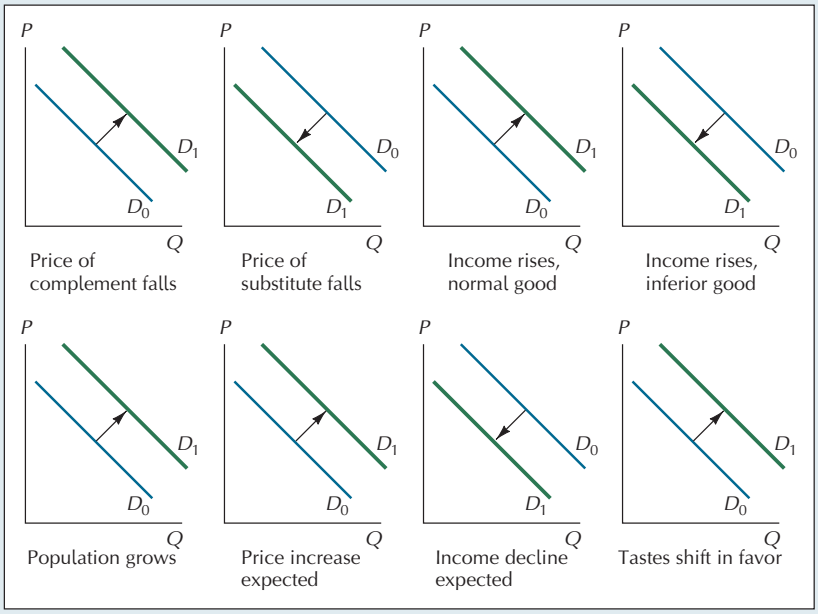


FIGURE 2.8
Factors That Shift Demand Curves
Prices of substitutes and complements, incomes, population, expectation of future price and income changes, and tastes all influence the position of the current demand curve for a product.

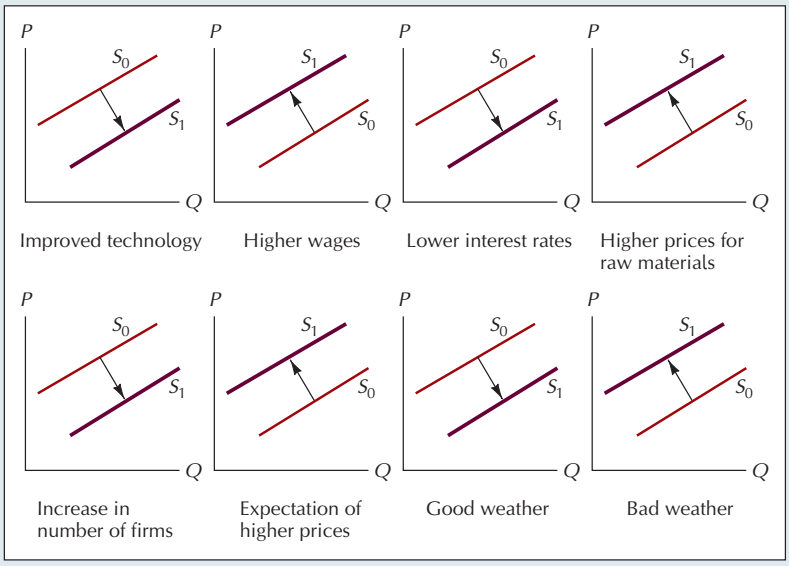


FIGURE 2.9
Factors That Shift Supply Schedules
Technology, input prices, the number of firms, expectations about future prices, and the weather all affect the position of the supply schedule for a given product.

DETERMINANTS OF SUPPLY

Technology

The amount suppliers are willing to offer at any price depends primarily on their costs of production. These costs, in turn, are closely linked to technology. For instance, the discovery of a more efficient lobster trap will reduce the cost of harvesting lobsters, which results in a rightward shift in the supply schedule.

Factor Prices

A supplier's costs also depend on the payment it must make to its factors of production: labor, capital, and so on. If the price of lobster boats rises, or if the wage paid to lobstermen goes up, the supply schedule for lobsters shifts to the left.

The Number of Suppliers

The more firms that can supply a good, the greater will be the quantity supplied of it at any given price. The supply schedule of personal computers has shifted sharply to the right as more and more companies have begun producing them.

Expectations

Suppliers too take expected changes in prices into account in their current production decisions. For example, if ranchers expect beef prices to rise sharply in the future because of an epidemic affecting young cattle, they are likely to withhold current supplies of mature livestock to take advantage of the higher future prices.[1]

Weather

For some products, particularly agricultural ones, nature has significant effects on the supply schedule. In years of drought, for example, the supply schedule for many foodstuffs shifts to the left.

Figure 2.9 shows the effects of some factors that shift supply schedules.

Neither of the preceding lists of supply and demand shifters is meant to be exhaustive.

[1]Note that supply is the quantity offered for sale at various prices, not necessarily current production (when suppliers are able to store inventory). Hence, the ranchers reduce sales of cattle in the current period, since they can sell them in a later period when prices are higher.

CHANGES IN DEMAND VERSUS CHANGES IN THE QUANTITY DEMANDED

When economists use the expression *change in demand,* they mean a shift in the entire demand curve. Thus, when the average income level of buyers changes, the demand curve shifts—there is a change in demand. When we say *change in the quantity demanded,* we mean a movement along the demand curve. When the price of a good falls, for example, the result is an increase in the quantity demanded, not an increase in demand.

Analogous interpretations attach to the expressions *change in supply* and *change in the quantity supplied.* These terminological distinctions are important for clear communication both in classroom discussion and on exams. And if the experience of previous generations of students is any guide, it requires effort to keep them straight.

PREDICTING AND EXPLAINING CHANGES IN PRICE AND QUANTITY

To predict or explain changes in equilibrium prices and quantities, we must predict or account for the shifts in the relevant supply and/or demand schedules. When supply and demand curves have the conventional slopes, the following propositions about equilibrium prices and quantities will hold:

- An increase in demand will lead to an increase in both the equilibrium price and quantity.
- A decrease in demand will lead to a decrease in both the equilibrium price and quantity.
- An increase in supply will lead to a decrease in the equilibrium price and an increase in the equilibrium quantity.
- A decrease in supply will lead to an increase in the equilibrium price and a decrease in the equilibrium quantity.

There is no point in memorizing this list, since each proposition can be easily derived by shifting the relevant curve in a standard supply-demand diagram.

These simple propositions permit us to answer a variety of questions.

ECONOMIC NATURALIST 2.1

Why do the prices of some goods, like apples, go down during the months of heaviest consumption while others, like beachfront cottages, go up?

The answer is that the seasonal consumption increase is the result of a supply increase in the case of apples, a demand increase in the case of cottages. As shown in Figure 2.10, these shifts produce the observed seasonal relationships between equilibrium prices and quantities. (The subscripts w and s in Figure 2.10 are used to denote winter and summer values, respectively.) When demand increases (as for cottages), the increase in the equilibrium quantity occurs concurrently with an increase in the equilibrium price. When supply increases (as for apples), the increase in the equilibrium quantity occurs concurrently with a decrease in the equilibrium price.

EXERCISE 2.3

What will happen to the equilibrium price and quantity in the fresh seafood market if each of the following events occurs: (1) a scientific report is issued saying that fish contains mercury, which is toxic to humans, and (2) the price of diesel fuel (used to operate fishing boats) falls significantly?

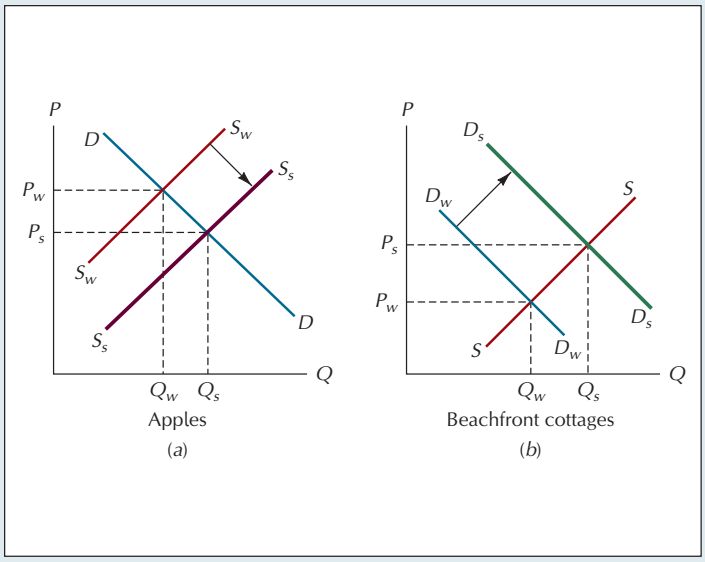


FIGURE 2.10
Two Sources of Seasonal Variation
The quantities consumed of both apples and beachfront cottages are highest in the summer months. (*a*) Apple prices are at their lowest during the summer because the quantity increase is the result of increased supply. (The subscripts *w* and *s* denote winter and summer values, respectively.) (*b*) Cottage prices are at their highest in summer because the quantity increase is the result of an increase in demand.

EXAMPLE 2.3

If soybeans are one of the ingredients in cattle feed, how does a price support program in the soybean market affect the equilibrium price and quantity of beef?

The price support program raises the price of cattle feed, which causes a leftward shift in the supply schedule for beef. (See Figure 2.11.) This, in turn, results in an increase in the equilibrium price and a reduction in the equilibrium quantity of beef.

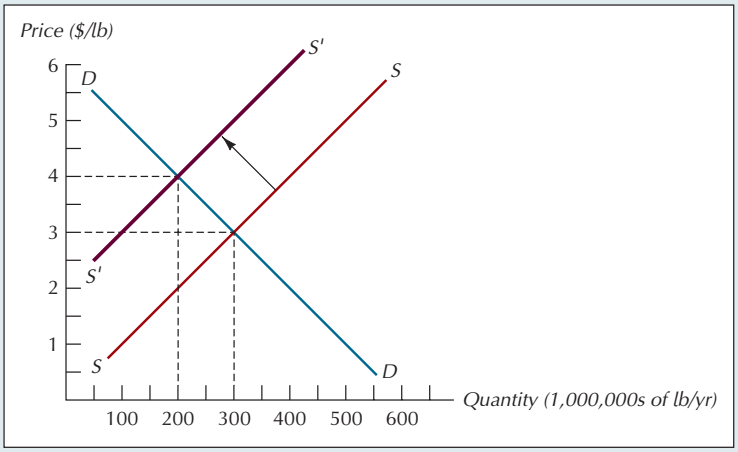
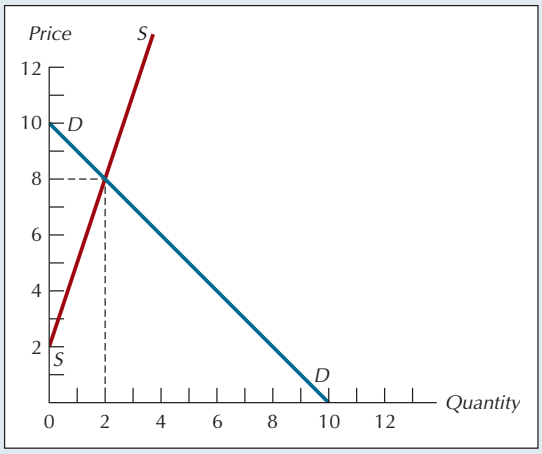


FIGURE 2.11
The Effect of Soybean Price Supports on the Equilibrium Price and Quantity of Beef
By raising the price of soybeans, an input used in beef production, the price supports produce a leftward shift in the supply curve of beef. The result is an increase in the equilibrium price and a reduction in the equilibrium quantity.

THE ALGEBRA OF SUPPLY AND DEMAND

The examples thus far have focused on a geometric approach to market equilibrium. This approach is fine for illustrating the basic principles of the theory. But for actually computing numerical values, it usually is more convenient to find

FIGURE 2.12
Graphs of Equations 2.1 and 2.2
The algebraic and geometric approaches lead to exactly the same equilibrium prices and quantities. The advantage of the algebraic approach is that exact numerical solutions can be achieved more easily. The geometric approach is useful because it gives a more intuitively clear description of the supply and demand curves.



equilibrium prices and quantities algebraically. Suppose, for example, the supply schedule for a product is given by

$$P = 2 + 3Q^s, \tag{2.1}$$

and its demand schedule is given by

$$P = 10 - Q^d, \tag{2.2}$$

where P is the product price and Q^s and Q^d stand for the quantity supplied and the quantity demanded, respectively. In equilibrium, we know that $Q^s = Q^d$. Denoting this common value as Q^*, we may then equate the right-hand sides of Equations 2.1 and 2.2 and solve:

$$2 + 3Q^* = 10 - Q^*, \tag{2.3}$$

which gives $Q^* = 2$. Substituting $Q^* = 2$ back into either the supply or demand equation gives the equilibrium price, $P^* = 8$.

Needless to say, we could have graphed Equations 2.1 and 2.2 to arrive at precisely the same solution (see Figure 2.12). The advantage of the algebraic approach is that it is much less painstaking than having to produce accurate drawings of the supply and demand schedules.

EXERCISE 2.4

Find the equilibrium price and quantity in a market whose supply and demand curves are given by $P = 4Q^s$ and $P = 12 - 2Q^d$, respectively.

SUMMARY

- The supply curve is generally an upward-sloping line that tells what quantity sellers will offer at any given price. The demand curve is a downward-sloping line that tells what quantity buyers will demand at any given price. In an unregulated market, the equilibrium price and quantity are determined by the intersection of these two curves.

- If price is above its equilibrium, there will be dissatisfied sellers, or excess supply. This condition motivates sellers to cut their prices. By contrast, when prices are below equilibrium, there will be dissatisfied buyers, or excess demand. This condition motivates sellers to charge higher prices. The only stable outcome is the one in which excess demand and excess supply are exactly zero.

- Given the attributes of buyers and sellers, the equilibrium price and quantity represent the best attainable outcome, in the sense that any other price-quantity pair would be worse for at least some buyers or sellers.

- The fact that market outcomes are efficient in this sense does not mean they necessarily command society's approval. On the contrary, we often lament the fact that many buyers enter the market with so little income. Concern for the well-being of the poor has motivated the governments of almost every society to intervene in a variety of ways to alter the outcomes of market forces.

- Sometimes these interventions take the form of laws that peg prices above or below their equilibrium levels. Such laws often generate harmful, if unintended, consequences. Rent controls, for example, interfere with both the rationing and allocative functions of the price mechanism. They lead to black marketeering and a rapid deterioration of the stock of rental housing. By the same token, price support laws in agriculture tend to enrich large corporate farms while doing little to ease the plight of the small family farm. In almost every instance, it is possible to design an alternative intervention that is better in every respect.

- If the difficulty is that the poor have too little money, the solution is to discover ways of boosting their incomes directly. Legislatures cannot repeal the law of supply and demand. But legislatures do have the capacity to alter the underlying forces that govern the shape and position of supply and demand schedules.

- Supply and demand analysis is the economist's basic tool for predicting how equilibrium prices and quantities will change in response to changes in market forces. Four simple propositions guide this task: (1) an increase in demand will lead to an increase in both the equilibrium price and quantity; (2) a decrease in demand will lead to a decrease in both the equilibrium price and quantity; (3) an increase in supply will lead to a decrease in the equilibrium price and an increase in the equilibrium quantity; and (4) a decrease in supply will lead to an increase in the equilibrium price and a decrease in the equilibrium quantity.

- Incomes, tastes, the prices of substitutes and complements, expectations, and population are among the factors that shift demand schedules. Supply schedules, in turn, are governed by such factors as technology, input prices, the number of suppliers, expectations, and, for agricultural products, the weather.

QUESTIONS FOR REVIEW

1. What is the difference between "scarcity" and "shortage"?
2. What would the supply curve look like for a good that is not scarce? Assuming the good is useful, what would its demand curve look like? Explain why a positive price for a commodity implies that it is scarce.
3. Give two examples of actions taken by the administration of your college or university whose effect is to prevent specific markets from reaching equilibrium. What evidence of excess supply or excess demand can you cite in these examples?
4. What is the difference between "a reduction in supply" and "a reduction in the quantity supplied"?
5. Identify each of the following as (1) a change in demand or (2) a change in the quantity demanded.
   a. Grape consumption falls because of a consumer boycott.
   b. Grape consumption falls because of a tax on grape producers.
   c. Grape consumption rises because of a good harvest.
   d. Grape consumption rises because of a change in tastes.
6. When there is excess supply, why is any single seller able to sell all she wants to by offering only a small reduction below the current market price?
7. Give an example of a market in which the allocative function of price is not very important.
8. Suppose you are a government official and need to collect revenue by taxing a product. For political reasons, you want the burden of the tax to fall mostly on consumers, not firms (who have been substantial contributors to your campaign fund). What should you look for when picking a product to tax?
9. Which would a rational poor person be more likely to accept and why?
   a. A $50,000 Mercedes (immediate resale value = $30,000)
   b. $35,000 cash

PROBLEMS

1. Assume that tea and lemons are complements and that coffee and tea are substitutes.
   a. How, if at all, will the imposition of an effective ceiling price on tea affect the price of lemons? Explain.
   b. How, if at all, will the imposition of an effective ceiling price on tea affect the price of coffee? Explain.

2. The market for DVDs has supply and demand curves given by $P' = 2Q^s$ and $P = 42 - Q^d$, respectively.
   a. How many units will be traded at a price of \$35? At a price of \$14? Which participants will be dissatisfied at these prices?
   b. What quantity of DVDs at what price will be sold in equilibrium?
   c. What is the total revenue from DVD sales?

3. Hardware and software for computers are complements. Discuss the effects on the equilibrium price and quantity
   a. In the software market, when the price of computer hardware falls.
   b. In the hardware market, when the price of computer software rises.

4. Suppose a newly released study shows that battery-powered toys harm a child's development and recommends that parents adjust their purchasing behavior accordingly. Use diagrams to show the effect on price and quantity in each of the following markets:
   a. The market for battery-powered toys.
   b. The market for D batteries.
   c. The market for yo-yos (which do not require batteries).

5. Using diagrams, show what changes in price and quantity would be expected in the following markets under the scenarios given:
   a. *Crude oil:* As petroleum reserves decrease, it becomes more difficult to find and recover crude oil.
   b. *Air travel:* Worries about air safety cause travelers to shy away from air travel.
   c. *Rail travel:* Worries about air safety cause travelers to shy away from air travel.
   d. *Hotel rooms in Hawaii:* Worries about air safety cause travelers to shy away from air travel.
   e. *Milk:* A genetically engineered hormone enables large milk producers to cut production costs.

6. For each scenario in Problem 5, state whether the effect is a change in demand or just a change in quantity demanded.

7. Suppose demand for seats at football games is $P = 1900 - (1/50)Q$ and supply is fixed at $Q = 90{,}000$ seats.
   a. Find the equilibrium price and quantity of seats for a football game (using algebra and a graph).
   b. Suppose the government prohibits tickets scalping (selling tickets above their face value), and the face value of tickets is \$50 (this policy places a price ceiling at \$50). How many consumers will be dissatisfied (how large is excess demand)?
   c. Suppose the next game is a major rivalry, and so demand jumps to $P = 2100 - (1/50)Q$. How many consumers will be dissatisfied for the big game?
   d. How do the distortions of this price ceiling differ from the more typical case of upward-sloping supply?

8. The demand for apartments is $P = 1200 - Q$ while the supply is $P = Q$ units. The government imposes rent control at $P = \$300$/month. Suppose demand grows in the market to $P = 1400 - Q$.
   a. How is excess demand affected by the growth in demand for apartments?
   b. At what price would the government have to set the rent control to keep excess demand at the same level as prior to the growth in demand?

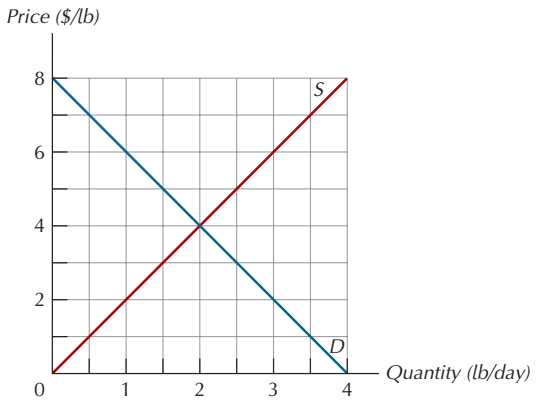
9. Suppose demand is $P = 600 - Q$ and supply is $P = Q$ in the soybean market, where Q is tons of soybeans per year. The government sets a price support at $P = \$500$/ton and

purchases any excess supply at this price. In response, as a long-run adjustment, farmers switch their crops from corn to soybeans, expanding supply to $P = (1/2)Q$.

a. How does excess supply with the larger supply compare to excess supply prior to the farmers switching crops?

b. How much more does the government have to spend to buy up the excess supply?

10. How would the equilibrium price and quantity change in the market depicted below if the marginal cost of every producer were to increase by $2/pound? (Hint: Recall the vertical interpretation of the supply curve discussed in Chapter 1.)

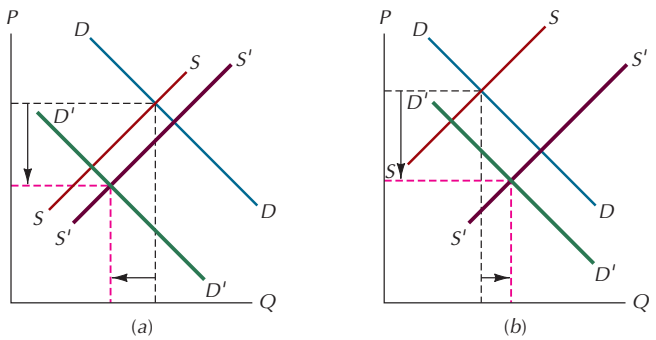


ANSWERS TO IN-CHAPTER EXERCISES

2.1 At a price of $4/lobster, the quantity demanded is 5000 lobsters/day and the quantity supplied is 1000 lobsters/day, making excess demand equal to 4000 lobsters/day. At a price of $20/lobster, excess supply is 4000 lobsters/day.

2.2 A rent control level set above the equilibrium price has no effect. The rent will settle at its equilibrium value of $600/mo.

2.3 The fall in the price of diesel fuel shifts the supply curve to the right. The report on mercury shifts the demand curve to the left. As shown in the following diagrams, the equilibrium price will go down (both panels) but the equilibrium quantity may go either up (panel *b*) or down (panel *a*).



2.4 $4Q^* = 12 - 2Q^*$, which yields $Q^* = 2$ and $P^* = 4Q^* = 8$.