

## CHAPTER 1

### WHAT ECONOMICS IS AND HOW IT HELPS YOU SUCCEED IN YOUR CAREER AND LIFE



#### What's in It for You?

Why are you taking this course? We suspect, most of you would say, "because it's required." OK. But how about the proven fact that learning economics actually helps you make good business and personal-life decisions? to see how, you first need to have a clear understanding of what economics is. Misconceptions about the subject of economics and its role in real world are widespread, with the perceptions ranging from "it tells you how to get rich quick" to "it's all about government policies" to "it's a bunch of abstract theories with dense math that have no use in real life." in this chapter, and the whole course for that matter, we try to dispel these and other common misconceptions about economics and help you discover the power of economic thinking—an invaluable asset that helps you succeed in your career and life.

We first define the subject of economics in general and business-oriented applied microeconomics in particular. then, we present key concepts and ideas of economics that we will discuss in more detail throughout the course. after this overview, we outline the methods used to examine economic relationships and recommend solutions for real-world problems. Finally, we explain how the knowledge and skills learned from this and other economics courses can open exciting career opportunities for you and help you succeed in your career and life.



#### Learning Objectives

at completion of this learning module you are expected to be able to:

- Define and explain the subject of microeconomics
- Define, explain, and apply (at a basic level) key concepts and principles of economics: opportunity cost, cost-benefit analysis, choice at the margin, gains from trade, and efficiency
- Explain what it means to think like an economist and how economists use models and data to examine real-world problems and help find solutions.
- illustrate how economics is used in various organizations and outline career opportunities for college graduates skilled in economics

## 1.1 Applied Microeconomics in Perspective

Economics in general studies human behavior in most, if not all, of its manifestations. As such, it offers a way of thinking about how the world works and a framework for making choices and decisions of all kinds. Economics gives us a unique perspective on a wide variety of human activities and social institutions. A common thread running through all definitions of economics is that it is the study of how individuals, who have virtually limitless wants, choose to allocate scarce resources to best satisfy their wants. This leads us to what economists call "*the economic problem*."

### The Economic Problem

Think about all the things people consume: food, housing, clothing, transportation, healthcare, entertainment, and many more. The list is endless. We are never satisfied with what we have and will forever be lured by more tempting foods, more cleverly engineered electronic devices, more up-to-date fashions, etc. Why can't we have everything we want? The answer is, because for us to consume good or services, they first need to be produced. And to produce them, the economy needs **resources**, such as land, structures, machines, energy, and workers with certain skills. Economists call things used to produce goods and services **factors of production**.

Unlike our wants, society's resources are limited or, as economists say, scarce and therefore can produce only certain amounts of goods and services. **Scarcity** is an important general concept in economics. It means the resources available to individuals and society are not enough to produce the amounts of goods and services that would satisfy all the desires for them. All individuals, businesses, and societies—no matter how wealthy they are—face scarcity one way or another. The United States, for example, has 1.5 million sq. miles of land, much of which is rich in natural resources (such as natural gas, oil, iron ore, and gold), 960 million acres of agricultural land, more than \$51 trillion worth of capital stock (yes, 51 with twelve zeros!), and 160 million people in the labor force, many of which are highly skilled. Yet, these tremendous amounts of resources are far from being sufficient to produce all the goods and services that 320 million people resided in the United States would like to have. We want healthier food, bigger and more comfortable homes, faster and safer transportation, more effective health care, better schools, more security, and the list goes on.

So, all of us face the situation in which the limited resources we have cannot satisfy all our endless wants. This is ***the economic problem***. And this is what defines the subject of economics in general. Since we cannot satisfy all our wants, we must make economic choices, i.e. decide which wants to satisfy and which ones to do without. Families must decide whether to spend their money on a new car or a fancy vacation. Towns must choose whether to put more of their budget into police and fire protection or into the school system. Governments must decide whether to devote more funds to national defense or to protecting the environment. The role of economics is to explain how all these decisions are made and how we can get as much as possible of what we want. That is:

**Economics** is the study of how people make choices under the condition of scarcity and how to direct scarce resources in the way that best satisfies their wants.

the economic problem applies to all individuals, businesses, and societies. Methods of dealing with it differ depending on resource endowment, available technology, economic and legal systems, cultural traditions, and religious beliefs; but the fundamental problem is the same everywhere and at all times.

## The Subject of Applied Microeconomics

You might remember from your introductory economics courses that economics has two branches, microeconomics and macroeconomics. **Microeconomics** focuses on individual units that make up the economy: households, firms, industries, and markets. **Macroeconomics** studies an economy as a whole, dealing with such issues as economic growth, unemployment, and inflation.

in this course we study applied microeconomics, which provides analytical frameworks for making individual and business choices. those choices may be private, such as how much you should invest in getting your college degree, whether you should buy a new car or a used one, how to price your laptop on eBay, how much help to hire for a business you run and how to price your product, etc. or they may be public choices, such as whether to impose a tariff on imports from China, whether to sign an international agreement on climate change, whether to raise the cigarette tax and use the additional budget revenue to increase the funding of higher education, etc. these are all economic choices and they are all important.

In this course, we focus on private choices made by firms and consumers. We start with examining how decisions made by consumers and producers determine prices and quantities of goods sold in competitive markets and how various events influence those decisions. then, we look deeper into how individual consumers and firms make their choices. on the producer side, those choices depend to a large extent on what kind of market the firm operates in, so analyzing firms' decisions in various market structures, from perfect competition to monopoly, is an important part of this course. Government economic policies and regulations—such as taxes, subsidies, and price controls—surely affect producers' and consumers' choices, and we examine them from that perspective. thus, we can define the subject of this course as

applied microeconomics that studies how producers and consumers interact, how government policies affect their choices, and how optimal decisions can be made given certain market conditions and other constraints.



### Checkpoint 1

the subject of this course is best defined as the study of which of the following?

- a. Various microeconomic theories
- B. How businesses can influence government policies in the way that best achieves their goals
- C. How consumers and producers make optimal decisions given certain market conditions.
- D. How firms respond to government macroeconomic policies

## E. How a market economy works

Check your answer

## 1.2 Foundations of Economics

Before we dive deeper into the specific topics of applied microeconomics, let's outline five key concepts on which they are based: (1) opportunity cost, (2) cost-benefit analysis, (3) marginal thinking, (4) gains from trade, and (5) efficiency. We will use these concepts throughout the course, applying them from various perspectives.

### True Cost Is Opportunity Cost

While it is customary to view costs as the money paid for goods or services, it is usually not an accurate measure of true costs. Often, the amount of money you pay to get something is only part of what it actually costs you and in some cases, only part of that amount is your true cost. How come?

Economists measure the cost of everything as opportunity cost. As we discussed above, scarcity forces us to make choices. And when we choose to get or do something, we almost always have to give up something else. The value of what we give up is the opportunity cost of what we get. That is:

The **opportunity cost** of what we get is the value of what we give up to get it.

Here are two examples that illustrate the concept of opportunity cost.

#### *Example 1: How Much Does It Cost to Have a Break?*

Polina is a freelance graphic designer. She earns on average \$40 per hour and has no problem getting new clients and take on more work. She's been working hard and has gotten tired, so she decides to take a break and go to a rock concert. She gets a ticket for \$55 and expects to spend \$10 on snacks and drinks. It will take her 5 hours and \$5 worth of gas to get to the venue, attend the concert, and come back. What is Polina's cost of going to the concert?

Let's calculate Polina's opportunity cost. Surely, the money she pays for the ticket, snacks and drinks, and gas ( $\$55 + \$10 + \$5 = \$70$ ) is part of it because she is giving up something else she could buy for that money. But she is also giving up 5 hours of her time that she could spend working on her design project and earn  $\$40 \times 5 = \$200$ . These forgone earnings together with the monetary costs associated with attending the concert amount to Polina's total opportunity cost of  $\$70 + \$200 = \$270$ .

Polina's \$270 cost of going to a rock concert might not look plausible, but it is actually a much more accurate estimate of what the concert will cost her than just the monetary cost of \$70. Since \$270 is what she actually gives up if she chooses to go to the concert, it is her true cost of it that she should take into account when making her decision. •

### **Example 2: The Opportunity Cost of Summer School**

Bart, a Georgia southern student, is considering taking courses this summer. tuition and fees for the two courses he intends to take are \$1,890, and the estimated cost of books is \$200. Bart is renting an apartment near the campus for \$500 per month and will live in it no matter whether or not he goes to school in the summer. His other living expenses won't depend on whether or not he takes summer courses either. Further, Bart is offered a summer job that would pay \$2,000, but he would not be able to take it if he goes to school. How much will the summer school cost Bart?

To calculate Bart's true cost of the summer courses, let's see what he gives up if he decides to take them. that includes tuition, fees, and books—since by paying this money for the school, Bart is giving up something else he could buy for it. But what about the rent he pays for his apartment? surely, Bart gives up this money too, but it has nothing to do with his cost of the summer school, as he pays the same amount no matter whether or not he attends it. The same is true about his living expenses. so, when calculating Bart's opportunity cost of the summer courses, we only include tuition, fees, and books:  $\$1,890 + \$200 = \$2,090$ . Fur-ther, to attend the school, Bart has to give up a job that pays \$2,000, which means these forgone earnings are part of his opportunity cost as well. Thus, Bart's total opportunity cost, i.e. his true cost of the summer school, is  $\$2,090 + \$2,000 = \$4,090$ . And that's the cost he should consider when deciding whether or not to take the summer courses. •

When determining the opportunity cost of a choice, it is important to keep in mind that:

When there are several alternatives to a choice and they are mutually exclusive, only one of them, the best one, should be used to determine the opportunity cost.

Back to our first example, suppose Polina is considering giving up freelancing and working for hire instead. She has two offers of a fulltime job: one at Stark Graphics, Inc., which pays \$35 per hour, and the other at Thor Images, Ltd., paying \$45 per hour. Recall that as a freelancer, she earns \$40 per hour. If she quits freelancing and accepts the job at Thor Images, what will be her opportunity cost?

The answer is \$40 per hour. To see why, note that Polina's choices are mutually exclusive: she is quitting freelancing, and she cannot work two fulltime jobs at the same time. Thus, only the best alternative to her choice—continuing freelancing and earning \$40 per hour—counts. So, that's her opportunity cost.



### **Checkpoint 2**

Dan is calculating the opportunity cost of getting his college degree. If he goes to college, each year, he'll pay \$9,000 for tuition, \$1,500 for textbooks, \$4,500 for housing, and \$2,500 for food. If he decides not to go to college, his parents will let him live at home for free, and he will spend only \$1,000 per year on food. The rest of his expenses won't depend on whether or not he goes to college. While deciding whether to go to college, Dan is offered a job paying \$30,000

per year, which he won't be able to take if he goes to college. What is Dan's opportunity cost of four years in college?

Check your answer

## Benefits vs. Costs: Choice at the Margin

Now you know how to determine the true cost of an action. The question, however, is whether that action should be taken. Should Polina go to the concert? Should Bart take the summer courses? To answer these questions, we need to know the person's benefit from taking the action along with her opportunity cost of it. That is, we need to determine the value the person gains by taking the action and compare that value with the person's opportunity cost.

How can we evaluate a person's benefits? Can we, for example, attach a dollar value to Polina's enjoyment of the rock concert? Economists measure a person's benefit—i.e. the value received from consuming a good or a service—by the highest price she is willing to pay for it, which is called **willingness to pay**. That is:

The **benefit** (or **value**) received by a person from enjoying a good or a service is the highest price the person is willing to pay for it.<sup>1</sup>

Is Polina willing to pay \$270 for the rock concert? One way to find it out is to ask her (or she can ask herself) whether she would give up going to the concert if offered that amount in cash instead. If she would, than her benefit from the concert is less than \$270. If she would not, that means she values enjoying the concert at higher than \$270.

The decision-making rule then is:

Compare the benefit of taking an action with the opportunity cost of it. If the benefit exceeds the cost, take the action; if the cost exceeds the benefit, don't.

So, Polina will go to the concert if the value she places on enjoying it is higher than her opportunity cost of \$270, and she won't go if she values it below \$270.

The same principle is used to make business decisions. In that case, the benefit is the revenue received from selling a product and the cost is the opportunity cost of producing and selling it (which is not necessarily, and usually not, the same as the firm's accounting cost).<sup>2</sup> Let's consider another example.

### **Example 3: Can an Economist Make a Good Manager?**

Elizabeth, a student majoring in economics at a small college, is running a student theater, called Actonomics, which plays sketches illustrating how economics principles work in the

<sup>1</sup> We discuss how to evaluate the benefits (utility) received by consumers in more detail in Chapter 5.

<sup>2</sup> We address the difference between economic costs (i.e. opportunity costs) and accounting costs in more detail in Chapter 6.

real world. The theater becomes so popular that there is not enough room on campus to satisfy the demand for its shows. So, Elizabeth is looking for an external venue for an all-day festival.

As a good economist, she estimates the Actonomics's opportunity cost of such a festival, compares it with the expected revenue from the ticket sales, and figures out that the most Actonomics is willing to pay to rent an auditorium is \$400.

A recently built concert hall in town, called Midtown Hall, is a perfect venue for the festival. So, Elizabeth approaches Dwight, an account manager at Midtown Hall, and asks him if she could rent the auditorium for the whole day on the upcoming Monday. Dwight says yes, as no other event is scheduled for that day, and tells Elizabeth that the rent will be \$1,300.

Surprised, Elizabeth asks Dwight to explain why the rent is so high and here is what he says: "Midtown Hall is still repaying a bank loan taken to help pay for its construction, which is \$600 per day. Also, we pay \$100 per day for the building insurance and \$200 per day in property taxes. The extra cost of electricity and janitorial services for a one-day event is \$250. So, the total cost we would need to cover is \$1,150. With our usual profit margin added, the charge is \$1,300."

Elizabeth suspects that Dwight did not do well in his economics classes when he was in college. She says, "Well, I'm offering you \$300, which is a pretty generous offer, and you'll make a profit if you accept it." Dwight thinks Elizabeth is kidding him. Fortunately, his supervisor, Jan—who has a degree in economics—happens to be around and overhear the conversation. She agrees with Elizabeth and even offers her a job as a financial manager at Midtown Hall. Elizabeth accepts the offer. Later, she uses her adventure at Midtown Hall to write a new sketch for Actonomics.



Elizabeth's sketch ends with the scene where Jan explains puzzled Dwight why she has agreed with Elizabeth. Try to figure it out yourself before reading the explanation below.

Can you see why Jan agreed with Elizabeth? As economists, they both used the decision rule we've stated above: compare the opportunity cost of renting out the facility with the benefit of it, and if the benefit exceeds the cost, accept the offer. Midtown Hall's opportunity cost is only the *additional* costs associated with the festival, i.e. the extra cost of electricity and janitorial and other services (\$250). And the benefit is the revenue received, i.e. the amount of rent that Elizabeth would pay (\$300). Since the benefit from renting out the auditorium exceeds the cost, Dwight should have accepted Elizabeth's offer. In fact, he should have accepted any offer above \$250 (that's why Elizabeth said her offer was generous). By refusing to accept \$300 to cover the additional costs of \$250, Dwight was about to lose the opportunity for Midtown Hall to make an extra profit of \$50.

The other costs that Dwight included in his calculations were *not* opportunity costs and therefore should not have been taken into account. Can you see why not? The concert hall has to repay the bank loan and pay the insurance premium and property taxes no matter whether or not Actonomics rents the facility. That is, those costs are irrelevant when making

the decision whether to accept Elizabeth's offer. And the "usual profit margin" is irrelevant here either. Since no one else wants to rent the auditorium on that day, Midtown Hall would not receive any profit on it at all if it refused Elizabeth's offer. •

### **Sunk Cost**

The analysis in Example 3 leads us to a related important principle of decision making. Note that repaying the bank loan, paying for insurance premium, and property taxes are costs that the Midtown Hall could not avoid. It has already invested the money to construct the facility, signed a contract with the insurance company, and is obligated to pay property taxes by law. These are what economists call sunk costs.

A **sunk cost** is a cost that has already been paid—or must be paid due to an unavoidable commitment—and that cannot be recovered or refunded.

Another illustration of a sunk cost would be if Bart in Example 2 rented his apartment for the whole year and the lease agreement obligated him to pay the rent for twelve months—no matter whether or not he lives in the apartment—and forbade subletting. In that case, the amount of rent Bart pays for the apartment would not influence his opportunity cost of taking summer courses even if he could, say, live in his parents' house for free during the summer in case he decided not to go to school. In general:

Sunk costs are *not* opportunity costs and therefore should *not* be taken into account when making decisions.

The notion that rational decision makers only consider the opportunity cost of a choice and ignore sunk costs—or as economists call it **think at the margin**—is one of the key themes in economics. In reality, however, people—consumers, firm managers, and government officials alike—are often influenced by sunk costs when making decisions. In behavioral economics, this is known as the **sunk cost fallacy**. We discuss it in more detail in Chapter 5.



### **Checkpoint 3**

Suppose Sony has decided to develop a new digital camcorder. The project costs 22 billion yen to complete. The company's managers expected that the new camcorder would bring 28 billion yen in additional sales. When Sony has already invested 12 billion yen, it suddenly finds out that Canon is introducing a similar camcorder, which is expected to reduce Sony's revenue from its new camcorder to 9 billion yen. Would you advise Sony to finish the project and launch the new camcorder or discontinue it?

Check your answer

## Marginal Analysis

The choices in our examples above are all "yes-or-no" decisions: to go or not to go to a concert, to take or not to take summer courses, to accept or not to accept an offer. But the principle of thinking at the margin also applies to "how-many" (or "how-much") type of choices, which individuals and firms have to make even more frequently. In this case, the decision maker compares the marginal benefit of increasing the activity (e.g., selling one more unit of a product) with its marginal cost.

The **marginal benefit** is the additional benefit received from an increase in an activity.

The **marginal cost** is the additional cost resulting from an increase in an activity.

The decision-making rule then is:

Continue to increase the level of the activity as long as the marginal benefit exceeds the marginal cost. Stop before the marginal cost becomes greater than the marginal benefit.

Our next example illustrates how marginal analysis works.

### Example 4: The Barbershop is Open Until...?

Hannah, a student living in a college town, runs a small barbershop at her home. The barbershop is pretty popular among students, so Hannah has no problem with getting clients. She charges \$8 per haircut and gives on average 3 haircuts per hour. Her only significant cost is the opportunity cost of her time. The longer her barbershop stays open, the more of other, increasingly valuable, activities she must forgo. For example, if Hannah is working at her barbershop for two hours a day, she has to give up some time she would spend watching TV; if she works for another hour, she must also give up some of her study time, which she values more highly; if her barbershop stays open for one hour more, she must forgo more study time and also some of her sleep time, which is even more valuable to her, and so on.

The opportunity costs of each additional hour of Hanna's time are her marginal costs. We can express them in dollar terms by determining the lowest amount of money that Hannah would be willing to accept in order to forgo her best alternative to working for each additional hour. These marginal costs are shown in Table 1.

The table also shows Hannah's marginal benefits from staying open for an additional hour, which are the monies she receives from clients during that time. Economists call it **marginal revenue**. Since Hannah gives three haircuts per hour and charges \$8 per haircut, her marginal revenue from each additional hour of work is  $18 \times 3 = \$24$ .

Hanna's barbershop opens at 5:00 pm (after she and most of her clients are done with their classes). For how long should it stay open?

**Table 1 Hanna's Marginal Costs and Marginal Revenue**

Hour	Marginal Cost (\$)	Marginal Revenue (\$)
First	6	24
Second	12	24
Third	22	24
Fourth	36	24
Fifth	54	24

Let's use the marginal analysis to figure it out. As the numbers in the table show, for the first three hours, Hanna's marginal cost is below her marginal revenue. This means, up to that point she is better off staying open. For example, staying open for the third hour brings her an additional benefit of  $\$24 - \$22 = \$2$ . The marginal cost of the fourth hour, however, exceeds the marginal revenue. That is, if the barbershop continues to stay open for another hour, Hannah will be worse off (by  $\$36 - \$24 = \$12$ ). Thus, her best decision is to stay open for three hours, i.e. from 5:00 pm to 8:00 pm.



### Checkpoint 4

Viola gives private piano lessons. She is a good music teacher, so she has no problem with getting customers. Viola charges \$30 per hour for her lessons. Her only significant cost is the opportunity cost of her time. The more time she spends giving her piano lessons, the more of other, increasingly valuable, activities she must forgo. The table shows the costs of each additional hour of Viola's time during a day. How many hours per day should Viola devote to giving piano lessons?

Check your answer

## Trade Creates Value

You might be surprised by the title of this subsection, which we claim to be one of key ideas of economics. Is not trade a zero-sum game? That is, when a buyer gets a good or a service of a certain value, doesn't the seller who parts with that good or service get the same value in money so that no new value is created? To see why the answer to these questions is "no," let's revisit our discussion of benefits and costs.

Recall that:

The benefit that a buyer receives from a good she gets is the highest price she would be willing to pay for it. And the value of that good to seller is his opportunity cost of providing it.

In our Example 3, the highest price Actonomics was willing to pay to rent the auditorium was \$400, so the value it placed on being able to use it was \$400. And Midtown Hall's opportunity cost of providing the facility for the festival was \$250. Thus, when Elizabeth rented the auditorium for \$300, Actonomics received a value of \$400 while giving up only \$300. And Midtown Hall received \$300 while giving up only \$250. That is, the transaction generated an additional value of  $\$400 - \$300 = \$100$  for Actonomics and  $\$300 - \$250 = \$50$  for Midtown Hall—a total gain of  $\$100 + \$50 = \$150$ .

Hour	Cost (\$)
First	16
Second	20
Third	24
Fourth	28
Fifth	32
Sixth	36

Note that both parties in our example entered the transaction voluntarily. As a student of economics, Elizabeth could clearly see the gain from it for her company, and Jan could see the gains for hers. If one of the parties did not benefit from the transaction, it would simply not take place. Thus:

Trade creates value because voluntary transactions generate gains for both buyers and sellers.

Further, the possibility to gain from trade gives people the incentive to specialize. In the modern world this is done by setting up business firms that produce certain goods or services. And when we specialize, we focus on certain activities, develop expertise in them and therefore become more productive, thus creating more value.

Gains from trade, however, can only be realized if potential buyers and sellers are brought together in some way so that they can transact. Such arrangements are called markets.

A market is any arrangement that enables buyers and sellers to interact with each other.

Modern economies, therefore, are essentially collections of markets. Nearly everything, from goods and services to resources and raw materials to real estate, financial assets, trademarks, and intellectual property, is traded in various kinds of markets, from bazaars and farmers' markets to Walmart and auto dealerships to law firms and insurance agencies to Amazon and eBay to mercantile and stock exchanges and financial intermediaries.

In the modern world where billions of voluntary transactions occur every day, market making has become an important business itself. Companies such as Walmart, eBay, Amazon, Alibaba, and many others specialize in facilitating markets for billions of buyers and sellers around the world. More than 2 billion transactions per day take place on eBay alone. Can you imagine how much value is generated by all those transactions?



### Checkpoint 5

Suppose you were willing to pay \$140 for a textbook to use it for the semester, but you bought it for \$90 at the bookstore. Now you have completed the course and the book is worth only \$30 to you. You can keep it or sell it back to the bookstore. The bookstore will pay you 50% of the original price. Should you keep the book or sell it? If you make your best choice, how much value will you get from the textbook overall?

Check your answer

## Efficiency

In our everyday life, when we say a person or a company is *efficient*, we mean they work with little waste or unnecessary effort. This is what economists generally mean by efficiency too. More specifically, in economics efficiency means the absence of lost opportunities to generate

value. As we've noted above, in today's world, billions of value-creating transactions take place every day.

Economic efficiency is achieved when all transactions that can potentially generate value for their participants are fully consummated.

In reality, however, not all opportunities to create value are effectuated. Some of them are completely lost and others are not fully realized. Economists call these unrealized opportunities *inefficiencies*. Consider the following example.

***Example 5: Can you find your perfect match?***

Cindy, a college student living in Georgia, is looking for a laptop computer that she could use to edit videos. She is willing to pay \$500 for it. Suppose this is the highest price that any potential buyer of such a computer is willing to pay. At the same time, Zach, a video game designer living in Ohio, just got a new powerful computer, so he is willing to sell the laptop he used before—which has all the features that Cindy wants—for as low as \$300. Suppose this is the lowest price that any potential seller of such a computer is willing to accept. If Cindy buys the computer from Zach (e.g., on eBay), this transaction will generate a value of \$200. (Can you see how?)

But what if Cindy and Zach never meet (in the cyberspace or otherwise)? If Cindy never finds a laptop she wants offered for less than \$500 and if Zach is never able to sell his laptop for more than \$300, the opportunity to generate that value of \$200 will be completely lost. And if, for example, Zach sells his laptop to someone who places a lower value on it (say, \$450 instead of Cindy's \$500), then the value gained from the transaction will be smaller (\$150 instead of \$200), i.e. the potential gain from trade will be partially lost.

In Chapter 2, we explain in detail how competitive markets help eliminate inefficiencies such as in the example above and why market making has become an important business.

The concept of efficiency also applies to organizing production and managerial decision making within a firm, from buying raw materials and parts from suppliers to managing capital and human resources to selling finished products. From this perspective, an efficient manager is one who can spot unrealized value-generating opportunities and take full advantage of them by moving the company's resources from lower-valued to higher-valued uses.

Back to our Example 3, what would happen if Jan was not around and Dwight refused Elizabeth's offer? The potential gains of \$100 for Actonomics and \$50 for Midtown Hall would be lost. And since Dwight did not see the opportunity to generate value for his company and would lose it, he was an inefficient manager. Elizabeth, on the other hand, was an effective manager, as she could see right away how both Actonomics and Midtown Hall could gain value from renting the auditorium for the festival and made her offer accordingly (so, no wonder that Jan offered her a job!).



## Checkpoint 6

Maura, a photography hobbyist, is looking for a DSLR camera. She is willing to pay \$700 for it. At the same time, Steven, a professional photographer who just got a new high-end camera, is willing to sell his old camera—which has all the features that Maura wants—for \$400. Maura and Steven never meet. Maura never finds a camera she wants offered for less than \$750, and Steven sells his camera for \$450 to someone who values it at \$560. In this scenario, how much value was created by the transaction that actually happened? Assuming that Maura is the potential buyer of the camera who are willing to pay the highest price and Steven is the seller who is willing to accept the lowest price for it, how much value was lost due to inefficiency?

Check your answer

### 1.3 How Economists Examine Problems and Help Find Solutions

#### Building Economic Models

Economists develop and use economic theories to analyze real-life situations. To organize their thoughts, they build **models**, which can be expressed in verbal, graphical, or mathematical form. To be useful in helping economic agents—individuals, firms, and governments—make decisions, economic models must be practical, focused on the purpose at hand, and empirically tested against real-world data.

To serve its intended purpose well, an economic model must abstract from factors that are either irrelevant or won't change the results of the analysis significantly. We must abstract from unimportant factors to isolate and examine most relevant influences because, as one economist has put it, people's minds are limited and nature's riddles are complex. Humanity has never progressed very far in understanding anything—be it biology, physics, or economics—without abstracting from many factors that are not essential to a given problem. Thus:

An economic model that performs and predicts well must present a simplified reflection of the real world that makes the problem we are addressing easier to analyze.

To build such models economists make **assumptions**. It is tempting to judge an economic model based on how realistic its assumptions are. We could reason that we should view with skepticism the conclusions drawn from a model based on unrealistic assumptions, such as "there are only two goods that a consumer can choose from," "the only two factors of production that a firm uses are plain labor and homogeneous capital," or "a firm produces only one generic product." We make such assumptions not because we think they are true but because they make a model easier to follow and do not change any of the important insights we can get from it.

Note that economics is not the only science that models real-world relationships using simplifying assumptions. Consider, for instance, what takes place in the chemistry lab. Various chemicals are tediously measured, combined in a sterile beaker, and placed over a Bunsen burner—all to learn about the properties of the chemicals involved. How realistic is such a process? What takes place in the chemistry lab may never take place in nature, so we could call virtually all chemistry experiments "unrealistic." However, chemists learn from these experiments and are able to apply what they have learned to the "real world." Likewise, economists make simplifying assumptions to learn about essential relationships (e.g., between the price a firm charges for its product and the quantity of the product demanded) and then apply what they have learned to real life (e.g., to help firms make their pricing decisions).

The important point here is that models should be judged on the accuracy of their *conclusions*, not on the accuracy of their assumptions. Remember this every time when you think an economic model presented in this course is practically useless because its assumptions are "ridiculous."

The purpose of economic models presented in this principle-level course is mainly educational, i.e. to help you understand the essential relationships underlying optimal decisions made by individuals and firms. Keeping our models simple makes it easier for you to see these economic relationships at work and use that knowledge later, when studying more elaborate economic models and applying them in practice.

On the other hand, oversimplified economic models, especially when their assumptions are not stated clearly, can be misleading. This kind of "economics" is habitually exploited by politicians and companies to promote their hidden agendas. For example, you might hear opponents of government regulations referring to the notion of economics that unregulated competitive markets provide the most economically efficient outcomes. But they "forget" to mention that it is only true under certain conditions, which in many real-world situations don't hold.

Albert Einstein once said, "Everything should be made as simple as possible, but not simpler," and that's the adage we strive to follow in this course. Throughout the course, we try to avoid both unnecessary complications and oversimplifications to the extent possible. And we hope studying economics with us will help you learn not only how economic analysis works, but also think critically and be able to detect unstated assumptions and hidden purposes behind illusory political and business promises propped by simplistic populist economics.



## Checkpoint 7

"A good economic model is one that is based on realistic assumptions and therefore can make accurate predictions." True or false? Explain.

Check your answer

## 1.4 Why Study Economics?

Given what you've learned so far about the subject, key ideas, and methods of economics, you might already have a good answer to this questions. Economics can help you succeed in your career and life in many ways. The main advantage of studying economics is that by doing so you develop valuable analytical, quantitative, and problem-solving skills that equip you to successfully pursue various careers paths. Click on the box below to play the video about different career opportunities for people skilled in economics.



As a business major, you probably plan to become a manager or business analyst. Economics will provide you with powerful tools for making various kinds of business decisions. As you could see from our examples, it teaches you how to spot value-generating opportunities everywhere and take full advantage of them by directing resources from lower-valued to higher-valued uses. Although those examples are fictional, they are not far from reality. Billions of dollars are lost each year because business managers fail to properly use the methods and tools of economic analysis when making pricing and output decisions, optimizing production processes, choosing resources, or designing incentives for the employees.

In the modern world of "big data" and powerful computers, companies are seeking employees who have quantitative and problem-solving skills necessary to make use of those data and computer technology to perform accurate and meaningful analysis and make evidence-based decisions. And to acquire such skills, studying economics is a must.

Here is a question a real student got when interviewing for a marketing internship position at Compaq. "I am the product manager for the new X type server that is to be launched next month at a cost of \$5,500. Dell launched their new Y type server last week; it has the same features (and even a few more) for a cost of \$4,500. To date, Compaq has put over \$2.5 million in the development process for this server, and as such my manager is expecting above normal returns for the investment. What advice would you give to me on how to approach the launch of the product? Do I go ahead with it at the current price, if at all, even though Dell has a better product out that is less expensive, not forgetting the fact that I have spent all the development money and my boss expects me to report a super return?" Later, the student wrote to his economics professor: "I laughed at the question... He wanted to see if I got caught worrying about all the development costs in giving advice to scrap the launch or continue ahead as planned. I ...could see that coming a mile away ... thanks to economics, right?!!!"<sup>3</sup>

Now, if you were asked this question when interviewing for a job, how would you answer it?

<sup>3</sup> Adapted from Luke M. Froeb, et al. "Managerial Economics: A Problem Solving Approach." 4<sup>th</sup> ed., p. 9-10.



Imagine that you are getting ready for a job interview and the interviewer will most likely ask a question like the one above. Try to prepare your answer and then compare it with the one suggested below. Hint: Review the key ideas of economics that we've discussed in this chapter; the answer is right there!

All right, here is how an economist would answer the question. First, as the author of the e-mail points out and as we explain earlier in this chapter (p. 8), you should ignore the \$2.5 million that Compaq has already invested. This is a sunk cost. Now, following the principle of marginal cost-benefit analysis (which we discuss on p. 6-8), Compaq should launch the new server only if the projected revenue from its sales—i.e. Compaq's *marginal benefit*—is greater than (or at least equal to) the additional costs of producing and selling it—i.e. the *marginal cost*.

Note that the position in our example was in marketing, which you might think has little to do with economics. Well, apparently the employer thought otherwise. In fact, college graduates skilled in economics are in high demand in any field where analytical thinking and problem solving skills are important.

Table 2 show top ten jobs for economics majors with brief descriptions. What is common about the skills that employers expect you to have to be a successful candidate for those positions—from market, credit, and policy analysts to financial consulting to law and business journalism—is critical thinking and the ability to conduct in-depth research with quantitative analysis using the methods and tools of economics.

**Table 2 Top Ten Jobs for Economics Majors**

Market research analyst	Gather data and analyze market trends to assess how products or services might fare under various economic conditions, quantify results and present them to clients.
Economic consultant	Use analytical and research skills to carry out studies considering various economic scenarios to help organizations in a variety of industries—including business, finance, health care, education, government, and more—improve their performance.
Compensation and benefits manager	Evaluate options for pay and benefits, study trends in the labor market and assess supply and demand for various classes of jobs, establish an efficient structure for the company's pay and benefits.
Actuary	Apply advanced mathematical and statistical skills to determine the likelihood of insurable events like fires, deaths, illnesses, and business failures, analyze risk profiles to establish a profitable structure for insurance policies.

**Table 2 (Continued)**

Credit analyst	Conduct microeconomic analyses to assess the risks involved with loaning funds to individuals and businesses, examine economic trends and factors impacting the regions, industries, and competitors of prospective clients, suggest interest rates that are appropriate given the risk profile of clients.
Financial analyst	Use advanced quantitative methods to research companies, industries, stocks, bonds, and other investment instruments, write reports and prepare presentations for colleagues and clients to help make decisions about investments, stock/bond offerings, and mergers/acquisitions.
Policy analyst	Analyze issues regarding legislation and government economic policies, such as healthcare, taxes, energy, the environment, and international trade; present these research results to legislators and the public.
Lawyer	Use critical thinking and analytical skills to prepare and try cases. Many areas of law such as corporate law, tax law, antitrust law, personal injury, and medical malpractice involve the application of economic analysis.
Management consultant	Analyze business problems and research possible solutions to present to clients.
Business reporter	Research, write, and broadcast stories about companies, industry trends, business leaders, economic developments, and financial markets.

Source: <https://www.thebalance.com/top-jobs-for-economics-majors-2059650>

Naturally, high demand for such skills leads to high earnings for those who possess them. Table 3 shows the median starting and mid-career salaries of college graduates with majors in various business disciplines. As you can see, ranked by the mid-career salary, economics majors are at the top. The table also shows salaries for some specific economics majors—economics with mathematical methods and economics for business (which is basically a BBA in economics, such as the one offered here at Georgia Southern). As evident from these numbers, economics and mathematics is the most valuable mix of skills. Keep in mind that the numbers in the table show the median salaries by major regardless of what the person's occupation is. For instance, the starting salary of an economics major is \$54,100 no matter whether that person works as an economic consultant or, say, a marketing specialist. Thus, it is likely that with a degree in economics, you will be earning more in any, even seemingly unrelated, specific area of business than a graduate with a degree in that specific subject will.

**Table 3 Bachelor Degrees in Business by Salary Potential**

Major	Median Salary	
	Early Career*	Mid-Career**
Economics	\$54,100	\$103,200
Economics and mathematics	\$60,000	\$122,900
Economics and business	\$53,900	\$104,900
Economics and finance	\$56,600	\$103,300
Information Systems	\$55,800	\$96,900
Finance	\$53,300	\$93,200
Marketing	\$45,200	\$84,900
Accounting	\$48,400	\$82,800
Management	\$45,400	\$76,500
Logistics	\$51,700	\$75,300

\*0-5 years of work experience; \*\*10 or more years of work experience.

Source: College Salary Report 2017-18 by PayScale (<https://www.payscale.com/college-salary-report/majors-that-pay-you-back/bachelors>).

PayScale surveyed 2.3 million graduates of more than 2,700 colleges and universities.

Notice also that the salary of economics majors almost doubles throughout the period from early career to mid-career, rising markedly faster than the salaries of other business majors. That is, the skills acquired when studying economics are growing even more valuable with the work experience. New BBA's in economics often start out in positions such as research analyst, research assistant, or junior consultant, where they support the work of more experienced employees, but they move up pretty fast to more highly paid positions such as economic, financial, or management consultant.

We hope that now you can see more clearly what economics is about and how it can help you succeed in your career and life. So, let's embark on our exciting journey into the world of applied microeconomics. We will try and do our best to make it useful and enjoyable experience for you.



## Checkpoint Answers

1

How consumers and producers make optimal decisions given certain market conditions. As defined above, the subject of this course is how producers and consumers interact and make their choices given the constraints they face under certain market conditions.

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2

Dan's opportunity costs are what he gives up *if* he goes to college. This includes tuition (\$9,000), textbooks (\$1,500), housing (\$4,500) (since otherwise he'd live at home for free), and the additional amount he'd spend on food when in college (\$2,500 - \$1,000 = \$1,500). Dan's opportunity costs of college also include the earnings from the job he would have to give up (\$30,000). Thus, his opportunity cost of a year in college is  $9,000 + \$1,500 + \$4,500 + \$1,500 + \$30,000 = \$46,500$ , so his opportunity cost of four years in college is  $\$46,500 \times 4 = \$186,000$ .

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3

Discontinue the project. The additional revenue from the new product (9 billion yen) is expected to be less than the additional cost of finishing the project (10 billion yen). Therefore, Sony should discontinue the project. The 12 billion yen already invested is a sunk cost, which should not be taken into account when making the decision.

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4

Viola should give piano lessons for four hours a day. Viola should continue to give piano lessons as far as her marginal cost, i.e. the costs of an additional hour of her time shown in the table, is below her marginal revenue, i.e. \$30 received for each additional hour of her work. This is the case up to the fourth hour, for which the marginal cost is \$28 while the marginal revenue is \$30. Viola's opportunity cost of the fifth hour, however, is \$32, which is greater than her revenue of \$30. Therefore, Viola should not continue to work for the fifth hour.

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5

You should sell the book. If you do, your overall value gain will be \$65. If you sell the book at the end of the semester for  $\$90 \times 0.5 = \$45$ , you will gain an additional value of  $\$45 - \$30 =$

\$15. At the beginning of the semester, you were willing to pay \$140 for the text, but you got it for \$90, so you gained  $\$140 - \$90 = \$50$ . Thus, your overall gain is  $\$50 + \$15 = \$65$ .

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**6**

The value gain from the actual transaction is \$160. The value lost due to inefficiency is \$140. When Steven, who is willing to accept \$400 for the camera, sells it for \$450 to someone who values it at \$560, Steven gains  $\$450 - \$400 = \$50$  and the buyer gains  $\$560 - \$450 = \$110$ . Thus, the value gain from the transaction is  $\$50 + \$110 = \$160$ . If Steven sold the camera to Maura, she would receive a value of \$700 while Steven would part with a value of \$400, so the value gain would be  $\$700 - \$400 = \$300$ . Thus, the potential value gain is  $\$300 - \$160 = \$140$  greater than the actual value gain, which means \$140 is lost due to inefficiency.

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**7**

False. An economic model should be judged on the accuracy of their conclusions, not on how realistic its assumptions are. A good economic model is a simplified picture of reality that eliminates irrelevant or unimportant factors and hence allows us to focus on the essential relationships we want to examine.

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## CHAPTER 2

# DEMAND AND SUPPLY IN COMPETITIVE MARKETS



### What's in It for You?

The average price of regular gasoline in the United States rose from \$1.09 in January 2002 to \$4.00 per gallon in July 2008 and then dropped to \$1.68 per gallon in February 2016. What caused such wide fluctuations in the price of gas? What should you expect to happen to it in the future? Now suppose you are considering starting a web design business. The market for such services is currently booming. But is this trend likely to continue, so you should pursue your venture and expect it to be profitable? And here is another business dilemma. As organic food is becoming increasingly popular in the United States and worldwide, suppose your friend, a farmer, is wondering if she should go organic. Converting a conventional farm to organic takes years, and producing organic food is costlier than conventional farming. What advice should you give to your friend? To find the answers to all these and many other such questions, you must first understand how consumers' demand interacts with producers' supply.

In this chapter, we explain how buyers and sellers interact in competitive markets, how this interaction determines the quantities of goods and services produced and the prices at which they are sold, and how you can use the demand and supply model to explain the effects of various events on the market and predict changes in the market prices and quantities. For now, we assume that the forces of supply and demand alone determine the market outcomes. We will discuss how government economic policies influence markets in later chapters.



### Learning Objectives

At completion of this learning module you are expected to be able to:

- Describe the characteristics of the markets where the competitive demand and supply model is applicable and explain how real-world markets can be analyzed using the demand and supply model.
- Describe the relationships reflected by the demand and supply curves and distinguish between movements along the curves and shifts of the curves.
- Explain how an equilibrium is reached in competitive markets.
- List key factors that influence buyers' and sellers' decisions and explain how they shift the demand and supply curves.

- Use the demand and supply model to explain observed changes in prices and quantities sold in competitive markets and predict how changes in demand and supply will affect the market equilibrium.
- Explain the concepts and assess the values of consumer surplus, producer surplus, total surplus, and deadweight loss.
- Define economic efficiency and list the conditions necessary for competitive markets to be efficient.

## 2.1 Applying the Demand and Supply Model

Recall from Chapter 1 that in microeconomics we view modern economies as collections of markets and that by a market we mean any arrangement that enables buyers and sellers to interact with each other. Many things are traded in various kinds of markets, from farmers' markets, Walmart, and eBay to markets for real estate, financial assets, and foreign exchange. In this chapter though, we'll focus on markets for goods and services.

### Where Can We Use the Demand and Supply Model?

The demand and supply model that we study here can be applied to markets for various things, including all those mentioned above. But the model assumes that no individual buyer or seller can significantly influence the market price (and no groups of buyers or sellers are acting together as one), so the price is determined by all buyers and sellers in the market with each of them acting independently. Economists use the term **competitive market** to describe this kind of buyers' and sellers' interaction.

The demand and supply model works best when the market is **perfectly competitive**. We will discuss the features of perfectly competitive markets in more detail in Chapter 7. For now, the two conditions necessary for a market to be perfectly competitive are: (1) Buyers view products offered in the market as exactly the same no matter who sells them. (2) There are so many buyers and sellers in the market that each of them accounts for a very small fraction of the total sales so that the influence of each buyer or seller on the market is negligible. Since in this situation buyers and sellers must accept the market price as a given, economists call them **price takers**.

Although some markets can be viewed as perfectly competitive (e.g., the markets for grain, beef, orange juice, metals, and other commodities), most markets do not exactly meet the conditions above. Many markets, however, meet them closely enough, so we can ignore the imperfections. For example, consider the U.S. market for gasoline. Regular gas is a standardized product. Different gas stations may charge different prices, but the deviations are small and due mainly to the differences in gas stations' locations and conveniences they offer (such as food, clean restrooms, ATM machines, etc.), not to the gas they sell. Thus, if we want to predict or explain changes in the average price of regular gas in the United States, we can safely ignore those differences and use the demand and supply model for the purposes of our analysis.

We can even use the demand and supply model to analyze markets where the products sold by different firms differ significantly. For example, suppose we want to analyze the market for laptop computers. Of course, laptops sold by different firms differ by their technical

characteristics, quality, design, etc. Nevertheless, if we want to see, for instance, why laptops in general have become cheaper, we can combine all kinds of laptops into a single whole and treat them as the same good. Thus, the uses of the demand and supply framework discussed in this chapter go far beyond perfectly competitive markets. The model can be applied to gain important insights into how prices and quantities sold are determined in many real-world markets.



## Checkpoint 1

"The demand and supply model is applicable only to perfectly competitive markets, and few real-world markets are perfectly competitive." True or false? Explain.

Check your answer

## What Is a Price?

The answer to the question above seems obvious. Is not it the number of dollars you pay for a unit of a good? Not exactly. Recall, from Chapter 1 that economists measure the cost of everything as opportunity cost and that the opportunity cost of a good you get is the value of your best alternative given up. For example, if you buy a concert ticket for \$28, and your second-best choice is to go to the movies, paying \$7 per ticket, then the opportunity cost of your attending the concert is  $\$28/\$7 = 4$  movies. This ratio of one nominal price to another is called a **relative price** or **real price**. And it is the relative prices, not nominal prices, that are relevant when examining how the forces of demand and supply interact in a market.

In practice, however, we don't need to calculate the price of the good in question in terms of every other related good. Instead, we can calculate the price of any good of our interest in terms of a "basket" that represents all goods and services and then compare this relative price with the relative prices of other goods calculated the same way. As you might remember from your first economics course, this can be done using the Consumer price index (CPI). For example, the prices of gas quoted at the beginning of this chapter are money prices (also called nominal prices). For more meaningful comparisons, we can convert them into relative (i.e. real) prices using the CPI. Since in January 2002 the CPI was 1.77, we can say that the relative price of gas in January 2002 was  $\$1.09/1.77 = \$0.62$  per gallon. In July 2008, the CPI was 2.20, so the relative price of gas in July 2008 was  $\$4.00/2.20 = \$1.82$ . Comparing these numbers, we can see that the price of gas still rose substantially (2.9 times), but not as much as the nominal prices suggest (3.7 times). The 2.9 times price increase was caused by the forces of demand and supply, while the rest of the increase in the nominal price of gas was due to inflation, which is a macroeconomic monetary phenomenon and therefore is irrelevant to our analysis of what's going on in a particular market such as the market for gas.



## Checkpoint 2

"In the demand and supply model, the market price is the money that buyers pay and sellers receive per unit of the good they exchange." True or false? Explain.

Check your answer

## 2.2 Demand, Supply, and Market Equilibrium

### The demand curve

The buyers' side of the market is reflected by the **demand relationship**, the graphical representation of which is called the **demand curve**. You should be familiar with the demand curve, as it is a key concept studied in all introductory economics courses. The term "demand" is also widely used (and often misused) in the media, political debates, and everyday life. Here is the precise definition of the demand relationship that economists use:

The market demand curve for a good shows how much of the good offered in the market consumers are willing to buy over a certain period of time at each given price, holding constant all other factors that influence their choice.

Figure 2-1 presents an example of a demand curve that reflects the demand relationship in a (hypothetical) market for gasoline. The demand curve shows, for instance, that when the price of gasoline is \$1.60 per gallon, the quantity of gasoline demanded is 260 million gallons per month (point A) and when the price rises to \$2.20 per gallon, the quantity demanded decreases to 245 million gallons per month (point B). The demand relationship shown by the graph seems pretty straightforward and self-explanatory. This simplicity, however, can be deceptive. In fact, misconceptions about what "demand" means are widespread. Students, business people, politicians, government officials, and the media alike tend to use the term demand in meanings that do not accurately reflect the definition of demand that economists use. Since that definition of demand plays a key role when applying the demand and supply model, it is important to keep in mind the following when analyzing demand.

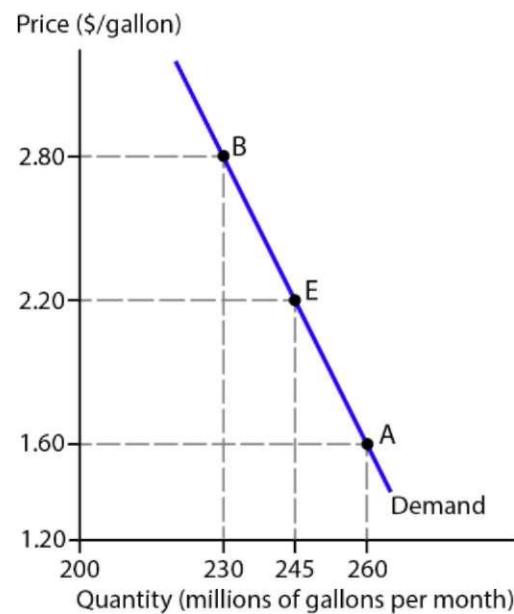


Figure 2-1 Demand for gasoline

### ***Demand is not the same as a want or a need***

Consumers may want a lot of things, but they don't necessarily have demand for them. An individual has a demand for a good only if she is willing to buy it given the price of the good and her budget constraint. For example, Alissa wants a new car priced at \$20,000, but she would not buy it because, given her budget constraint, she prefers to spend this amount of money on other goods. Thus, she does not have a demand for the car. As clear from this example, a consumer's demand is based on her choice that takes into account the opportunity costs. This is discussed in detail in Chapter 5.

### ***Quantity demanded and quantity bought are two different concepts***

The demand curve tells us nothing about the availability of the good to consumers. For example, the demand curve in Figure 2-1 shows that at \$1.60, consumers are willing to buy 260 million gallons of gas (point A). But it does not tell whether that quantity of gas is available for them to purchase, since it does not show what quantity of gas sellers are willing to supply at this price.

### ***Demand is the relationship between price and quantity demanded***

A typical demand curve slopes downward, reflecting a negative relationship between the price and the quantity demanded. For instance, in Figure 2-1, if the price of gas rises from \$2.20 to \$2.80 per gallon, the quantity of gas demanded decreases from 245 million to 230 million gallons. Note that quantity demanded is always measured over a certain period of time, a month in our example. This relationship seems obvious: the more expensive the good is, the less of it people want to buy. However, this is not what we always observe in reality. For example, in 2004 the real price of gas in the United States was 15.6 % higher than in 2003, but the consumption of gas still increased by 2.2%. This fact may look puzzling, but the explanation of it is quite simple: price is not the only factor that influences consumer choice. Therefore, to correctly account for the effect of price, and only price, on quantity demanded, we must hold constant all other factors that affect quantity demanded, such as consumer income, prices of related goods, etc. As we explain in Chapter 1, holding all other factors constant when examining the influence of the factor of our interest is a powerful method that economists apply to discover and analyze economic relationships. Thus, when drawing a demand curve, we hold all influences on consumers' choices other than the price of the good fixed at certain levels. Then, our demand curve will reflect what economists call the **law of demand**:

When the price of a good rises, the quantity of the good demanded decreases, holding constant all other factors that influence consumers' choices.

Obviously, the law of demand works in the opposite direction as well: when the price falls, the quantity demanded increases. It is referred to as a law because the negative relationship between the price and the quantity demanded holds in most markets most of the time.

### Demand and quantity demanded are two different terms

The term demand refers to the whole *relationship* between the price of the good and the quantity of the good demanded, not to a particular quantity that consumers are willing to buy. To avoid confusion, we'll call that quantity "quantity demanded," as opposed to "demand," which refers to the entire curve. This change in quantity demanded is reflected by a *movement along the same demand curve*, (for example, from point A to point B in Figure 2.1). The demand—i.e. the existing relationship between the price and the quantity demanded—does not change in that case. Note that the only factor that can change quantity demanded without changing demand, i.e. cause a movement along the same demand curve, is the price of the good. A change in any other factor that influences buyers' choices will shift the demand curve. For example, if more consumers become environmentally conscious and want to decrease their consumption of gasoline, they will want to buy less gasoline at each given price, which will shift the demand curve leftward, from  $D_1$  to  $D_2$  as illustrated in Figure 2.2. That is, for instance, at \$2.80, consumers will want to buy 215 million gallons instead of 230 million gallons, at \$2.20, they will want to buy 230 million gallons instead of 245 million gallons, etc. We will study key factors that influence demand in the next section.

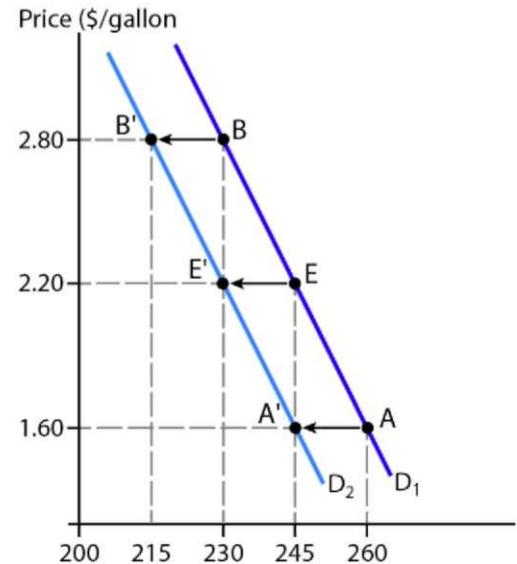


Figure 2-2 Demand for gasoline decreases



### Checkpoint 3

Which of the following statements are true and which are false? Explain.

- The price of a good and the quantity of the good demanded are negatively related.
- Other thing being equal, the demand for a good will increase if its price falls.
- An increase in consumer income causes a downward movement along the demand curve.
- A rise in the price of a good will result in a leftward shift of the demand curve.

Check your answer

### The supply curve

The counterpart of the demand relationship on the sellers' side of the market is the **supply relationship**, which is graphically represented by the **supply curve**. Just like demand, the term "supply" is widely used and often misused. The definition of the supply relationship used in economics is:

The market supply curve for a good shows how much of the good sellers are willing to offer over a certain period of time at each given price, holding constant all other factors that influence their decisions.

Let's consider again the market for gasoline in the previous example. Figure 2-3 presents the supply curve that reflects the sellers' decisions. For instance, when the price of gasoline is \$1.60 per gallon, the quantity of gasoline supplied is 215 million gallons per month (point F) and when the price rises to \$2.20 per gallon, the quantity supplied increases to 245 million gallons per month (point E). Since misconceptions about the meaning of the term "supply" are as widespread as those about the term "demand," it is important to clarify the following.

#### ***Supply is not what sellers have in stock***

In business, the word "supply" is commonly used to mean a stock of a good available for sale or something that the firm gets from its suppliers. This is not what economists mean by supply. In economics, the term "supply" is used to reflect a firm's decision to offer the quantity of a good that would maximize its profit given the cost of producing and selling the good. In Chapter 7, we will have much more to say about how competitive firms make their profit maximizing decisions and how these decisions result in a certain market supply curve.

#### ***Quantity supplied and quantity sold are two different concepts***

The supply curve tells us nothing about how much of the good sellers will actually be able to sell. For example, the supply curve in Figure 2-3 shows that at \$2.80, sellers are willing to offer 275 million gallons of gas (point G). But it does not tell whether consumers will want to buy that quantity of gas at that price. And if consumers don't want that much gas at \$2.80, sellers won't be able to sell it at that price.

#### ***Supply is the relationship between price and quantity supplied***

A typical supply curve slopes upward, reflecting a positive relationship between the price and the quantity supplied. For instance, as shown in Figure 2-3, if the price of gas rises from \$2.20 to \$2.80 per gallon, the quantity of gas supplied increases from 245 million to 275 million gallons. Note that, just like quantity demanded, quantity supplied is always measured over a certain period of time (a month in our example). Why does the quantity supplied increase when the price of the good rises? In a nutshell, this is because a rise in price makes producing a greater quantity of the good more profitable. Recall from Chapter 1 that an increase in output will always increase profit if the extra revenue from selling the additional units of output exceeds the additional costs. A higher market price of its product increases the firm's additional revenue from selling more of it, covering the firm's additional costs. Thus, to increase its profit, the firm will want to sell a greater quantity of the product. In

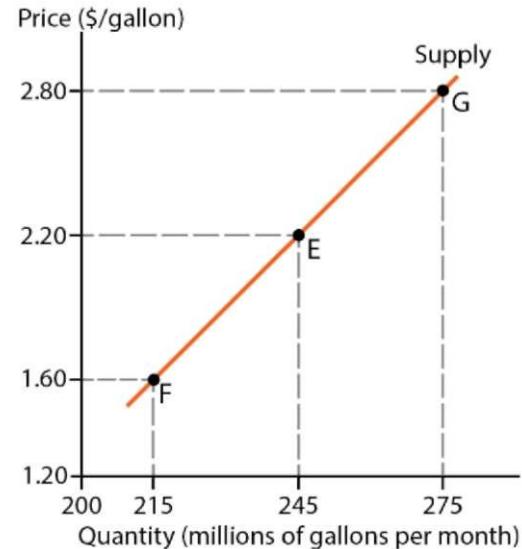


Figure 2-3 Supply of gasoline

Chapter 7, we'll discuss in detail how firms choose their profit maximizing quantity of output given the market price of their product.

Note further that, just like with the quantity demanded, to correctly account for the effect of the price alone on the quantity supplied, we must hold constant all other factors that affect firms' supply decisions, such as technology, prices of inputs, etc. So, when drawing a supply curve, we hold all influences on sellers' choices other than the price of the good fixed at certain levels. Then, our supply curve will reflect the **law of supply**:

When the price of a good rises, the quantity of the good supplied increases, holding constant all other factors that influence sellers' decisions.

obviously, the law of supply works in the opposite direction as well: when the price falls, the quantity supplied decreases.

### **Supply and quantity supplied are two different terms**

Similarly to demand, the term supply refers to the *whole relationship* between the price of the good and the quantity of the good supplied, not to a particular quantity that sellers are willing to offer. To make it clear, we'll call that quantity "quantity supplied," as opposed to "supply," which refers to the entire curve. A change in quantity supplied is reflected by a *movement along* the same supply curve, (for example, from point F to point G in Figure 2-3). The supply—i.e. the relationship between the price and the quantity supplied—does not change in that case. And just like with demand, the only factor that can change quantity supplied without changing supply, i.e. cause a movement along the same supply curve, is the price of the good. A change in any other factor that influences sellers' decisions will shift the supply curve. For example, if a technological advance allows oil refineries to produce more gasoline with the same amount of resources, they will want to supply more gas at any given price, which will shift the supply curve rightward, from  $S_1$  to  $S_2$  as illustrated in Figure 2-4. For instance, at \$1.60, sellers will want to sell 245 million gallons instead of 215 million gallons, at \$2.20, they will want to sell 275 million gallons instead of 245 million gallons, etc. We will study key factors that influence supply in the next section.

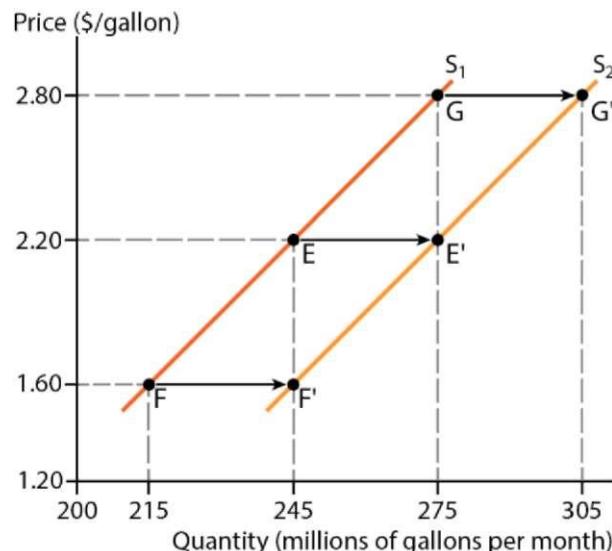


Figure 2-4 Supply of gasoline increases



## MAKE THE GRADE

When supply increases, can you say that since it "goes up," the supply curve shifts upward? And when supply decreases, does this mean the curve shifts downward? If you look at Figure 2.4, you can see that a rightward shift of the supply curve, which is an increase in supply is actually a downward shift. While using "rightward"/"upward" and "leftward"/"downward" interchangeably may work when speaking about shifts of the demand curve, even in that case it makes more sense to describe them as rightward or leftward rather than upward or downward.

Recall, for instance, that a decrease in demand means that consumers are willing to buy less of the good at each given price, as illustrated in Figure 2.2. That is, all points on the original demand curve (D1) shift leftward along the quantity axis so that the entire curve shifts leftward. The same logic applies to an increase in demand, when all points on the original curve shift rightward, and to changes in supply reflecting sellers' willingness to supply a greater or a lower quantity at each given price.

Later in the course, we'll see that sometimes it makes more sense to talk about upward or downward shifts of the supply and demand curves (for example, when analyzing the effects of taxes or subsidies). But when you use the demand and supply model to analyze the kinds of problems and applications that are discussed in this chapter, it is best to view changes in demand and supply as rightward or leftward shifts of the curves.



### Checkpoint 4

Which of the following statements are true and which are false? Explain.

- A. The price of a good and the quantity of the good supplied are negatively related.
- B. Other things being equal, the supply of a good will increase if its price rises.
- C. A technological improvement will cause an upward shift of the supply curve.
- D. A fall in the price of a good will result in a leftward and downward movement along the supply curve.

Check your answer

## Market equilibrium

To see how the forces of demand and supply determine market prices and quantities, let's put the two sides of the market together. Figure 2-5 combines the demand and supply curves in the market for gasoline shown in Figures 2-1 and 2-3. The demand curve (D) represents buyers' choices and the supply curve represents sellers' decisions at each given price. As you can see, when the price is \$2.20 per gallon, the demand curve shows that buyers are willing to purchase 245 million gallons of gas. And the supply curve shows that sellers want to offer the same quantity of gas. Graphically, this is the point where the two curves intersect (point E). Since buyers want to buy the same quantity of gas as sellers want to sell, the market is in a steady state or, as economists call it, in **equilibrium**. The price at which the quantity demanded (Q<sub>D</sub>) equals the quantity supplied (Q<sub>S</sub>) is called the **equilibrium price**, and the quantity that corresponds to this price is called the **equilibrium quantity**.

In the real-world, markets are not always in equilibrium. Rather, prices and quantities gravitate to the equilibrium point while fluctuating around it. That is, every time a deviation from equilibrium occurs, the market tends to move back toward it. To see why, let's consider a situation when the price is below the equilibrium, such as that depicted in the left panel of Figure 2-6. Suppose the current price of gas is \$1.60 per gallon. As the demand curve shows, at this price consumers want 260 million gallons of gas (point A). But, as evident from the supply curve, sellers are willing to offer only 215 million gallons at this price (point F). That is, there is an **excess demand** of 45 million gallons. As buyers want a greater quantity of

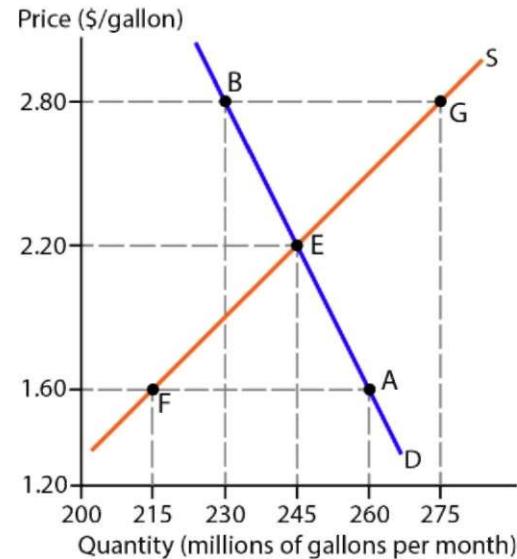


Figure 2-5 Demand and supply in a market for gasoline

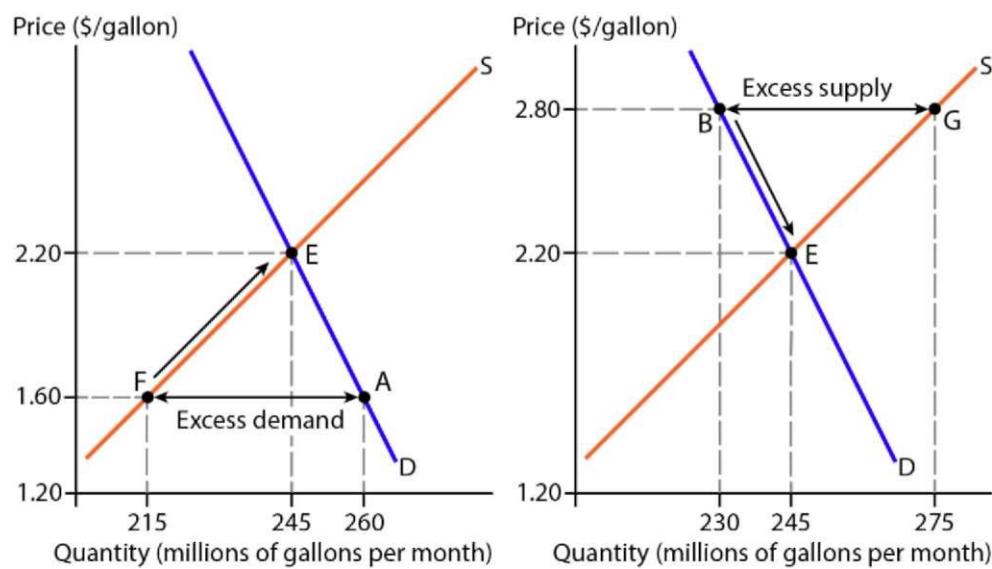


Figure 2-6 Market adjustments toward equilibrium

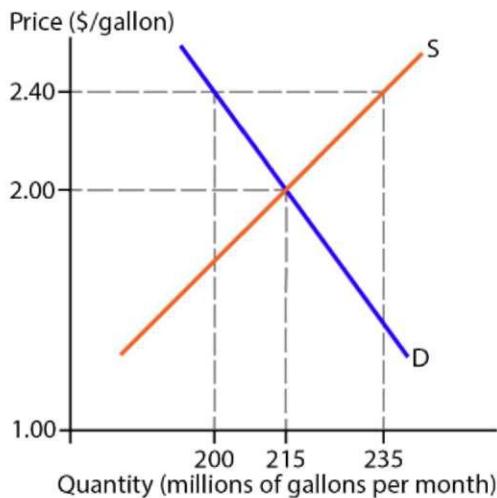
gas than is available in the market, they will be willing to pay a higher price to get more gas. And as buyers bid up the price, the quantity of gas supplied—as well as the actual quantity sold—increases along the supply curve. On the other hand, as the price rises, the quantity of gas demanded decreases along the demand curve. The price continues to rise and the market continues to adjust until the quantity of gas demanded equals the quantity supplied so that the excess demand disappears and the market is in equilibrium at point E, where  $Q_D = Q_S = 245$  million.

Now suppose the price of gas is currently \$2.80 per gallon. As the right panel of Figure 2-6 illustrates, at this price sellers are willing to offer 275 million gallons of gas (point G), but buyers only want 230 million gallons (point B). That is, there is an **excess supply** of 45 million gallons. As sellers compete with each other to sell their gas, they lower the price. As a result, the quantity of gas demanded—as well as the actual quantity purchased—increases along the demand curve. On the other hand, as the price falls, the quantity of gas supplied decreases along the supply curve. The price continues to fall and the market continues to adjust until the quantity of gas demanded equals the quantity supplied so that the excess supply disappears and the market is in equilibrium again with  $Q_D = Q_S = 245$  million (point E). Thus, if for some reason the current price deviates either up or down from its equilibrium level, the competitive forces of demand and supply will work to bring the market back to equilibrium.



### Checkpoint 5

The figure below shows a market for gasoline. Suppose the price is currently \$2.40 per gallon. What is the quantity of gasoline demanded? Quantity supplied? Quantity sold? What do you predict will happen to the price of gasoline?



Check your answer



## TOOLS OF ECONOMICS

### The Mathematics of Demand and Supply

As noted in Chapter 1, economics speaks three languages: words, graphs, and mathematical formulas. In our analysis above, to find the equilibrium price and quantity graphically, we drew the demand curve and the supply curve on the same graph. Then we marked the point where the two curves intersect, which showed us the equilibrium price on the vertical axis and the equilibrium quantity on the horizontal axis. We can also find the market equilibrium using algebraic representations of the demand and supply curves.

To simplify our analysis, we'll assume that both curves are *linear*, i.e. are straight lines. Although the real-world demand and supply curves may have different shapes, for practical purposes, they are usually reasonably close to their linear approximations in the price and quantity ranges of our interest. The demand curve shown in Figure 2-5 can be represented by the following equation:

$$QD = 300 - 25xP$$

where  $QD$  is the quantity of gas demanded (millions of gallons) and  $P$  is the price of gas (\$ per gallon). The coefficient of  $P$  in this equation tells us that for every \$1 increase in price, the quantity of gas demanded decreases by 25 million gallons. The constant term (300) reflects the influence on the quantity demanded of all other factors, which we held constant when drawing the demand curve.

The supply curve in Figure 2-5 is given by:

$$QS = 135 + 50xP$$

where  $QS$  is the quantity of gas supplied and  $P$  is the price of gas. The coefficient of  $P$  in this equation tells us that for every \$1 increase in price, the quantity of gas supplied increases by 50 million gallons. The constant term (135) reflects the influence on the quantity supplied of the factors held constant.

Note that in both equations, since the quantity depends on the price, the quantity is the **dependent variable** and the price is the **independent variable**. This means the demand and supply graph reverses the common practice of putting the independent ("X") variable on the horizontal axis and the dependent ("F") variable on the vertical axis. Although this might seem arbitrary and inconvenient at this point, you'll see later on in the course why economists prefer to graph the demand and supply curves that way. Also, recall from Chapter 1 that modeling economic relationships is based on real-world observations. Therefore, the mathematical models that economists come up with work only for the values of the variables that can actually be observed. For example, if in the market for gas the actual price has never fallen below \$1.20 per gallon and never risen above \$3 per gallon, our demand and supply equations are applicable only to that price range.

Now let's find the market equilibrium price using the demand and supply equations above. We know that the market is in equilibrium when the quantity of gas demanded equals the quantity supplied, that is:

$$QD = QS$$

using the demand and supply equations above, we can write:

$$300 - 25xP = 135 + 50xP$$

Since the only unknown in this equation is  $P$ , we can use the rules of algebra to isolate  $P$  on the left side of the equation. First, we subtract 300 from both sides of the equation, which gives us:

$$-25xP = -165 + 50xP$$

Second, we subtract  $50xP$  from both sides, resulting in

$$-75xP = -165$$

Third, we divide both sides by  $-75$  and get

$$P = 2.2$$

Thus, the market equilibrium price is \$2.20, which is what our graph in Figure 2-5 shows as well.

Since the equilibrium price equates the quantity demanded with the quantity supplied, we can find the equilibrium quantity by plugging it into either the demand or the supply equation. Using the demand equation:

$$\begin{aligned} QD &= 300 - 25x2.20 \\ QD &= 245 \end{aligned}$$

Thus, the equilibrium quantity is 245 million gallons, which is the equilibrium quantity shown in Figure 2-5. To verify our solution, we can plug the equilibrium price into the supply equation as well:

$$\begin{aligned} QS &= 135 + 50x2.20 \\ QS &= 245 \end{aligned}$$

As you can see, our solution is correct: at \$2.20 per gallon, and the equilibrium quantity is 245 million gallons,  $QD = QS = 245$  million gallons.

The market equilibrium price and quantity will remain unchanged as far as the demand curve and the supply curve stay intact. But what will happen if some event shifts one of the curves or both curves? We address this question in the next section.

## 2.3 Changes in Demand and Supply and How They Affect the Market

### Key Factors That Shift the Demand Curve

As noted in the previous section, a change in any factor influencing buyers' choices other than the price of the good changes demand, i.e. shifts the demand curve. Let's discuss key factors that affect demand, key "*demand shifter*," so to speak. Remember that when discussing the effect of each of those factors, we follow the *ceteris paribus* principle, i.e. change one factor at a time while holding constant all others, *including the price*.

#### *Consumer tastes and preferences*

The most obvious influences on demand are those associated with changes in consumer tastes and preferences. Consumers' attitudes toward a good may change for different reasons. We've already discussed one example: when more consumers become environmentally conscious and want to decrease their gas consumption—e.g., by switching to hybrid or fully electric cars—they will want to buy less gas at each given price, which will shift the demand curve leftward, as shown in Figure 2-2.

Consumer preferences may change for different reasons. In the example above, the shift of preferences away from gasoline is likely due to consumers' becoming increasingly informed of the credible scientific evidence suggesting that carbon dioxide (CO<sub>2</sub>) released into the atmosphere when we burn gas is a major contributor to global warming, which endangers our health, hurts the economy, and even jeopardizes national security.

Consumer tastes may also be altered by advertising, whether it is *informative*, i.e. providing information about the existence and features of the product, or *persuasive*, i.e. trying to influence consumers psychologically. An example is a "buy American" advertising campaign appealing to consumers' patriotic sentiments. If it is successful, consumers will want to buy more of a domestically produced good—say, American made cars—at each given price, shifting the demand curve for that good rightward.

Finally, consumer tastes may change as a result of changing social and cultural attitudes, fashions, or fads. For example, the recent nostalgia for analog music spontaneously developed among the younger generation of consumers has substantially increased the demand for vinyl disks and audio cassettes, as well as for turntables and cassette players.

#### *Income and wealth*

Income is another factor whose influence on demand seems to be pretty obvious. The higher the income, the more of a good consumers will be able to afford at each given price, which means when consumers' incomes increase, their demand for a good increases, i.e. the demand curve shifts rightward. And when consumer income decreases, the demand curve shifts leftward. This positive relationship holds for most goods, which are therefore called **normal goods**.

For some goods, however, the direction of the relationship between consumer income and demand is negative. That is, a rise in income results in a decrease in demand, and a fall in income decreases demand. For example, consumers who want to buy used cars do so mainly because they cannot afford a new car. But when their income rises, they are likely to switch

to more expensive and appealing new cars. Other examples are fast food and cheap grocery items, such as instant noodles or canned meat. During the Great Recessions of 2007-2009, when real median household income in the United States fell by almost 5%, the purchases of canned and preserved food increased by about 6%. And when the economy started to recover and incomes began to rise, consumers started to replace those inferior food items with more expensive fresher and healthier products, so by 2013, the purchases of canned and preserved food fell by about 5%.<sup>1</sup> Goods for which demand decreases when income rises and increases when it falls are called **inferior goods**.

Note that whether a good is normal or inferior is determined by how the demand for it reacts on a change in consumer income, not the other way around. That is, we can only speculate if a good is likely to be normal or inferior considering its physical qualities, but we can't tell that for sure until we see how the demand for the good changes in response to a change in consumer income other things being equal. Moreover, a good can be inferior for some groups of consumers but normal for others. For example, used cars are an inferior good for the middle-class Americans, but for the poor, who can't afford a new car even if their income rises, a used car is a normal good, as their demand for used cars is likely to increase in response to an increase in income.

Consumer wealth influences demand in a similar same way income does. It is important, however, to see the difference between these two concepts when analyzing factors influencing demand. **Income** is what you earn over a certain *period of time*, for example your monthly salary. **Wealth** is what you own (i.e. your assets such as cash, bank accounts, stocks, real estate, etc.), minus what you owe (i.e. your liabilities such as home mortgage, student loan, credit card debt, etc.) at a certain *point in time*. Saved income increases wealth, e.g., when you deposit part of your salary in your savings account. And wealth can generate income, e.g., dividends paid to stock owners. However, a higher income does not necessarily mean a greater wealth, and vice versa, so both factors need to be taken into account when analyzing demand. For example, other things being equal, a college graduate with a job paying \$3,000 per month, an unpaid student loan of \$70,000, and no savings will probably want to go out for dinner less frequently than an individual with a salary of \$2,500 per month, no debt, and \$100,000 in his savings account. In general:

An increase in consumer income or wealth increases the demand for a normal good and decreases the demand for an inferior good.

Obviously, the inverse is also true, i.e. a decrease in consumer income or wealth decreases the demand for a normal good and increases the demand for an inferior good.

### **Prices of related goods**

As we've shown in the previous section, a change in the price of the good itself does not shift the demand curve. But changes in prices of other goods do. There are two kinds of related goods that affect the demand for the good in question, substitutes and complements.

<sup>1</sup> "In Pursuit of 'Freshness,' Americans Buy Fewer Canned Foods." By Venessa Wong. Bloomberg, October 22, 2013.

A **substitute** is a good that can be used in place of another good because it serves more or less the same purpose. For example, both pizza and sandwiches satisfy your demand for food, and so do pasta and rice, chicken and pork, and so on. To see how the price of a substitute influences the demand for the good we are analyzing, let's consider the market for strawberries produced using conventional farming systems, i.e. with synthetic chemical fertilizers, pesticides, herbicides and other inorganic inputs. A higher-quality substitute for conventional strawberries are organic strawberries, i.e. strawberries produced using only organic inputs. Suppose advances in the technology of organic farming lower the price of organic strawberries. How will this influence the demand for conventional strawberries? As organic strawberries become relatively less expensive, consumers will be willing to buy more organic strawberries, substituting them for conventional ones. As a result, at each given price of conventional strawberries, consumers want to buy fewer conventional strawberries, which means the demand curve for conventional strawberries shifts leftward. In general:

A fall in the price of a substitute decreases the demand for a good, shifting the demand curve leftward.

By the same logic, when the price of a substitute rises, the demand for the good in question increases, i.e. the demand curve shifts rightward.

A **complement** is a good that is used together with another good. Examples are cars and gasoline, computers and software, pancakes and maple syrup, etc. Let's consider the market for pickup trucks to see how the price of a complement, gasoline, influences the demand there. When the real price of gas almost tripled over the period from 2002 to 2008, using gas guzzling vehicles such as pickup trucks became significantly more expensive. As a result, many consumers wanted to switch to more fuel-efficient vehicles, which shifted the demand curve for pickup trucks leftward. In general:

A rise in the price of a complement decreases the demand for a good, shifting the demand curve leftward.

By the same logic, a fall in the price of a complement rises the demand for the good in question shifting the demand curve rightward.

### **Consumers' Expectations**

Consumers' expectations—particularly those about future prices—can also influence current demand for the good. This is particularly true about goods that can be stored. For example, if you expect the price of coffee to go up, you may want to buy more coffee *now*, before the price rises, which means your current demand for coffee increases. Expected future prices is a major factor affecting demand in speculative markets, such as the markets for stocks, bonds, foreign currency, and real estate. For example, if you expect the price of Apple stock to rise next month, you may want to buy it now so that you'd be able to sell it later at a profit. In general:

An expectation that the price of a good will rise in the future increases the current demand for the good, shifting the demand curve rightward.

Similarly, if consumers expect a lower price of a good in the future, they are likely to postpone the purchase until then, which causes the current demand for the good to decrease.

### ***Population***

The market demand depends on the number of potential buyers:

The more potential buyers are in the market, the greater the demand.

The number of potential buyers depends not only on the size of the population within the market's reaches, but also on its demographic and social structure. For example, aging population increases the demand for health care, and a higher proportion of high school and college students results in greater demand for laptop computers, smart phones, and music downloads.



### **Checkpoint 6**

Explain how the following events will affect the demand for:

- A. Honda cars when the price of Toyota cars rises
- B. pizza in Statesboro when a new semester begins at Georgia Southern
- C. Large SUV's when the price of gas falls
- D. Junk food when consumers become warier of health risks associated with it
- E. TVs this month when consumers expect the prices of TVs to fall next month
- F. Orange juice when the price of orange juice falls

Check your answer

## **Key Factors That Shift the Supply Curve**

A change in any factor influencing sellers' choices other than the price of the good changes supply, i.e. shifts the supply curve. Let's now discuss key factors that affect supply, i.e. key *"supply shifter."* Again, it is important to keep in mind that when discussing the effect of each of these factors, we follow the *ceteris paribus* principle, i.e. change one factor at a time while holding constant all others, *including the price.*

### ***Technology***

As we discussed earlier, a technological advance allows producers to increase output using the same amount of resources, which shifts the supply curve rightward, as shown in Figure 2-4. Improvements in technology can increase supply quite dramatically. For example, new technologies used in corn production doubled the corn yields in the United States over the

last 40 years, which was a major contributing factor to the 2.4 times increase in corn production.<sup>2</sup> Thus:

Technological advances in the production of a good increase the supply of the good, shifting the supply curve rightward.

### ***Input prices***

By an **input** we mean any resource, material, part, or ingredient used to produce a good. For example, oil refineries process crude oil, a raw material, to produce gasoline (and other petroleum products). To process crude oil, a refinery needs a chemical plant, a system of processing units with piping running throughout. Economists call it a capital input. The refinery also needs workers who operate the plant, i.e. a labor input. Now suppose that the price of crude oil falls. Then, refineries will be able to buy more oil at the same cost. As a result, they will be willing to supply more gasoline at each given price. That is:

A fall in the price of an input increases supply, shifting the supply curve rightward.

Conversely, when inputs become more costly, supply decreases, i.e. the supply curve shifts leftward.

### ***Prices in alternative markets***

When producers are making decisions about how much of their product to supply to a particular market, they consider alternative markets and alternative products. An alternative product is another good that the firm can produce with the resources it has or can easily get. An alternative market is another market where the firm can sell its product.

Consider, for example, the market for wheat in the United States. When farmers make their decisions how much of their land to use to produce wheat, they consider how profitable wheat production is relative to other crops that can be grown on that land, such as corn. Over the period of 2006-2016, for instance, the price of corn relative to wheat has increased by about 50%, making corn relatively more profitable. In response, farmers have reallocated their land and other resources to produce more corn, leaving fewer resources to produce wheat. As the data show, the acreage of land used for growing wheat decreased by 13%, while the acreage used for corn increased by 20%.<sup>3</sup> Other things being equal, using fewer resources to produce wheat will cause the supply of wheat to decrease.

Now suppose the price of wheat in Canada increases relative to that in the United States. Since it becomes more profitable for U.S. farmers to export wheat to Canada than sell it domestically, they will want to supply more wheat to the Canadian market rather than to the U.S. market. On the other hand, Canadian farmers will want to sell more of their wheat domestically rather than exporting it to the United States. As a result, the supply of wheat to the U.S. market will decrease. Thus:

<sup>2</sup> "The Crop That Ate America." By Alan Bjerga, Jeremy Diamond and Cindy Hoffman. Bloomberg, May 11, 2017.

<sup>3</sup> Source: USDA - National Agricultural Statistics Service (<https://www.nass.usda.gov>).

A rise in the price in a market for an alternative product or in a different market for the same product decreases the supply in the market in question, shifting the supply curve leftward.

Likewise, a fall in the price in an alternative market increases the supply in the market in question, shifting the supply curve rightward.

#### ***Sellers' Expectations***

Sellers' expectations—especially about the price of the good in the future—can also influence the current supply of the good. This factor is particularly relevant when sellers can hold inventories of the goods or when producers can easily vary the levels of their output over time. For example, if producers of condensed milk expect a higher price of condensed milk in the future, they may want to sell less of condensed milk now at any given price, storing it until they can sell it at a higher price. Just like on the buyers' side, expected future prices is a major factor affecting sellers' decisions in speculative markets. For instance, if United Airlines stock holders expect the price of the stock to go down next month, they may want to sell it now to avoid a capital loss. Thus:

An expectation that the price of a good will rise in the future decreases the current supply of the good, shifting the supply curve leftward.

Similarly, if sellers expect a lower price of a good in the future, they will want to supply more of it now, before the lower price makes selling the good less profitable.

#### ***Number of firms***

The market supply curve shows how much of the good a certain number of producers are willing to supply at each given price. If the number of sellers in the market increases, the total quantity they want to sell at any given price will increase, shifting the market supply curve rightward. For example, in the late 1990s—a period of rapid growth in the usage and adaptation of the Internet by businesses and consumers—a lot of new companies providing e-commerce services (so called "dot-coms") were founded, so the supply of those services increased sharply. That is:

An increase in the number of sellers in a market increases the market supply, shifting the supply curve rightward.

Conversely, all else equal, a decrease in the number of sellers in the market will decrease the market supply.

#### ***Natural events***

Natural events can also affect supply, especially when production depends on natural conditions such as weather and climate. These conditions can be viewed as natural technology. For instance, in agriculture, favorable weather results in higher crop yields. It increases supply much like better technology does in general. On the other hand, as a recent national climate

assessment report indicates, the global warming has had and will continue to have a destructive impact of on the U.S. agriculture, causing declines in crop and livestock production due to weeds, diseases, pests, and other climate change induced stresses.<sup>4</sup> Natural events can also affect the supply of goods whose production does not directly rely on natural technologies. Natural disasters such as hurricanes, earthquakes, and tsunamis destroy productive resources and therefore decrease supply in industries that use them. For example, the damage from Hurricane Matthew, which hit the United States in 2016, reached about \$10 billion. In Georgia alone, over 250,000 customers were left without electric power.



### Checkpoint 7

Explain how the following events will affect the supply of:

- A. Smart phones if new firms enter the market for smart phones
- B. Solar panels when technological advances in the production of solar panels occur
- C. Chicken in the United States when the price of chicken in Europe falls
- D. Milk when the price of milk falls
- E. Desktop computers this year when sellers expect the price of desktop computers to fall next year
- F. Wheat (in the long run) if the price of corn falls steadily relative to the price of wheat
- G. Cars if U.S. automakers move their assembly facilities from Mexico back to the United States, where the wages of assembly workers are higher

Check your answer

### Predicting the Effects of Changes in Demand and Supply

The demand and supply model we study in this chapter is a powerful tool of economics that allows us to predict what will happen to the market prices and quantities of goods sold and bought in response to various events that affect the markets. As we've noted earlier in this chapter, prices and quantities of goods sold and bought in a market gravitate toward the market equilibrium. Every time a deviation from the equilibrium point occurs, the market tends to move back toward it, and once an equilibrium is reached, the market price and quantity will remain unchanged as far as the demand curve and the supply curve stay intact. But if some event shifts one of the curves or both curves, the market will move toward a new equilibrium along the path depending on which curve has shifted and in which direction it has shifted. Thus, to predict what will happen to the market price and quantity of a good in response to a certain event we need to determine (1) which curve is affected (demand, supply, or both); (2) in which direction (rightward or leftward) the affected curves shift; (3) where the new market equilibrium is. perhaps the best way to learn how to make such predictions is to consider some examples.

<sup>4</sup> National Climate Assessment Report. (<http://nca2014.globalchange.gov>)

### Example 1: Consumer Income Increases

Consider the market for gasoline we've discussed in the previous section. Figure 2-7 shows it again, with the initial equilibrium at point  $E_1$ , where the price is \$2.20 per gallon and the quantity of gasoline sold is 245 million gallons per month. Suppose that the average income of buyers in this market increases. As we could see earlier in this section, consumer income is one of the factors that affect demand. Next, we can reason that gasoline is a normal good,

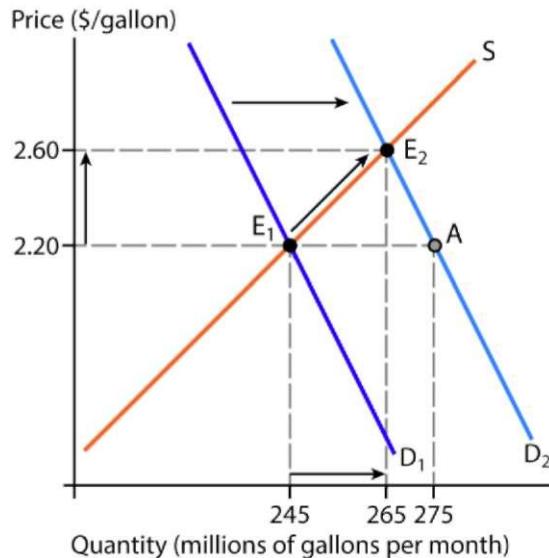


Figure 2-7 The effects of an increase in consumer income

i.e. consumers are willing to buy more of it as their incomes rise (and econometric studies support this theory). This means the demand curve for gasoline will shift rightward, from  $D_1$  to  $D_2$ , as shown in Figure 2-7. Now, as the new demand curve indicates, at \$2.20 consumers want to buy 275 million gallons of gas (point A), while—since the supply curve remains intact—sellers are still willing to offer only 245 million gallons at this price. That is, the market is no longer in equilibrium at \$2.20 per gallon, there is excess demand at that price. And we know what happens when there is excess demand: as buyers bid up the price, the quantity of gas supplied increases along the supply curve together with the actual quantity sold. On the other hand, as the price rises, the quantity of gas demanded decreases along the demand curve  $D_2$ . The price continues to rise and the market continues to adjust until the quantity of gas demanded equals the quantity supplied in a new equilibrium. As shown in Figure 2-7, the new equilibrium occurs at point  $E_2$ , where the price is \$2.60 per gallon, and  $QD = QS = 265$  million gallons. Thus, the increase in consumer income causes the equilibrium price to rise from \$2.20 per gallon to \$2.60 per gallon and the equilibrium quantity to increase from 245 million gallons to 265 million gallons.

It is important to note that while the shift of the demand curve has caused a movement along the supply curve from point  $E_1$  to point  $E_2$ , increasing the quantity supplied in response to a rise in price, the supply itself has not changed, i.e. the supply curve has not shifted, as none of the other factors that influence sellers' decisions has changed.

### Example 2: The Price of Oil Falls

Now let's go back to the initial equilibrium in the market for gasoline where the price is \$2.20 per gallon and the quantity of gasoline sold is 245 million gallons per month (point  $E_1$  in Figure 2-8). Suppose now that the price of oil falls. As we've mentioned before, oil refineries process crude oil to produce gasoline, i.e. oil as an input used to produce gas. We also know

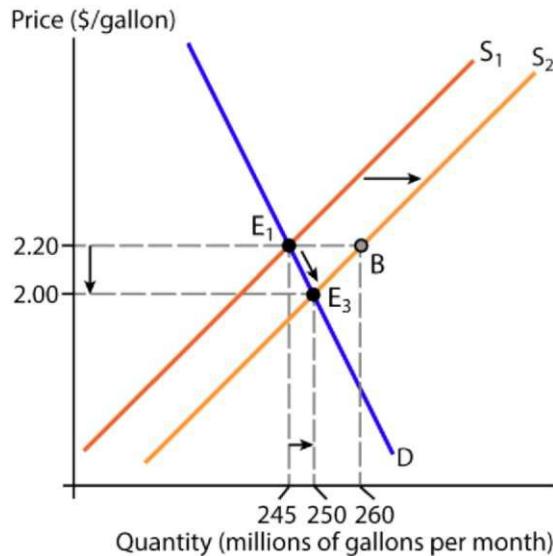


Figure 2-8 The effects of a fall in the price of oil

from our previous discussion that a fall in the price of an input increases supply, that is shifts the supply curve rightward, from  $S_1$  to  $S_2$ , as shown in Figure 2-8. As the new supply curve shows, at \$2.20 sellers now offer 260 million gallons of gas (point  $B$ ), while—since the demand curve remains intact—consumers are still willing to buy only 245 million gallons. That is, the market is no longer in equilibrium at \$2.20 per gallon: there is excess supply. So, sellers lower the price, and as they do so, the quantity of gas demanded—as well as the actual quantity sold—increases along the demand curve. On the other hand, as the price falls, the quantity of gas supplied decreases along the supply curve. The price continues to fall and the market continues to adjust until the quantity of gas demanded equals the quantity supplied in a new equilibrium, which occurs at point  $E_3$ , where the price is \$2.00 per gallon and  $Q_D = Q_S = 250$  million gallons. Thus, the fall in the price of oil causes the equilibrium price of gasoline to fall from \$2.20 per gallon to \$2.00 per gallon and the equilibrium quantity to increase from 245 million gallons to 250 million gallons.

Note again that while the shift of the supply curve has caused a movement along the demand curve from point  $E_1$  to point  $E_3$ , increasing the quantity demanded in response to a fall in price, the demand itself has not changed, i.e. the demand curve has not shifted, as none of the other factors that influence buyers' decisions has changed.

### Example 3: Consumer Income Increases while the Price of Oil Falls

Now let's see what happens when the two events described above occur at the same time. In such situations, we should still analyze the effects of each event separately and then combine the results of our analysis. Figure 2-9 shows the effects of the two events together combining our analyses in the previous examples. The increase in income shifts the demand curve rightward, from  $D_1$  to  $D_2$ . The fall in the price of oil shifts the supply curve rightward, from  $S_1$  to  $S_2$ . The resulting equilibrium occurs at point  $E_4$ , where the new demand curve ( $D_2$ ) intersects the new supply curve ( $S_2$ ) and where the price is \$2.40 per gallon and the quantity is 270 million gallons.

As you can see, when the two events happen at the same time, the equilibrium quantity increases from 245 million gallons at  $E_1$  to 270 million gallons at  $E_4$ , i.e. the increase in quantity is even greater than when each of the events happened alone. This is because a rightward shift in the demand curve alone causes the equilibrium quantity to increase, as shown by the blue arrow in Figure 2-9. And a rightward shift in the supply curve alone causes the equilibrium quantity to increase as well, as shown by the orange arrow. So, when both curves shift rightward, the combined effect is always an increase in equilibrium quantity.

But what about the equilibrium price? As shown in Figure 2-9, it rises from \$2.20 at  $E_1$  to \$2.40 at  $E_4$ . Notice, however, that in this case the effects of the two events have opposite directions. The rightward shift of the demand curve raises the price (as shown by the blue arrow), whereas the rightward shift of the supply curve lowers the price (as shown by the orange arrow). In our example, the demand driven rise in price is greater than the supply driven price fall and therefore the combined effect is a rise in price. But if the effect of the increased supply was greater than that of the increased demand, the equilibrium price would fall. Figure 2-10 shows this possibility. In this case the demand driven rise in price (shown by the blue arrow) is smaller than the supply driven price fall (shown by the orange arrow). Therefore the combined effect is a fall in price from \$2.20 in the initial equilibrium ( $E_1$ ) to \$2.00 in the new equilibrium ( $E_7$ ). Thus, unless we know the magnitudes of the demand and supply shifts, we

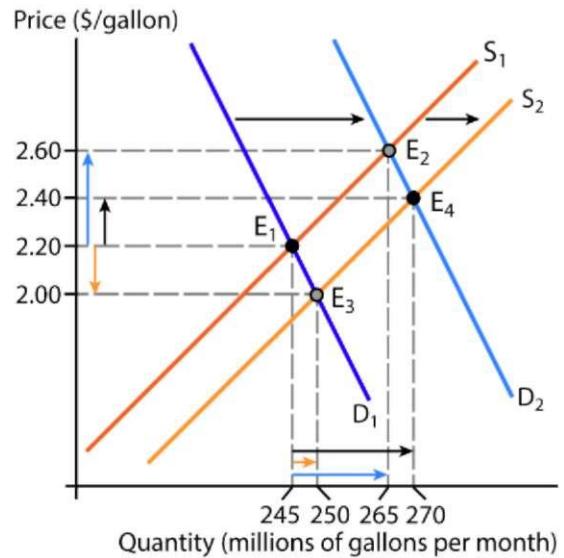


Figure 2-9 Combined effects of an increase in income and a fall in the price of oil: the increased demand prevails

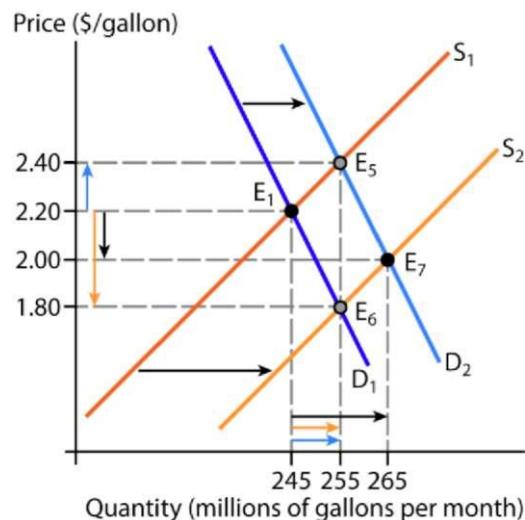


Figure 2-10 Combined effects of an increase in income and a fall in the price of oil: the increased supply prevails

can't predict what will happen to the equilibrium price: it may rise, fall, or remain unchanged depending on which of the two events has a greater impact on it.



MAKE THE GRADE

When predicting how a market equilibrium will change in response to certain events, it is important to keep in mind the difference between changes in *demand* or *supply*, which are *shifts* of the curves, and changes in *quantity demanded* or *quantity supplied*, which are *movements along* the curves. Consider Example 2 again. Suppose an exam question asks you to predict what will happen to the equilibrium price of gasoline when the price of crude oil falls. After you've figured out that a lower price of oil shifts the supply curve for gasoline rightward, causing the equilibrium price of gas to fall, you continue to reason as follows: "As the price of gas falls, the demand for it increases, i.e. the demand curve shifts rightward. This causes the price to rise." So, you answer: "The price may fall, rise, or remain unchanged depending on whether the supply change or the demand change has a greater impact on it." This answer is incorrect.

Where is your mistake? As explained in Example 2, the supply curve does shift rightward causing the price to fall. But a lower price does *not* cause an increase in demand. That is, there will be no shift of the demand curve. Instead, a lower price will cause an increase in *quantity demanded*, i.e. a downward-leftward movement along the demand curve, as shown in Figure 2-8. So, the correct answer is that the equilibrium price of gas will definitely fall.

Our examples illustrate how particular changes in demand and supply affect the market equilibrium price and quantity. Of course, there are other possibilities. Table 2-1 summarizes all possible demand and supply shifts and their combinations and shows how the equilibrium price and quantity change in each case.

## A Four-Step Process of Analyzing Influences on a Market Equilibrium

Although Table 2-1 is a useful summary, you should not simply try to memorize it. As we've emphasized in Chapter 1, economics is an art and science of analytical thinking where simply memorizing and mechanically applying concepts and tools may often lead to erroneous results. Also, the key "shifters" of demand and supply that we've discussed are not the only factors that can influence the demand and supply curves. Keep in mind that no summaries or cheat sheets can take into account all the varieties of situations and specific circumstances that we face when analyzing real-world events. To help you organize your analysis of events affecting a market and predict the resulting new equilibrium price and quantity, we suggest a four-step analytical process.

Table 2-1 The effects of shifts in demand and supply on equilibrium price and quantity

Demand	Supply	Price	Quantity
→	No change	↑	→
←		↓	←
No change	→	↓	→
	←	↑	←
→	→	?	→
→	←	↑	?
←	→	↓	?
←	←	?	←

### Step 1: Define the Market

Before we examine what happens in a market, we need to clarify to ourselves what that market exactly is. For example, are we examining the demand for and supply of gasoline only or all motor fuels? It is important to clarify because in the former case the market for diesel fuel is an alternative market, while in the latter case it is part of the same market. We also need to clarify who the buyers and sellers in the market are. If, for instance, we are examining the market for cars in the United States only, then a change in incomes of American consumers will directly affect the demand, while a change in incomes in China will not. Finally, we need to define the time period we are looking at. For example, in a long run, the supply of wheat will decrease if the price of corn (an alternative product for farmers) rises, but it is not likely to happen in a short run, when farmers don't have enough time to reallocate their land from wheat to corn.

### Step 2: Define the Initial Equilibrium

Sketch a demand and supply graph, find and clearly mark the equilibrium point and the corresponding price and quantity, just like we did in the examples above.

### **Step 3: Find the New Equilibrium**

First, determine which curve will the event in question affect and in which direction (rightward or leftward) the curve will shift. Then, shift the curve (draw a new curve) and find and clearly mark the new equilibrium. If you are analyzing the effects of several events or if an event affects both demand and supply curves, shift one curve at a time and mark each new equilibrium resulting from just this one shift, indicating that this is an intermediate equilibrium (as we did in Example 3). This will help you see whether different curve shifts affect the price or quantity in the same direction or in opposite directions. After that, find and clearly mark the final equilibrium resulting from the combined effects of all the changes.

### **Step 4: Compare the Initial Equilibrium with the New Equilibrium**

Compare the new equilibrium price and quantity with the ones in the initial equilibrium. Be sure to check whether different curve shifts have offsetting effects on the price or quantity, in which case you can only be certain about the direction in which the equilibrium price or quantity will ultimately change if you know how far the curves shift.

The "Problem Solved!" box below provides an example of using this four-step process to analyze the effects of changes in demand and supply on the market equilibrium.



#### PROBLEM SOLVED!

Consider the U.S. market for strawberries produced using conventional farming systems. predict what will happen to the equilibrium price and quantity in this market over the current year if the following trends persist: (1) Consumers become increasingly aware that conventionally produced strawberries top the "Dirty Dozen" list of the fruits and vegetables contaminated with pesticide residues even after they are rinsed in the field and washed before eating; (2) Technological advances in organic farming lower the price of organically grown strawberries. Let's employ our suggested four-step process to solve this problem.

#### **Step 1. Define the Market**

Since our purpose is to predict the changes in the equilibrium price and quantity of conventional strawberries in the United States over the current year, the market we are examining is for conventional strawberries only, the sellers are farmers who use conventional technologies of growing strawberries, the buyers are consumers living in the United States, and the relevant time period is one year.

#### **Step 2: Define the Initial Equilibrium**

The first graph below shows the initial equilibrium (**E1**) in the market for conventional strawberries, where **D1** is the demand curve, **S1** is the supply curve, **P1** is the equilibrium price, and **Q1** is the equilibrium quantity.

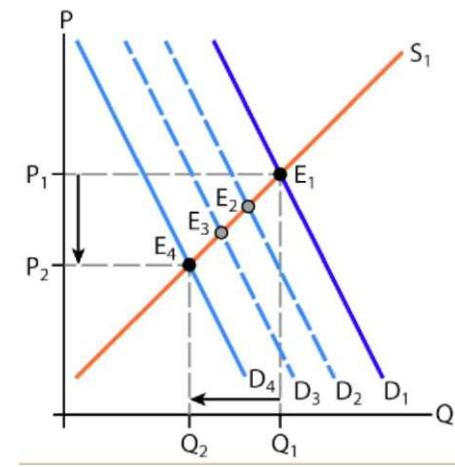
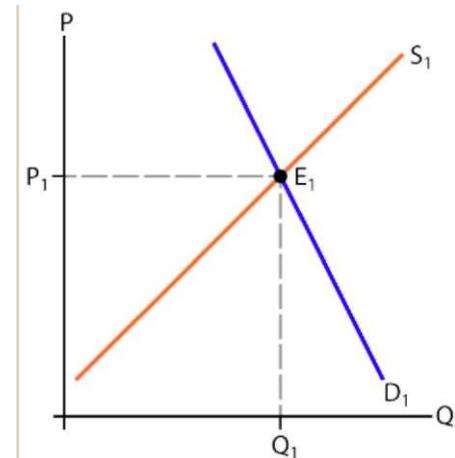
### Step 3: Find the New Equilibrium

Now we need to determine which curve(s) will shift and in which direction. Let's consider one event at a time.

First, when consumers become more aware of the pesticide residues contaminating conventional strawberries, which have adverse effects on their health, they become less willing to buy conventional strawberries at any given price. That is, the demand curve shifts leftward, say, from  $D_1$  to  $D_2$ , as shown on the second graph. The new equilibrium resulting from this shift is at point  $E_2$ .

Second, organic strawberries are a (higher-quality) substitute for conventional strawberries. So, other things being equal, when the price of organic strawberries falls, consumers are willing to buy more organic strawberries, substituting them for conventional strawberries. As a result, at each given price of conventional strawberries, consumers want to buy fewer of them. That is, the demand curve for conventional strawberries shifts leftward, from  $D_1$  to  $D_3$ . The new equilibrium resulting from this shift is at point  $E_2$ .

Since both events shift the demand curve leftward, their combined effect is an even farther leftward shift of the demand curve, with the resulting equilibrium at point  $E_4$  where the price is  $P_2$  and the quantity is  $Q_2$ .



### Step 4. Compare the Initial Equilibrium with the New Equilibrium

As we can see on the graph, the equilibrium price of conventional strawberries decreases from  $P_1$  to  $P_2$  and the equilibrium quantity decreases from  $Q_1$  to  $Q_2$ . Since each of the two events affects both price and quantity in the same direction, reinforcing each other, our prediction is certain, i.e. it does not depend on which of the events has a greater influence on the price or quantity.



## TOOLS OF ECONOMICS

### The Mathematics of Demand and Supply Revisited

Earlier in this chapter, we showed how to find the market equilibrium using algebraic representations of the demand and supply curves. Now we'll show how we can use algebra to examine the effects of changes in demand and supply. We will use the same examples as we did for our graphical analysis.

The initial demand curve shown in Figure 2-9 is given by the following equation:

$$QD1 = 300 - 25xP$$

where  $QD1$  is the quantity of gas demanded (millions of gallons) and  $P$  is the price of gas (\$ per gallon). And the initial supply curve is given by

$$QS1 = 135 + 50xP$$

where  $QS1$  is the quantity of gas supplied and  $P$  is the price of gas. As we've found previously using these demand and supply equations, the market is in equilibrium ( $QD1 = QS1$ ) where the price is \$2.20 and the quantity is 245 million gallons, which are the initial equilibrium price and quantity shown in Figure 2-9 (point E1).

Now suppose that as a result of an increase in consumer income, the demand curve shifts rightward by 30 million gallons (from  $D1$  to  $D2$ ); that is, at each given price of gas, consumers are willing to buy 30 million gallons more. That is, the new demand curve ( $D2$ ) is

$$QD2 = 300 - 25xP + 30$$

which simplifies to

$$QD2 = 330 - 25xP$$

Further, suppose that as a result of a fall in the price of oil, the supply curve shifts rightward by 15 million gallons (from  $S1$  to  $S2$ ); that is, at each given price of gas, sellers are willing to supply 15 million gallons more. That is, the new supply curve ( $S2$ ) is

$$QS2 = 135 + 50xP + 15$$

which simplifies to

$$QS2 = 150 + 50xP$$

Solving for the new equilibrium ( $QD2 = QS2$ ), we have:

$$\begin{aligned} 330 - 25xP &= 150 + 50xP \\ -25xP &= -180 + 50xP \\ -75xP &= -180 \\ P &= 2.4 \end{aligned}$$

So, the market equilibrium price is \$2.40.

To find the equilibrium quantity, we plug the new equilibrium price into either the **D2** or **S2** equation. Using the demand equation:

$$\begin{aligned} QD2 &= 330 - 25x2.40 \\ QD2 &= 270 \end{aligned}$$

To verify this result, we plug the equilibrium price into the supply equation as well:

$$\begin{aligned} QS2 &= 150 + 50x2.40 \\ QS2 &= 270 \end{aligned}$$

Thus, the new market equilibrium occurs where price is \$2.40 per gallon, and the quantity is 270 million gallons, which is what Figure 2-9 shows as well.



### Checkpoint 8

Suppose both buyers and sellers of coffee hear a credible forecast that the price of coffee will fall next month. What will happen to the current price of coffee in response to this news? What will happen to the quantity of coffee sold this month?

Check your answer

## 2.4 Demand, Supply, and Economic Efficiency

As you've learned in Chapter 1, one of the key ideas of economics is that voluntary exchange creates value and makes both participating parties better off. Recall that we've defined a market as an arrangement that enables buyers and sellers to interact with each other facilitating voluntary exchange between them. In the modern world where billions of voluntary transactions occur every day, market making is an important business itself. Companies such as Walmart, eBay, Amazon, Alibaba, and many others specialize in facilitating markets for billions of buyers and sellers around the world. more than 2 billion transactions per day take place on eBay alone. So far, we've used the demand and supply model to examine how the equilibrium prices and quantities are determined in competitive markets. Now we'll see how the model can be used to measure the benefits that buyers' and sellers' get from voluntary exchange.

### Willingness to Pay and Demand

perhaps the best way to see the gains from voluntary exchange is to consider an online auction, such as eBay. Out of many markets facilitated by eBay, let's focus on one: the market

for laptop computers.<sup>5</sup> Further, although in reality there may be thousands of bidders for laptops on eBay, to keep our analysis simple, let's first assume that there are only four: Anna, Bart, Cindy, and Don.

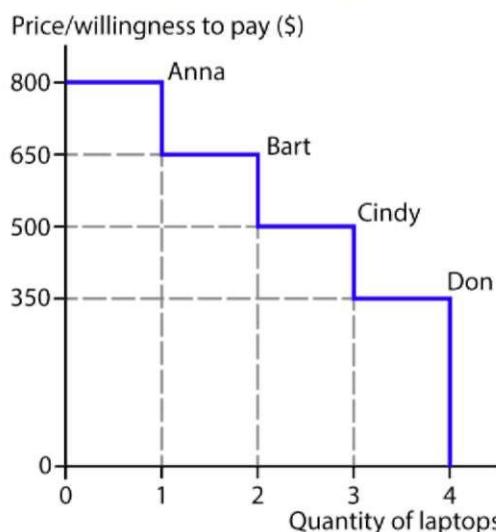
Individuals who bid for laptops will or will not be willing to buy them depending on the price. Obviously, buyers want to pay as little as possible, but each of them has in mind a certain highest price that he or she is willing to pay. Economists call this price the buyer's **reservation price** or **willingness to pay**. Thus, each of the bidders in our example wants to purchase a laptop for a price that is as low as possible, but will continue to bid as far as the price does not exceed her reservation price. She will stop bidding only when the price passes her reservation price.

Since willingness to pay depends on buyers' individual preferences and budget constraints, it is likely to be different for different buyers. Let's suppose that our four bidders have the reservation prices shown in Table 2-2. We can also present each buyer's willingness to pay graphically, as in panel A of Figure 2-11. Let's take a closer look at the graph. It shows

Table 2-2 Willingness to pay

Bidder	Willingness to Pay
Anna	\$800
Bart	\$650
Cindy	\$500
Don	\$350

A. Four consumers



B. Many consumers

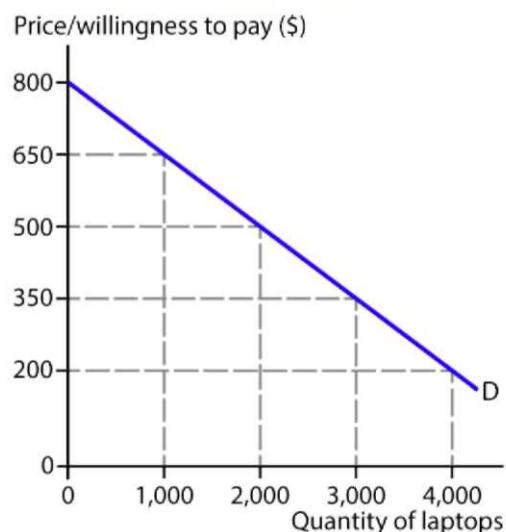


Figure 2-11 Willingness to pay and the demand for laptops

<sup>5</sup> As we've noted in the first section of this chapter, for the purposes of our analysis, we can safely assume that there is only one kind of laptops (think of a laptop with average technical characteristics, quality, design, etc.).

that none of our four buyers is willing to pay more than \$800 for a laptop, so if the price is above \$800, the quantity of laptops demanded (**Q<sub>D</sub>**) is zero. At a price of \$800, only Anna would bid, so the quantity demanded is one. At \$650, we'll have two bidders, Anna and Bart, which means **Q<sub>D</sub> = 2**. At \$500, Cindy would also bid, so **Q<sub>D</sub> = 3**. And at \$350 and below, all four potential buyers bid, so **Q<sub>D</sub> = 4**.

As you've probably noticed from the analysis above, our four-consumers' willingness to pay curve is also their demand curve, since it shows how many laptops they are willing to buy given a certain price. The reason why it is not a smooth curve like the demand curves we've seen before is that it represents a small number of consumers, each buying only one unit of the good. If we drew it for a much larger market, with many consumers and many units of the good, ordering consumers according to their willingness to pay, the steps shown in panel A of Figure 2-11 would be very small, virtually invisible, so the curve would smooth out and look like one shown in panel B.

What is important to note is that in both panel A and panel B, the height of the demand curve shows consumers' willingness to pay for the corresponding unit of the good. For example, in the market shown in panel B, the highest price that consumers' are willing to pay for the 2,000<sup>th</sup> laptop is \$500. In general:

A demand curve viewed as a willingness-to-pay curve shows the price that consumers are willing to pay given a certain quantity of the product in the market.

## Consumer Surplus

Willingness to pay represents the value that consumers place on a good. For example, since the highest price Anna is willing to pay for a laptop is \$800, she values it at \$800, and since Bart's willingness to pay for a laptop is \$650, he values it at \$650, and so on.

Suppose now that the market price of a laptop is \$380. This means three laptops will be purchased, since Anna, Bart, and Cindy are willing to pay even a higher price. In fact, given that these three consumers are willing to pay more than \$380, the values they will receive will exceed the price they pay. These differences between the value each of them receives when purchasing a laptop and the price they pay are their surpluses. In general:

The difference between the value consumers receive when purchasing a good or a service and the price they pay for it is called **consumer surplus**. Consumer surplus measures the net benefits that consumers receive as a result of their participation in the market.

Figure 2-12 illustrates the consumer surplus in our example. As shown in panel A, since Anna values a laptop at \$800 but gets it for \$380, her surplus is  $\$800 - \$380 = \$420$ . Bart values a laptop at \$650 but gets it for \$380, so his surplus is  $\$650 - \$380 = \$270$ . And Cindy values it at \$500 but pays \$380, so her surplus is  $\$500 - \$380 = \$120$ . Don, however, values a laptop at \$350, which is below the market price, so he won't buy it and won't receive any consumer surplus. Thus, the total surplus received by our four consumers is  $\$420 + \$270 + \$120 + \$0 = \$810$ . Graphically, this surplus is represented by the area below the demand curve and above the price.

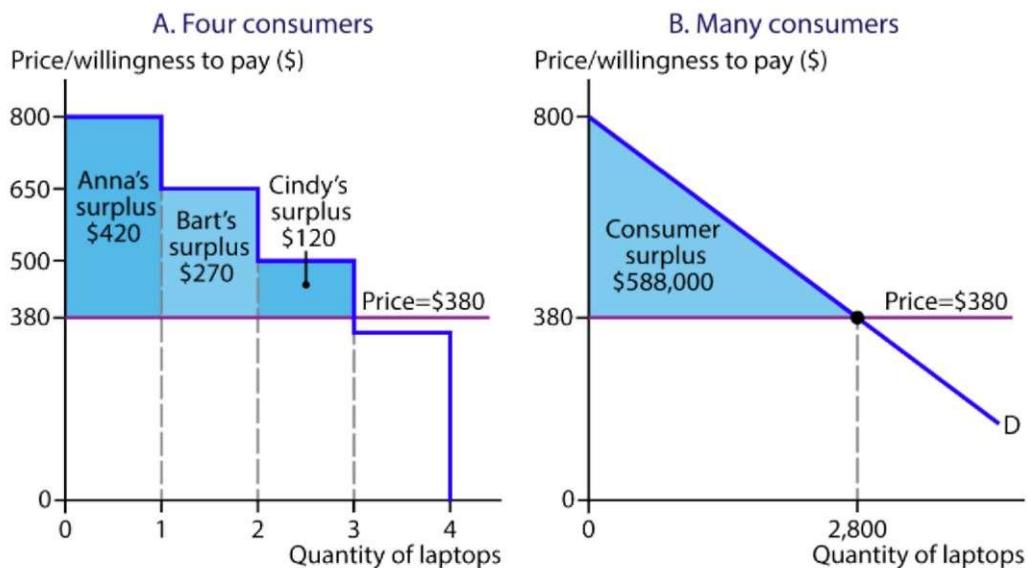


Figure 2-12 Consumer surplus in the market for laptops

The same is true about a market with many consumers and a large quantity of the good, such as that shown in panel B of Figure 2-12. In this case, consumer surplus is represented by the distances between the demand curve and the price for each of the thousands of units sold. Together, these distances form the triangular area below the demand curve and above the price. The dollar amount of the consumer surplus then can be calculated using the formula for the area of a triangle:<sup>6</sup>

$$\text{Area} = \text{Base} \times \text{Height} / 2$$

In our example, the distance between the demand curve and the price when the quantity is zero can be viewed as the base of the triangle, and the quantity bought at the market price can be viewed as its height. Thus, the consumer surplus (CS) can be calculated as:

$$CS = (\$800 - \$380) \times 2,800 / 2 = \$588,000$$

What does this number tell us? It tells us that the value consumers have received as a result of their participation in the market for laptops exceeds the amount they've paid for the laptops by \$588,000. In other words, the 2,800 transactions in the market for laptops have generated an additional value of \$588,000 for the participating consumers.

<sup>6</sup> Assuming that the demand curve is a straight line.



## Checkpoint 9

In the example above, suppose the market price rises from \$380 to \$510. How will this affect the consumer surplus in the market with the four consumers?

Check your answer

## Willingness to Sell and Supply

Now let's take a look at the seller's side of the market for laptops. Again, although in reality there are many sellers, to keep our analysis simple, we'll start with assuming that there are only four: Zach, Yoko, Xander, and Wendy. Obviously, each seller wants to sell his laptop for as much as possible, but each also has in mind a certain lowest price that he is willing to accept. This price is called the seller's **reservation price** or **willingness to sell**. Thus, each of the sellers in our example wants to sell his laptop for a price that is as high as possible but will keep offering it unless the price falls below his reservation price.

Willingness to sell depends on sellers' individual situations. For example, Zach might be a college graduate who was given a laptop as a graduation present but no longer needs it because he just landed a job that provides a laptop for him, so he is willing to sell his laptop for as low as \$200. Wendy, on the other hand, might be a sales representative for a laptop producer, authorized to sell a laptop for a price of \$600 or higher. The reservation prices of our four sellers are shown in Table 2-3 and in panel A of Figure 2-13. As you can see, none of our four sellers is willing to sell a laptop for less than \$300, so if the price is below \$300, the quantity of laptops supplied ( $QS$ ) is zero. At a price of \$300, only Zach would sell it, so the quantity supplied is one. At \$400, we'll have two sellers, Zach and Yoko, which means  $QS = 2$ . At \$500, Xander would also sell his laptop, so  $QS = 3$ . And at \$600 and above, all four sellers would sell their laptops, so  $QS = 4$ .

Table 2-3 Willingness to sell

Bidder	Willingness to Sell
Zach	\$300
Yoko	\$400
Zander	\$500
Wendy	\$600

As you can see, our four-sellers' willingness to sell curve is also their supply curve, as it shows how many laptops they are willing to sell given a certain price. And if we drew a willingness to sell curve for a market, with many sellers and a large number of units of the good, the steps shown in panel A of Figure 2-13 would be invisible, i.e. the curve would smooth out and look like the one shown in panel B.

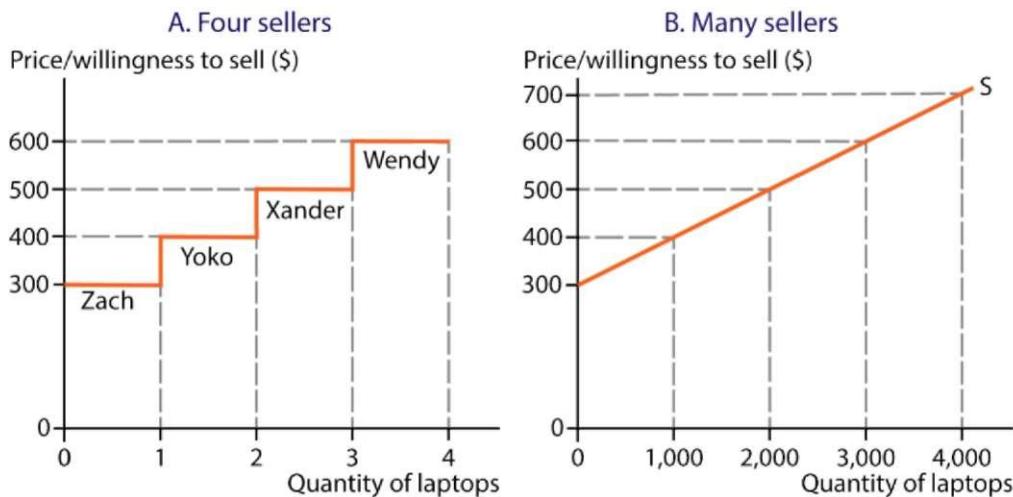


Figure 2-13 Willingness to sell and the supply of laptops

Note that in both panel A and panel B, the height of the supply curve shows sellers' willingness to sell for the corresponding unit of the good. For example, in the market shown in panel B, the lowest price that sellers' are willing to accept for the 2,000<sup>th</sup> laptop is \$500. In general:

A supply curve viewed as a willingness-to-sell curve shows the price sellers are willing to accept given a certain quantity of the product in the market.

## Producer Surplus

Willingness to sell a good is determined by the seller's opportunity cost of providing it. For a laptop user, for example, the opportunity cost of selling it is the value of its best alternative uses that the seller is giving up. For a laptop manufacturer, it is the opportunity cost of resources needed to produce it.

Suppose now that the market price of a laptop is \$550. This means three laptops will be sold, since Zach, Yoko, and Xander are willing to accept even a lower price. And because these three sellers receive a higher price than the lowest price they are willing to accept, we know the price they receive exceeds their opportunity costs. These difference between the price they receive when selling a laptop and the opportunity cost of it to each of them are their surpluses. In general:

The difference between the price sellers receive for each unit of a good sold and the opportunity costs of those units is called **producer surplus**.<sup>7</sup> Producer surplus measures the net benefits that sellers receive as a result of their participation in the market.

Figure 2-14 illustrates the producer surplus in our example. As shown in panel A, since Zach's opportunity cost of his laptop is \$300 but he gets \$550 for it, his surplus is \$550 - \$300

<sup>7</sup> The term "producer surplus" is used even if the seller is not a producer.

$= \$250$ . Yoko's opportunity cost is  $\$400$ , but she gets  $\$550$ , so her surplus is  $\$550 - \$400 = \$150$ . And Xander's opportunity cost is  $\$500$ , but the price he receives is  $\$550$ , so he gets a surplus of  $\$550 - \$500 = \$50$ . Wendy's reservation price, however, is higher than  $\$550$ , so she won't sell her laptop and thus won't receive any surplus. Then, the total surplus received by our four sellers is  $\$250 + \$150 + \$50 + \$0 = \$450$ . Graphically, it is represented by the area below the price and above the supply curve.

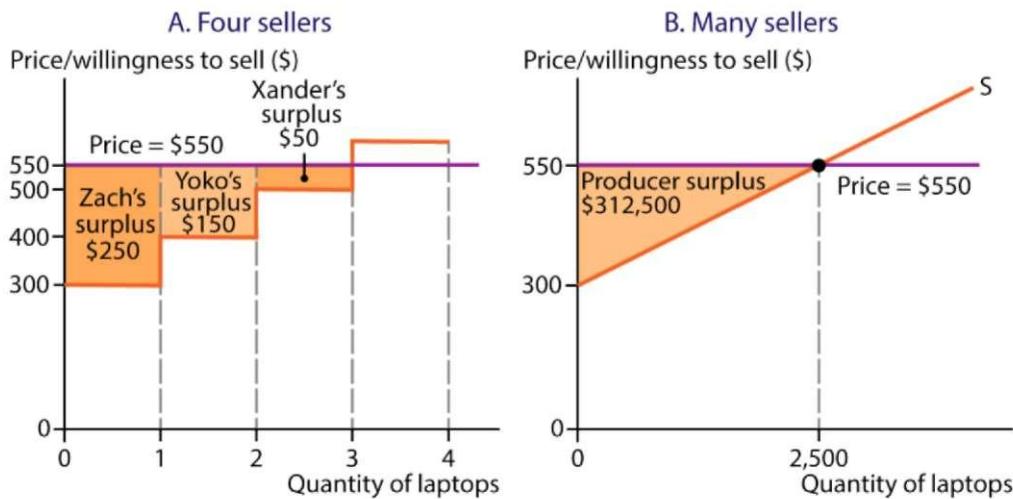


Figure 2-14 Producer surplus in the market for laptops

Similarly, in a market with many sellers and a large quantity of the good, such as that shown in panel B of Figure 2-14, producer surplus is represented by the distances between the price and the supply curve for each of the thousands of units sold. Together, these distances form the triangular area below the price and above the supply curve. The dollar amount of the producer surplus then is the area of the triangle whose base is the distance between the price and the supply curve when the quantity is zero and whose height is the quantity of sold.<sup>8</sup> Thus, the producer surplus (PS) is:

$$PS = (\$550 - \$300) \times 2,500 / 2 = \$312,500$$

That is, the amount of revenue sellers have received as a result of their participation in the market for laptops exceeds their opportunity costs of providing laptops to the market by  $\$312,500$ . In other words, the 2,500 transactions in the market for laptops have generated an additional value of  $\$312,500$  for the participating sellers.

<sup>8</sup> Assuming that the supply curve is a straight line.



## Checkpoint 10

In the example above, suppose the market price falls from \$550 to \$410. How will this affect the producer surplus in the market with the four sellers?

Check your answer

## Total Surplus

Once we understand what the consumer surplus is, what the producer surplus is and how buyers and sellers benefit from participating in the market, the next question is, what will be the actual market price that determines how much surplus consumers and producers receive? To answer this question, we'll put the demand and supply curves together to see where the market equilibrium will be. Recall that a market equilibrium occurs when the quantity of the good consumers are willing to buy, i.e. the quantity demanded, equals the quantity sellers are willing to sell, i.e. the quantity supplied. Figure 2-15 combines the demand curve in panels B of Figure 2-12 with the supply curve in panel B of Figure 2-14. As you can see, the market is in equilibrium when the price of a laptop is \$500. At this price, the quantity of laptops sold is 2,000. The consumer surplus then is the area below the demand curve and above \$500 (area A on the graph), that is:

$$CS = (\$800 - \$500) \times 2,000 / 2 = \$300,000$$

The producer surplus is the area above the supply curve and below \$500 (area B), that is:

$$PS = (\$500 - \$300) \times 2,000 / 2 = \$200,000$$

The amount of total gains from trade received by the market participants is called **total surplus**.

In our example, the total surplus (TS) in the market for laptops is:

$$TS = CS + PS$$

$$TS = \$300,000 + \$200,000 = \$500,000$$

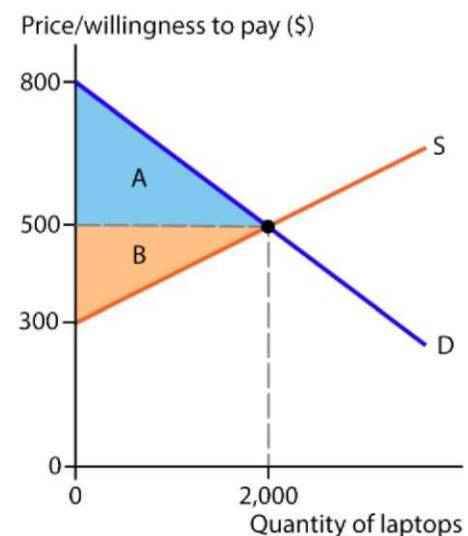


Figure 2.15 Total surplus in the market for laptops



## Checkpoint 11

"Since a fixed quantity of laptops is traded in the market, no additional value is created as a result of these transactions. Laptops just change hands. Therefore, it is a zero-sum game. When one market participant gains, another one loses an equal amount." True or false? Explain.

Check your answer

## Market Equilibrium and Efficiency

We've seen earlier in this chapter how free competitive markets work to equate the quantity of the good demanded with the quantity supplied through the price adjustment mechanism so that in equilibrium there is no excess demand or excess supply. The concepts of consumer surplus and producer surplus allow us to see another important aspect of market equilibrium: it is also the point where the market participants receive the greatest total surplus possible, i.e. the highest overall gains from trade given the values placed on the product by consumers and the opportunity costs of it to sellers. To see why, let's return to our example of the market for laptops and consider what will happen if for some reason the market is not in equilibrium. For example, the initial auction price is set above the equilibrium price, say at \$650, so that sellers cannot offer laptops at a lower price. This situation is depicted in Figure 2-16.

The \$150 increase in price decreases the quantity of laptops demanded, and therefore the quantity sold, from 2,000 to 1,000. As a result of a higher price and a lower quantity of laptops purchased, the consumer surplus—the area below the demand curve and above the price—decreases. Its dollar value (represented by area A) is now:

$$CS = (\$800 - \$650) \times 1,000 / 2 = \$75,000.$$

The producer surplus increases because of a higher price, but decreases because sellers now are only able to sell 1,000 laptops instead of 2,000. The value of the producer surplus is now represented by the trapezoid area B + F, which can be calculated using the following formula:

$$\text{Area} = (\text{Longer base} + \text{Shorter base}) \times \text{Height} / 2$$

In our example, the longer base is  $\$650 - \$300 = \$350$  and the shorter base is  $\$650 - \$400 = \$250$ . The height is the quantity sold. Thus, the producer surplus is:

$$PS = (\$350 + \$250) \times 1,000 / 2 = \$300,000$$

Thus, as a result of a higher price that drives the market away from equilibrium, consumer surplus decreases by \$225,000 while producer surplus increases by \$100,000. Part of the loss

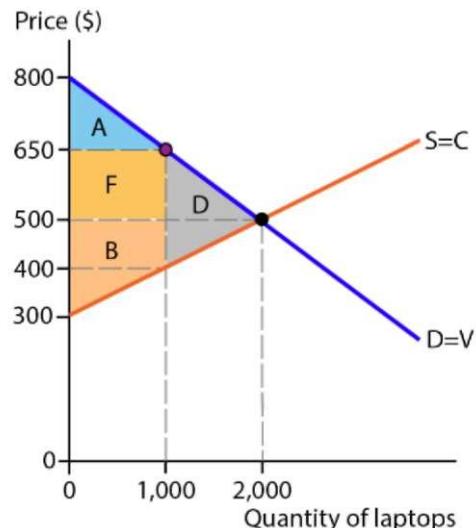


Figure 2.16 Total surplus in the market for laptops

for consumers is a gain for producers. Area F in Figure 2-16 represent this transfer of surplus. Note, however, that area D is no longer part of either consumer or producer surplus. It is lost for both consumers and producers. This loss of the potential total surplus is called a **deadweight loss**. Notice that the deadweight loss (area D in Figure 2-16) is a triangle whose base equals the difference between the price consumers are paying (\$650) and the cost to the producers of the last unit sold (\$400). And the height of the deadweight loss triangle is the difference between the equilibrium quantity and the quantity actually sold (2,000 - 1,000 = \$1,000). Using the formula for the area of a triangle, we can calculate the deadweight loss (DWL) in the market for laptops as:

$$DWL = (\$650 - \$400) \times 1,000 / 2 = \$125,000$$

Thus, a deviation from the market equilibrium reduced the total surplus by \$125,000. We can confirm this by calculating the total surplus when the price of a laptop is \$650 as the sum of the consumer surplus and producer surplus:

$$TS = \$75,000 + \$300,000 = \$375,000$$

which is \$125,000 less than the \$500,000 total surplus received by consumers and producers when the market was in equilibrium.

Likewise, total surplus will be reduced if the price is below the market equilibrium. Check-point 2-12 asks you to show this using our market for laptops example. An important point that follows from this discussion is:

Total surplus in a free competitive market is maximized, i.e. the greatest possible gains from trade are achieved, when the market is in equilibrium. In this situation, there is no deadweight loss, as all potential gains from trade in the market are realized. Such market outcome is called **efficient**. And if total surplus is below its potentially achievable level, i.e. there is a deadweight loss, the outcome is called **inefficient**.

efficiency of a competitive market equilibrium is a key reason why all modern advanced economies rely on markets. However, free markets are efficient only under certain conditions. We will address them in later chapters. Here is an overview of the conditions necessary for an unregulated market to be efficient.

***The market is perfectly competitive; that is, no individual seller or buyer can influence the price***

For instance, in our example above, if sellers of laptops could collude to fix the price at a level above the competitive equilibrium, say \$650, they will gain producer surplus at the expense of consumers and will be better off by \$100,000 (see Figure 2-16). But as you could see, this would lead to a deadweight loss that reduces the total surplus by \$125,000. That is, the market outcome would be inefficient. We'll address the inefficiencies caused by sellers' market power in Chapters 8-10.

***No externalities are generated by production or consumption of the good***

An **externality** is a cost or benefit resulting from production or consumption of a good that is imposed on someone other than its buyers or sellers. For example, suppose a factory that produces laptops pollutes the nearby river with toxic chemicals. In an unregulated market, the factory decides how many laptops to produce and what price to accept based only on its

own internal costs of producing laptops. It does not take into account external costs imposed on bystanders downstream, such as dead fish, contaminated drinking water, and people getting sick. Since in cases like this free markets fail to account for all the costs imposed on society, they are not efficient. We will discuss the market failures due to externalities and what government can do about them in Chapter 4.

### ***The good traded is a private good***

Free markets can only be efficient when a private good or service is traded. They fail to efficiently provide so called **public goods** because of the nature of those goods. For example, a laptop is a private good. You can only use it if you pay a certain price for it, so you make your decision whether or not to buy it by comparing the value of it to you with the price for which you can get it. Then, if you buy it, you own it, i.e. no one else can use it without your permission. Compare this with a good such as national defense. Obviously, national defense has a certain value to everyone living in the country, as it protects the nation from external enemies. However, no private individual or entity would be willing to pay for the national defense system based on its value to them because (1) it is impossible to limit access to the protection to only those who pay for it and (2) once the system is in place, protecting an additional person does not reduce the benefits to others, i.e. the opportunity cost of protecting another individual is zero, which means the efficient price is also zero. Because markets cannot supply public goods efficiently, if at all, these goods are usually provided by government. We will have more to say about public goods in Chapter 4.

### ***All relevant information is available to both buyers and sellers***

When you are buying a laptop, you have a pretty good idea about what exactly you are getting and of what value it is to you. But when you get sick and are deciding whether to go to a doctor, you usually don't know what exactly is wrong with you and of what value the doctor's service will be to you. You leave it to the doctor to figure out, which basically means you let the doctor, the seller of the service, determine your willingness to pay for it! And you have to rely on the doctor's conscience and integrity in the hope that his motive is to provide a treatment that is best for you and not to get the highest profit for himself. Conscience and integrity, however, are not market categories, and the profit motive is exactly what markets are all about. Thus, with a lack of information about the good or service traded, such as in the example above, free markets fail to provide efficient outcomes.

As you might suspect, in the real world it is rarely the case that all the conditions listed above hold. Therefore, none of the modern economic systems relies exclusively on free markets. In all of them government plays an important role, correcting inefficiencies caused by market failures and stepping in when markets fail to provide socially valuable goods or services. Unfortunately, the determination to what extent an economy relies on free markets and to what extent and where the government should intervene is often left to ideological doctrines and political power rather than economic efficiency considerations. Discussing why and how this occurs is beyond the scope of this course. We hope, however, that our discussion of economic efficiency in this chapter and then of the role of government later on in this course will help you see the economic truth behind the political demagogic of the preachers of both free markets almighty and omnipotent government.



## Checkpoint 12

Show that total surplus will be reduced if the price falls below the equilibrium price. Suppose that in our example, the price is \$400 instead of \$500. How will this change the consumer surplus? The producer surplus? How much will be the deadweight loss?

Check your answer



## Economics at Work: Explaining Oil Prices

As we discussed earlier in this chapter, since oil is an essential input used to produce gasoline, the price of oil is a key factor that determines gasoline prices. Indeed, as statistical data show, gas prices follow oil prices very closely. The importance of oil, however, expands far beyond that. In fact, oil is used to produce nearly everything, from heating and electricity generation to plastics, fertilizers, roofing, clothing, aspirin, and guitar strings. To satisfy the demand for all those products, the world produces about 100 million barrels (3.2 billion gallons) of oil per day. No wonder that fluctuations in oil prices affect nearly all industries and may even alter the global macroeconomic situation.

Because of such profound effects of oil prices on the global economy, it is important to examine the past trends in oil prices so that we could better predict how they might change in the future. And oil prices do tend to fluctuate substantially. Take a look at Figure 2.17,

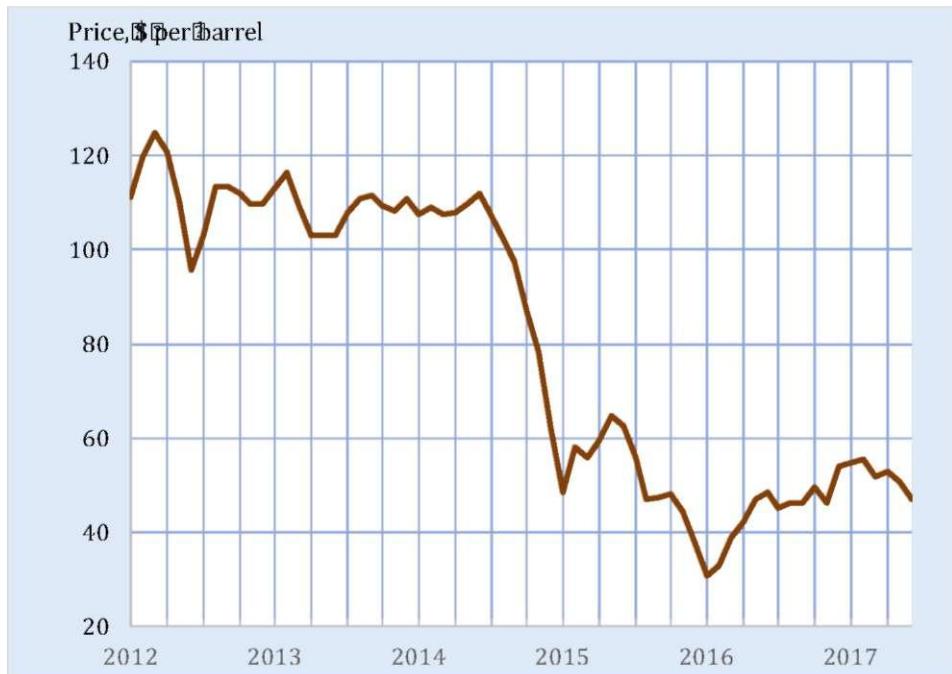


Figure 2-17 Crude oil prices in 2012-2017  
(Source: International Monetary Fund)

which shows how the "spot" prices of crude oil changed over the last five years.<sup>9</sup> Particularly remarkable is the steep slump from about \$112 per barrel to about \$31 per barrel that occurred over the period from June 2014 to January 2016. It is also worthy of note that despite this 72% price drop, the consumption of oil during this period increased rather modestly: from about 94 million to about 96 million barrels per day, i.e. by only about 2%.<sup>10</sup> What caused such a dramatic drop in the price of oil accompanied by only a slight increase in quantity? The demand and supply model discussed in this chapter will help us answer this question.

Let's go through the four steps we've suggested in the previous section to help us better organize our analysis of events influencing the market for oil. First, we need to define the market we want to analyze. Since our purpose is to explain a trend in the world price of oil, not oil prices in particular countries or regions, it makes sense to examine the market for oil as a *global market*.<sup>11</sup> The suppliers in this global market are all oil producers around the world, and the buyers are all world's consumers of oil, which are predominantly businesses that use oil to produce other goods.

One important question is whether the world market for oil fits our definition of a competitive market, i.e. one where no individual seller or buyer can influence the price. Recall that the two conditions necessary for the buyers and seller to take the market price as given are (1) the product is standardized, and (2) each buyer and seller holds a very small fraction of the market, so the influence of an individual buyer or seller on the price is negligible. The first condition is certainly present, since crude oil is a standardized product (commodity). The second one does not strictly hold. The reason is that about 40% of the world's crude oil is produced by the Organization of the Petroleum Exporting Countries (OPEC), which controls (or at least tries to) oil production in its member countries by setting production targets.<sup>12</sup>

Because OPEC accounts for such a large share of the world's market for oil, it can affect its price. Historically, crude oil prices have risen when OPEC reduced its production targets. In our demand and supply model, we can reflect this OPEC's influence by shifting the world oil supply curve accordingly. However, OPEC's ability to shift the world supply curve cannot change the law of supply. That is, when the price of oil rises due to OPEC's production cuts, other oil producers have the incentive to increase their output, since it becomes more profitable to produce more oil even if it results in higher costs. Thus, we can use the competitive demand and supply model to analyze the world market for oil.

The second step is to define the initial market equilibrium. We will start from June 2014, when the equilibrium price of oil was at its peak of about \$112 per barrel and its equilibrium quantity was about 94 million barrels per day. In Figure 2.18, D<sub>14</sub> and S<sub>14</sub> are, respectively,

<sup>9</sup> Spot prices are prices at which oil is actually sold and bought for immediate delivery (as opposed to futures prices, i.e. prices at which contracts promising future delivery of oil are bought and sold).

<sup>10</sup> Source: U.S. Energy Information Administration. Short-Term Energy Outlook, July 2017.

<sup>11</sup> Note that examining regional prices of oil are of less interest. Those prices do not differ much, as they are equalized through worldwide trade. That is, if the price of oil is significantly higher in a particular region, it is pretty easy to ship more oil there, as the cost of shipping a barrel of oil from one world's region to another is usually immaterial in comparison with its price.

<sup>12</sup> OPEC has fourteen Member Countries, with Saudi Arabia accounting for about 32% of the Organization's total oil production, seven other Middle Eastern countries producing another 49%, and Venezuela, Angola, and Nigeria producing almost all the rest.

the demand curve and the supply curve in June 2014, so point **E<sub>14</sub>** marks the initial equilibrium.

The third step is to find the new equilibrium. Note, however, that our analysis here is a little different from what we've done before: we already know that in January 2016 the equilibrium price of oil was about \$31 per barrel and the equilibrium quantity was about 96 million barrels per day.<sup>13</sup> What we need to figure out is which curve shifted in which direction, as we want to explain how the market got there.

Let's start with the supply side. Most remarkable there is the phenomenal growth of oil production in the United States. The U.S. oil boom started in 2008, when the first well was drilled into a shale. Since then, with the help of horizontal drilling and hydraulic fracturing (commonly known as fracking), billions of additional barrels of oil have been produced. Between 2008 and 2015, U.S. oil production almost doubled, reaching 9.4 million barrels per day and threatening to surpass Saudi Arabia as the world's largest producer of oil.

In this situation, the OPEC countries faced a tough choice: cut their oil production to prop up the price, as they've done in the past, or maintain their output and let the price continue to fall with the purpose of driving the producers of the more costly shale oil—in the United States and everywhere else—out of business. Quite surprisingly, OPEC, led by Saudi Arabia, decided not just to go with the latter choice, but increase their oil production substantially in the hope to win the global battle for market share. The U.S. shale oil producers, however, did not back off. Armed with new drilling and other cost saving technologies, they continued to pump oil at near-record levels. The result was a large rightward shift of the supply curve in the world market for oil as shown in Figure 2-19, where **S<sub>16</sub>** is the supply curve in January 2016.

But what happened on the buyers' side of the market? Because, as we noted earlier, oil is used to produce nearly every product, the demand for it is largely driven by the demand for all those products, which increases when economies are growing. From this perspective, although the global demand for oil increased, driven mainly by continuing economic growth in

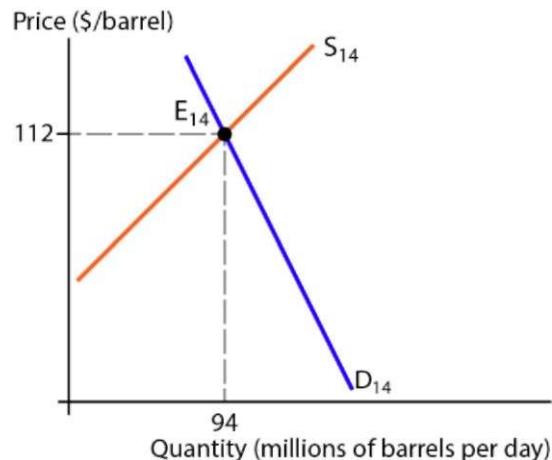


Figure 2-18 The world market for oil, June 2014

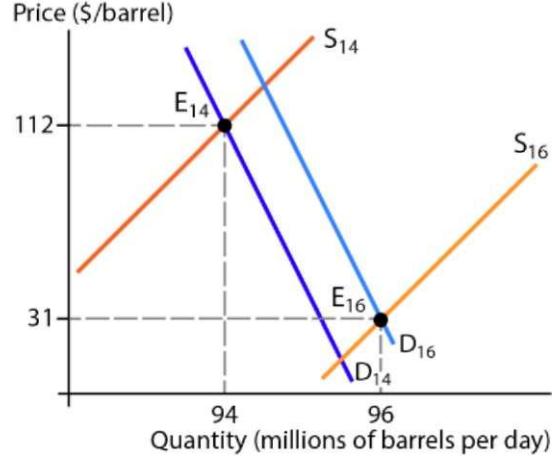


Figure 2-19 The fall in the price of oil explained

<sup>13</sup> You might recall that for meaningful comparisons of price changes over time, the demand and supply model should use real prices, i.e. prices adjusted for inflation, rather than nominal prices. However, during the period we are analyzing, the inflation rate was close to zero, so the difference between the nominal and real prices is immaterial here.

India and China, the increase was rather modest. China's growth was shaky, and in Europe and the United States the annual rates of growth were below 3%. Thus, although the world's demand curve for oil shifted rightward (from **D14** to **D16** in Figure 2-19), the effect of the demand shift was much smaller than that of the supply shift.

As you can see in Figure 2-19, since the downward effect on the price of the increased supply was much greater than the upward effect on it of the increased demand, the price dropped dramatically, from \$112 per barrel in the June 2014 equilibrium (**E14**) to \$31 per barrel in the January 2016 equilibrium (**E16**).

You might be wondering, however, why such a substantial drop in the price of oil resulted in only a relatively small increase in its quantity. Given that the rightward shifts of both supply and demand curves worked in the same direction, reinforcing each other to increase the equilibrium quantity, wouldn't we expect a much greater quantity increase? The answer to this question is that, first, the shift in the demand curve was rather small. Second, along the new same demand curve (**D16**) the responsiveness of the quantity of oil demanded to a change in price was very small. Economists call it a very price inelastic demand. We discuss the economic concept of the price elasticity of demand and the reasons why the demand for oil is very price inelastic in Chapter 3.



## Checkpoint Answers

1

False. Most markets are not strictly perfectly competitive but meet the conditions for perfect competition closely enough for us to ignore their imperfections. We can even use the demand and supply model to analyze markets where the products sold by different firms differ significantly if we combine those products into a single good with typical characteristics. Thus, the uses of the demand and supply model go far beyond strictly perfectly competitive markets.

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2

False. The money that buyers pay and sellers receive per unit of a good is a nominal price. But it is relative prices, not nominal prices, that are relevant when examining how the forces of demand and supply interact in a market. Nominal prices are influenced by inflation, which is a macroeconomic monetary phenomenon and thus irrelevant to the analysis of demand and supply particular markets.

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3

- A. True. This statement reflects the law of demand.
- B. False. Other thing being equal, a fall in price increases the *quantity demanded*. The demand for the good remains unchanged, i.e. the demand curve does not shift.

- C. False. An increase in consumer income shifts the demand curve. The only factor that can cause a movement along the demand curve is the price of the good.
- D. False. A rise in the price, of a good, other things being equal, will result in a leftward and upward movement along the demand curve. It won't shift of the curve.

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**4**

- A. False. The price of a good and the quantity of the good supplied are positively related.
- B. False. The quantity supplied of a the good will increase. The supply will not change, i.e. the supply curve won't shift.
- C. False. A technological improvement will cause a rightward shift of the supply curve, i.e. an increase in supply. An upward shift of the supply curve would also be a leftward shift, which means a decrease in supply.
- D. True. According to the law of supply, other things being equal, a fall in the price of a good results in a decrease in quantity supplied, which means a leftward and downward movement along the supply curve.

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**5**

As the demand curve shows, at \$2.40, the quantity demanded is 200 million gallons. And as the supply curve shows, the quantity supplied at this price is 235 million gallons. Although sellers are willing to offer 235 million gallons, buyers only want 200 million gallons, i.e. there is an excess supply of 35 million gallons. As sellers compete to sell their gas, they lower the price, so the price will fall.

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**6**

- A. Honda cars and Toyota cars are substitutes. When the price of Toyotas rises, some consumers will choose to buy a Honda instead of a Toyota. Thus, the demand for Hondas will increase.
- B. When students come for the new semester, the number of potential buyers of pizza increases. Thus, the demand for pizza will increase.
- C. SUV's and gas are complements. When the price of gas falls, driving large SUV's, which consume a lot of gas, becomes significantly less expensive. As a results, the demand for large SUV's will increase.
- D. When consumers become more aware of health risks associated with junk food, their preferences change away from it, which will decrease the demand for junk food.
- E. When buyers expect the prices of TVs to fall next month, some of them may decide to wait until then. As a results, the demand for TVs this month will decrease.

F. When the price of orange juice falls, the quantity of orange juice demanded will increase. The demand for orange juice, however, won't change (i.e. there will be a movement along the demand curve, but the curve won't shift).

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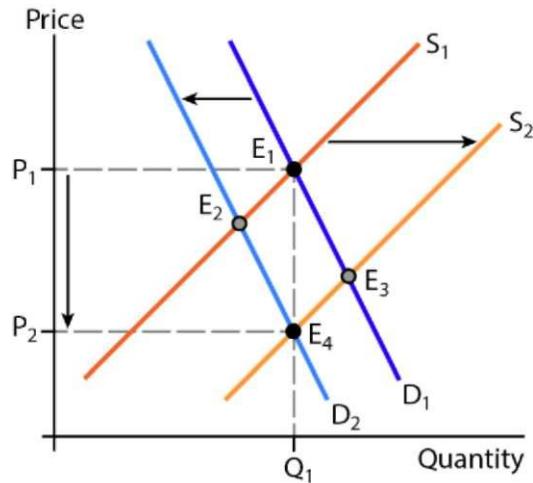
7

- A. As the number of sellers in the market for smartphones increases, the supply of smartphones will increase, i.e. the supply curve will shift rightward.
- B. Technological advances in the production of solar panels allows the producers to increase output using the same amount of resources, which will increase the supply of solar panels, i.e. the supply curve will shift rightward.
- C. When the price of chicken in Europe falls, it becomes more profitable for U.S. producers to sell more of their chicken domestically rather than exporting it to Europe. On the other hand, European producers will want to export more of their chicken to the United States, where the price becomes relatively higher. As a result, the supply of chicken to the U.S. market will increase, i.e. the supply curve will shift rightward.
- D. When the price of milk falls, the quantity supplied of milk will decrease. The supply of milk, however, won't change (i.e. there will be a movement along the supply curve, but the curve won't shift).
- E. When sellers expect the price of desktop computers to fall next year, they want to sell more desktop computers this year, before the price falls. As a result, the supply of desktop computers this year will increase, i.e. the supply curve will shift rightward.
- F. When the price of corn falls relative to the price of wheat, it becomes more profitable to produce wheat compared with corn. Thus, farmers will reallocate their land and other resources to produce more wheat, leaving fewer resources to produce corn. As a result, the supply of wheat will increase, i.e. the supply curve will shift rightward.
- G. Higher wages in the United States make the labor input more costly to the car producers. As a result, they will be able to hire fewer assembly workers at the same cost. Therefore, the supply of cars will decrease, i.e. the supply curve will shift leftward.

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**8**

First, clarify to yourself that you are looking at the *current* market for coffee, not the market for coffee next month. In the figure, the initial equilibrium is at point  $E_1$ , where the price is  $P_1$  and the quantity is  $Q_1$ . Buyers' expectations of a lower future price decrease the current demand for coffee, shifting the demand curve leftward. The equilibrium resulting from this shift alone is at point  $E_2$ , where both price and quantity are lower. Sellers' expectations of a lower future price increase the current supply of coffee, shifting the supply curve rightward. The equilibrium resulting from this shift alone is at point  $E_3$ , where the price is lower and the quantity is greater. Since both curve shifts lower the price, their combine effect is to lower the equilibrium price. But since the leftward shift of the demand curve decreases the quantity while the rightward shift of the supply curve increases it, the resulting effect on the quantity depends on how far each of the curves shifts. As shown in the figure, the equilibrium quantity remains at  $Q_1$ . But if, for example, the demand curve shifted further to the left, the quantity would decrease. And if the supply curve shifted further to the right, the quantity would increase.



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**9**

The consumer surplus would shrink. Anna's surplus will be  $\$800 - \$510 = \$290$ , Bart's will be  $\$650 - \$510 = \$140$ , while Cindy and Don will not receive any surplus. The highest price they are willing to pay is below the market price, so they won't buy a laptop. Thus, the total surplus received by our four consumers will be  $\$290 + \$140 + \$0 + \$0 = \$430$ .

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**10**

The producer surplus would shrink. Zach's surplus will be  $\$410 - \$300 = \$110$ , Yoko's will be  $\$410 - \$400 = \$10$ , while Xander and Wendy will not receive any surplus. They won't sell their laptops because the market price is below the lowest prices at which they are willing to sell. Thus, the producer surplus received by the four sellers will be  $\$110 + \$10 + \$0 + \$0 = \$120$ .

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**11**

False. No one loses from voluntary exchange. As we could see from our example, each buyer and each seller of laptops gains a certain amount of surplus, i.e. everyone gains from trade.

Since the exchange is voluntary, people simply won't engage in a transaction if they lose from it.

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**12** The situation is depicted in the figure below. The \$100 increase in price decreases the quantity of laptops supplied, and therefore the quantity sold, from 2,000 to 1,000. As a result of a lower price and a smaller quantity sold, the producer surplus—the area below the price and above the supply curve—decreases. Its dollar value (represented by area B) is now:

$$\text{Producer surplus} = (\$400 - \$300) \times 1,000 / 2 = \$50,000.$$

The consumer surplus increases because of a lower price but decreases because consumers now are only able to sell 1,000 laptops instead of 2,000. The value of the consumer surplus is represented by the trapezoid area A + F, which can be calculated as:

$$\text{CS} = (\$400 + \$250) \times 1,000 / 2 = \$325,000$$

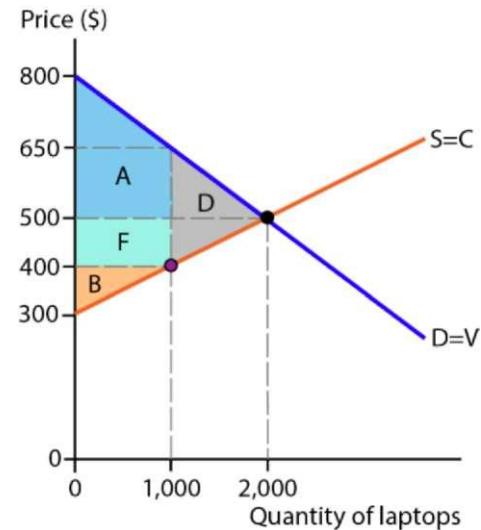
Thus, the consumer surplus increases by \$25,000, while the producer surplus decreases by \$150,000. part of the loss for producers is a gain for consumers. Area F represent this transfer of surplus. However, area D is no longer part of either consumer or producer surplus. It is a deadweight loss. We can calculate the dollar value of the deadweight loss as:

$$\text{DWL} = (\$650 - \$400) \times 1,000 / 2 = \$125,000.$$

That is, the deviation from the market equilibrium reduced the total surplus by \$125,000. We can confirm this by calculating the total surplus when the price of a laptop is \$400 as the sum of the consumer surplus and producer surplus:

$$\text{TS} = \$325,000 + \$50,000 = \$375,000$$

which is \$125,000 less than the \$500,000 total surplus received by consumers and producers when the market was in equilibrium. Thus, a price below the equilibrium led to a deadweight loss in a way similar to how a price above the equilibrium did.



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## CHAPTER 3

### ELASTICITY OF DEMAND AND SUPPLY



#### What's in It for You?

In the previous chapter, you've learned the law of demand: a higher price will lead to a lower quantity demanded. But how much lower? Similarly, the law of supply states that a higher price causes quantity supplied to increase. By how much? To answer these questions, we need to understand and be able to apply the concept of **elasticity**, which economists use to measure the degree of *responsiveness*, or sensitivity, of one variable to a change in another. Consider the following situations:

- You are a pricing manager at Apple Inc. Your boss asks you to predict what will happen to Apple's receipts from iTunes downloads if it raises the price. What should you tell your boss?
- As the vice president for business and finance at a private college, you are trying to figure out if raising the tuition will increase the college's revenue. Will it?
- You are a soybean farmer. Unfavorable weather decreases soybean production everywhere. Should you prepare to tighten your belt?
- You are running an oil refinery, which uses crude oil to produce gasoline and other petroleum products, so the price of crude oil is a crucial factor influencing your production decisions. Suddenly, a crisis in the Middle East disrupts oil production in the region. How will that influence the price your refinery pays for crude oil?
- You are the manager of a Walmart store. Due to an increase in the federal minimum wage, the average income of your customers rises by 5%. How should you adjust your purchases of goods from suppliers?
- You are an economist at Dell. Hewlett Packard lowers the price of their laptops by 10%. Your boss wants to know how this will affect the sales of Dell laptops with similar characteristics. How can you figure it out?

We can continue this list of questions to include many other situations in which knowing and being able to apply the concept of elasticity helps make better business decisions. in this chapter we explain how.



## Learning Objectives

At completion of this learning module you are expected to be able to:

- Define and explain the concepts of price elasticity of demand, income elasticity of demand, cross-price elasticity of demand, and price elasticity of supply.
- Calculate the elasticities mentioned above given the corresponding price and quantity changes.
- Predict changes in quantities demanded and supplied given the corresponding changes in prices or income and relevant elasticities; predict changes in prices given the corresponding changes in quantities and relevant elasticities.

Predict the effect of a change in price on the firm's total revenue given the price elasticity of demand for its product.

### 3.1 Price Elasticity of Demand

The price elasticity of demand tells us how sensitive the quantity demanded is to a change in price. Two things are important to keep in mind when defining and measuring price elasticity of demand:

1. Compare *percentage* changes, not absolute changes, in price and quantity.
2. Hold constant all other variables that influence consumers' decisions.

The **price elasticity of demand** for a good is the percentage change in the quantity of the good demanded in response to a one percent change in its price. Or, mathematically:

$$E_D = \frac{\% \Delta Q_D}{\% \Delta P} \quad (1)$$

where  $E_D$  is the price elasticity of demand,  $\% \Delta Q_D$  is the percentage change in quantity demanded, and  $\% \Delta P$  is the percentage change in price.

Note that according to the formula above, if  $\% \Delta P = 1\%$ ,  $E_D = \% \Delta Q_D$ , which is what the definition says.

To illustrate the concept of price elasticity of demand, let's consider the demand curve for oranges shown in Figure 1. Since we must hold constant all influences on consumer choices other than price, we measure changes in price and quantity along the same demand curve. In the figure, along the demand curve D, when the price of oranges rises by 25% ( $\% \Delta P = 25\%$ ), from  $P_1$  to  $P_2$ , the quantity of oranges demanded decreases by 50% ( $\% \Delta Q = -50\%$ ). Thus, the price elasticity of demand for oranges is:

$$E_D = \frac{-50\%}{25\%} = -2$$

This number tells us that for each 1% rise in price, the quantity of oranges demanded decreases by 2%.

Recall that according to the law of demand, the relationship between price and quantity demanded is negative: when the price rises, the quantity demanded decreases and when the price falls, the quantity demanded increases. This means the price elasticity of demand is always a negative number. The sensitivity of quantity demanded to a change in price, however, is measured by the magnitude of the elasticity number regardless of its sign: the greater the *absolute value* elasticity, the more price sensitive—i.e. more elastic—the demand is. Therefore, when comparing price elasticities of demand, we should ignore the minus signs and look only at the absolute values. For example, if the price elasticity of demand for grapefruits is  $-3$ , then the demand for grapefruits is more elastic than the demand for oranges because  $|-3| = 3$ ,  $|-2| = 2$ , and  $3 > 2$ . In general:

The greater the *absolute value* of the elasticity number, the more elastic the demand is.

Given that the magnitude of elasticity is what matters, we will always refer to its absolute value ( $|ED|$ ) when interpreting and comparing price elasticities of demand.



## Checkpoint 1

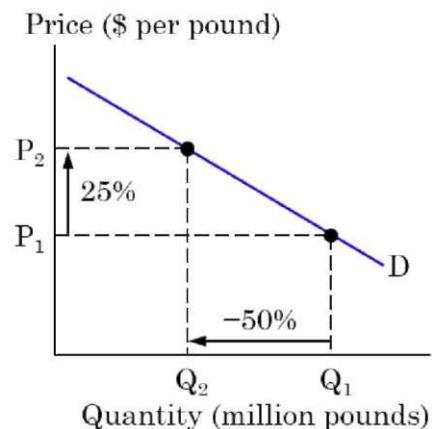
Which of the following statements about the price elasticity of demand are true and which are false? Explain.

- it is the same as the slope of the demand curve.
- it shows the percentage change in quantity demanded caused by a 1 percent change in price.
- It is a negative number, but what matters when comparing elasticities is its absolute value.
- It is the sensitivity of price to changes in demand.

Check your answer

## Calculating Price Elasticity of Demand

As follows from our discussion above, to calculate elasticity, we need to know the percentage changes in price and quantity. Let's continue our example of demand for oranges to see how



**Figure 1 Elasticity of demand for oranges**

to calculate those percentage changes. Figure 2 shows the numbers for the prices and quantities at points A and C on the demand curve D. To calculate the percentage change in price between points A and C, we use the following formula:

$$\% \Delta P = \frac{P_2 - P_1}{P_{AV}} = \frac{\Delta P}{P_{AV}}$$

where PAV is the average of P1 and P2:

$$P_{AV} = \frac{P_1 + P_2}{2}$$

This formula, called the *midpoint formula*, is the preferred way to calculate percentage changes when measuring elasticities. In our example:

$$P_{AV} = \frac{\$1.40 + \$1.80}{2} = \$1.60$$

so the percentage change in price is:

$$\% \Delta P = \frac{\$1.80 - \$1.40}{\$1.60} = \frac{\$0.40}{\$1.60} = 0.25 \text{ or } 25\%$$

Similarly, to calculate the percentage change in quantity, we use the formula:

$$\% \Delta Q = \frac{Q_2 - Q_1}{Q_{AV}} = \frac{\Delta Q}{Q_{AV}}$$

where QAV is the average of Q1 and Q2:

$$Q_{AV} = \frac{Q_1 + Q_2}{2}$$

In our example:

$$Q_{AV} = \frac{25 + 15}{2} = 20$$

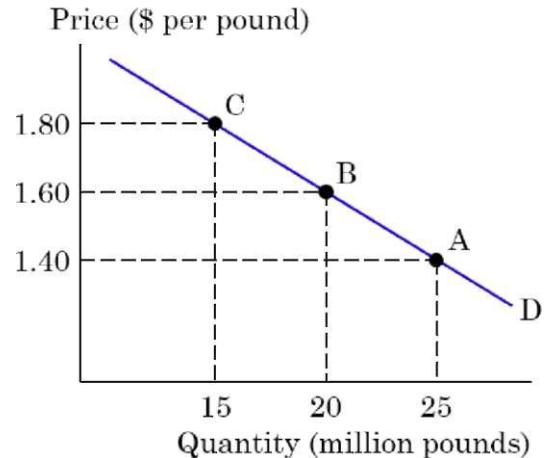
so the percentage change in quantity is:

$$\% \Delta Q = \frac{15 - 25}{20} = \frac{-10}{20} = -0.5 \text{ or } -50\%$$

Plugging these numbers into the elasticity formula, we get:

$$E_D = \frac{50\%}{25\%} = -2$$

the same result as we calculated above.



**Figure 2 Calculating the elasticity of demand for oranges**

Another way to calculate elasticities and see the underlying relationships is to rewrite the elasticity formula as follows:

$$E_D = \frac{\% \Delta Q_D}{\% \Delta P} = \frac{\Delta Q_D}{Q_{AV}} \div \frac{\Delta P}{P_{AV}} = \frac{\Delta Q_D}{Q_{AV}} \times \frac{P_{AV}}{\Delta P}$$

Or, rearranging the terms:

$$E_D = \frac{\Delta Q_D}{\Delta P} \times \frac{P_{AV}}{Q_{AV}}$$

Using the numbers in our example:

$$E_D = \frac{-10}{0.40} \times \frac{1.60}{20} = -2$$

As you can see, the two formulas produce the same result.

In addition to calculating elasticity between two points on the demand curve (A and C in our example), which is called *arc elasticity*, the second formula allows us to calculate the elasticity at a point on the demand curve, called *point elasticity*. While arc elasticity tells us how quantity demanded reacts to a certain change in price, point elasticity shows us the speed at which quantity demanded changes at a certain instant.

To measure elasticity at a point, we assume that the changes in price (AP) and quantity ( $\Delta Q_D$ ) are very small, approaching zero. How can we measure those changes then? We can't measure them separately, of course, but we can still calculate their ratio  $\frac{\Delta Q_D}{\Delta P}$ , as far as we know the slope of the demand curve. In our example, the demand curve is linear (i.e. a straight line). Recall from your math courses that the slope of a straight line is constant and can be calculated between any two points on the line as "the rise over the run." Between points A and C, for example, the rise is  $\Delta P = \$0.40$  and the run is  $\Delta Q_D =$

### Side Note 1

Why use the midpoint formula and not the usual percentage change formula, where we divide the change in a variable by its starting value? For example, for the price rise in our example, the percentage change in quantity would be

$$\% \Delta Q = \frac{Q_2 - Q_1}{Q_1} = \frac{15 - 25}{25} = -0.4 \text{ or } -40\%$$

But suppose that instead of rising, the price falls. Then the percentage change in quantity is:

$$\% \Delta Q = \frac{25 - 15}{15} = 0.67 \text{ or } 67\%$$

Thus, the percentage change in quantity will depend on the direction in which the price changes.

The same will be true about the percentage change in price calculated using the conventional percentage change formula. When the price rises,  $\% \Delta P = 29\%$ , and when it falls,  $\% \Delta P = -22\%$ . So, when the price rises, the elasticity is

$$|E_D| = \left| \frac{-40\%}{29\%} \right| = 1.4$$

and when the price falls, it is:

$$|E_D| = \left| \frac{67\%}{-22\%} \right| = 3$$

That is, if we use the conventional percentage change formula, the elasticity we calculate will depend on whether the price rises or falls. To avoid this problem, we use the midpoint formula, which allows us to obtain a measure of elasticity that does not depend on the direction in which the variables change.

<sup>1</sup> If the demand curve is not a straight line, we can still calculate its slope at a point as the slope of the straight line tangent to that point.

-10 (it is negative because the quantity decreases, i.e. "runs back," so to speak). So, the slope of the demand curve is  $\frac{\Delta P}{\Delta Q_D}$  and the term  $\frac{\Delta Q_D}{\Delta P}$  in the formula above is the inverse of its slope, which can be calculated directly as "the run over the rise." Now we can compute the elasticity at point B as follows:

$$E_D = \frac{1}{\text{slope}} \times \frac{P_B}{Q_B} \quad (2)$$

$$E_D = \frac{-10}{0.40} \times \frac{1.60}{20} = -25 \times \frac{1.60}{20} = -2$$

The elasticity at point B is the same as the arc elasticity between points A and C because point B is the midpoint between points A and C. But we can use the same number for the inverse of the slope to calculate the elasticity at any other point on the curve. For example, at point A, the price elasticity of demand is:

$$E_D = -25 \times \frac{1.40}{25} = -1.4$$



## Checkpoint 2

Suppose the price of strawberries falls from \$2.80 per pound to \$2.50 per pound. As a result, the quantity of strawberries demanded increases from 35 million pounds to 45 million pounds. What is the arc price elasticity of demand for strawberries in this price range? What is the elasticity at the point where the price is \$2.80 per pound?

Check your answer

## Price Elasticity Along a Straight-Line Demand Curve

Throughout this course, we draw demand and supply curves as straight lines. This simplifies our analysis, and within a realistic price range, a straight line is usually a reasonable approximation even if the actual demand curve is not linear. It is worth to discuss then how the price elasticity of demand is related to the slope of the demand curve.

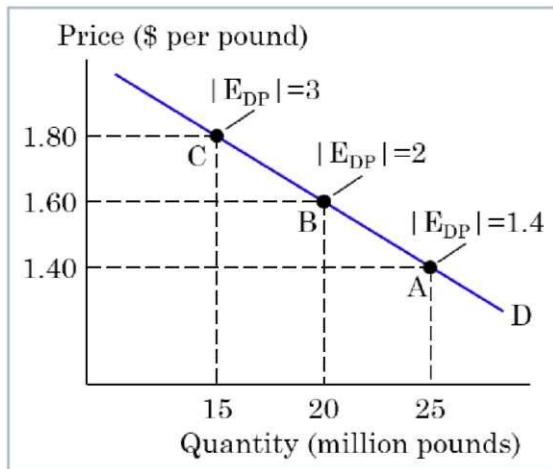
First, note that although both slope and elasticity show how much quantity demanded changes in response to a certain change in price, they are two different concepts. The inverse of the slope tells us by how many *units* the quantity changes when the price rises or falls by *one dollar*. The price elasticity of demand shows the *percentage change* in quantity demanded in response to a *one percent change* in price. Second, while the slope remains constant along a linear demand curve, the elasticity does not.

Let's return to our demand curve for oranges (Figure 3). As we've calculated before, the absolute value of the elasticity at point A is 1.4, while at point B it is 2. Why does the demand become more elastic as we move up along the curve from point A to point B?

Take a look at the point-elasticity formula again:

$$E_D = \frac{1}{\text{slope}} \times \frac{P}{Q}$$

Since a linear demand curve has a constant slope, when we move along the



**Figure 3 Elasticity along a linear demand curve**

curve, the first term in the formula,  $\frac{1}{\text{slope}}$ , remains the same. However, the

second term,  $\frac{P}{Q}$ , increases as we move up

along the curve because the price rises and the quantity decreases. In our example, it is  $1.40/25 = 0.056$  at point A,  $1.60/20 = 0.08$  at point B, and  $1.80/15 = 0.12$  at point C. Therefore, the absolute values of elasticities are  $25 \times 0.056 = 1.4$ ,  $25 \times 0.08 = 2$ , and  $25 \times 0.12 = 3$  at points A, B, and C, respectively. Thus:

As the price rises and we move upward and leftward along a linear demand curve, the demand becomes more price elastic.

Obviously, the reverse is also true: as the price falls and we move downward and rightward along a linear demand curve, the demand becomes less elastic.

### Side Note 2

There are two problems with using the slope of a demand curve to measure the responsiveness of quantity to a change in price. First, slopes depend on the units of measurement. If, for example, we measured the quantity of oranges in kilograms instead of pounds (as all the countries in the world, except for the United States, Liberia, and Myanmar, do), the quantities of oranges would be 11.3 million kg and 6.8 million kg at points A and C, respectively, so the  $|\Delta Q|$  would be  $16.8 - 11.3 = 4.5$ , and the inverse of the slope would be  $4.5/0.40 = 11.25$  by the absolute value. But the fact that it is now 11.25 instead of 25 doesn't mean that consumers are 45% as price-sensitive as before, since nothing has changed except for the units of measurement.

The second problem with using the slope to measure the responsiveness of quantity to a change in price is that we can't meaningfully compare the slopes of demand curves across different products. Suppose, for example, that we want to compare consumers' price sensitivity in the market for oranges with that in the market for t-shirts. The inverse of the slope of the demand curve for t-shirts would show how many more t-shirts consumers would buy if the price falls by \$1. Say, we've calculated it at 50 million. How can we compare the price sensitivity of 50 million t-shirts per dollar with that of 25 million pounds of oranges per dollar? Such comparisons make no sense.

Now suppose we want to compare the price elasticity of demand for oranges ( $D_O$ ) with that for grapefruits ( $D_G$ ). Figure 4 shows the two demand curves. Both are straight lines. Clearly, at the point where the curves intersect (point A), the P to Q ratio is the same for both curves (0.056). However, the demand curve for grapefruits is less steep than the demand curve for oranges, which means absolute value of the inverse of the slope for  $D_G$  is greater than that for  $D_O$ . As we can calculate from Figure 4, for  $D_G$ , the absolute value of the inverse of the slope ("the run over the rise" between points A and F) is  $|-10-K|.20| = 50$ , compared to 25 for  $D_O$ . Therefore, the elasticity of demand for grapefruits at point A,  $|ED| = 50 \times 0.056 = 2.8$ , is twice that of the demand for oranges (1.4). In general, at a given point, a flatter demand curve is more elastic.

Figure 4 also shows that when two different linear demand curves have a common point, in a given price range that starts (or ends) at that point, the flatter demand curve is more elastic. As we calculated before, using the midpoint formula, when the price rises from \$1.40 to \$1.60 (i.e. when we move from point A to point B along  $D_O$  and to point F along  $D_G$ ), the percentage change in price is the same (25%, as we calculated it before). But since  $D_G$  is flatter than  $D_O$ , the quantity response to that change in price is greater along  $D_G$  than along  $D_O$ .



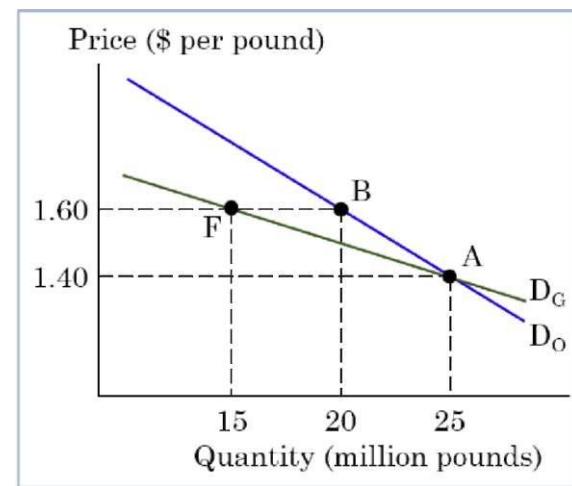
### Checkpoint 3

Refer to the figure on the right. Which of the following is true? Explain.

The demand is more elastic between points \_\_\_\_\_ than between points \_\_\_\_\_.

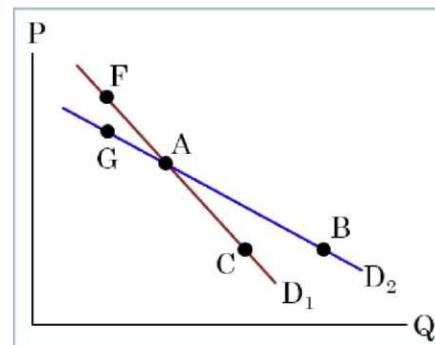
1. A and B; A and C
2. A and F; A and G
3. A and F; A and C
4. A and B; A and G

Check your answer



**Figure 4 Elasticities of demand for oranges and grapefruits**

In general, at a given point, a flatter demand curve is more elastic.

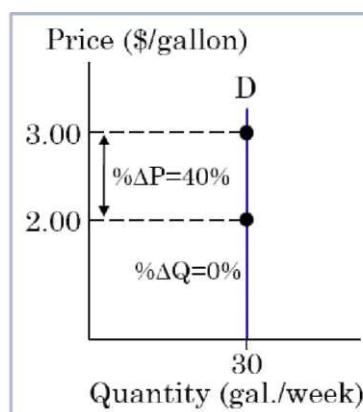


## Categorizing Elasticities by Magnitude

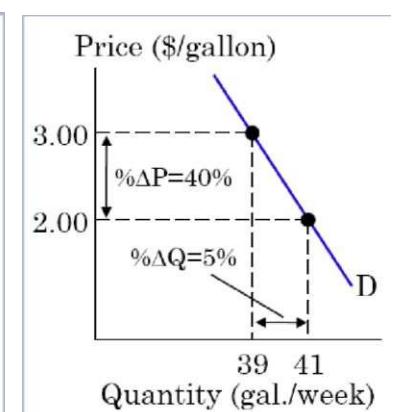
It is useful to categorize elasticity numbers based on their magnitudes. Let's start with an extreme case where the price elasticity of demand is zero, which means the quantity demanded does not change at all in response to a price change. Figure 5-a shows an example. Jake would buy the same quantity of gas per week, no matter whether the price is \$2 or \$3 per gallon. That is, his  $\%ΔQ = 0$  when the  $\%ΔP = 40\%$ . Thus, the price elasticity of Jake's demand for gas is  $ED = 0\% / 40\% = 0$ . This is called **perfectly inelastic** demand, and it is reflected by a vertical demand curve. We should always keep in mind, however, that the price elasticity of demand may be different in a different price range. If, for example, the price of gas rises from \$3 to \$4, Jake's demand will not necessarily—and most likely not—remain perfectly inelastic.

When the price elasticity of demand is between zero and one ( $0 < |ED| < 1$ ), the demand is called **inelastic**. An example is shown in Figure 5-b. When the price of gas rises by 40%, Rona's quantity of gas demanded decreases by 5%. That is, the price elasticity of her demand for gas is  $|ED| = 5\% / 40\% = 0.125$ . Since Rona's quantity demanded changes in response to a change in price, her demand is not perfectly inelastic. But as far as the percentage change in quantity is smaller than the percentage change in price, which means  $|ED| < 1$ , the demand is categorized as price inelastic.

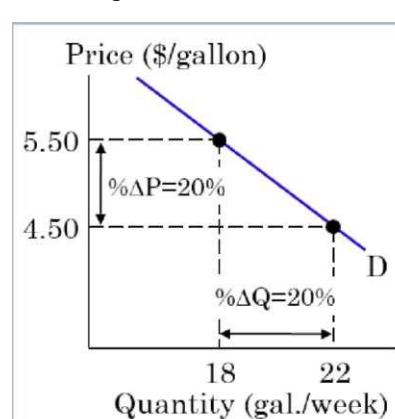
A notable case of elasticity is when the percentage change in quantity is the same as the percentage change in price so that the price elasticity of demand equals one. This is called



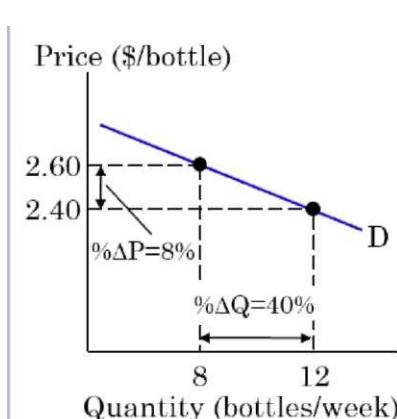
**Figure 5-a** Jake's perfectly inelastic demand for gas



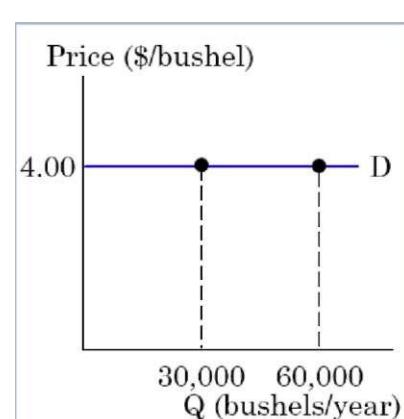
**Figure 5-b** Rona's inelastic demand for gas



**Figure 5-c** Rona's unitary elastic demand for gas



**Figure 5-d** Susan's elastic demand for Coke



**Figure 5-e** Perfectly elastic demand for Dean's wheat

**unitary elastic** demand. For example, in a higher price range, Rona's demand for gas is likely to be more elastic. As shown in Figure 5-c, when the price of gas rises from \$4.50 to \$5.50 per gallon, i.e. by 20%, Rona's quantity demanded decreases also by 20%. That is, the elasticity of her demand in this price range is  $|ED| = |-20\% + 20\%| = 1$ .

Note that when the demand is unitary elastic, consumers want to spend a *constant amount* on the good no matter what its price is. This is because the amount spent (TX) is the price of the good (P) times the quantity of the good bought (Q):  $TX = PxQ$

So when the quantity decreases (or increases) by the same percentage as the price increases (or decreases), the  $PxQ$  remains unchanged. In our example in Figure 5-c, when the price is \$4.50, Rona wants to spend  $\$4.50 \times 22 = \$99$  and when the price is \$5.50, she wants to spend the same amount:  $\$5.50 \times 18 = \$99$ .

When the elasticity value is greater than one ( $|ED| > 1$ ), the demand is called **elastic**. An example is shown in Figure 5-d. When the price of Coke rises from \$2.40 to \$2.60 per bottle, i.e. by 8%, Susan's quantity demanded decreases by 40%, which means the elasticity of Susan's demand for Coke is  $|ED| = |-40\% - 8\%| = 5$ .

In certain situations, the quantity demanded is extremely sensitive to price changes so that the elasticity number is practically infinity. In such cases the demand is considered to be **perfectly elastic**. Figure 5-e shows an example. Dean's farm is one among millions of other farms producing wheat. And wheat is a standardized product, so consumers do not care whether it is produced at Dean's farm or somewhere else. As a result, the price of wheat is determined by the competitive forces of market supply and demand. In Figure 5-e, it is \$4 per bushel. If Dean tries to charge a price that is even slightly above \$4, the quantity demanded for his wheat will be zero, since consumers will be able to buy wheat elsewhere at a lower price. On the other hand, if Dean charges a price just a little below \$4, the quantity of his wheat demanded will become practically infinite: since, Dean's wheat is as good as that produced elsewhere but is sold at a lower price, every potential buyer will want to get it.<sup>2</sup> This means the demand curve for Dean's wheat can be viewed as perfectly elastic — horizontal at the market price of \$4.



## Checkpoint 4

Every time Vincent goes to a gas station, he gets 18 gallons of gas without looking at the price. His fiance, Lisa, however, always wants to spend 36 dollars on gas no matter what the price is. What can you tell about the price elasticity of Vincent's demand for gas? Price elasticity of Lisa's demand for gas? Explain your answers.

Check your answer

<sup>2</sup> Of course, Dean's farm won't be able to satisfy all that huge demand, but that's not the point here. Recall from Chapter 2 that the quantity demanded and quantity actually bought are two different concepts. Later in the course (in Chapter 7), we will see how the concept of perfectly elastic demand helps us analyze firms' decisions in perfectly competitive markets.

## Price Elasticity of Demand and Pricing

Knowing and understanding the price elasticity of demand can help firms optimally price their products. Consider the following example.

### Example 1: Does Raising Price Bring in More Revenue?

Suppose you are an economist at Apple Inc. Your boss asks you to predict what will happen to the receipts from iTunes downloads if Apple raises their price from \$1.29 to \$1.39 per song. Let's see how you can use the information about price elasticity of demand for iTunes downloads to accomplish this task.

The term for total receipts used in economics is **total revenue (TR)**, which is the price per unit (P) times the quantity (number of units) sold (Q):

$$TR = P \times Q$$

As clear from this formula, raising the price, i.e. selling each download for more, will increase the total revenue. On the other hand, according to the law of demand, a higher price will decrease the quantity of downloads demanded, so Apple will be able to sell fewer downloads, which will decrease its total revenue. So the resulting change in total revenue will depend on which of the two effects—the price effect or the quantity effect—is greater. And all we need to know to figure this out is the price elasticity of demand for iTunes downloads.

It can be shown mathematically that

$$\% \Delta TR \approx \% \Delta P + \% \Delta Q \quad (3)$$

Further, recall that according to the law of demand, if  $\% \Delta P$  is positive (i.e. the price rises), then  $\% \Delta Q$  is negative (i.e. the quantity decreases). Hence, if  $| \% \Delta P | > | \% \Delta Q |$ , i.e. the price effect prevails, the total revenue increases. And if  $| \% \Delta Q | > | \% \Delta P |$ , i.e. the quantity effect prevails, the total revenue decreases.

How do we know which percentage change,  $| \% \Delta P |$  or  $| \% \Delta Q |$ , will be greater? The price elasticity of demand tells us exactly that. Recall that the price elasticity of demand is

$$E_D = \frac{\% \Delta Q_D}{\% \Delta P}$$

According to this formula, if the demand is inelastic ( $| E_D | < 1$ ), then  $| \% \Delta P |$  must be greater than  $| \% \Delta Q |$ . And if the demand is elastic ( $| E_D | > 1$ ), then  $| \% \Delta Q |$  must be greater than  $| \% \Delta P |$ .

Back to our example, having realized that you need to know the price elasticity of demand for iTunes downloads, you conduct a market research and estimate it at -1.2. This number tells you that for each 1% rise in price, the quantity of iTunes downloads will decrease by 1.2%. As equation (3) shows, this means the negative effect on the total revenue of the decreased quantity will more than offset the positive effect of the higher price. Therefore, you predict that the total revenue will decrease.

You can even tell your boss by how much (in percentage terms) you predict the total revenue to decrease. When the price is raised from \$1.29 to \$1.39, the percentage change in price (calculated using the midpoint formula) is 7.5%. So, using the elasticity formula, we can write:

$$-1.2 = \frac{\% \Delta Q}{7.5\%}$$

Solving this equation for  $\% \Delta Q$ , we get:

$$\% \Delta Q = -1.2 \times 7.5\% = -9.0\%$$

And from equation (3):

$$\% \Delta TR \approx 7.5\% - 9.0\% = -1.5\%$$

That is, you predict that raising the price of iTunes downloads from \$1.29 to \$1.39 will decrease Apple's receipts by about 1.5%.<sup>3</sup>

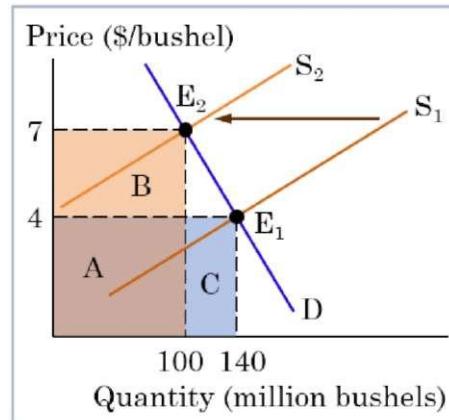
### Example 2: Can Farmers Benefit from Bad Weather?

Suppose unfavorable weather conditions decrease soybean production everywhere. Can you predict what will happen to soybean farms' revenues?

To make our prediction, let's first visualize the situation in the market for soybeans. It is depicted in Figure 6. Suppose that initially, the equilibrium price of soybeans is \$4 per bushel, and the equilibrium quantity is 140 million bushels (point E<sub>1</sub>).<sup>4</sup> As you've learned from Chapter 2, unfavorable weather will decrease the supply of soybeans, shifting the supply curve leftward (from S<sub>1</sub> to S<sub>2</sub> in Figure 6). As a result, the price of soybeans rises and the quantity of soybeans demanded decreases along the demand curve (D). Therefore, to predict what will happen to the farmers' revenue, we need to know the price elasticity of demand.

Suppose the price elasticity of demand for soybeans is estimated at -0.6. This means for each 1% increase in price, the quantity of soybeans demanded will decrease by 0.6%. So, according to equation (3), the gain in total revenue due to a higher price will more than offset the loss of it due to a decreased quantity. As a result, the farmers' total revenue will increase.

This may sound counterintuitive. How can bad weather increase farmers' revenue? Let's take a look at Figure 6 again. Initially (at point E<sub>1</sub>), the total revenue is \$4x140 million = \$560 million (area A+C). When the price rises to \$7 and the quantity decreases to 100 million bushels (i.e. when the market moves to the new equilibrium, point E<sub>2</sub>), farmers gain \$3x100 million = \$300 million (area B) due to the rise in price and lose \$4x40 million = \$160 million (area C) due to the decrease in quantity. Since the price effect on total revenue exceeds the



**Figure 6** Bad weather decreases soybean production

<sup>3</sup> Using equation (3) to calculate the approximate change in total revenue works pretty well when the percentage changes in P and Q are relatively small. The result is less accurate for larger percentage changes.

<sup>4</sup> We use these price and quantity numbers for demonstration purposes only. You don't really need to know them to make the prediction in question. As you'll see shortly, the only number that you need to know is the price elasticity of demand for soybeans.

quantity effect by \$300 million - \$160 million = \$140 million (area B - area C), the total revenue increases by that amount. In the new equilibrium (E2),  $TR = \$7 \times 100$  million = \$700 million (area A+B), which is \$140 million more than the \$560 million in the initial equilibrium.

The same reasoning applies when we want to figure out what will happen to total revenue if the price falls. Table 1 shows all possible scenarios. Note that when the demand is inelastic, the total revenue changes in the same direction as does the price because in that case the price effect prevails. And when the demand is elastic, the total revenue changes in the direction opposite to the price change because now the quantity effect prevails. Note also that when the demand is unitary elastic ( $|ED| = 1$ ), the total revenue remains the same no matter whether the price rises or falls.

**Table 1 Effects of price changes on total revenue**

<b>Price elasticity of demand</b>	<b>Effect on total revenue</b>	
	<b>Price rises: Price falls:</b>	
Inelastic ( $ ED  < 1$ )	Increases	Decreases
Unitary elastic ( $ ED  = 1$ )	No change	No change
Elastic ( $ ED  > 1$ )	Decreases	Increases



### Checkpoint 5

Suppose Netflix lowers the price of its monthly streaming subscription from \$9.99 to \$8.99. In this price range, the price elasticity of demand for Netflix subscriptions is -1.4. What will be the percentage change in the number of subscriptions demanded? What will happen to Netflix's total revenue?

Check your answer

## What Determines Price Elasticity of Demand?

What makes demand more price elastic and what makes it less price elastic? Table 2 shows price elasticities of demand for some goods and services drawn from a variety of studies by economists. So, why is the price elasticity of demand for restaurant meals ( $|ED| = 2.27$ ) so much higher than that for salt ( $|ED| = 0.10$ )? Let's discuss factors that could cause this and other differences in price elasticity of demand. To better understand the influences on elasticity, keep in mind that it measures the responsiveness of quantity demanded to a change in price. That is, when consumers are more responsive to price changes, the demand is more elastic and when they are less responsive, the demand is less elastic.

### **Availability and Closeness of Substitutes**

As you can see in Table 2, the demand for beef is more elastic than the demand for electricity. One reason is that there are several rather close substitutes available for beef (e.g., pork, lamb, or turkey), so if the price of beef rises, consumers can pretty easily switch to those substitutes, which will result in a substantial decrease in the quantity of beef demanded. But there are practically no good substitutes for electricity. So, when electric power suppliers raise the price, households may try to reduce their electricity consumption by using more energy-efficient electric appliances, but this only can be done to a certain extent. Therefore, the demand for electricity is significantly less sensitive to a change in price than the demand for beef. In general, other things being equal:

The more and/or closer substitutes for a good are available, the more price elastic the demand for that good is.

Note that the availability of close substitutes depends on how broadly we define the market. For example, if we are looking at the market for Coke, than Pepsi, Sprite, and other soft drinks are very close substitutes. So, if the price of Coke rises, the quantity of Coke demanded is likely to decrease substantially as consumers switch to those substitutes. If, however, we define the market more broadly, e.g., as the market for all soft drinks, then substitutes will be harder to find. As a result, when the price of all soft drinks rises, the quantity demanded is not likely to decrease that much. As you can see in Table 2, the demand for Coke is much more elastic ( $|E_D = 1.71|$ ) than the demand for soft drinks in general ( $|E_D = 0.75|$ ).

### **Whether the Good is a Necessity or a Luxury**

Most people consider goods such as, housing, electricity, and gasoline to be essential for living. These goods are called "necessities." When the price of such a good rises, consumers can "tighten their belts" to some extent, but given that the good is a necessity, these possibilities are rather limited, so the quantity demanded is not likely to change much. On the other hand, there are goods that consumers can easily do without, called "luxuries." Examples are entertainment, exotic vacations, and meals at fine restaurants. If the price of such goods rises, consumers can reduce their purchases substantially or even not buy those goods at all, since they can easily live without them. As shown in Table 2, the demand for luxuries such as

**Table 2 Price elasticities of demand for some goods and services**

<b>Good or service</b>	<b>Elasticity (absolute value)</b>
Salt	0.10
Housing	0.12
Electricity	0.20
Gasoline — short run	0.26
Gasoline — long run	0.58
Beef	0.59
Soft drinks	0.75
Air travel — business	0.80
Motor vehicles	1.40
Air travel — leisure	1.60
Coke	1.71
Restaurant meals	2.27

restaurant meals and leisure air travel, is distinctly more elastic than the demand for necessities, such as housing, gasoline, and business air travel. In general, other things being equal:

Demand for necessities tends to be less price elastic than the demand for luxuries.

#### ***Proportion of Income Spent on the Good***

Compare the price elasticities of demand for salt and for motor vehicles shown in Table 2. Most consumers would view both goods as necessities. Both markets are rather broadly defined (as they include all kinds of salt and motor vehicles). Why then is the price elasticity of demand for motor vehicles ( $|ED| = 1.4$ ) much higher than that of salt ( $|ED| = 0.1$ ). The answer is, this is because motor vehicles are much more expensive than salt and hence account for a much larger share of consumers' budgets.

To illustrate this point, let's say the prices of both goods double. Since the price of salt is very low and people usually don't need much of it, to buy the same quantity of salt, an average household would probably spend about \$1 instead of \$0.50 per month. Clearly, the impact on consumers' budgets and therefore on the quantity of salt demanded would be negligible. But imagine what will happen if the average monthly car loan payments increase from \$250 to \$500. Since this will significantly impact most households' budgets, many people would have to postpone buying a new car and some would not be able to afford it at all. Thus, the quantity of motor vehicles demanded would likely decrease quite substantially. In general, other things being equal:

The larger proportion of households' budgets the good is accounted for, the more elastic the demand tends to be.

#### ***Time Span***

The more time consumers have adjust for a price change, the more responsive their quantity demanded is likely to be. Consider, for example, the demand for gasoline. If the price of gasoline rises significantly, how can consumers respond in the short run? Surely, some may be able to use public transportation more frequently, arrange car pools, or eliminate non-essential trips. But these possibilities are limited. In a longer run, however, people can do more to reduce their gas consumption, e.g., buy more fuel-efficient vehicles, move closer to their jobs or to areas where public transit is better. Therefore, as you can see in Table 2, the demand for gas is about twice as elastic in the long run as it is in the short run. In general, other things being equal:

Demand tends to be more elastic in the long run than in the short run.



#### **Checkpoint 6**

Which of the following statements are true and which are false? Explain.

- A. The demand for coal is likely to be more price elastic in the short run than in the long run.
- B. The demand for all oats cereals is likely to be less elastic than the demand for Kellogg's oats cereals and more elastic than the demand for all cereals.
- C. The demand for basic cable TV subscriptions is likely to be more elastic than the demand for subscription with premium channels.
- D. The demand for taxi services in a city is likely to be more elastic than the demand for public transportation.

Check your answer

## 3.2 Income Elasticity of Demand

As we've noted previously, the concept of elasticity can be applied to measure the responsiveness of any variable to a change in another variable. The income elasticity of demand tells us how responsive quantity demanded is to changes in consumers' incomes.

The **income elasticity of demand** for a good is the percentage change in the quantity of the good demanded in response to a one percent change in potential buyers' income. Or, mathematically:

$$E_I = \frac{\% \Delta Q_D}{\% \Delta I} \quad (4)$$

where  $E_I$  is the income elasticity of demand,  $\% \Delta Q_D$  is the percentage change in quantity demanded, and  $\% \Delta I$  is the percentage change in income.

For example, if a 5% increase in consumers' income causes a 4% increase in quantity demanded, the income elasticity of demand is:

$$E_I = \frac{4\%}{5\%} = 0.8$$

It is important to keep in mind that, as with the price elasticity of demand, when determining income elasticity, we must hold constant all other variables influencing consumers' decisions. There are two important differences, however, between the income elasticity of demand and the price elasticity of demand.

First, while we measure price elasticity along the same demand curve, moving from one price to another, we measure income elasticity as the percentage increase in quantity demanded at a *given* price when the demand curve *shifts* in response to a change in income.

Second, although both income elasticity and price elasticity measure the degree of responsiveness of quantity demanded by the absolute value of the number, unlike the price elasticity (which is always negative), the sign of the income elasticity—which can be positive or negative—must be given attention. A positive income elasticity means that when income increases, the demand for the good increases. That is, as you learned in Chapter 2, the good is

*normal*. A negative income elasticity means an increase in income causes demand to decrease. That is, in this case, the good is *inferior*. So:

A positive income elasticity indicates a normal good, while a negative income elasticity indicates an inferior good.

The following example illustrate a practical use of information on income elasticity.

**Example 3: How Much Canned Tuna to Order?**

Suppose you are the manager of a grocery store. Due to an increase of the federal minimum wage, the average income of your customers has increased by 5%. How should you adjust your purchases of canned tuna from suppliers? Your market research suggests that the income elasticity of demand for canned tuna is -0.7.

To properly adjust your orders from supplier, you need to know how the demand for canned tuna will change in response to a higher customers' income. We can use the information on the income elasticity of demand for canned tuna to figure it out. Note first that the income elasticity is negative, which means canned tuna is an inferior good, i.e. a higher consumer income will decrease the demand for it. But by how much? Using the income elasticity formula (4) we can write:

$$-0.7 = \frac{\% \Delta Q}{5\%}$$

Solving this equation for  $\% \Delta Q$ , we get:

$$\% \Delta Q = -0.7 \times 5\% = -3.5\%$$

That is, you should reduce your purchases of canned tuna from suppliers by 3.5%.



### Checkpoint 7

Suppose you are the manager of a Walmart store in a small town. The average income of your customers has decreased by 6%. How should you adjust your purchases of canned chicken from suppliers? Your market research consultant estimates the income elasticity of demand for canned chicken in the area you serve at -0.3.

Check your answer

## 3.3 Cross-Price Elasticity of Demand

The cross price elasticity of demand tells us how responsive the quantity demanded of a good is to changes in the price of *another* good.

The **cross-price elasticity of demand** for a good is the percentage change in the quantity of the good demanded in response to a one percent change in the price of another good. Or, mathematically:

$$E_{XY} = \frac{\% \Delta Q_{DX}}{\% \Delta P_Y} \quad (5)$$

where  $E_{XY}$  is the cross-price elasticity of the demand for good X with respect to the price of good Y,  $\% \Delta Q_{DX}$  is the percentage change in the quantity demanded of good X, and  $\% \Delta P_Y$  is the percentage change in the price of good Y.

For example, if a 5% decrease in the price of organic apples causes a 6% decrease in the quantity of conventional apples demanded, the cross-price elasticity of the demand for conventional apples with respect to the price of organic apples is:

$$E_{CO} = \frac{6\%}{5\%} = 1.2$$

Again, it is important to keep in mind that we must hold constant all other variables influencing consumers' decisions when determining cross-price elasticity of demand.

As with income elasticity, we measure the cross-price elasticity of demand as the percentage increase in quantity demanded at a *given* price of the good when the demand curve *shifts* in response to a change in the price of another good. And as with income elasticity, the sign of a cross-price elasticity matters. A positive cross-price elasticity means that the two goods are *substitutes*, such as conventional apples and organic apples in the example above. A negative cross-price elasticity means that the two goods are *complements*, so a fall in the price of one good increases the demand for the other. In general:

A positive cross-price elasticity of demand indicates that the two goods are substitutes, while a negative cross-price elasticity indicates that they are complements.

The cross-price elasticity of demand has useful business applications. Here is an example.

**Example 4: How Will a Competitor's Pricing Affect Your Sales?**

You are an economist at Dell. Hewlett Packard (HP), Dell's competitor, lowers the price of their laptops by 10%. Your boss wants to know how this will affect the sales of Dell laptops with similar characteristics. How can you figure it out?

Again, you'll need to conduct an econometric study to estimate the cross-price elasticity of demand for Dell laptops with respect to the price of HP laptops. Let's say you estimate it at 1.1. Note that the number is positive, which is no wonder, since Dell laptops and HP laptops with similar characteristics are obvious substitutes. Now you can use the cross-price elasticity formula (5) to write:

$$1.1 = \frac{\% \Delta Q}{-10\%}$$

Solving this equation for  $\% \Delta Q$ , you get:

$$\%ΔQ = 1.1 \times (-10\%) = -11\%$$

So, you report to your boss that she should expect the demand for Dell's laptops to drop by 11%.



### Checkpoint 8

Suppose you are an economist at Google. Apple, lowers the price of their music downloads by 8%. Your boss wants to know how this will affect the number of Google music downloads. You estimate the cross-price elasticity of demand for Google downloads with respect to the price of Apple downloads at 0.9. What should you tell your boss?

Check your answer

## 3.4 Price Elasticity of Supply

All the elasticities we've discussed so far refer to the buyers' responsiveness to changes in factors that influence their demand decisions. The sellers' responsiveness to a change in the market price of their products is measured by the price elasticity of supply.

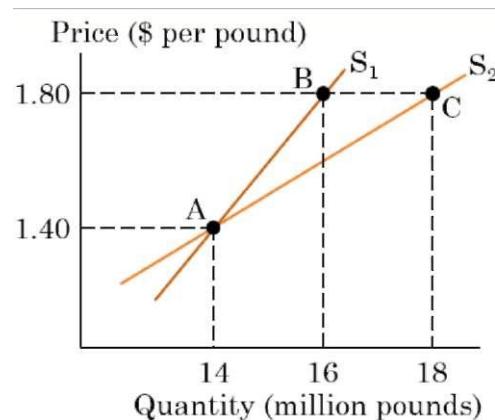
The **price elasticity of supply** of a good is the percentage change in the quantity of the good supplied in response to a one percent change in its price. Or, mathematically:

$$E_S = \frac{\%ΔQ_S}{\%ΔP} \quad (6)$$

where  $E_S$  is the price elasticity of supply,  $\%ΔQ_S$  is the percentage change in quantity supplied, and  $\%ΔP$  is the percentage change in price.

Recall that according to the law of supply, the relationship between price and quantity supplied is positive: when the price rises, the quantity supplied increases and when the price falls, the quantity supplied decreases. This means the price elasticity of supply is a positive number.

In many ways, the concept of the price elasticity of supply is similar to the price elasticity of demand. Like the price elasticity of demand, we can calculate it using the midpoint formula. Let's consider the market for oranges again (Figure 7). Suppose the price of oranges rises from \$1.40 to \$1.80 per pound, so the percentage change in price is:



**Figure 7** Elasticity of supply of oranges

$$\% \Delta P = \frac{P_2 - P_1}{P_{AV}} = \frac{\Delta P}{P_{AV}} = \frac{\$0.40}{\$1.60} = 0.25 = 25\%$$

As shown in the figure, this price change causes the quantity supplied to increase along the supply curve S1 from 14 million pounds to 16 million pounds, so the percentage change in quantity is:

$$\% \Delta Q = \frac{Q_2 - Q_1}{Q_{AV}} = \frac{\Delta Q}{Q_{AV}} = \frac{2}{15} = 0.133 = 13.3\%$$

Thus, the price elasticity of supply is:

$$E_S = \frac{\% \Delta Q_S}{\% \Delta P} = \frac{13.3\%}{25\%} = 0.53$$

The determinants of the price elasticity of supply are also similar to those of the price elasticity of demand. The major factors are the following.

#### *Sellers' Ability to Supply Products to Alternative Markets*

The price elasticity of supply depends on the extent to which producers can realize more profitable alternatives to sell their products once they arise.

When can we expect suppliers to be able to realize such alternatives? First, this happens when producers can easily switch their existing resources or obtain additional resources to produce more profitable alternative goods. For example, when the price of SUVs rises due to a higher demand, auto producers can fairly easily switch their resources from producing cars or pickup trucks to producing SUVs, so the quantity of SUVs supplied can be expected to increase substantially in response to a higher price, i.e. the supply of SUVs is likely to be rather price-elastic. On the other hand, if the price of fine wines rises, the quantity supplied is not likely to increase much because the production of fine wines requires rare or unique resources.

Second, the supply is more price elastic when sellers can supply their products to alternative locations. For example, the supply of oranges to the market in Georgia is likely to be highly elastic. If the price of oranges in Georgia falls due to a lack of demand, the producers of oranges can easily find alternative markets in other states.

#### *Time Span*

Just like with the price elasticity of demand, the more time producers have to adjust their quantity supplied after a price change, the greater the price elasticity of supply. For example, if the price of oranges rises, in the short run, orange producers can use more fertilizer and improved irrigation to increase the yield of the existing trees, but they can't increase the number of orange-producing trees. In the long run, however, when they have enough time to plant new trees and grow them to full maturity, the quantity of oranges supplied can increase substantially.

In Figure 7, we can view S1 as a less elastic short-run supply curve for oranges and S2 as a more elastic long-run supply curve. Note that, as with the price elasticity of demand, when two different linear supply curves have a common point, in a given price range that starts (or ends) at that point, the flatter supply curve is more elastic. As we've calculated earlier, when

the price rises from \$1.40 to \$1.80, the elasticity of supply along  $S_1$  is 0.53. Along  $S_2$ , however (as you can calculate using the midpoint formula), the price elasticity of supply is 1.

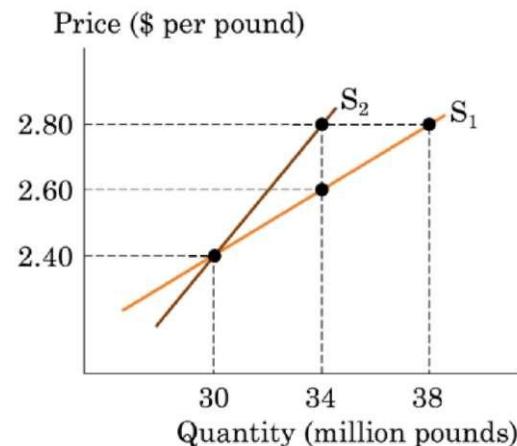


### Checkpoint 9

The graph shows the supply curves in a market for apples.

- What is the price elasticity of supply along the supply curve  $S_1$  in the price range between \$2.40 and \$2.80?
- Which of the supply curves,  $S_1$  or  $S_2$ , is more price elastic? Explain.
- Which of the curves do you think is a short-run supply curve and which is a long-run supply curve? Explain.

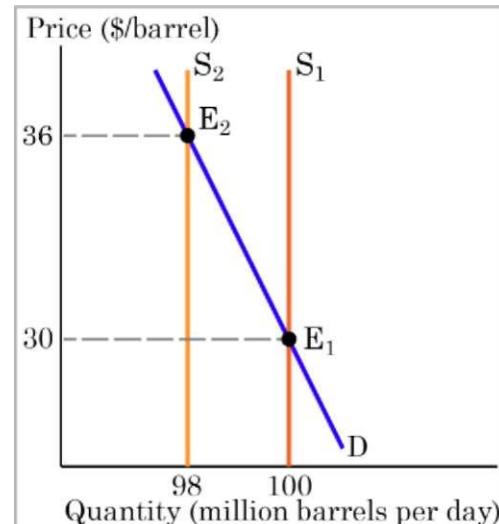
Check your answer



### Economics at Work: Oil Prices Revisited

Recall from our discussion of the dynamics of the world oil prices in Chapter 2 that in early 2016, the world price of oil fell to almost \$30 per barrel. In this situation, the OPEC countries, which were losing their revenue from oil sales, faced a tough choice: cut their oil production to prop up the price, as they've done in the past, or maintain their output and let the price continue to fall with the purpose of driving the producers of the more costly shale oil out of the market. As we could see, OPEC decided not just to go with the latter choice, but increase their oil production substantially. What we've learned above about the price elasticities of demand and supply will help us better understand why OPEC made that decision.

Let's see what would have happened had OPEC decided to cut its oil production instead of increasing it. Suppose OPEC is making its decision when the price of oil has fallen to \$30 and the world production of oil is 100 million barrels per day. OPEC accounts for about 40% of the world oil production, i.e. produces 40 million barrels per day, so its total revenue from oil is  $\$30 \times 40$  million = \$1,200 million



**Figure 8-a OPEC cuts oil production—very short run**

or \$1.2 billion. Will OPEC be able to increase its oil revenue if it reduces its production target by, say, 5%, to boost the price?

Let's first consider what will happen in a very short run, when other countries don't have enough time to increase their oil production. Figure 8-a illustrates this situation. The world market is initially in equilibrium at point E<sub>1</sub>, where the price of oil is \$30 per barrel and 100 million barrels per day is supplied. In the very short run, the supply of oil is practically perfectly inelastic; that is, the supply curve is vertical.

If OPEC cuts its oil production by 5% (i.e. by 40 million  $\times 0.05 = 2$  million barrels per day),<sup>5</sup> the world production will decrease from 100 million to 98 million barrels per day. That is, the OPEC's production cut will shift the supply curve from S<sub>1</sub> to S<sub>2</sub>, so the market will move along the demand curve (D) from the initial equilibrium, E<sub>1</sub>, to a new equilibrium, E<sub>2</sub>, where the price is higher.

We can predict what the new price of oil will be given that the short-run price elasticity of demand for oil is estimated at -0.1. Since the percentage change in quantity is -2% (using the conventional formula,  $\% \Delta Q = (98 - 100)/100 = -0.02$  or -2%), we can write:

$$E_D = \frac{\% \Delta Q_D}{\% \Delta P}$$

$$-0.1 = \frac{-2\%}{\% \Delta P}$$

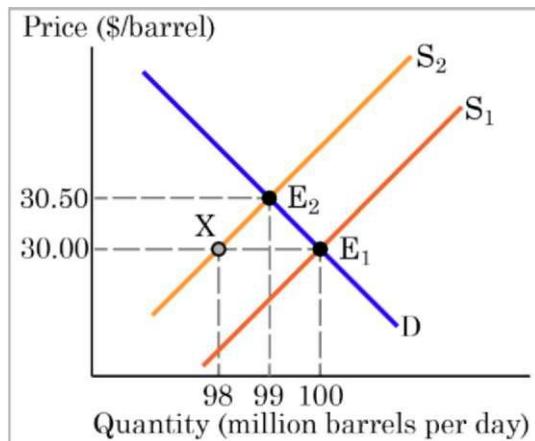
Solving this equation for  $\% \Delta P$ , we get:

$$-0.1 \times \% \Delta P = -2\%$$

$$\% \Delta P = \frac{-2\%}{-0.1} = 20\%$$

That is, the price rises by  $\$30 \times 0.2 = \$6$ , from \$30 to \$36.

Since OPEC is now selling 38 million barrels of oil at \$36 per barrel, its total revenue is  $\$36 \times 38$  million = \$1,368 million. This is \$168 million or 14% more than the revenue OPEC received before the oil production cut. Thus, by reducing its oil production OPEC was able to boost the price of oil, which increased its total revenue from oil sales. This should come as no surprise. As we've learned in this chapter, when the demand is price inelastic, raising the price increases total revenue. And when the demand is very price inelastic (which is the case here), even small reductions in quantity can lead to substantial price hikes and total revenue gains. This, however, is only true if the competition does not influence the market quantity supplied.



**Figure 8-b OPEC cuts oil production—longer run**

<sup>5</sup> Here and further in this analysis, to simplify calculations, we use the conventional percentage-change formula rather than the midpoint formula.

And in the case of the present day's world market for oil, that could be true in a very short run, but not in a longer run.

Let's see how the world market for oil will respond to OPEC's production cuts in a longer run, when other countries—including such major world oil producers as the United States and Russia—increase their production of oil in response to a higher price. As we know, both demand and supply are more price elastic in the long run than in the short run. Figure 8-b shows what happens if the world supply of oil is still inelastic, but no longer perfectly inelastic (say,  $ES = 0.2$ ) and the demand for oil becomes less inelastic (say,  $ED = -0.2$ ).

Now, when OPEC reduces its production of oil by 2 million barrels shifting the world supply curve from  $S_1$  to  $S_2$ , other oil producers respond to the initial excess demand for oil and a higher price resulting from it by increasing their production, which partly compensates the OPEC's reduced supply. The market moves along the supply curve  $S_2$  from point X to the new equilibrium at point  $E_2$ , where the price of oil is \$30.50 per barrel and the quantity is 99 million barrels per day. As you can see, because both demand and supply are now less price inelastic, the price rises only by \$1.50 (5%).

Will the OPEC's total revenue from oil still increase? Note first that since other countries increase their oil production while the OPEC countries reduce theirs, the OPEC's market share decreases from 40% to 38.4% (as OPEC is now producing 38 million barrels per day out of the total world production of 99 million barrels per day). The OPEC's total revenue then is  $\$30.50 \times 38 \text{ million} = \$1,159 \text{ million}$ , which is 3.4% less than its revenue before the production cut (\$1,200 million).

Of course, in an even longer run, when both demand and supply are even more elastic, OPEC's oil production cuts to prop up the price will result in even greater losses of their oil revenues.



## Checkpoint Answers

1

A. False. The price elasticity of demand is the *percentage* change in quantity demanded in response to a certain *percentage* change in price:

$$E_D = \frac{\% \Delta Q_D}{\% \Delta P}$$

The slope of the demand curve is the *absolute* change in price divided by the *absolute* change in quantity:

$$\text{Slope} = \frac{\Delta P}{\Delta Q}$$

that is, the "rise" over the "run."

B. True. The price elasticity of demand for a good is the percentage change in the quantity of the good demanded in response to a one percent change in its price.

C. True. Since the relationship between price and quantity demanded is negative the price elasticity of demand is always a negative number. The sensitivity of quantity demanded to a change in price, however, is measured by the magnitude of the elasticity number regardless of its sign. For example, if the elasticity of demand for potatoes is -0.9, and the elasticity of demand for onions is -0.6, then the demand for potatoes is more elastic than the demand for onions because  $|-0.9| = 0.9$ ,  $|-0.6| = 0.6$ , and  $0.9 > 0.6$ .

D. False. The price elasticity of demand measure the sensitivity of the quantity demanded to a change in price, not the other way around. Also, it is about the change in *quantity demanded*, not demand, since it's measured along the same demand curve.

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**2**

The change in quantity is  $\Delta Q_D = 10$  million pounds. The midpoint  $Q_A V = 40$  million pounds. So the percentage change in quantity is  $10/40 = 0.25$  or 25%. The change in price is  $\Delta P = -\$0.30$ . The midpoint  $P_A V = \$2.65$ . So the percentage change in price is  $-\$0.30/\$2.65 = -0.113$  or -11.3%. Thus, the arc price elasticity of demand in this price range is

$$E_D = \frac{\% \Delta Q_D}{\% \Delta P} = \frac{25\%}{-11.3\%} = -2.2$$

The inverse of the slope of the demand curve is  $\Delta Q_D/\Delta P = -33.3$ . When the price is \$2.80, the price to quantity ratio is  $P/Q_D = 2.80/35 = 0.08$ . Thus, the elasticity at the point where the price is \$2.80 per pound is

$$E_D = \frac{1}{\text{slope}} \times \frac{P}{Q} = -33.3 \times 0.08 = -2.7$$

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**3**

1. True. The two demand curves intersect at point A and the demand curve D2 is less steep than the demand curve D1. Therefore, the demand is more elastic along D2.
2. False. The two demand curves intersect at point A and the demand curve D1 is steeper than the demand curve D2. Therefore, the demand is more elastic along D2.
3. True. As we move upward along the linear demand curve D1, the demand becomes more price elastic.
4. False. As we move downward along the linear demand curve D2, the demand becomes less price elastic.

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**4**

Vincent wants to buy a constant quantity of gas no matter what the price is, which means his demand for gas is perfectly inelastic ( $E_D = 0$ ). Lisa wants to spend a constant amount on

gas, no matter what the price is, which means her demand is unitary elastic. For example, if the price is \$2 per gallon, her quantity demanded would be  $\$36/\$2 = 18$  gallons and if the price is \$2.40 per gallon, it would be  $\$36/\$2.40 = 15$  gallons. In either case the amount she wants to spend ( $P_x Q = \$36$ ) would not change.

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## 5

To calculate the percentage change in the number of subscriptions, we first calculate the percentage change in price. Using the midpoint formula, we get:

$$\% \Delta P = \frac{\Delta P}{P_{AV}} = \frac{-\$1}{\$9.49} = -10.5\%$$

Given that the price elasticity of demand for Netflix subscriptions is -1.4, we can write:

$$-1.4 = \frac{\% \Delta Q_D}{-10.5}$$

Solving this equation for  $\% \Delta Q$ , we get:

$$\% \Delta Q = -1.4 \times (-10.5\%) = 14.7\%$$

Given that

$$\% \Delta TR \approx \% \Delta P + \% \Delta Q$$

we can now calculate the approximate percentage change in Netflix's total revenue:

$$\% \Delta TR \approx -10.5\% + 14.7\% = 4.2\%$$

That is, Netflix's total revenue will increase by about 4.2%. Due to the fact that the demand for Netflix subscriptions is price elastic, the negative effect on the total revenue of the lower price is more than offset by the positive effect on it of the greater quantity demanded.

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## 6

- A. False. If the price of coal rises, in the short run, coal consumers (e.g., electric power plants) have only limited possibilities to reduce their use of coal, such as adjusting their equipment to make it more efficient and eliminating waste throughout the production process. In a longer run, however, when consumers have enough time to switch to alternative fuels, such as natural gas, the quantity of coal demanded can be reduced substantially. Thus, the demand for coal is more price elastic in the long run than in the short run.
- B. True. "All oats cereals" is a broader definition of the market than "Kellogg's oats cereals." So, it is easier to find close substitutes for Kellogg's oats cereals (e.g., Post oats cereals) than for all oats breakfast cereals. Therefore, the demand for all oats cereals is likely to be less elastic than the demand for Kellogg's oats cereals. But "all cereals" is an even broader definition of the market than "all oats cereals." Therefore, the demand for oats cereals is likely to be more elastic than the demand for all cereals.

C. False. Basic cable TV can be viewed as more of a necessity, while premium channels are more of a luxury. Therefore, the demand for basic cable TV subscriptions is likely to be less elastic than the demand for subscription with premium channels.

D. True. The demand for taxi services is likely to be more elastic for two reasons. First, compared to public transit, taxi services can be considered a luxury. Second, taxis are substantially more expensive than public transportation and therefore account for a greater share of consumers' budgets.

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**7**

Given that the income elasticity is negative, you know that canned chicken is an inferior good, i.e. a lower consumer income will increase the demand for it. To calculate by how much, you can use the income elasticity formula (4) to write:

$$-0.3 = \frac{\% \Delta Q}{-6\%}$$

Solving this equation for  $\% \Delta Q$ , you get:

$$\% \Delta Q = -0.3 \times (-6\%) = 1.8\%$$

That is, you should increase the quantity of canned chicken you order by 1.8%.

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**8**

You can use the cross-price elasticity formula (5) to write:

$$0.9 = \frac{\% \Delta Q}{-8\%}$$

Solving this equation for  $\% \Delta Q$ , you get:

$$\% \Delta Q = 0.9 \times (-8\%) = -7.2\%$$

So, you report to your boss that you expect the demand for Google downloads to drop by 7.2%.

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**9**

a. The change in price is  $\Delta P = \$0.40$ . The midpoint PAV =  $\$2.60$ . So the percentage change in price is  $\$0.40/\$2.60 = 0.154$  or 15.4%. The change in quantity is  $\Delta Q_S = 8$  million pounds. The midpoint QAV = 34 million pounds. So the percentage change in quantity is  $8/34 = 0.235$  or 23.5%. Thus, the price elasticity of supply is

$$E_D = \frac{\% \Delta Q_S}{\% \Delta P} = \frac{23.5\%}{15.4\%} = 1.5$$

- b. When two linear supply curves have a common point, in a given price range that starts at that point, the flatter supply curve is more elastic. The supply curves on the graph intersect at  $P = \$2.40$  and  $Q = 30$  million pounds. Thus, in the price range between  $\$2.40$  and  $\$2.80$ , the flatter supply curve,  $S_1$ , is more price elastic.
- c. The more time producers have to adjust their quantity supplied after a price change, the greater the price elasticity of supply. Therefore, the more elastic supply curve,  $S_1$ , must be the long-run curve and the less elastic supply curve,  $S_2$ , must be the short-run curve.

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## CHAPTER 4

### MARKETS AND GOVERNMENT



#### What's in It for You?

So far, we've discussed freely functioning competitive markets where prices and quantities of goods produced and consumed are determined only by the forces of demand and supply. The reality is, however, that in all modern economies governments intervene in markets. The ways and degree of that intervention and the economic role of government in general is the subject of hot political debates. Different schools of economic thought have different views on these issues too. But there are certain things about government economic policies on which most economists agree.

In this learning module, we examine how government interventions affect market outcomes and economic efficiency. We start with a discussion of price controls, which are legal restrictions on how high or low the price of a good may go. A maximum price that sellers can legally charge is called a price ceiling, and a minimum price below which exchange between buyers and sellers is illegal is called a price floor.

For instance, a price ceiling that is perhaps most well-known is rent control, i.e. when a local government puts a cap on monthly rent for apartments. The intention is to make rental housing more affordable, a rent ceiling may sound like a good idea. But will it really benefit tenants? How will it affect the availability of affordable housing? The economic efficiency of the market? The most hotly debated price floor is the minimum wage, which is essentially the lowest price of labor that employers must pay. The intention here is to help the working poor make ends meet and decrease income inequality. But do the minimum wage laws really make workers better off? We address these questions.

Then we turn to a government intervention that does not directly sets prices but influence the market equilibrium through shifting either the demand or the supply curve. Specifically, we discuss excise taxes, i.e. taxes imposed on a particular good or service. We examine how an excise tax on sellers or buyers of a good influences its equilibrium price and quantity. An important question here is, who actually pay the tax? The buyers or the sellers? For example, the gasoline tax is levied on sellers of gas (i.e. gas stations are responsible for sending the tax money to the government). Does this mean gas sellers pay the whole tax? Or do they pass it on to buyers by charging a higher price? You will learn how to figure out who actually pays the tax. You will also see how taxes affect economic efficiency of competitive markets.

Finally, as we've noted in Chapter 2, competitive markets can only be economically efficient if no externalities are generated by production or consumption of the good. Recall that an externality is a cost or benefit resulting from production or consumption of a good that is imposed on someone other than its buyers or sellers. An example is a paper mill that pollutes

the nearby river with toxic chemicals, imposing costs—such as health problems, contaminated drinking water, and dead fish—on people and businesses downstream. Free markets fail to account for these external costs. We show how government intervention can help reduce the adverse effects of market failures due to externalities.



## Learning Objectives

At completion of this learning module you are expected to be able to:

- Explain the concepts of price ceiling and price floor and show the effects of price controls on the market outcomes and economic efficiency
- Explain the concept and purposes of excise taxes, show the effects of an excise tax on the equilibrium price and quantity of the good and on economic efficiency, determine the tax incidence and explain the factors that influence it
- Explain the concepts of negative and positive externalities and show how external costs and benefits make unregulated competitive markets inefficient
- Show how in the presence of external costs, an excise tax can make the market more efficient

### 4.1 Price Controls

As we mentioned above, price controls are government regulations that restrict market prices. There are two kinds of price controls: a price ceiling, a maximum price sellers can legally charge for a good or service and a price floor, a minimum price buyers are required to pay for a good or service. Let's start with price ceilings.

#### Price Ceilings

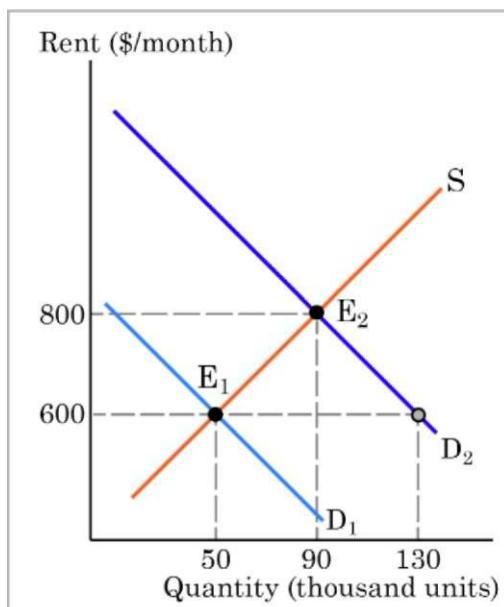
A **price ceiling** is a *maximum* legal price in a market: the highest price that sellers can legally charge. For a price ceiling to be effective, the government agency that establishes it must also have the authority to take action, such as fines or jail time, against sellers who charge a price that's higher than the price ceiling.

In the United States, price ceilings have been proposed for a number of goods and services, for example, prescription drugs, doctor and hospital fees, the charges made by automatic teller bank machines, and auto insurance rates. And they could be relatively easily implemented in those and other markets, but it's rarely done. One exception is **rent controls**, which are price ceilings imposed on the markets for rental housing. Rent controls exist in large cities, such as New York City, San Francisco, and Washington D.C. They could, however, be applied to any local housing market.

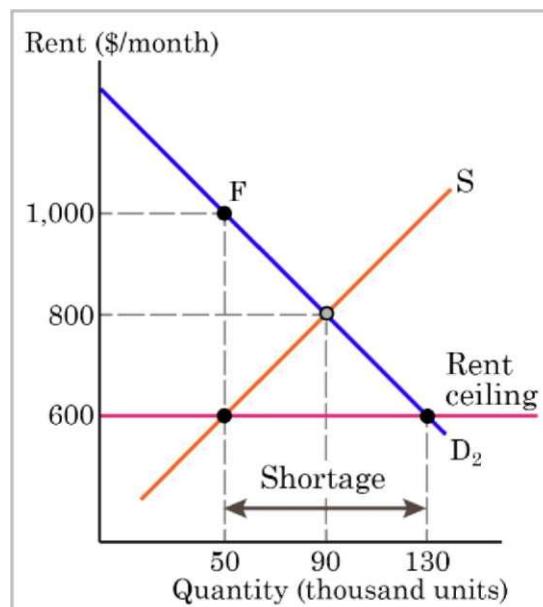
Note that for a price ceiling to affect the market outcome, it must be set *below* the market equilibrium price. Since sellers are allowed to charge a price that is lower than the price ceiling, when the price ceiling is set above the equilibrium price, market forces will drive the

price down to the equilibrium price and the price that is actually charged will be the market equilibrium price. That is, the price ceiling will not affect the market outcome.

Consider the market for rental housing in the imaginary city of Mountain View shown in Figure 1-a. To keep our analysis simple, let's assume that all apartments are exactly the same and therefore would rent for the same price. Initially, the equilibrium rent is \$600 per month, and the quantity of apartments rented at this price is 50,000 units (point E<sub>1</sub>). Then, local businesses expand rapidly, bringing more people into the city, so the demand for rental housing shifts from D<sub>1</sub> to D<sub>2</sub>. As a result, with the current rent of \$600 per month, the quantity of apartments demanded is 130,000 units now, while the quantity supplied remains at 50,000 units. That is, there is an excess demand of 70,000 units. As we could see in Chapter 2, in an unregulated market, as buyers bid up the price, it will keep rising until the quantity demanded equals the quantity supplied so that the excess demand disappears and the market is in equilibrium again. In Figure 1-a, this happens at point E<sub>2</sub>, where the rent is \$800 per month and QD = QS = 90 thousand units.



**Figure 1-a An increase in the demand for housing**



**Figure 1-b A rent ceiling**

But suppose that the city council decides that a rent of \$800 per month is unaffordable to many people who would like to live and work in the city. So the city government implements a rent ceiling at \$600 per month. The results are shown in Figure 1-b. Since the rent is no longer allowed to adjust to the equilibrium level, it remains at \$600, so the quantity of apartments demanded stays at 130,000 units, while the landlords are willing to supply only 50,000 units at this price. That is, the excess demand of 80,000 units now becomes a persistent shortage of rental housing.

Does the rent control accomplish its purpose to make housing more accessible to lower-income tenants? Note first that although some tenants are able to rent an apartment at a lower price (\$600 per month instead of \$800 per month), the quantity of units available is less than it would be if the market were in equilibrium (50,000 units compared to 90,000 units).

second, since the desires of buyers and sellers are not synchronized at the rent ceiling, if the government succeeds in enforcing it, some *nonprice rationing* scheme must be used to determine who gets an apartment and who doesn't. Apartment owners could make the units available on a first-come, first-served basis, in which case long waiting lists would form. Other possibilities would be for government to establish priority structures, with some potential tenants being permitted to rent and others being denied that opportunity.

The irony here is that government imposed the rent ceiling to protect consumers from the hardship of high prices, but the result is that many of them have to deal with the hardships that result from the shortage of housing: wasting time and money on long commutes to work from places where housing is available, filling out forms in an attempt to meet some arbitrary government criteria required to get an apartment, or simply giving up the opportunity to and work in the city. Frustrated housing seekers will spend considerable amounts of time on networking, web searches, scanning the local newspaper ads, etc., desperately trying to find ways to get an apartment closer to the area and then racing to be first when hearing any breaking news of such an opportunity. If we include the opportunity cost of the time spent on all these activities (which, as we showed in Chapter 1 we should), the actual cost of rental housing in Mountain view to consumers is likely to be well above the rent ceiling and even above the free-market rent.

As shown in Figure 1-b, with the rent ceiling in effect, only 50,000 units are available. This quantity corresponds to point F on the demand curve, which means consumers are willing to pay \$1,000 per month to rent an apartment. This amount can be viewed as the **full economic price** paid by consumers, which equals the amount explicitly paid for the apartment (the rent ceiling of \$600) plus the implicit amount paid through the opportunity cost (\$400), which can be called the **nonpecuniary price**. As you can see in Figure 1-b, the full economic price of an apartment in Mountain view (\$1,000) exceeds the free-market equilibrium rent (\$800).

since in the presents of a binding rent ceiling the potential tenants are willing to pay higher prices than the controlled rate, if the government fails to strictly enforce the rent ceiling, black markets may develop where the price could be as high as the full economic price. A **black market** is a market where goods or services are sold illegally. For example, illegal side payments to landlords, known as "key money" (exorbitant prices that tenants pay "for new locks and keys") are common in rent-controlled cities. Another form of a black market is informal (i.e. unregistered) subletting for a price above the rent ceiling.

To quantify the effects of a price ceiling on buyers, sellers, and society as a whole, as well as on the market efficiency, let's use the concepts of consumer surplus, producer surplus, total social surplus, and deadweight loss that we presented in Chapter 2. Figure 1-c shows the effects of the rent ceiling in Mountain View. With no rent ceiling—i.e. when the market is in equilibrium with the rent of \$800 per month and 90,000 units rented—the consumer surplus (CS) is the triangular area A+B+C, which equals

$$CS = (\$1,250 - \$800) \times 90,000 / 2 = \$20.25 \text{ million}$$

the producer surplus is the triangular area E+D+G, which equals

$$PS = (\$800 - \$350) \times 90,000 / 2 = \$20.25 \text{ million}$$

and the total society surplus generated in the market for rental housing is

$$TS = PS + CS = \$20.25 \text{ million} + \$20.25 \text{ million} = \$40.5 \text{ million}$$

With the rent ceiling in effect—i.e. when the rent is \$600 per month and 50,000 units are rented, the consumer surplus is the trapezoid area A+B+E, which equals

$$CS_C = [(\$1,250 - \$600) + (\$1,000 - \$600)] \times 50,000/2$$

and the producer surplus is the triangular area G, which equals

$$PS_C = (\$600 - \$350) \times 50,000/2 = \$6.25 \text{ million}$$

and the total society surplus is

$$TS_C = PS_C + CS_C = \$26.25 \text{ million} + \$6.25 \text{ million} = \$32.5 \text{ million}$$

As you can see, the rent ceiling transfers part of the producer surplus (area E =  $\$200 \times 50,000 = \$10 \text{ million}$ ) to consumers, but the overall consumers' gain ( $\$26.25 \text{ million} - \$20.25 \text{ million} = \$6 \text{ million}$ ) is less than the overall producers' loss ( $\$20.25 \text{ million} - \$6.25 \text{ million} = \$14 \text{ million}$ ) because parts of both consumer and producer surpluses (area C and D) are lost because of the under-consumption and under-supply of housing due to the rent ceiling. That is, the rent ceiling reduces the total society surplus by the amount of the deadweight loss, i.e. area C+D, which is

$$DWL = (\$1,000 - \$600) \times (90,000 - 50,000)/2 = \$8 \text{ million}$$

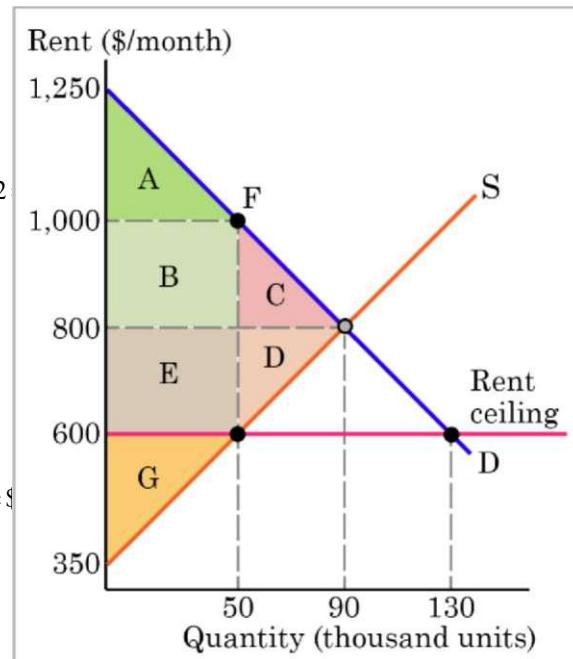
You might say, "OK, I can see that the rent ceiling in Mountain View causes an overall economic efficiency loss, reducing the total society surplus by \$8 million. But tenants, the poor, still benefit, and they benefit at the expense of landlords, the rich, as the consumer surplus increases by \$6 million." This, however, is not correct for several reasons.

First, note that we calculated the consumer surplus with the rent ceiling based only on the explicit legal price that tenants pay. However, as we discussed above, consumers also pay the opportunity costs of time wasted on search activities and of troubles associated with the shortage of housing. And some of them may end up paying the higher black-market price. In Figure 1-c, the potential loss of consumer surplus due to these circumstances is shown by area B+E. That is, if we took into account the full economic price of an apartment given the quantity of units available when the rent ceiling is in effect, the consumer surplus would be reduced to just area A, that is to

$$CS_{CF} = (\$1,250 - \$1,000) \times 50,000/2 = \$3.125 \text{ million}$$

Second, the enforcement of the rent ceiling may be costly to the government, so the renters' surplus is likely to be further reduced because of higher local taxes they would probably have to pay to cover those costs.

Third, we have assumed in the foregoing discussion that the quality of goods and services produced remains the same when price controls are established. This is not generally the



**Figure 1-c The welfare effects of a rent ceiling**

case, as landlords have little incentive to maintain rental property. Excess demand for apartments at the controlled price makes it possible to obtain tenants even if the unit deteriorates. Thus, regulations that prevent prices from adjusting to equilibrium levels cause predictable changes in quality. Landlords tend to spend less on maintenance and on essentials like heating, cooling, hot water, and lighting. So, when renters get "cheaper" housing than the market requires, they tend to also end up with lower quality housing. Markets can clear at lower prices if quality is reduced to a sufficiently low level. In addition, renters (or potential renters) lose their housing as landlords convert apartments to co-ops and condos.

Finally, as experience with rent controls in cities as diverse as New York City; Lisbon, Portugal; and Berkeley, California shows that rent ceilings tend to allocate low-priced apartments to the well-connected and well-to-do rather than provide better housing to low-income renters. The tenants who occupy rent-control housing are usually those who have lived in a the city for a long time, which often includes the rich and famous.

## Price Floors

A **price floor** is a legally established minimum price that can be paid for a good or service. As with the price ceiling, for this established price to be effective it must have the force of the law, i.e. the government or some other agency with enforcement power must be behind it. The government agency that establishes the price floor must also have the authority to take action, such as fines or jail time, against buyers who pay a price that's lower than the price floor. A price floor is sometimes referred to as a price support.

Unlike a price ceiling, for a price floor to have an effect on the market outcome, it must be set *above* the market equilibrium price. Buyers are allowed to pay a price that's higher than the price floor, so if the price floor is set below the equilibrium price, it will not affect the market outcome.

Price floors are common in the markets for agricultural commodities. Around the world, many countries, including the United States, have passed laws to create agricultural price supports. Farm prices and thus farm incomes fluctuate, sometimes widely, from year to year. A change in the demand or supply of a particular commodity will cause its price to either rise or fall. So even if farm incomes are adequate on average, in some years they can be quite low. The purpose of price supports in agriculture is to prevent these swings.

Perhaps the best-known example of a price floor is the minimum wage, which is based on the belief that someone working full time ought to be able to afford a basic standard of living. In other words, it's argued that the minimum wage can be used as a poverty-fighting tool. The federal minimum wage was raised to its current level of \$7.25 per hour on July 24, 2009. Congress periodically raises the federal minimum wage, but historically the increases have been irregular. Table 1 shows the history of the federal minimum wage back to 1978. As can be seen in the table, there've been some fairly long gaps between increases in the federal minimum wage. There was a gap of just over nine years from January 1, 1981 to April 1, 1990, and there was a gap of just under ten years from September 1, 1997 to July 24, 2007. As this is being written, it's been nearly eight years since the last increase. Long gaps between increases are not historically unusual then.

In addition to the federal minimum wage, numerous states and some municipalities (i.e., counties, cities, and towns) have established their own minimum wage that exceeds the federal minimum wage. If a worker has a job in such a state or city, then his/her minimum wage would be the one established by the state or city, rather than the federal minimum wage. Currently (March 2017) the states with the highest minimum wage are the District of Columbia, at \$11.50 per hour, followed by Massachusetts and Washington (state), tied at \$11.00 per hour. A number of municipalities also have higher than the federal minimum wages. For example, San Francisco's and Santa Fe Counties had minimum wages of \$14 per hour and \$11.09 per hour, respectively, and Seattle, Washington had a minimum wage of \$11 per hour in 2017.<sup>1</sup>

To examine the effects of a minimum wage law on the market outcome, let's consider a hypothetical market for unskilled labor in a city shown in Figure 2-a. Note first that in labor markets, unlike the product markets we've examined so far, people are the sellers and firms are the buyers. In other words, workers supply their labor services and firms demand labor services. Nonetheless, the labor demand and supply model works the same way as that for goods and services. We should also keep in mind that the minimum wage applies to unskilled and low-skill workers only. Skilled workers, such as doctors, lawyers, accountants, and airline pilots earn much more than the minimum wage and are not competing with unskilled and low-skilled workers for the same jobs.

As you can see in Figure 2-a, the market equilibrium wage of unskilled workers is \$5.25 per hour and the market equilibrium quantity of unskilled labor is 8 million hours per year. But suppose that the minimum wage is set at \$7.25 per hour. Since the minimum wage is above the market equilibrium wage, it will affect the market outcome. Although at a wage of \$7.25 per hour workers are willing to supply 12 million hours of labor, employers are willing to hire only 4 million hours. Therefore, the number of labor hours that is actually hired is 4 million. That is, the minimum wage creates a surplus of 8 million hours of labor, which is

**Table 1 Recent History of the Federal Minimum Wage**

Date wage was increased	Federal minimum wage
January 1, 1978	\$2.65
January 1, 1979	\$2.90
January 1, 1980	\$3.10
January 1, 1981	\$3.35
April 1, 1990	\$3.80
April 1, 1991	\$4.25
October 1, 1996	\$4.75
September 1, 1997	\$5.15
July 24, 2007	\$5.85
July 24, 2008	\$6.55
July 24, 2009	\$7.25

*Source:* U.S. Department of Labor, Wage and Hour Division, "History of Federal Minimum Wage Rates Under the Fair Labor Standards Act, 1938-2009," accessed at <https://www.dol.gov/whd/minwage/chart.htm>)

<sup>1</sup> Sources: U.S. Department of Labor, Wage and Hour Division, "Minimum Wage Laws in the States—January 1, 2017," <https://www.dol.gov/whd/minwage/america.htm>). San Francisco Office of Labor Standards Enforcement, "Minimum Wage Ordinance (MWO)," <https://sfgov.org/olse/minimum-wage-ordinance-mwo>. Santa Fe County, "Living Wage Ordinance," <https://www.santafecountynm.gov/livingwage>. Seattle Office of Labor Standards, "Information for Small Employers," <https://www.seattle.gov/laborstandards/ordinances/minimum-wage/small-employers>.

referred to as **unemployment** (or underemployment). Note also that the minimum wage decreases employment of unskilled labor by 4 million hours as compared with the labor market where there is no minimum wage.

To address the question of whether the minimum wage laws effectively serve their purposes, let's first examine the effects of the minimum wage using the concepts of consumer surplus (in this case employer surplus), producer surplus (i.e. worker surplus), total social surplus, and society's deadweight loss.

As shown in Figure 2-b, with no rent ceiling—i.e. when the labor market is in equilibrium with the wage of \$5.25 per hour and 8 million hours of labor employed—the employer surplus is the triangular area A+B+C, which equals

$$ES = (\$9.25 - \$5.25) \times 8 \text{ million} / 2 = \$16 \text{ million}$$

the worker surplus is the triangular area E+D+F, which equals

$$WS = (\$5.25 - \$1.25) \times 8 \text{ million} / 2 = \$16 \text{ million}$$

and the total society surplus generated in the market for unskilled labor is

$$TS = ES + WS = \$16 \text{ million} + \$16 \text{ million} = \$32 \text{ million}$$

With the minimum wage in effect—i.e. when the wage is \$7.25 per hour and 4 million hours of labor are employed—the employer surplus shrinks to the triangular area A, which equals

$$ESM = (\$9.25 - \$7.25) \times 4 \text{ million} / 2 = \$4 \text{ million}$$

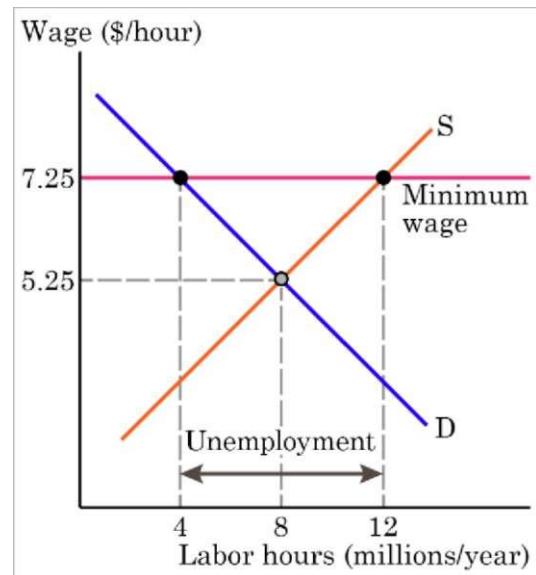
the worker surplus is the trapezoid area B+D+F, which equals

$$WSM = [(\$7.25 - \$1.25) + (\$7.25 - \$3.25)] \times 4 \text{ million} / 2 = \$20 \text{ million}$$

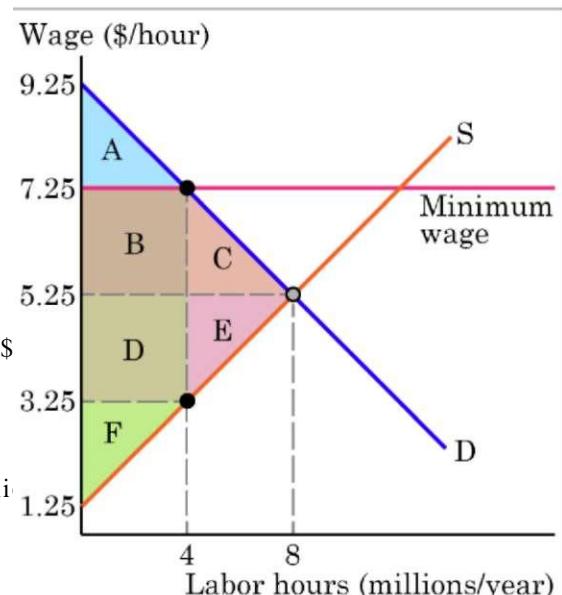
and the total society surplus is

$$TSM = ESM + WSM = \$4 \text{ million} + \$20 \text{ million} = \$24 \text{ million}$$

As you can see, the minimum wage transfers part of the employer surplus (area B = \$4 \times 4 \text{ million} = \\$16 \text{ million}) to workers, but the overall workers' gain (\$20 million - \$16 million = \$4 million) is less than the overall employers' loss (\$16 million - \$4 million = \$12 million) since parts of both employer and worker surpluses (area C and E) are lost because of the unemployment due to the minimum wage. That is, the



**Figure 2-a Minimum wage in a market for unskilled labor**



**Figure 2-b The welfare effects of a minimum wage**

minimum wage reduces the total society surplus by the amount of the deadweight loss, i.e. area C+E, which is

$$DWL = (\$7.25 - \$3.25)x(8 \text{ million} - 4 \text{ million}) / 2 = \$8 \text{ million}$$

So, again, it looks like a price control—the price of labor in this case—works as intended, increasing the workers' surplus. But does it really? Note first, that in our example, although workers who are employed get higher wages, 4 million hours of labor are unemployed, i.e. many workers who are willing to work for that wage can't find a job or are underemployed.

Second, as in the case of a rent ceiling, we should consider the opportunity cost of time and troubles to unskilled or low-skilled workers are desperately trying to find a job. If we account for these opportunity costs, the actual economic pay that workers receive may potentially fall to \$3.25, and the actual worker surplus may potentially shrink to area F, that is to

$$WSMF = (\$3.25 - \$1.25)x4 \text{ million} / 2 = \$4 \text{ million}$$

Proponents of minimum wage increases claim they are just trying to help out the working poor. To be sure, an individual who works 2,000 hours during a year, will earn an annual gross income of only \$10,300—a figure well below the poverty line. Supporters claim that increases in the minimum wage are necessary to achieve "basic fairness" (a nebulous concept at best). Opponents of the minimum wage recognize that like all effective price floors, it often results in an increased unemployment rate, with unskilled workers, particularly minorities, most detrimentally effected.<sup>2</sup> In addition, some researchers have found no evidence that minimum wage laws reduce poverty, material hardship, or the receipt of public benefits.<sup>3</sup> If the minimum wage is increased, the argument goes, a surplus of workers will be the result. However, a closer look at the minimum wage reveals that the debate may be much ado about nothing.

Firms compensate workers for their toil in more ways than one. The level of "full compensation" that firms pay workers comes in three main forms: wages, fringe benefits, and training opportunities. Consider the following equation:

$$\text{Full Compensation} = \text{Wages} + \text{Fringe benefits} + \text{Training opportunities}$$

If government imposes a higher minimum wage, firms can keep the level of full compensation constant simply by lowering fringe benefits and/or training opportunities. One method of lowering fringe benefits involves the ratio of part-time workers to full-time workers that the firm employs. Because of union contracts and federal laws, part-timers generally receive fewer fringe benefits than full-timers. That being the case, a firm facing a higher minimum wage can keep the average level of full compensation constant by replacing full-time workers with part-time ones. Economic research has demonstrated that increases in the minimum wage are often accompanied by increases in the prominence of part-time employment. The laws of demand and supply matter because they have repeatedly been shown to be more powerful and effective than the laws of government. Although governments often interfere with the workings of the market, markets will adjust and prevail, in time.

<sup>2</sup> Neumark, D., and W. Wascher. "Minimum wages and employment." *Foundations and Trends in Microeconomics* 3:1-2 (2007): 1-186.

<sup>3</sup> Sabia, Joseph J., and Robert B. Nielsen. "Minimum wages, poverty, and material hardship: new evidence from the SIPP." *Review of Economics of the Household* 13.1 (2015): 95-134.

## 4.2 Excise Taxes

An **excise tax** is a tax that's levied on the purchase or sale of a particular good or service. Unlike a general sales tax that's levied on virtually any good or service that's bought or sold, an excise tax is imposed on a specific good or service. For example, in the United States, excise taxes are levied on gasoline, cigarettes, alcoholic beverages, and tanning services. Excise taxes can be implemented by governments at the federal, state, or even local level. When, for instance, you purchase a gallon of gasoline in Georgia, \$0.18 of the amount collected by the gas station goes to the federal government and \$0.31 goes to the state government.

There are three main reasons why governments levy taxes, whether it's an excise tax or some other form of tax, such as an income tax or a property tax. The primary purpose, is to obtain revenue to support government operations, including providing national defense, police and fire protection, financing education and social programs, road repairs and maintenance, and parks and recreation. The second purpose is to correct inequities in the distribution of income and wealth, given the fact that letting market forces play freely may result in extreme income and wealth inequalities. The third purpose, particularly relevant to excise taxes, is to reduce the production of socially undesirable goods or byproducts, such as cigarettes, alcohol, air and water pollutants, and carbon dioxide—a byproduct of burning fossil fuels, such as gasoline, that traps heat in the atmosphere causing global climate change.

### How an Excise Tax Affects the Market

To see how an excise tax affects the market for the good it is imposed on, let's consider a competitive market for pizza in the city of Raspboro shown in Figure 3-a. With no excise tax, the equilibrium price is \$12 per pizza and the equilibrium quantity is 40,000 pizzas. Now suppose the city council imposes an excise tax on sellers of pizza, requiring them to pay \$4 per pizza to the government. How will the tax affect the market equilibrium?

Let's note first that pizza producers perceive the tax as a \$4 per-pizza increase in their costs. As we know from Chapter 2, this raises the price that sellers are willing to accept to offer a given quantity of pizza by the amount of that additional cost. For example, to supply 40,000 pizzas, sellers now ask \$16 per pizza instead of \$12 per pizza. This means the supply curve shifts upward by the amount of the per-unit tax (\$4), from  $S$  to  $S_T$ .

As you can see in Figure 3-a, after the supply curve shifts, the market is no longer in equilibrium at 40,000 pizzas. Although sellers would accept the price of \$16 per pizza to supply that quantity, buyers are willing to buy 13,000 pizzas at this price. After the market price adjusts to eliminate that excess supply, the equilibrium price is \$15 per pizza and the equilibrium quantity is 20,000 pizzas.

Notice that the shift of the supply curve resulting from the tax works in a different way than do supply-

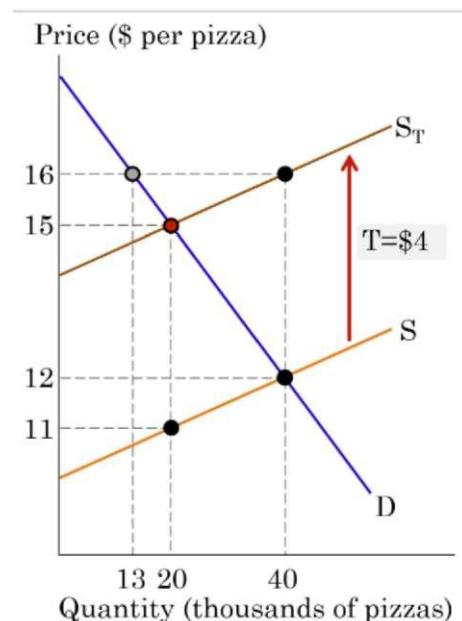


Figure 3-a An excise tax on sellers

curve shifts we studied in Chapter 2. The tax drives a wedge between the price buyers pay (the market price) and the price that sellers actually get (the market price minus the tax). In the example in Figure 3-a, with the tax in effect, in equilibrium, buyers pay \$15 per pizza, but sellers actually only get  $\$15 - \$4 = \$11$ , as they have to send \$4 to the government per each pizza sold.

Two important conclusions follow from this analysis. First, an excise tax reduces the equilibrium quantity of the good on which it is imposed. Second, the tax raises the market price of the good, but the price rises by less than the amount of the per-unit tax. In our example, as a result of a \$4 per pizza tax, the market price rises by \$3 per pizza, not by \$4 per pizza.

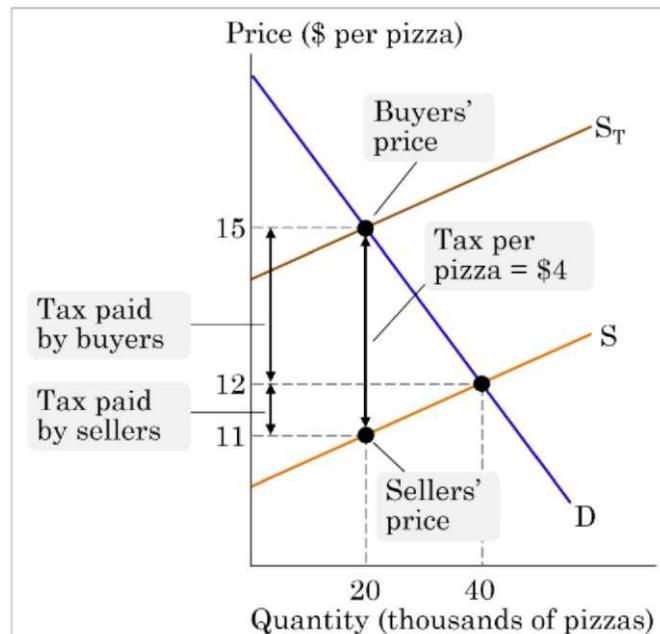
## Who Is Paying the Tax?

Let's continue our pizza example. Recall that the tax is collected from pizza sellers. But who really bears the burden of it? Do sellers pass it on to buyers altogether? The distribution of the tax burden between buyers and sellers is called **tax incidence**. We can determine the tax incidence by comparing the prices that buyers pay and sellers receive before and after the tax is imposed.

As shown in Figure 3-b, with no tax, buyers pay \$12 per pizza and with the tax in effect, they pay \$15. So, the tax incidence that falls on buyers is  $\$15 - \$12 = \$3$  per pizza. What about sellers? With no tax, they receive \$12 per pizza, the same price as buyers pay. With the tax, however, sellers collect \$15 per pizza from buyers but \$4 of that goes to the government, so sellers end up keeping  $\$15 - \$4 = \$11$  per pizza sold. Note that the price that sellers actually get after the tax (\$11) is shown by the point on the no-tax supply curve (S) that corresponds to the equilibrium quantity with the tax in effect (20,000 pizzas). So, the tax incidence that falls on sellers is  $\$12 - \$11 = \$1$  per pizza.

Thus, our example shows—and it is generally the case—that the incidence of an excise tax falls on both sides of the market. With the tax, buyers pay more and sellers receive less per each unit of the good bought and sold.

But what if instead of sellers, the government collects the tax from buyers? Will this increase the tax incidence that falls on buyers? Or maybe buyers then will pay the whole tax? Let's change the scenario in our example. Suppose now that the \$4 per pizza tax is collected



**Figure 3-b The incidence of a tax collected from sellers**

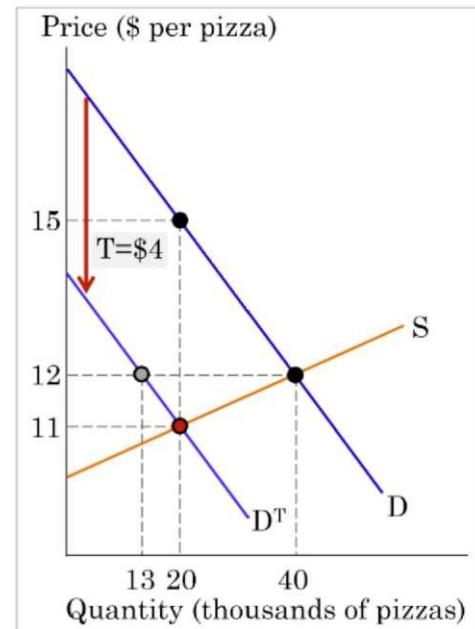
from buyers, i.e. for each pizza bought, buyers are obligated to pay \$4 as a tax.<sup>4</sup> Figure 3-c shows the effects on the market.

We start with the same no-tax equilibrium, where price is \$12 per pizza and the quantity is 40,000 pizzas. Now, buyers realize that at each given quantity of pizza, the value that they receive from consuming a pizza is reduced by the amount of the tax they have to pay per each pizza bought, i.e. by \$4. As a result, the demand curve—which as we learned in Chapter 2 reflects consumers' willingness to pay—shifts downward by the amount of the per-unit tax, from D to  $D^T$  in Figure 3-c.

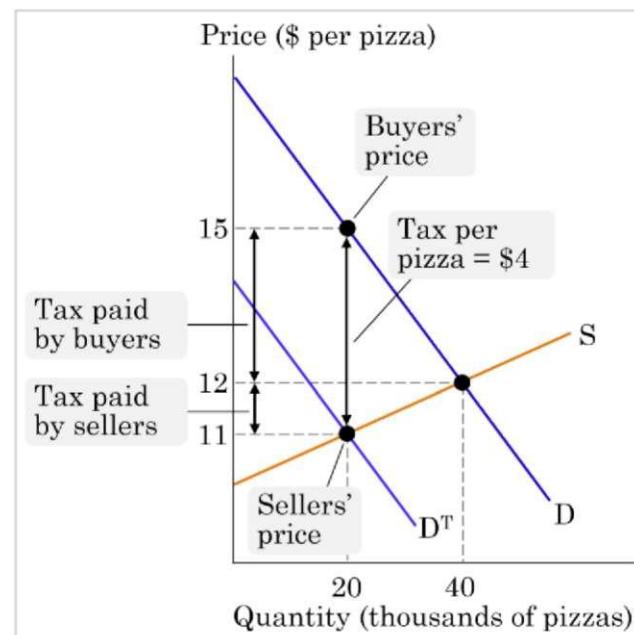
As you can see, after the demand curve shifts, the market is no longer in equilibrium at 40,000 pizzas. Although sellers would accept the price of \$12 per pizza to supply that quantity, buyers are willing to buy only 13,000 pizzas at this price. After the market price adjusts to eliminate that excess supply, the equilibrium price is \$11 per pizza and the equilibrium quantity is 20,000 pizzas.

Again, the tax drives a wedge between the price buyers actually pay (the market price plus the tax) and the price that sellers actually get (the market price). That is, the buyers' price is  $\$11 + \$4 = \$15$  per pizza while the sellers price is \$11.

Now we can determine the tax incidence the same way we did when the tax was imposed on sellers, i.e. by comparing the prices that buyers pay and sellers receive before and after the tax is imposed. As shown in Figure 3-d, with no tax, buyers pay \$12 per pizza and with the tax in effect, they pay \$15. So, the tax incidence that fall on buyers is  $\$15 - \$12 = \$3$  per pizza. With no tax, sellers receive \$12 per pizza and with the tax they get \$11 per pizza. So, the tax incidence that fall on sellers is  $\$12 - \$11 = \$1$  per pizza. As you can see, the incidence of an excise tax collected from buyers is exactly the same as of that collected from sellers!



**Figure 3-c An excise tax on buyers**



**Figure 3-d The incidence of a tax collected from buyers**

<sup>4</sup> For the sake of argument, let's not worry here about the fact that collecting a tax from consumers for each pizza bought would be impractical.

This leads us to an important general conclusion:

The incidence of an excise tax is the same no matter whether it is collected from buyers or sellers.

## Tax Incidence and Elasticity

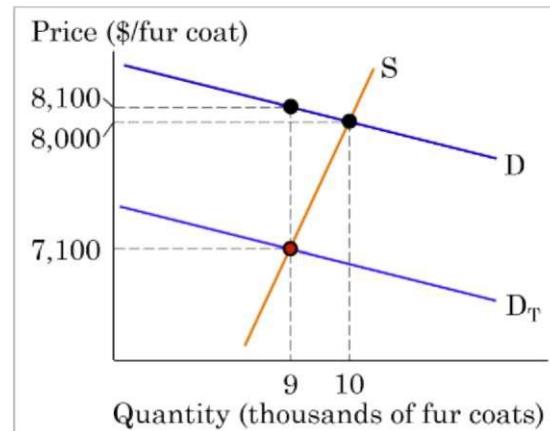
If an excise tax incidence does not depend on whether the tax is collected from sellers or buyers, then what does it depend on? The answer is, the price elasticity of demand and supply. To see how, let's consider another example of an excise tax, the so called "luxury tax".

In 1990, Congress enacted an excise tax on luxury goods, such as private jets, yachts, fur coats, diamonds, and luxury cars. Because only wealthy consumers could afford these goods, the purpose was to reduce income inequality and raise revenue for the government by taxing the rich. Do you think the tax effectively served its purpose?

To see how a luxury tax works, consider a (hypothetical) market for natural fur coats shown in Figure 4. First, recall from Chapter 3 that the demand for luxury goods tends to be elastic, and with the market defined to include just fur coats, it is likely to be very price elastic. If the price of fur coats rises, instead of a fur coat for his trophy wife, a millionaire can easily decide to use his money to buy a race horse or a bigger house or take an exotic vacation. This is reflected by a rather flat demand curve (D) in Figure 4. The supply of fur coats, on the other hand, is much less price elastic, at least in the short run. Resources used to produce natural fur coats are rather rare and it is not easy for natural fur producers to switch to an alternative product or find an alternative market. Therefore, in the same quantity range, the supply curve (S) in Figure 4 is much steeper than the demand curve.<sup>5</sup>

With no tax, the market is in equilibrium when the price of a fur coat is \$8,000, and 10,000 fur coats are sold. Now, suppose that the luxury tax imposed on buyers of fur coats is \$1,000 per coat. As we know from previous analysis, an excise tax collected from buyers shifts the demand curve downward by the amount of the tax. Thus, the demand curve in Figure 4 shifts down by \$1,000, from D to D<sub>T</sub>. After the market adjusts, the equilibrium price of a fur coat is \$7,100 and the equilibrium quantity is 9,000 coats.

Let's see now what the fur coat tax incidence is. With no tax, buyers pay \$8,000 per coat, while with the tax in effect they pay \$7,100 + \$1,000 = \$8,100 per coat. So, the tax incidence that fall on buyers is \$8,100 - \$8,000 = \$100 per coat. With no tax, sellers receive \$8,000 per coat, while with the tax they get \$7,100 per coat. So, the tax incidence that falls on sellers is \$8,000 - \$7,100 = \$900 per coat. In other words, the wealthy buyers of fur coats pay only 10%



**Figure 4 A tax on buyers of fur coats**

<sup>5</sup> It can be calculated that in the relevant price and quantity ranges, the price elasticity of demand (absolute value) is about 8.5, while the price elasticity of supply is about 0.9.

of the tax, while the rest of it is paid by sellers—i.e. firms and workers who produce fur coats—which is not what was intended when the tax was enacted.

This example shows once again that tax incidence does not depend on whether the tax is collected from buyers or sellers. It also illustrates how tax incidence depends on the price elasticities of demand and supply. With highly elastic demand and much less elastic supply, the burden of the luxury tax collected from buyers falls mostly on sellers. This became apparent shortly after the tax was enacted. Since the tax did not serve its purpose, Congress mostly repealed it in 1993. In general:

The incidence of an excise tax falls more heavily on the side of the market that is less elastic.

The intuition behind this conclusion is as follows. A low elasticity of demand means that buyers are not willing to give up much of the good when its price rises. And a low elasticity of supply means that sellers are not willing to give up much of the production of the good when the price they receive falls, perhaps because they can't find suitable alternatives. When a tax is imposed on the good, the side of the market that is willing to give up less has to bear more of the tax burden.

## Excise Taxes and Efficiency

To see how an excise tax affects the efficiency of competitive markets, let's return to our example of a tax imposed on sellers of pizza (Figure 3-a). The effects of the tax on consumer surplus, producer surplus, and total social surplus are shown in Figure 5.

With no tax—i.e. when the market is in equilibrium with the price of \$12 per pizza and 40,000 pizzas sold—the consumer surplus is the triangular area A+B+C, which equals

$$\begin{aligned} CS &= (\$18 - \$12) \times 40,000 / 2 \\ &= \$120,000 \end{aligned}$$

the producer surplus is the triangular area E+D+F, which equals

$$\begin{aligned} PS &= (\$12 - \$10) \times 40,000 / 2 \\ &= \$40,000 \end{aligned}$$

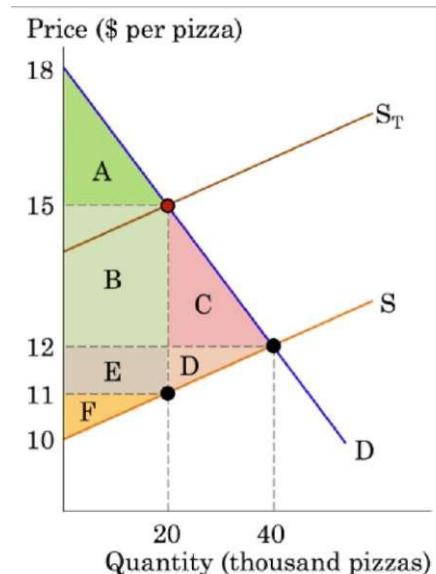
and the total society surplus generated in the market is

$$TS = CS + PS = \$120,000 + \$40,000 = \$160,000$$

With the tax in effect—i.e. when the market price is \$15 per pizza and 20,000 pizzas are sold, the consumer surplus shrinks to the triangular area A, which equals

$$CS_T = (\$18 - \$15) \times 20,000 / 2 = \$30,000$$

and the producer surplus reduces to area F, which equals



**Figure 5 The effect of an excise tax on the efficiency of the market**

$$P S T = (\$11 - \$10) \times 20,000 / 2 = \$10,000$$

The government collects a tax revenue equal to the per unit tax (\$4) times the quantity of pizza sold (area B+E):

$$G R = \$4 \times 20,000 = \$80,000$$

which can be viewed as government surplus. Then, the total society surplus is

$$T S T = C S T + P S T + G R = \$30,000 + \$10,000 + \$80,000 = \$120,000$$

As you can see, the tax transfers part of the consumer surplus (area B =  $\$3 \times 20,000 = \$60,000$ ) and part of the producer surplus (area E =  $\$1 \times 20,000 = \$20,000$ ) to the government. But part of the consumer surplus (area C) and part of the producer surplus (area D) go to a deadweight loss. That is, the tax reduces the total society surplus by the amount of the deadweight loss (area C+E), which is

$$D W L = (\$15 - \$11) \times (40,000 - 20,000) / 2 = \$40,000$$

The main conclusion from our example is that excise taxes create deadweight losses and reduce society total surplus. This happens because an excise tax raises the price paid by buyers, so they choose to buy less than they would with no tax, and lowers the price received by sellers, so they choose to supply less than they would with no tax. As a result, the market equilibrium quantity falls below the efficient level.

### 4.3 Correcting for Externalities

From our discussions in the previous sections you might get the impression that any government intervention in competitive markets causes inefficiencies, i.e. results in deadweight losses. This impression, however, is wrong.

Recall from Chapter 2 that competitive markets can only be efficient if *no* externalities are generated by production or consumption of the good. An **externality** is a cost or benefit resulting from production or consumption of a good that is imposed on someone other than its buyers or sellers. Costs imposed on a third party are **negative externalities**. Benefits received by a third party are **positive externalities**. Free markets fail to account for externalities, which results in deadweight losses for society. In such situations, government interventions can make market outcomes more efficient.

Consider, for example, an unregulated competitive market for gasoline. For the market outcome to be efficient, the price of gas must include all the costs associated with its production and consumption. This, however, is not the case because when we drive, we impose substantial *external* costs on others, which the market fails to account for.

Economists have identified three main categories of external costs associated with the use of gasoline. First, burning gas emits carbon dioxide, the main contributor to the global climate change, which is expected to impose large economic costs on certain businesses, cause health problems for many people, and even threaten national security. Second, air pollution by automobile fumes causes health problems—such as asthma attacks—increasing health care costs and leading to premature deaths. Third, cheaper gas results in more driving, leading to traffic congestion, which imposes external costs in the forms of higher opportunity costs of time spent on traveling and higher accident-related costs.

To illustrate a market failure due to external costs, let's consider a (hypothetical) unregulated competitive market for gasoline shown in Figure 6-a. Suppose that the external costs of gasoline are \$1 per gallon. The market, however, ignores these costs. Consumers make their decision based on their private benefits reflected by the demand curve (D). And producers decide how much gas to sell based on their private opportunity costs reflected by the supply curve (S). Producers are willing to sell 400 million gallons of gas at \$2 because this price covers their opportunity cost of producing the 400 millionth gallon (i.e. their marginal cost of it). And consumers are willing to pay \$2 to get that quantity of gas. Thus, the market is in equilibrium where the price of gas is \$2.00 and the quantity of gas bought is 400 million gallons.

The problem here is that the market price does not cover all the **social costs (SC)**—i.e. the true costs—of gasoline, which equal the producers' **private costs (PC)** plus the **external costs (XC)**:

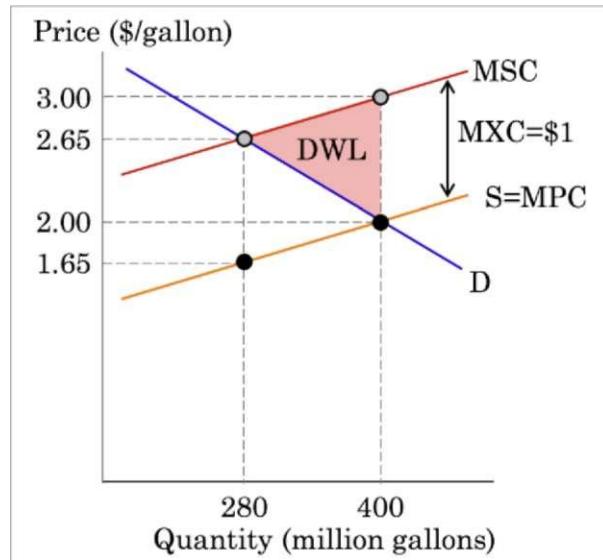
$$SC = PC + XC$$

In Figure 6-a, to find the true social cost of an additional gallon of gas, we add the external cost of gas ( $MXC = \$1$  per gallon) to its marginal private cost ( $MPC$ ) shown by the supply curve at each quantity of gas supplied. So, graphically, the marginal social cost curve ( $MSC$ ) lies \$1 above the market supply curve ( $S = MPC$ ). Now we can see that when the market is in equilibrium at 400 million gallons, the true cost of the last gallon sold is \$3, while its value to consumers is only \$2. This means the market does not produce the efficient quantity of gas.

What quantity of gas is efficient then? As you can see in Figure 6-a, the marginal social cost of gas equals its marginal benefit to consumers at the point where the price is \$2.65 per gallon and the quantity of gas sold is 280 million gallons. For each additional gallon above this quantity, the marginal social cost exceeds the marginal benefit, which means those additional gallons should not be produced. That is, in the presence of the external costs, the market overproduces  $400\text{ million} - 280\text{ million} = 120\text{ million}$  gallons of gas.

The total efficiency loss (i.e. deadweight loss) due to the fact that the market does not take external costs into account is shown by the triangular area  $DWL$  in Figure 6-a, which equals

$$DWL = (\$3 - \$2)x(400\text{ million} - 280\text{ million})/2 = \$60\text{ million}$$

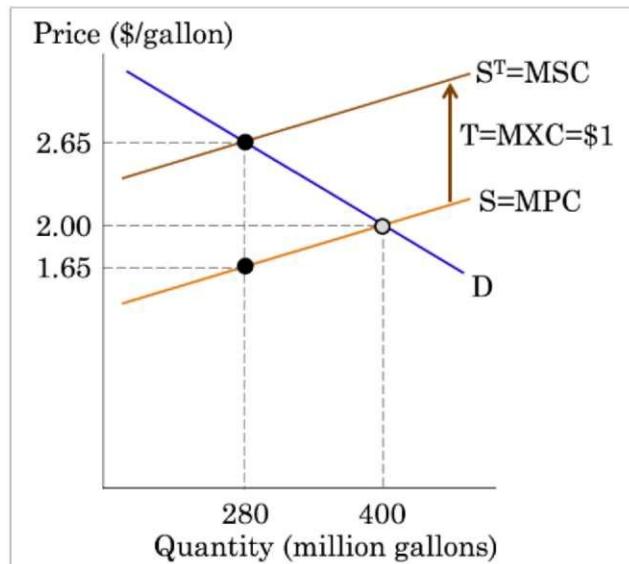


**Figure 6-a Market inefficiency due to external costs**

Thus, a free competitive market fails to achieve the efficient outcome in the presence of externalities. Can government interventions help make it more efficient? One way to *internalize* external costs, i.e. make producers and consumers of the good whose production or consumption causes them, is to impose an excise tax on that good.

Continuing our example of a market for gasoline, suppose the government levies a tax on sellers of gas that is equal to the external costs, \$1 per gallon (Figure 6-b). As we know, an excise tax on sellers shifts the supply upward by the amount of the per unit tax. So the gas tax of \$1 per gallon will shift the supply curve ( $S$ ) in Figure 6-b up by \$1. As a result, the market equilibrium with the tax occurs where the price of gas is \$2.65 and the quantity of gas sold is 280 million gallons. Since the supply curve with the tax ( $S^T$ ) coincides with the marginal social cost curve (MSC), this is also where the marginal social cost equals the marginal benefit. This means the market price of gasoline now accounts for all of its costs, including the external costs, so the market outcome is efficient.

In reality, however, dealing with externalities is not that simple. The main problem is that external costs are very hard to quantify. For example, economists have been trying to estimate the external costs of gasoline for a long time, with different studies producing different results ranging from \$1.00 to \$2.00 per gallon. A recent study by the International Monetary Fund has found that for the United States, the external costs of gasoline amount to \$1.60 per gallon.<sup>6</sup> If this estimate is correct, then the tax on gasoline in the United States that would result in the efficient market outcome is \$1.60 per gallon, which is much higher than the current average \$0.52 per gallon.<sup>7</sup>



**Figure 6-b An excise tax internalizing external costs**

<sup>6</sup> Ian Parry, et al. *Getting Energy Prices Right : From Principle to Practice*. International Monetary Fund, 2014. DOI:<http://dx.doi.org/10.5089/9781484388570.07>.

<sup>7</sup> Including federal, state, and local taxes and fees. Click [here](#) for detailed information about the U.S. gasoline tax from the American Petroleum Institute.

## CHAPTER 5

### CONSUMER CHOICE



#### What's in It for You?

Microeconomics seeks to understand the behavior of individual economic agents such as individuals and businesses. Economists believe that individuals' decisions, such as what goods and services to buy, can be analyzed as choices made within certain constraints. Generally, consumers are trying to get the most for their limited income budget but other constraints might also apply. Time and calories are two examples of non-income things that consumers frequently budget when making consumption decisions. In economic terms, consumers are trying to maximize total utility, or satisfaction, given their constraints.

Everyone has their own personal tastes and preferences. The French say: *Chacun a son gout*, or "Each to his own taste." An old Latin saying states, *De gustibus non est disputandum* or "There's no disputing about taste." If people's decisions are based on their own tastes and personal preferences, however, then how can economists hope to analyze the choices consumers make?

An economic explanation for why people make different choices begins with accepting the proverbial wisdom that tastes are a matter of personal preference. But economists also believe that all consumers' preferences satisfy a basic set of assumptions that lead to rational choices. This chapter introduces the economic theory of how rational consumers make choices about what to buy given fixed prices and limited incomes.



#### Learning Objectives

At completion of this learning module you are expected to be able to:

- Construct a consumer's budget set graphically and mathematically given prices and income, and show how the budget set changes with changes in prices and income
- Appraise the major assumptions economists make about consumer preferences
- Maximize a consumer's utility graphically and mathematically using marginal analysis
- Decompose changes in quantity demanded resulting from price changes into income and substitution effects using a graph
- Explain and give examples of how people make decisions that systematically deviate from those predicted by rational choice models and how markets take advantage of these tendencies.

## 5.1 Consumption Possibilities: The Budget Set

Consider the typical consumer's budget problem. Consumers have a limited amount of income to spend on the things they need and want. Suppose Alphonso has \$10 in spending money each week that he can allocate between bus tickets for getting to work and the burgers that he eats for lunch. Burgers cost \$2 each, and bus tickets are 50 cents each. Alphonso's budget set describes all combinations of burgers and bus tickets that Alphonso can afford given fixed prices and income. In other words, it includes all combinations that satisfy the following inequality:

$$\begin{aligned} & \text{Alphonso's Expenditures on Burgers} + \\ & \text{Alphonso's Expenditures on Bus Tickets} < \text{Alphonso's Income} \end{aligned}$$

Letting  $B$  represent the number of burgers he purchases and  $T$  represent the number of bus tickets he purchases, we can simplify the description of his budget set to:

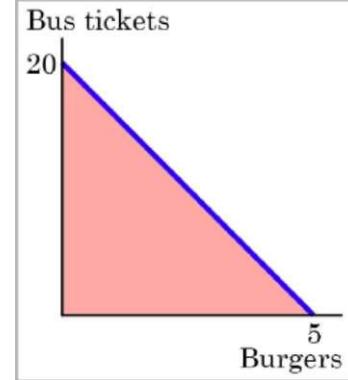
$$2B + 0.50T < 10$$

The budget set identifies all the opportunities for spending, including those that leave him with income left over. For example, Alphonso could afford one burger and one ticket ( $\text{cost} = \$2 + \$0.50 = \$2.50$ ) so this combination is part of his budget set. The budget line indicates all the combinations of burgers and bus tickets Alphonso can afford when he exhausts his budget. The formula for his budget line would be given by:

$$2B + 0.50T = 10$$

We can show Alphonso's budget set and his budget line on the graph in Figure 1, where we measure the quantity of bus tickets on the vertical axis and the quantity of burgers on the horizontal axis. The thick blue line shows all combinations of tickets and burgers that cost exactly \$10. The red shaded area represents combinations that cost less than his income of \$10. The line is therefore Alphonso's budget line while budget set includes all combinations on the line but also those in the shaded area below the line. The intercepts represent the extreme situations where Alphonso either spends all of his money on bus tickets or on burgers. If Alphonso chooses to consume only bus tickets, he could afford 20 bus tickets per week ( $\$10 \text{ income per week} - \$0.50 \text{ per ticket} = 20 \text{ tickets per week}$ ) and no burgers. Likewise, he could choose to spend his entire income on burgers in which case he could afford 5 burgers per week ( $\$10 \text{ income per week} - \$2 \text{ per burger} = 5 \text{ burgers per week}$ ) and no tickets.

If Alphonso is like most people, he will likely choose some combination that includes both bus tickets and burgers. That is, he will choose some combination on the budget line that connects the vertical intercept and the horizontal intercept. Any point beyond the budget line is not affordable, because it would cost more money than Alphonso has available in his budget.



**Figure 1** The budget set: consumption possibilities

## Opportunity Cost and the Budget Line

The budget line clearly shows the tradeoff Alphonso faces in choosing between burgers and bus tickets. Suppose he is currently purchasing 20 bus tickets and zero burgers. What would it cost Alphonso to have one burger? It would be natural to answer \$2, but that's not the way economists think. Instead they ask, how many bus tickets would Alphonso have to give up to get one more burger, while staying within his budget? The answer is four bus tickets.

Recall from Chapter 1 that economists use the term opportunity cost to indicate what must be given up to obtain something that is desired. The idea behind opportunity cost is that the cost of one item is the lost opportunity to do or consume something else. When Alphonso buys a burger, he spends \$2. How many bus tickets could he have purchased with that money? The answer is given by the relative price of burgers:

$$\frac{P_B}{P_T} = \frac{\$2}{\$0.50} = 4$$

Notice that the slope of the budget line in Figure 1 represents the opportunity cost of burgers. The slope of the line is  $-4 / 1$ , meaning Alphonso must give up four bus tickets ( $-4 = \text{rise}$ ) in order to gain one additional burger ( $+1 = \text{run}$ ). The opportunity cost describes what Alphonso must do and is a function of the prices of the two goods only. The fact that prices dictate that he must give up four bus tickets to afford one additional burger does not necessarily mean that he would be willing to do so. For two generic goods X and Y with prices  $P_X$  and  $P_Y$ , the following summary may be helpful:

Equation for the budget set	$P_X x X + P_Y x Y < I$
Equation for the budget line	$P_X x X + P_Y x Y = I$
Opportunity Cost of one more unit of good X	$P_X / P_Y$
Opportunity Cost of one more unit of good Y	$P_Y / P_X$

As we discussed in Chapter 1, a fundamental principle of economics is that every choice has an opportunity cost. If you sleep through your economics class (not recommended, by the way), the opportunity cost is the learning you miss from not attending class. If you spend your income on video games, you cannot spend it on movies. If you choose to marry one person, you give up the opportunity to marry anyone else. In short, opportunity cost is all around us and part of human existence.

In many cases, it is reasonable to refer to the opportunity cost as the price. If your cousin buys a new bicycle for \$300, then \$300 measures the amount of "other consumption" that he has given up. For practical purposes, there may be no special need to identify the specific alternative product or products that could have been bought with that \$300, but sometimes the price as measured in dollars may not accurately capture the true opportunity cost. This problem can loom especially large when costs of time are involved.

In some cases, realizing the opportunity cost can alter behavior. Imagine, for example, that you spend \$8 on lunch every day at work. You may know perfectly well that bringing a lunch from home would cost only \$3 a day, so the opportunity cost of buying lunch at the restaurant is \$5 each day (that is, the \$8 buying lunch costs minus the \$3 your lunch from home would cost). \$5 each day does not seem to be that much. However, if you project what that adds up to in a year—250 days a year  $\times$  \$5 per day equals \$1,250, the cost, perhaps, of a decent

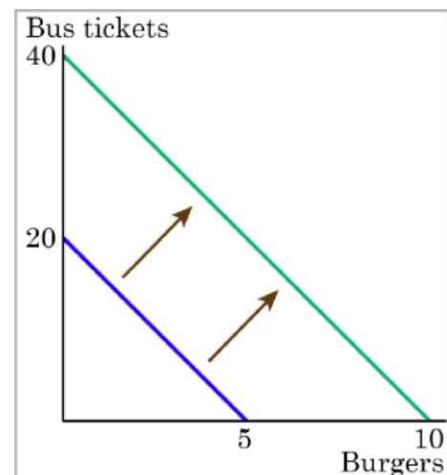
vacation. If the opportunity cost is described as "a nice vacation" instead of "\$5 a day," you might make different choices.

## Changes in the Budget Set

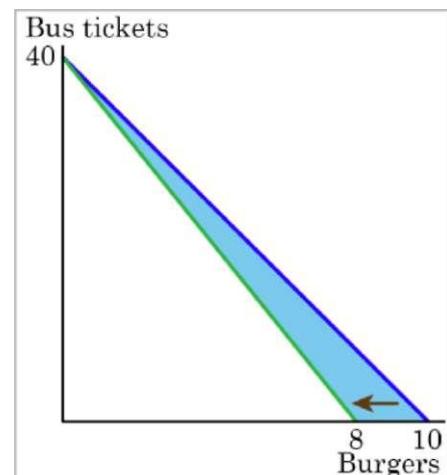
The budget set is defined for fixed prices and income. If either of these things change, the budget set and budget line will also change. For instance, if Alphonso's income were to increase from \$10 to \$20 he would clearly have an expanded budget set. Notice that the slope of his budget line, given by  $- P_B / P_T$ , would not be affected since it does not depend on his income. This change in his budget line is shown in Figure 2. A decrease in Alphonso's income would have the opposite effect: the budget line would shift in closer to the origin while maintaining the same slope. Decreases in income shrink the budget set but leave the opportunity cost of either good unchanged.

A change in a good's price will also have an impact on the budget set and budget line. If Alphonso finds that the price of burgers has increased from \$2 to \$2.50, this will affect not only the set of available options but also the opportunity cost of either good. Graphically, an increase in price of one good will shrink the budget set and also change the slope of the budget line. The blue shaded area in Figure 3 represents the loss in Alphonso's budget set when the price of burgers increased. Notice that the maximum number of bus tickets he can afford has not changed, while the maximum number of burgers he could afford has decreased from ten to eight. The new slope of  $-5$  indicates that he now must give up five bus tickets in order to consume an additional burger. While the opportunity cost of a burger has increased, the opportunity cost of bus tickets has fallen: he now only gives up one-fifth of a burger each time he takes the bus ( $\$0.50 - \$2.50 = 1/5$  of a burger per bus ticket).

A decrease in the price of burgers would have expanded Alphonso's budget set while lowering the opportunity cost of a burger—the slope would become flatter. Likewise, changes in the price of bus tickets would affect the slope of the budget line by altering the vertical intercept while leaving the maximum number of burgers he could afford unchanged. An increase in the price of bus tickets would lower the opportunity cost of a burger and a decrease in the price of bus tickets would raise the opportunity cost of a burger.



**Figure 2 Changes in the budget set: an increase in income**



**Figure 3 An increase in the price of burgers**

## 5.2 Consumer Preferences

In the previous section we learned how to represent Alphonso's budget set both graphically and mathematically. We even said that he would likely prefer to consume at some point on the interior of his budget line rather than at one of the extremes where he spends all of his income on a single good. What does it mean to be like most consumers? Is it possible that Alphonso doesn't have any need to take the bus? What if Alphonso doesn't like burgers? In describing his budget set, we have shown all of the options available to Alphonso but we have not said anything about what combination of burgers and bus tickets Alphonso might prefer. Likewise, the slope of the budget line allowed us to say what he must do in order to attain an additional burger but it did not tell us whether he would actually be willing to do so. In order to gain insight into how a consumer will choose among the alternatives available in the budget set, we first need to make some basic assumptions. Because each consumer is unique and we want our results to be widely applicable, it is important that we have confidence that these assumptions apply to *all* consumers.

### What it means for Consumers to be Rational

In order to analyze the choices that consumers make in a formal way, it is necessary for consumers to behave in a rational manner. The first assumption we will make about consumers is that they are able to compare any two options by saying that either they like one better than the other or that they are completely indifferent between the two. In other words, we assume that preferences are **complete**. Sometimes we are offered a choice between two undesirable alternatives. Does this imply that we have incomplete preferences? Absolutely not. If a vegetarian is offered a choice between ham and turkey, they will report that they are indifferent—they receive exactly zero satisfaction, or utility, from either option!

The second assumption we will make about consumers is that they have consistent preferences. If you report that you prefer tacos to sushi and that you prefer sushi to burgers, then it must be the case that you prefer tacos to sushi. The assumption we are making here is that preferences are **transitive**. Transitivity also works with indifference between two options: if you are indifferent between jogging and swimming and you prefer cycling to swimming, then you must also prefer cycling to jogging. While this assumption may seem uncontroversial for an individual consumer, transitivity may fail to hold if we aggregate the preferences of a group. It is possible that a group of friends could vote for tacos over sushi and sushi over burgers but then vote for burgers over tacos. In what follows, however, we will consider only the preferences of a single individual.

These rationality assumptions do not imply that everyone will make the same choices or that consumers always make the choice that turns out to be best for them. Risky decisions and poorly informed decisions can also be perfectly rational decisions. What our assumptions do mean is that consumers are capable of choosing among alternatives and that their rankings of those alternatives are logically consistent.

Another common, but somewhat more controversial assumption that economists make is that consumers believe that **more is better**. By qualifying this statement slightly, we can have more confidence that it will hold for consumers in general. First, more of an *economic good* is better. Other things being equal, more disease is clearly not better. Disease in this case would be considered an *economic bad*. We can still analyze consumers' choices regarding disease by considering a related good rather than the bad itself: health would be a good and,

other things equal, more health would be better. Other times, we consume so much of a good that it actually lowers our overall utility. You may love pizza, but it is possible to eat too much and end up feeling sick. In this case, more doesn't turn out to be better. There are two reasons that this is at most a minor problem for our study of consumer choice. First, what we really mean is that a *little* more is better. Is one more bite of pizza better? The answer is probably yes. Second, even if one more bite of pizza makes us sick the important thing is that when we made the decision to take that bite we *believed* that one more was going to be better. In any case, it is a good idea to be aware of this assumption and realize when it might not hold so that we can adjust our analysis accordingly.

Based on the more is better assumption, we can already make one prediction about the choice that consumers will make. Consumers will choose a point on the budget line rather than the interior of the budget set. In other words, **consumers will spend all of their income**. Otherwise, they could afford more of either or both goods thereby making themselves better off. Keep in mind that this does not preclude savings. Future consumption can be considered a good just like any other and we can allocate some of our income to savings and still be considered to be spending all of our income.

## Utility and Diminishing Marginal Utility

People desire goods and services for the utility those goods and services provide. When we declare that we prefer option A to option B it is because option A provides us with greater utility than does option B. Utility is subjective but that does not make it less real. Our assumption that more is better means that the more of a good one consumes, the more utility one obtains. At the same time, the increase in utility a person receives from consuming the first unit of a good is typically more than the increase in utility received from consuming the fifth or the tenth unit of that same good. The increase in utility when we consume one additional unit of a good is called **the marginal utility (MU)**.

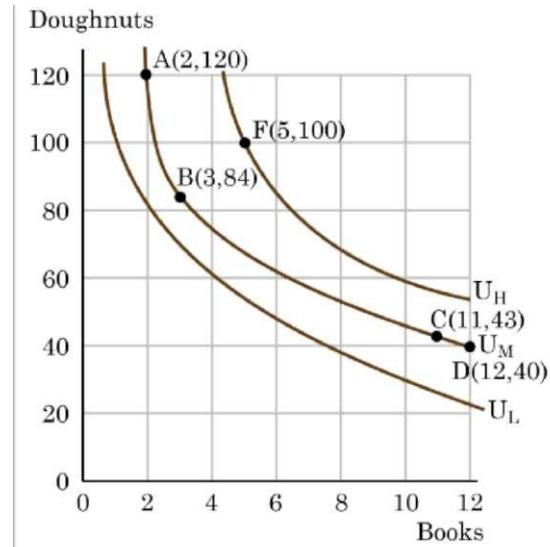
$$MU = \frac{\text{Change in total utility}}{\text{Change in consumption}}$$

Economists typically assume that as we increase our consumption of one good while holding all else constant, the marginal utility of that good will eventually decline. This is known as the **law of diminishing marginal utility**. When Alphonso chooses between burgers and bus tickets, for example, the first few bus rides that he chooses might increase his utility a great deal—perhaps they help him get to a job interview or a doctor's appointment. But later bus rides might provide much less utility—they may only serve to kill time on a rainy day. Similarly, the first burger that Alphonso chooses to buy may be on a day when he missed breakfast and is ravenously hungry. However, if Alphonso has a burger every single day, the last few burgers may taste pretty boring. The general pattern that consumption of the first few units of any good tends to bring a higher level of utility to a person than consumption of later units is a common pattern. Notice that we are not assuming that marginal utility always falls as we consume more. It could very well be that Alphonso barely tastes that first burger because he eats it so fast due to his hunger. Perhaps the second burger actually increases his utility by more than the first burger. The law of diminishing marginal utility only says that as he consumes more burgers, his marginal utility will *eventually* decline.

The law of diminishing marginal utility explains why people and societies rarely make all-or-nothing choices. You would not say, "My favorite food is ice cream, so I will eat nothing but ice cream from now on." Instead, even if you get a very high level of utility from your favorite food, if you ate it exclusively, the additional or marginal utility from those last few servings would not be very high. Similarly, most workers do not say: "I enjoy leisure, so I'll never work." Instead, workers recognize that even though some leisure is very nice, a combination of all leisure and no income is not so attractive.

## Indifference Curves: A Graphical Representation of Preferences

Rather than trying to compare each and every combination of goods that Alphonso can buy, we can use a graph to represent his preferences among these combinations in a simple way. An **indifference curve** shows graphically all combinations of goods that provide an equal level of utility. In other words, an indifference curve shows all combinations of goods among which the consumer is *indifferent*. Indifference curves allow us to graphically depict the amount of utility a consumer derives from two goods and to rank all potential combinations of those goods. For example, Figure 4 shows three indifference curves that represent Lilly's preferences for the tradeoffs that she faces in her two main relaxation activities: eating doughnuts and reading paperback books. Each indifference curve ( $U_L$ ,  $U_M$ , and  $U_H$ ) represents one level of utility. First we will explore the meaning of one particular indifference curve and then we will look at the indifference curves as a group.



**Figure 4** Indifference curves

## Characteristics of Indifference Curves

The indifference curve  $U_M$  has four points labeled on it: A, B, C, and D. Since an indifference curve represents a set of choices that have the same level of utility, Lilly must receive an equal amount of utility, judged according to her personal preferences, from two books and 120 doughnuts (point A), from three books and 84 doughnuts (point B) from 11 books and 43 doughnuts (point C) or from 12 books and 40 doughnuts (point D). She would also receive the same utility from any of the unlabeled intermediate points along this indifference curve.

The assumptions we have made about preferences tell us quite a bit about how indifference curves should look. For example, we know that Lilly's **indifference curves will be negatively sloped** because of our assumption that more is better. If we give her more books, we will have to take away some doughnuts or else she will be made better off. Likewise, we would need to take away some books in order to keep her indifferent if we were to give her more doughnuts.

In addition to being downward sloping from left to right, **indifference curves tend to be convex with respect to the origin**. In other words, they are steeper on the left and flatter on the right. The slope of an indifference curve tells us how much of the good on the vertical axis (doughnuts in Lilly's case) the consumer is *willing* to give up in order to consume one additional unit of the good on the horizontal axis (books for Lilly). Contrast this with the slope of the consumer's budget line, which tells us how much of the good on the vertical axis *must* be given up in exchange for one additional unit of the good on the horizontal axis. This willingness to trade one good for a *marginal* (i.e., one unit) increase in the other good while holding total utility constant is known as the **Marginal Rate of Substitution (MRS)**.

The convex shape of typical indifference curves means that the marginal rate of substitution decreases as we move down along an indifference curve. This shape results from another of our assumptions: that the law of diminishing marginal utility holds. Thus, the increase in utility that Lilly would gain from, say, increasing her consumption of books from two to three must be equal to the decrease in utility when her consumption of doughnuts was cut from 120 to 84 so that her overall utility remains unchanged between points A and B. At point A, where she has relatively large number of doughnuts and therefore her marginal utility from doughnuts will be relatively small. At the same time, she has relatively few books and therefore has a relatively high marginal utility for books. Viewed in terms of the marginal utilities of the two goods, it is easy to see why Lilly is willing to give up 36 doughnuts to increase the number of books she has from 2 to 3. When Lilly has a larger number of books and fewer doughnuts at point C in Figure 4, she will have a lower marginal utility for books and a higher marginal utility for doughnuts. In going from point C to point D, she is only willing to give up 3 of the now precious doughnuts for yet another book.

Computationally, the MRS is equal to the ratio of the marginal utilities of the two goods:

$$MRS_{Y,X} = \frac{MU_X}{MU_Y}$$

To understand why this is true, consider a consumer who receives  $MU_X = 20$  from good X and  $MU_Y = 4$  from good Y. How many units of good Y would the consumer be willing to substitute for one additional unit of good X? The one additional unit of good X will increase her total utility by 20. To remain on the same indifference curve, we need a decrease in good Y that will exactly offset this increase. A decrease of 5 units of good Y, which each give her 4 units of utility, known as **utils**, at the margin will lower total utility by the necessary 20 utils, leaving Lilly's overall utility unchanged:

$$MRS_{Y,X} = \frac{20}{4} = 5$$

Our assumption that preferences are complete implies that **there exists an indifference curve through every combination**. Thus, Lilly's preferences will include an infinite number of indifference curves lying nestled together on the diagram—even though only three of the indifference curves, representing three levels of utility, appear on Figure 4. In other words, an infinite number of indifference curves are not drawn on this diagram but you should remember that they exist.

The combination of the more is better and transitivity assumptions assure us that **higher indifference curves represent a greater level of utility** than lower ones. In Figure 4, indifference curve UL can be thought of as a "low" level of utility, while UM is a "medium" level of utility and UH is a "high" level of utility. All of the choices on indifference curve UH

are preferred to all of the choices on indifference curve **UM**, which in turn are preferred to all of the choices on **UL**.

To understand why higher indifference curves are preferred to lower ones, compare point **B** on indifference curve **UM** to point **F** on indifference curve **UH**. Point **F** has greater consumption of both books (5 to 3) and doughnuts (100 to 84), so point **F** is clearly preferable to point **B** due to our assumption that more is better. The more is better assumption, however, does not allow us to directly compare point **F** to point **C**, since point **F** has more doughnuts but point **C** has more books. Transitivity gives us the desired result: since point **F** is preferable to point **B** and point **B** gives the same level of utility as point **C**, point **F** is also preferable to point **C**. Given the definition of an indifference curve—that all the points on the curve have the same level of utility—if point **F** on indifference curve **UH** is preferred to point **B** on indifference curve **UM**, then it must be true that all points on indifference curve **UH** have a higher level of utility than all points on **UM**.

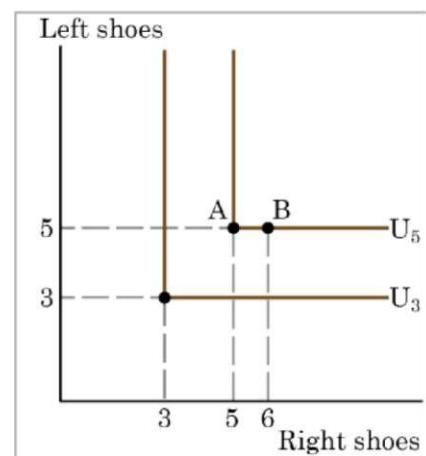
More generally, for any point on a lower indifference curve, like **UL**, you can identify a point on a higher indifference curve like **UM** or **UH** that has a higher consumption of both goods. Since one point on the higher indifference curve is preferred to one point on the lower curve, and since all the points on a given indifference curve have the same level of utility, it must be true that all points on higher indifference curves have greater utility than all points on lower indifference curves. A final point to note is that **indifference curves never cross**. If they did, then we would have a single combination—where the curves intersect—that would be assigned two levels of utility and transitivity would be violated.

These arguments about the shapes of indifference curves and about higher or lower levels of utility do not require any numerical estimates of utility, either by the individual or by anyone else. They are only based on the assumptions that we have made in this section. Given these gentle assumptions, an indifference map can be constructed to describe the preferences of any individual.

## The Individuality of Indifference Curves and Special Cases

Each person determines their own preferences and utility. Thus, while indifference curves have the same general characteristics—they exist, they are downward sloping, and they never cross—the specific shape of indifference curves can be different for every person. Figure 4, for example, applies only to Lilly's preferences. Indifference curves for other people would probably travel through different points. Also, the convexity of typical indifference curves is just that—typical. Not all indifference curves have this same type of curvature. Figure 5 shows two examples of indifference curves that are not convex to the origin.

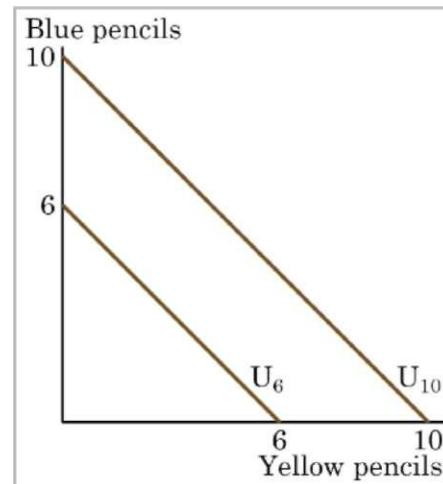
In Figure 5-a we have Jim's preferences over left shoes and right shoes. These goods are **perfect complements** for Jim, meaning he always consumes them together. The bend in the indifference curves represents situations where Jim has equal amounts of left and right shoes,



**Figure 5-a Perfect complements**

meaning he has a number of complete pairs of shoes. If, starting from Point A where Jim has exactly five pairs of shoes, we were to give him an extra right shoe would he be made better off? Not likely. Point B, where Jim has five left shoes and six right shoes, is therefore on the same indifference curve as Point A. The same would be true if we were to increase only his consumption of right shoes. Indifference curves for perfect complements are therefore L-shaped. Notice that not all examples of perfect complements are consumed in a 1:1 ratio. If you wear glasses, for example, you likely consume two lenses for each set of frames. Since perfect complements are always consumed together in a constant ratio, it is unsurprising that they also tend to be sold together as a bundle.

Figure 5-b shows Sally's preferences for blue pencils and yellow pencils. Since Sally has no preference over the color of the pencil she uses, the goods are **perfect substitutes**. She will trade one blue pencil for an additional yellow pencil no matter how many of each she has currently. What matters to Sally is not the number of each color but the total number of pencils. In this case the marginal rate of substitution is constant which implies that the indifference curves are linear. The key to perfect substitutes is that the marginal rate of substitution is constant, not that it is necessarily equal to one. Sally would be willing to trade 2 five-packs of pencils for one 1 ten-pack of pencils regardless of how many of each size package she has currently.



**Figure 5-b Perfect substitutes**

### 5.3 Two Approaches to Utility Maximization

Now that we have formalized our description of the budget set in Section 5.1 and the description of preferences in Section 5.2, we are ready to maximize a consumer's utility. As always, we will make decisions at the margin, comparing the incremental effects of any option we are considering. There are two equally valid ways we can approach the problem of utility maximization. In this section we will consider both methods.

### Utility Maximization Using Indifference Curves and Budget Lines

People seek the highest level of utility, which means that they wish to be on the highest possible indifference curve. However, people are limited by their budget sets, which show what tradeoffs are actually possible.

Return to the situation of Lilly's choice between paperback books and doughnuts. Say that books cost \$6, doughnuts are 50 cents each, and that Lilly has \$60 to spend. This information provides the basis for the budget line shown in Figure 6. Along with the budget line are shown the three indifference curves from Figure 4. What is Lilly's utility-maximizing choice? Several possibilities are identified in the diagram.

The choice of F with five books and 100 doughnuts is highly desirable, since it is on the highest indifference curve of those shown in the diagram (UH). However, it is beyond Lilly's budget set and is therefore not affordable given Lilly's income and the goods' prices. The

choice of H with three books and 70 doughnuts on indifference curve  $U_L$  is in her budget set but cannot be utility maximizing since more is better and she could afford more of both goods

### Utility Maximization Condition 1:

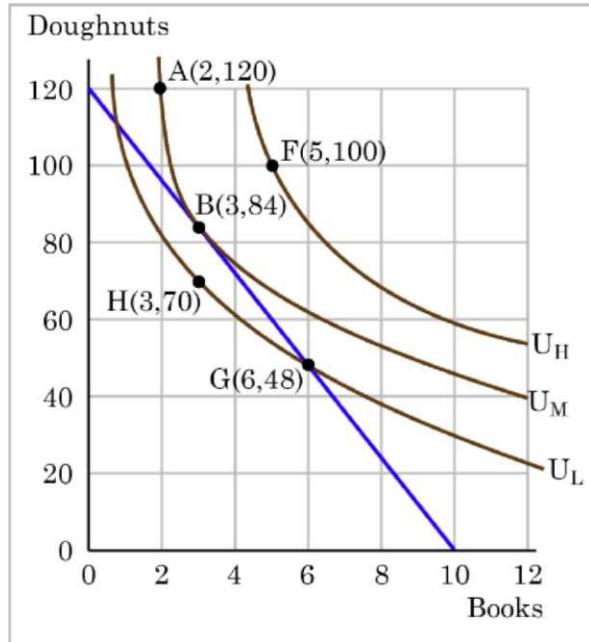
Consume at a point *on* the budget line.

$$P_X X + P_Y Y = I$$

starting from this point. As we noted in the previous section, Lilly will always prefer a choice on the budget constraint itself. This is the first condition of utility maximization.

Choices B and G are both on the budget line. However, choice G of 6 books and 48 doughnuts is on lower indifference curve  $U_L$  than choice B of 3 books and 84 doughnuts, which is on the indifference curve  $U_M$ . Consider choice G, where the budget line is steeper than the indifference curve. Recall that the slope of the budget line tells us the opportunity cost of a book and the slope of the indifference curve tells us Lilly's marginal rate of substitution. At point G, the opportunity cost of a book is greater than Lilly's MRS. At this point, she must give up more doughnuts (opportunity cost) than she is willing to give up (marginal rate of substitution) for an additional book. This means that she gave up more than she was willing for the last book consumed and would therefore be made better off by consuming fewer books and more doughnuts, so she should move towards point B. At point B, Lilly's marginal rate of substitution is exactly equal to the opportunity cost of a book. This means that consuming one more or one less book would cost her exactly what it is worth to her—she cannot be made no better off by adjusting her consumption. The highest achievable indifference curve touches the opportunity set at a single point of tangency. This condition that the slope of the budget line exactly equals the slope of the indifference curve is the second condition for utility maximization.

Since an infinite number of indifference curves exist, even if only a few of them are drawn on any given diagram, there will always exist one indifference curve that touches the budget line at a single point of tangency. All higher indifference curves, like  $U_H$ , will be completely above the budget line and, although the choices on that indifference curve would provide higher utility, they are not affordable given the budget set. All lower indifference curves, like



**Figure 6 Indifference curves and budget constraint**

### Utility Maximization Condition 2:

Consume at a point of tangency between an indifference curve and the budget line.

$$\frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

UL, will cross the budget line in two separate places. When one indifference curve crosses the budget line in two places, however, there will be another, higher, attainable indifference curve sitting above it that touches the budget line at only one point of tangency.

## Utility Maximization by Comparing Bang-for-the-Buck

The second, equally valid, approach to utility maximization relies on logic rather than the graphs we have developed above. As before, our consumer is going to want to spend all of their income in order to maximize their utility. The first condition for utility maximization is therefore the same as above.

### Utility Maximization Condition 1:

Spend *all* income.

$$P_{XXX} + P_{YY} = I$$

Since decisions should always be made *at the margin*, we should approach spending our income by incrementally considering where to spend each dollar. Having learned about utility, your initial reaction may be to spend your next dollar on the good that offers you the greatest utility. That approach, however, would be misguided. For many of us, that approach would lead to choose a good that is critical to our survival, like water. Presumably, being alive brings us much satisfaction. Why do we not continually purchase more water? The answer lies in the distinction between *total* and *marginal* utility. While water brings us a high level of overall utility, *another* glass of water probably won't add much to that level of happiness. This is the law of diminishing marginal utility at work. You've likely already consumed water today and the next glass will not make the difference between life and death.

If not the good that offers the greatest level of utility, perhaps we should spend the next dollar on the good that offers the greatest marginal utility. This is certainly an improvement over choosing the good offering the greatest total utility, but it will still lead us to making questionable decisions. What good would increase your overall happiness the most if you had one more unit? Perhaps an exotic sports car or maybe a trip to the South Pacific? Sounds good, right? Well, now imagine what happens if you show up at the car dealership with one dollar to spend. You're not going to be driving away in a new car! You would be lucky to get a key chain and more likely you would be laughed out of the dealership. So if you shouldn't spend the next dollar on the good offering either the greatest utility or the greatest marginal utility, where should you spend it? The answer is that **you should always spend the next dollar on the good offering the greatest marginal utility per dollar spent (MU / P)**. In other words, you should spend your next dollar on the good that offers you the most "bang-for-the-buck".

Consider the situation of Jose, who likes to wear t-shirts and watch movies. Jose has a total of \$77 to spend on these goods each month. The price of t-shirts is \$14 and the price of movies is \$7. Jose wishes to choose the combination that will provide him with the greatest utility. Table 1 shows how Jose's utility is connected with his consumption of t-shirts or movies. The first column of the table shows the quantity of t-shirts consumed. The second column shows the total utility, or total amount of satisfaction, that Jose receives from consuming that number of t-shirts. The third column shows **marginal utility**. Notice that Jose's preferences satisfy our assumption that more is better—consuming additional goods

**Table 1 Marginal utility per dollar spent**

Quantity of t-shirts	Total utility	Marginal utility	Marginal utility per dollar spent	Quantity of movies	Total utility	Marginal utility	Marginal utility per dollar spent
1	25	25	$25/\$14=1.8$	1	18	18	$16/\$7=2.3$
2	<b>47</b>	<b>22</b>	<b><math>22/\\$14=1.6</math></b>	2	35	17	$17/\$7=2.4$
3	68	21	$21/\$14=1.5$	3	50	15	$15/\$7=2.14$
4	88	20	$20/\$14=1.4$	4	64	14	$14/\$7=2$
5	106	18	$18/\$14=1.3$	5	77	13	$13/\$7=1.9$
6	122	16	$16/\$14=1.1$	6	89	12	$12/\$7=1.7$
7	136	14	$14/\$14=1$	<b>7</b>	<b>100</b>	<b>11</b>	<b><math>11/\\$7=1.6</math></b>
8	148	12	$12/\$14=1.2$	8	101	10	$10/\$7=1.4$

leads to greater total utility—and also the **law of diminishing marginal utility**—additional units increase his utility at a decreasing rate. For example, the first t-shirt Jose picks keeps him from being exposed to the elements and it gives him an addition of 22 utils. The fourth t-shirt is just to something to wear when all his other clothes are in the wash and yields only 18 additional utils. The final column shows how much marginal utility Jose receives per dollar spent. The rest of Table 1 shows the quantity of movies that Jose attends, his total and marginal utilities from seeing each movie, and his marginal utility per dollar spent for each number of movies. As with t-shirts, total utility from movies follows the expected pattern: it increases as the number of movies seen rises. Marginal utility also follows the expected pattern: each additional movie brings a smaller gain in utility than the previous one. The first movie Jose attends provides him with the highest level of utility or satisfaction. As he goes to more and more movies, the less he appreciates seeing yet another.

Jose's first purchase will be a movie. Why? Because it gives him the greatest marginal utility per dollar spent and it is affordable given his \$77 income. Now, Jose has \$70 left to spend and will choose a second movie since the second movie offers him more bang-for-the-buck than the first t-shirt. He will continue to purchase the good which gives him the highest marginal utility per dollar spent until he exhausts the budget. After purchasing the fifth movie, which still gives him more marginal utility per dollar spent (1.9 utils/dollar) than the first t-shirt (1.8 utils/dollar), Jose must choose between the sixth movie and the first t-shirt. The first t-shirt is now worth purchasing since it gives him more bang-for-the-buck than the seventh movie. After purchasing the first t-shirt, Jose chooses between the second t-shirt and the seventh movie. As you can see, he receives an equal level of marginal utility per dollar spent and is therefore indifferent between these two goods. Luckily, having purchased six movies for \$7 each and one t-shirt for \$14, he has \$21 left to spend and can just afford both the seventh movie and the second t-shirt (it makes no difference which he consumes first). So Jose will choose to purchase seven movies and two t-shirts.

In the case of Jose, we assumed that he was constrained to buying whole units of movies and t-shirts. In general, economists assume that goods are perfectly divisible so that you can buy any amount of the good you desire, including fractional units. This was true on the budget

line and the indifference curves presented before. While it may seem unrealistic to assume that one could purchase half of a t-shirt or one and two-thirds of a movie, a shift in our interpretation can help to understand this simplifying assumption. Half a t-shirt means that Jose purchases one t-shirt every other month so that he consumes half a t-shirt in an average month. This process of decision making suggests a rule to follow when maximizing utility. If we always spend the next dollar on the good offering the greatest marginal utility per dollar spent, then what must be true when we've exhausted all of our income? The goods must offer the same bang-for-the-buck!

Reverting to generic goods X and Y, if we spend all of our money and find that

$$\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$$

it is not possible that we have maximized our utility. Why? Imagine what would happen if we were to return one dollar's worth of good Y and use that dollar to buy one dollar's worth of good X. Our utility would fall by the bang-for-the-buck of the returned good Y but then it would rise by the bang-for-the-buck of the newly acquired good X. Having risen by more than it fell, our overall utility has increased. Anytime we get different bang-for-the-buck from different goods, we have the opportunity to increase our overall utility by exchanging a small amount of the good offering the lower marginal utility per dollar spent for more of the good with the higher marginal utility per dollar spent. The only time we can't make one of the small utility increasing trades is when the goods offer the same bang-for-the-buck. This is the second condition for utility maximization.

### Utility Maximization Condition 2:

Equate the marginal utility per dollar spent for each good.

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Clearly, the first condition for utility maximization is the same whether we use the indifference curve and budget line approach or we use the bang-for-the-buck approach. Consuming on the budget line is the same thing as spending all income. It turns out that the second conditions are also equivalent. If you multiply both sides of the above bang-for-the-buck condition by  $P_X$  and divide both sides by  $MU_Y$ , you will get the tangency condition from before:

$$\frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

Indeed, this tangency condition holds at Jose's utility maximization condition of two t-shirts and seven movies. He is willing trade two movies for one additional t-shirt:

$$MRS_{M,T} = \frac{MU_T}{MU_M} = \frac{22}{11} = 2$$

which is exactly the opportunity cost of an additional movie:

$$\frac{P_T}{P_M} = \frac{14}{7} = 2$$

## How Changes in Income Affect Consumer Choices

Just as utility and marginal utility can be used to discuss making consumer choices along a budget line, these ideas can also be used to think about how consumers respond when the budget constraint shifts due to a change in income.

Let's return now to Alphonso's choice of how many burgers and bus tickets to buy. Figure 7 adds indifference curves to Figure 2, which showed the effect on Alphonso's budget line of a doubling of his income from \$10 to \$20. When his income is \$10, he maximizes his utility by choosing the point on the budget line (Condition 1) where there is a tangency between the budget line and an indifference curve (Condition 2). At this point he consumes 2 burgers and 12 bus tickets. When his income increases, causing his budget line to shift out parallel to itself, he simply satisfies the same two conditions on his new budget line. In this case, Alphonso increased his consumption of burgers from 4 to 6 and his consumption of bus tickets from 12 to 16. **Normal goods** are defined as those for which consumption increases as income increases and vice versa. Because Alphonso increases his consumption of both goods when his income rises, they are both normal goods.

Figure 7-b shows another possibility. In this case, Alphonso responds to the same increase in income by increasing his consumption of burgers from 2 to 8 but decreasing his consumption of bus tickets from 12 to 8. In this case, bus tickets are an **inferior good** for Alphonso since he reduces his consumption of them as his income rises.

It would also have been possible for the tangency point on the new budget line to be up and to the left of the original utility maximizing combination. In that case, burgers would be an inferior good and bus tickets would be a normal good. Notice that, since more is better, it is not possible for all goods to be inferior—Alphonso must consume more of at least one good when his income rises or he will no longer be consuming at a point on his budget line.

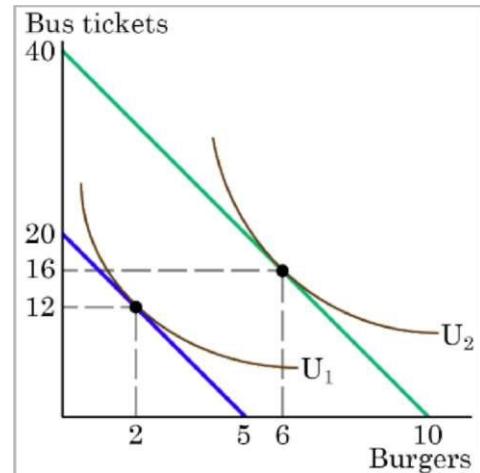


Figure 7-a An increase in

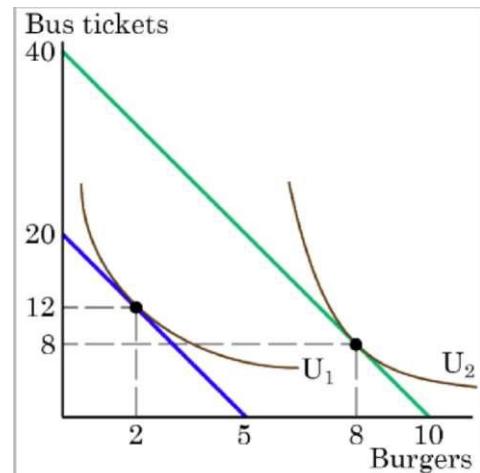


Figure 7-b An increase in income: an inferior good

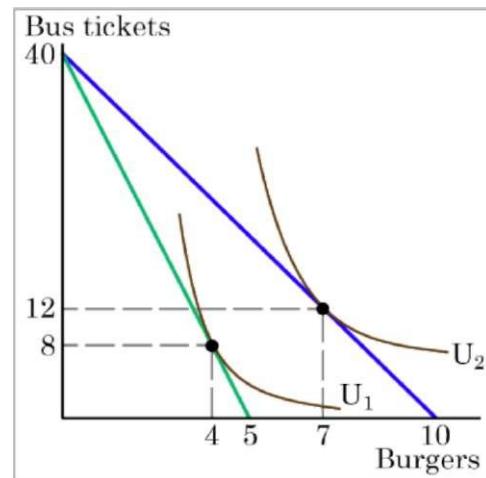
## How Price Changes Affect Consumer Choices

For analyzing the possible effect of a change in price on consumption, let's consider how Alphonso's friend Ray responds to an increase in the price of burgers from \$2 to \$4 while holding the price of bus tickets constant at \$0.50 and holding income constant at \$20. Figure 8 shows the effect this has on Ray's budget line as well as the impact that it has on his utility maximizing choice. As in Section 5.1, the increase in the price of burgers lowers the maximum number of burgers he can afford while leaving the maximum number of bus tickets he can afford unchanged. His budget line becomes steeper as the opportunity cost of a burger ( $P_B/PT$ ) increases from four bus tickets to eight bus tickets and the opportunity cost of a bus ticket ( $PT/P_B$ ) falls from one-fourth of a burger to one-eighth of a burger. Before the price increase, Ray maximizes his utility by consuming 7 burgers and 12 bus tickets (note that Ray has different preferences than Alphonso). When the price of burgers increases, he finds his new utility maximizing combination of 4 burgers and 8 bus tickets.

The typical response to higher prices is that a person chooses to consume less of the product with the higher price. This is the law of demand: as price rises quantity demanded falls, and as price falls quantity demanded rises. In fact, we have just found two points on Ray's demand curve for burgers. By varying the price of burgers while holding all other factors constant, we can map out the entire relationship between the price of burgers and the quantity that Ray would like to consume—the definition of demand. In this case, the increase in the price of burgers caused Ray to also consume fewer bus tickets.

It would be easy to show that, for another set of indifference curves, Ray could just as easily have reduced his consumption of burgers while increasing his consumption of bus tickets. It is also possible that Ray could have increased his consumption of burgers when the price of burgers increased. This would represent a violation of the law of demand. Goods that violate the law of demand, known as **Giffen goods**, are theoretically possible given the limited assumptions we have made about preferences. In practice, it is exceedingly difficult to find a solid real world example of a Giffen good. It is therefore left to the reader to ponder their existence. We will take a closer look at the effects of a price change in Section 5.4.

The key takeaway from this analysis is that it would be imprudent to assume that a change in the price of a good will only affect the good whose price is changed, while the quantity consumed of other goods remains the same. Since Ray purchases all his products out of the same budget, a change in the price of burgers can also have a range of effects, either positive or negative, on the quantity of other goods consumed. In short, a higher price typically reduces the quantity demanded of the good in question, but it can affect the demand for other goods as well.



**Figure 8 An increase in the price of burgers**

## Measuring Utility with Numbers

This discussion of utility started off with an assumption that it is possible to place numerical values on utility, an assumption that may seem questionable. You can buy a thermometer for measuring temperature at the hardware store, but what store sells an "utiliometer" for measuring utility? However, while measuring utility with numbers is a convenient assumption to clarify the explanation, the key assumption is not that utility can be measured by an outside party, but only that individuals can decide which of two alternatives they prefer.

To understand this point, think back to the step-by-step process of finding the choice with highest total utility by comparing the marginal utility that is gained and lost from different combinations of t-shirts and movies. When Jose decides what to buy next, what matters is not the specific numbers that he places on his utility—or whether he uses any numbers at all—but only that he personally can identify which choices he prefers.

In this way, the step-by-step process of choosing the highest level of utility resembles rather closely how many people make consumption decisions. We think about what will make us the happiest; we think about what things cost; we think about buying a little more of one item and giving up a little of something else; we choose what provides us with the greatest level of satisfaction. The vocabulary of comparing the alternatives using prices and marginal utilities is just a set of tools for discussing this everyday process in a clear and specific manner. It is welcome news that specific utility numbers are not central to the argument, since a good utiliometer is hard to find. Do not worry—while we cannot measure utils, we can transform our analysis into something we can measure—demand.

## Consumer Choice and Sunk Costs

As we could see in Chapter 1, economic decisions are made at the margin. This, of course, includes consumers' choices. Rational consumer do not look back to past choices. That is, **sunk costs**, which are costs that were incurred in the past and cannot be recovered, should not affect the current decision.

For example, consider the case of Selena, who pays \$8 to see a movie, but after watching the film for 30 minutes, she knows that it is truly terrible. Should she stay and watch the rest of the movie because she paid for the ticket, or should she leave? The money she spent is a sunk cost, and unless the theater manager is feeling kindly, Selena will not get a refund. But staying in the movie still means paying an opportunity cost in time. Her choice is whether to spend the next 90 minutes suffering through a cinematic disaster or to do something else. The lesson here again is that sunk costs should not influence your decisions. Forget about the money and time that is irretrievably gone and instead focus on the marginal costs and benefits of current and future options.

## From a Model with Two Goods to One of Many Goods

The budget set and indifference curves presented above, like most models used in this course, is not realistic. After all, in a modern economy people choose from thousands of goods. However, thinking about a model with many goods is a straightforward extension of what we discussed here. Instead of drawing just one budget constraint, showing the tradeoff between two goods, you can draw multiple budget constraints, showing the possible tradeoffs between

many different pairs of goods. In more advanced courses in economics you would use mathematical equations that include many possible goods and services that can be purchased, with their quantities and prices, and show how the total spending on all goods and services is limited to the overall budget available. The graph with two goods that was presented here clearly illustrates that every choice has an opportunity cost, which is the point that does carry over to the real world.

## 5.4 The Two Effects of a Price Change

As we have already seen in Figure 8, an increase in a good's price has two impacts on the budget set. First, the slope of the budget line increases—this represents an increase in the opportunity cost of that good and a decrease in the opportunity cost of the other good. At the same time, a portion of the overall budget set is lost—this represents a decrease in the purchasing power of the consumer's income. Conversely, a lower price for a good will lower that good's opportunity cost while raising the other good's opportunity cost and it will also increase the purchasing power of the consumer's income. We can explore the change in quantity demanded due to a price change in more detail by examining these changes separately. The **substitution effect** of a price change is caused by the change in relative prices (i.e., the slope of the budget line), holding purchasing power constant. The **income effect** of a price change is caused by the change in purchasing power, holding relative prices constant. The actual change in consumption due to a price change is a combination of these two effects, which depend on personal preferences.

If, for example, Rebecca goes to the store searching for broccoli and carrots to have with her dinner and finds that the price of broccoli has increased, she will likely reduce the amount of broccoli she buys. Partly, this is because she substitutes away from the now relatively expensive broccoli towards additional carrots, which have become relatively cheap. This is the substitution effect. At the same time, the increase in the price of broccoli has reduced Rebecca's overall set of affordable options—her budget set—making her feel less wealthy. The decrease in her purchasing power will cause Rebecca to buy less broccoli if broccoli is a normal good but will cause her to increase her broccoli consumption if broccoli is an inferior good. This is the income effect. It is important to note that we are not talking about an actual change in her income but rather a change in the purchasing power of her income. In a sense, an increase in price is "like" a decrease in income since they both reduce the consumer's purchasing power—making the consumer feel less wealthy. It might be more accurate to call the "income effect" a "purchasing power effect," but the "income effect" terminology has been used for decades, and it is not going to change during this course.

Notice that income and substitution effects work together (i.e., in the same direction) for normal goods. If the price of a normal good rises, the consumer substitutes away from that good towards another relatively cheap good. At the same time, the consumer feels less wealthy and therefore further reduces their consumption of the good. For normal goods, the income and substitution effects will both lead the consumer to buy less of the good when its price increases and will both lead the consumer to buy more of the good if its price falls. With inferior goods, the income and substitution effects work in opposite directions. When the price of an inferior good rises, the substitution effect still leads the consumer to substitute away from that good towards other goods that have become relatively cheap. The income effect, however, causes the consumer to increase their consumption since they now feel less wealthy because of the price increase. So the substitution effect always works in the opposite direction

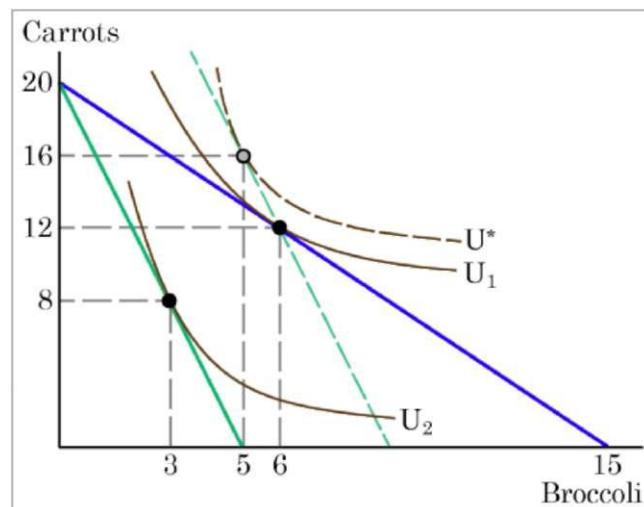
of the price change but the income effect can go in either direction depending on the type of good.

Income and substitution effects can tell us more about the possibility of Giffen goods, which were introduced in the previous section. A Giffen good violates the law of demand so that a price increase actually causes the consumer to buy more of the good. The hard part about finding an example of a Giffen good is making sure that an observed increase in quantity demanded is due to the price increased and not because some other influence on quantity demanded has changed. When we see people buying more bottled water at higher prices after a hurricane, for example, it is not the higher price that causes them to buy more but rather the preference for bottled water when other sources of water become unavailable. Likewise, when we buy more of a stock or collectible upon seeing its price rise we do not do so because the price went up but rather because we expect it to continue rising. In either of these examples, we have an outward shift in the entire demand curve rather than a demand curve with a positive slope. So what would it take to have a Giffen good? Since the substitution effect will always tell us to buy less of the good as price increases, Giffen goods must also be inferior goods. That is, the income effect must tell us to buy more of the good when its price rises. Not only must the good be inferior, the income effect must dominate the substitution effect so that the overall impact of a price change is that the consumer purchases more of the good. Normally, however, we expect the substitution effect to be stronger than the income effect.

Using indifference curves, we can illustrate the substitution and income effects graphically. In Figure 9, Rebecca chooses between broccoli and carrots. She originally faces the flatter blue budget line and maximizes her utility by purchasing 6 crowns of broccoli and 12 carrots.

When the price of broccoli increases, Rebecca's budget line rotates clockwise about the vertical axis to the new steeper green budget line, so Rebecca's budget line becomes steeper and she also loses a large portion of her budget set. Faced with the new higher price of broccoli, Rebecca now maximizes her utility by choosing 3 crowns of broccoli and 8 carrots. The 3 crown decrease in broccoli purchases is due to the combination of the substitution effect and the income effect.

To separate the substitution effect from the income effect, we ask the following hypothetical question: How would Rebecca change her consumption if the relative prices of the two goods changed but this change in relative prices did not affect her purchasing power? The dashed green line in Figure 9 is an imaginary budget line that provides the answer to this question. The imaginary budget line is parallel with the new budget line, so it reflects



**Figure 9 The substitution effect and the income effect**

the new relative prices, but it passes through Rebecca's original choice of 6 crowns of broccoli and 12 carrots, so it reflects the original level of purchasing power.

If faced with this imaginary budget line, Rebecca can still just afford the original combination if she wants but, as we can see, the imaginary budget line actually allows her to reach the higher indifference curve ( $U^*$ ) by substituting away from broccoli towards more carrots. This movement from the original utility maximizing combination (6 crowns of broccoli and 12 carrots) to the utility maximizing combination on the imaginary budget line (5 crowns of broccoli and 16 carrots) is the substitution effect. That is, if we change the relative price of broccoli while holding Rebecca's purchasing power constant, she will reduce her consumption of broccoli from 6 crowns to 5 crowns and increase her consumption of carrots from 12 to 16.

The income effect tells us the portion of the overall decrease in broccoli consumption that is due to Rebecca's loss of purchasing power. The movement from the imaginary dashed budget line to the new budget line is a parallel inward shift. This is exactly the effect that a decrease in income would have on the budget line, and the change in consumption associated with this shift is the income effect. In Figure 9 the income effect causes Rebecca to reduce her consumption from 5 crowns to 3 crowns—a 2 broccoli crown decrease due to the income effect. Since the income effect causes her to buy less when price rises, broccoli is a normal good for Rebecca. The parallel inward shift from the imaginary budget line to the new budget line also allows us to determine that carrots are a normal good for Rebecca since she reduces her consumption of them (from 16 to 8) when the budget line shifts in this way.

Now, put the substitution and income effects together. When the price of broccoli increased, Rebecca consumed 3 fewer crowns of it for two reasons: the substitution effect of the higher price causes her to consume 1 crown less and the income effect causes her to consume 2 crowns less. While the substitution effect alone would have caused her to increase her carrot consumption by 4, it is overpowered by the income effect, which leads her to consume 8 carrots less, so she ends up consuming  $8 - 4 = 4$  carrots less. Thus an increase in the price of broccoli causes Rebecca to consume less of both goods.

The size of these income and substitution effects will differ from person to person, depending on individual preferences. Typically, we expect the substitution effect to be stronger than the income effect but this is not always the case. For example, in the winter months of 2005, costs for heating homes increased significantly in many parts of the country as prices for natural gas and electricity soared, due in large part to the disruption caused by Hurricanes Katrina and Rita. Some people reacted by reducing the quantity demanded of energy; for example, by turning down the thermostats in their homes by a few degrees and wearing a heavier sweater inside. Even so, many home heating bills rose, causing a significant decrease in consumers' purchasing power. This large income effect reduced not only consumers' ability to afford natural gas or electricity but their ability to afford all goods.

A similar issue arises when the government imposes taxes on certain products, like it does on gasoline, cigarettes, and alcohol. Say that a tax on alcohol leads to a higher price at the liquor store, the higher price of alcohol causes the budget constraint to pivot left, and consumption of alcoholic beverages is likely to decrease. However, some people may have a relatively small substitution effect and respond mostly by cutting back on other purchases. If part of the goal of a tax is to alter consumers' behavior, it is important to be aware that a small substitution effect and a large income effect may lead to unintended consequences. If, however, the main goal of a tax is to raise revenue, then the government should seek out

goods for which the substitution effect is small in order to minimize the distortionary effects of the tax.

The consumer choice model serves as a constant reminder to think about the full range of effects that can arise from changes in income or price, not just effects on the one product that might seem most immediately affected. Finally, although the substitution and income effects are often discussed as a sequence of events, it should be remembered that they are twin components of a single cause—a change in price. Although you can analyze them separately, the two effects are always proceeding hand in hand, happening at the same time.

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## The Economics of Gift Giving: May All Your Sweaters Be Ugly and Bright

Economists generally view gift giving as inefficient reallocation of goods resulting in a loss of their value to consumers. Joel Waldfogel, a University of Minnesota economics professor, even published a book called "Scroogenomics: Why You Shouldn't Buy Presents for the Holidays." We'll use the model of consumer choice discussed in this chapter to see where the value loss comes from. Our analysis here applies to person-to-person gifts as well as in-kind government transfers of, say, housing or food. In either case, the effect on the recipient's

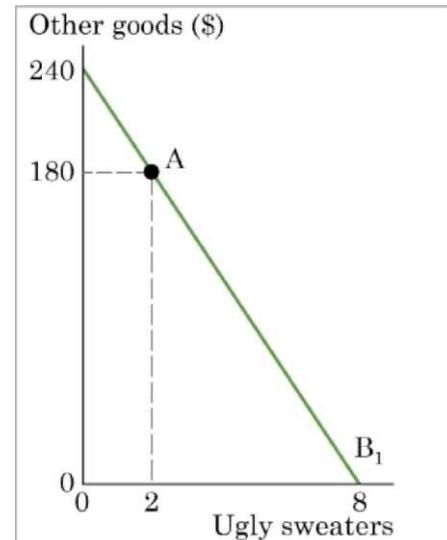
budget set is different from that of an equivalent increase in his/her income, e.g., a cash gift of the same value.

Let's consider Mary's holiday party budget. Each year, Mary is invited to a series of holiday parties where it is customary to wear the ugliest holiday sweater one can find. She has budgeted \$240 per year to spend on ugly sweaters and other items to take to the parties. Mary's problem is to choose the best (i.e., utility maximizing) combination of ugly sweaters and other goods to buy. The "other goods" in this example represents spending on all other items and therefore has a price of \$1 (a dollar of other goods costs exactly one dollar). If an ugly sweater costs \$30 and Mary has \$240 to spend on ugly sweaters and other goods, her budget line is B<sub>1</sub> in Figure 10-a.

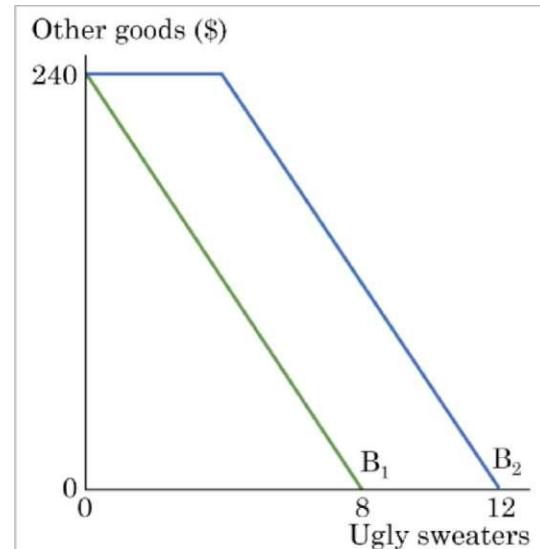
If Mary spends all of her income on other goods, she can afford 240 units (dollars' worth). If, instead, she spends all of her money on ugly sweaters, she could afford 8 sweaters. The opportunity cost of an ugly sweater is the price of an ugly sweater divided by the price of other goods:  $\$30/\$1 = 30$ . That is, \$30 worth of other goods is given up each time Mary buys an ugly sweater. For example, if Mary buys 2 ugly sweaters, she gives up  $\$30 \times 2 = \$60$  worth of other goods and has  $\$240 - \$60 = \$180$  left to spend on them, i.e. she consumes at point A on her budget line.

What will happen to Mary's budget constraint if she receives ugly sweaters as a gift? If Mary spends all of her income on other goods, she can still afford only \$240 worth of those goods (plus the gifted ugly sweaters), but if she spends all of her money on ugly sweaters she will now have 8 of them plus the number gifted. For example, suppose Mary gets a gift of four ugly sweaters. The effect of this gift on her budget line is shown in Figure 10-b. The budget line shifts rightward by the value of the four sweaters ( $\$4 \times 30 = \$120$ ) so that the new budget line (B<sub>2</sub>) is parallel to the original budget line (B<sub>1</sub>), much like it would be if Mary's income increased by \$120, except that points with more than \$240 worth of other goods are not part of her new budget set.

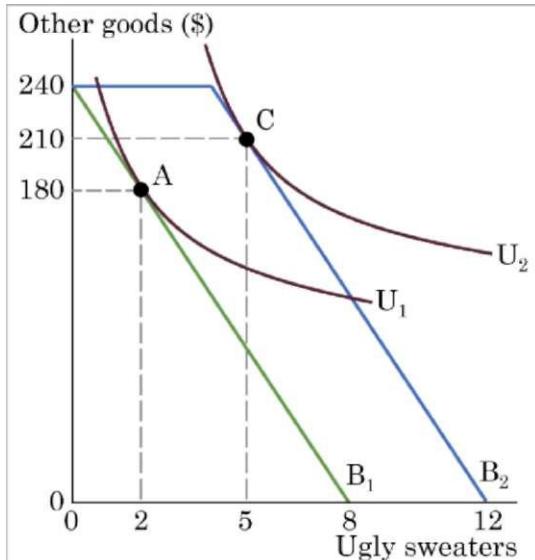
Will this gift of four sweaters give Mary the same additional benefits as its cash equivalent would? Figure 10-c shows this possibility. Suppose that with no gift, Mary maximized her utility, i.e. reached her highest indifference curve (U<sub>1</sub>) when consuming 2 ugly sweaters and \$180 worth of other goods (point A). When her budget line shifts, whether as a result of the gift or an equivalent increase in income, she gets maximum utility when consuming 5 sweaters



**Figure 10-a Mary's budget line with no gift**



**Figure 10-b Mary's budget line with a gift of four ugly sweaters (B2)**

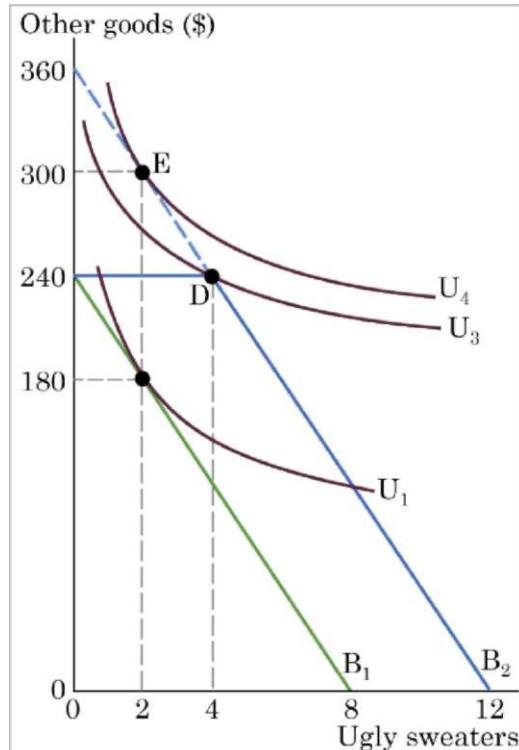


**Figure 10-c A gift of four ugly sweaters raises Mary's utility to the same level as additional benefits as its cash equivalent would**

and \$210 worth of other goods (point C). That is, with the new budget constraint, Mary buys only one sweater instead of two and spends the \$30 freed up as a result to buy an extra \$30 worth of other goods. Exactly the same would happen if Mary's income increased by \$30 due to a cash gift or something else. In each case Mary would receive the same utility gain, i.e. get on the same higher indifference curve, U2.

But what if with her new budget line (B2) Mary's utility maximizing choice is only four ugly sweaters? This situation is depicted in Figure 10-d. The highest indifference curve Mary can reach is U3, at point D, where she consumes the four ugly sweaters given to her as a gift and buys no more sweaters, spending all her \$240 budget on other goods. Now suppose that instead of the ugly sweaters, Mary is given \$120 in cash. In that case, her budget line would not kink at \$240, but would continue as a straight line until it intersects with the vertical axis at \$360, reflecting that with the additional \$120, Mary could spend \$240 + \$120 = \$360 on other goods if she does not buy any ugly sweaters. As shown in Figure 10-d, Mary can now reach a higher indifference curve, U4, consuming 2 ugly sweaters and \$300 worth of other goods (point E). Thus, when given ugly sweaters in kind, Mary is more constrained in her choice, which forces her to a lower level of utility than she could reach when given the equivalent amount of cash.

Note that beyond the possibility for Mary to lose utility because of her getting more sweaters than she would like, there is a good chance that the person who gives her that gift won't pick out the same ugly sweaters that Mary would have chosen for herself. In that case, Mary would probably go to the store and exchange the sweaters, which would cost her time and energy. This will result in more utility loss for her.



**Figure 10-d Mary's utility gain from a gift of four ugly sweaters compared with that from the equivalent amount of cash**

The problem in our example may seem rather trivial. After all, ugly sweaters are not that important in the big picture, and Mary could probably receive some additional utility from donating the sweaters to someone who could use them (although probably less than she would have received from the cash value of the sweaters). However, empirical economic studies show that utility losses from gift giving are generally quite substantial. Recipients value various gifts from holiday catalogs from 72% to 92% of the amount spent on them (depending on the kind of goods gifted and, remarkably, the value loss is highest for Christmas presents from grandparents).<sup>1</sup>

Furthermore, the same economic reasoning applies to in-kind government transfers, such as the federally-funded Supplemental Nutrition Assistance Program (SNAP). The idea is to give people aid that allows them to get enough food to meet basic nutritional needs. And it looks appealing because these benefits cannot be directly used to buy socially undesirable goods, such as alcohol or illegal drugs. However, like Mary with her ugly sweaters, recipients of these government transfers can simply reduce their expenditures on food by the amount of the assistance and spend their own money on other goods to maximize their utility. If the assistance is worth more than its recipients would have spent on food, then it is possible that they will get more nutrition. But it is also possible that they trade their benefits for a smaller amount of cash to spend on other goods.

<sup>1</sup> See "Economists Say 'Bah! Humbug!' to Christmas Presents." By Josh Zumbrun. The Wall Street Journal, December 23, 2015.