CHAPTER 2

Thinking Like an Economist

Every field of study has its own language and its own way of thinking. Mathematicians talk about axioms, integrals, and vector spaces. Psychologists talk about ego, id, and cognitive dissonance. Lawyers talk about venue, torts, and promissory estoppel.

Economics is no different. Supply, demand, elasticity, comparative advantage, consumer surplus, deadweight loss—these terms are part of the economist's language. In the coming chapters, you will encounter many new terms and some familiar words that economists use in specialized ways. At first, this new language may seem needlessly arcane. But as you will see, its value lies in its ability to provide you with a new and useful way of thinking about the world in which you live.

The purpose of this book is to help you learn the economist's way of thinking. Just as you cannot become a mathematician, psychologist, or lawyer overnight, learning to think like an economist will take some time. Yet with

a combination of theory, case studies, and examples of economics in the news, this book will give you ample opportunity to develop and practice this skill.

Before delving into the substance and details of economics, it is helpful to have an overview of how economists approach the world. This chapter discusses the field's methodology. What is distinctive about how economists confront a question? What does it mean to think like an economist?

2-1 The Economist as Scientist

Economists try to address their subject with a scientist's objectivity. They approach the study of the economy in much the same way a physicist approaches the study of matter and a biologist approaches the study of life: They devise theories, collect data, and then analyze these data in an attempt to verify or refute their theories.

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"I'm a social scientist, Michael. That means I can't explain electricity or anything like that, but if you ever want to know about people, I'm your man."

To beginners, the claim that economics is a science can seem odd. After all, economists do not work with test tubes or telescopes. The essence of science, however, is the *scientific method*—the dispassionate development and testing of theories about how the world works. This method of inquiry is as applicable to studying a nation's economy as it is to studying the earth's gravity or a species' evolution. As Albert Einstein once put it, "The whole of science is nothing more than the refinement of everyday thinking."

Although Einstein's comment is as true for social sciences such as economics as it is for natural sciences such as physics, most people are not accustomed to looking at society through a scientific lens. Let's discuss some of the ways in which economists apply the logic of science to examine how an economy works.

2-1a The Scientific Method: Observation, Theory, and More Observation

Isaac Newton, the famous 17th-century scientist and mathematician, allegedly became intrigued one day when he saw an apple fall from a tree. This observation motivated Newton to develop a theory of gravity that applies not only to an apple falling to the earth but to any two objects in the universe. Subsequent testing of Newton's theory has shown that it works well in many circumstances (although, as Einstein would later emphasize, not in all circumstances). Because Newton's theory has been so successful at explaining observation, it is still taught in undergraduate physics courses around the world.

This interplay between theory and observation also occurs in economics. An economist might live in a country experiencing rapidly increasing prices and be moved by this observation to develop a theory of inflation. The theory might assert that high inflation arises when the government prints too much money. To test this theory, the economist could collect and analyze data on prices and money from many different countries. If growth in the quantity of money were completely unrelated to the rate of price increase, the economist would start to doubt the validity of this theory of inflation. If money growth and inflation were strongly correlated in international data, as in fact they are, the economist would become more confident in the theory.

Although economists use theory and observation like other scientists, they face an obstacle that makes their task especially challenging: In economics, conducting experiments is often impractical. Physicists studying gravity can drop many objects in their laboratories to generate data to test their theories. By contrast, economists studying inflation are not allowed to manipulate a nation's monetary policy simply to generate useful data. Economists, like astronomers and evolutionary biologists, usually have to make do with whatever data the world happens to give them.

To find a substitute for laboratory experiments, economists pay close attention to the natural experiments offered by history. When a war in the Middle East interrupts the flow of crude oil, for instance, oil prices skyrocket around the world. For consumers of oil and oil products, such an event depresses living standards. For economic policymakers, it poses a difficult choice about how best to respond. But for economic scientists, the event provides an opportunity to study the effects of a key natural resource on the world's economies. Throughout this book, therefore, we consider many historical episodes. These episodes are valuable to study because they give us insight into the economy of the past and, more important, because they allow us to illustrate and evaluate economic theories of the present.

2-1b The Role of Assumptions

If you ask a physicist how long it would take a marble to fall from the top of a ten-story building, he will likely answer the question by assuming that the marble falls in a vacuum. Of course, this assumption is false. In fact, the building is surrounded by air, which exerts friction on the falling marble and slows it down. Yet the physicist will point out that the friction on the marble is so small that its effect is negligible. Assuming the marble falls in a vacuum simplifies the problem without substantially affecting the answer.

Economists make assumptions for the same reason: Assumptions can simplify the complex world and make it easier to understand. To study the effects of international trade, for example, we might assume that the world consists of only two countries and that each country produces only two goods. In reality, there are numerous countries, each of which produces thousands of different types of goods. But by considering a world with only two countries and two goods, we can focus our thinking on the essence of the problem. Once we understand international trade in this simplified imaginary world, we are in a better position to understand international trade in the more complex world in which we live.

The art in scientific thinking—whether in physics, biology, or economics—is deciding which assumptions to make. Suppose, for instance, that instead of dropping a marble from the top of the building, we were dropping a beach ball of the same weight. Our physicist would realize that the assumption of no friction is less accurate in this case: Friction exerts a greater force on a beach ball than on a marble because a beach ball is much larger. The assumption that gravity works in a vacuum is reasonable for studying a falling marble but not for studying a falling beach ball.

Similarly, economists use different assumptions to answer different questions. Suppose that we want to study what happens to the economy when the government changes the number of dollars in circulation. An important piece of this analysis, it turns out, is how prices respond. Many prices in the economy change infrequently; the newsstand prices of magazines, for instance, change only once every few years. Knowing this fact may lead us to make different assumptions when studying the effects of the policy change over different time horizons. For studying the short-run effects of the policy, we may assume that prices do not change much. We may even make the extreme and artificial assumption that all prices are completely fixed. For studying the long-run effects of the policy, however, we may assume that all prices are completely flexible. Just as a physicist uses different assumptions when studying falling marbles and falling beach balls, economists use different assumptions when studying the short-run and long-run effects of a change in the quantity of money.

2-1c Economic Models

High school biology teachers teach basic anatomy with plastic replicas of the human body. These models have all the major organs—the heart, the liver, the kidneys, and so on—which allow teachers to show their students very simply how the important parts of the body fit together. Because these plastic models are stylized and omit many details, no one would mistake one of them for a real person. Despite this lack of realism—indeed, because of this lack of realism—studying these models is useful for learning how the human body works.

Economists also use models to learn about the world, but unlike plastic manikins, their models mostly consist of diagrams and equations. Like a biology teacher's plastic model, economic models omit many details to allow us to see what is truly important. Just as the biology teacher's model does not include all the body's muscles and capillaries, an economist's model does not include every feature of the economy.

As we use models to examine various economic issues throughout this book, you will see that all the models are built with assumptions. Just as a physicist begins the analysis of a falling marble by assuming away the existence of friction, economists assume away many of the details of the economy that are irrelevant for studying the question at hand. All models—in physics, biology, and economics—simplify reality to improve our understanding of it.

2-1d Our First Model: The Circular-Flow Diagram

The economy consists of millions of people engaged in many activities—buying, selling, working, hiring, manufacturing, and so on. To understand how the economy works, we must find some way to simplify our thinking about all these activities. In other words, we need a model that explains, in general terms, how the economy is organized and how participants in the economy interact with one another.

circular-flow diagram
a visual model of the economy that shows how dollars flow through markets among households and firms

Figure 1 presents a visual model of the economy called a **circular-flow diagram**. In this model, the economy is simplified to include only two types of decision makers—firms and households. Firms produce goods and services using inputs, such as labor, land, and capital (buildings and machines). These inputs are called the *factors of production*. Households own the factors of production and consume all the goods and services that the firms produce.

Households and firms interact in two types of markets. In the *markets for goods and services*, households are buyers, and firms are sellers. In particular, households buy the output of goods and services that firms produce. In the *markets for the factors of production*, households are sellers, and firms are buyers. In these markets, households provide the inputs that firms use to produce goods and services. The circular-flow diagram offers a simple way of organizing the economic transactions that occur between households and firms in the economy.

The two loops of the circular-flow diagram are distinct but related. The inner loop represents the flows of inputs and outputs. The households sell the use of their labor, land, and capital to the firms in the markets for the factors of

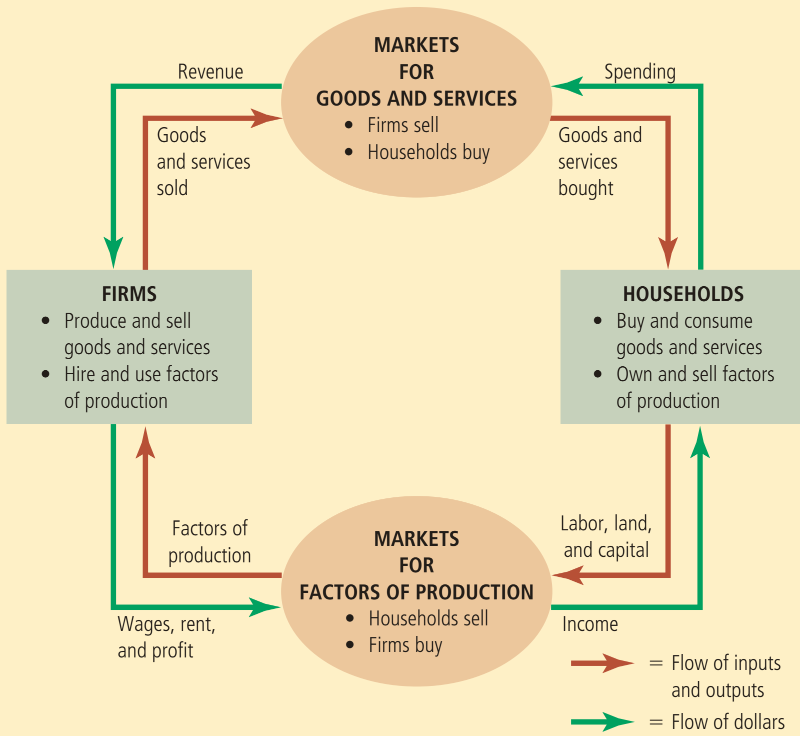


FIGURE 1

The Circular Flow

This diagram is a schematic representation of the organization of the economy. Decisions are made by households and firms. Households and firms interact in the markets for goods and services (where households are buyers and firms are sellers) and in the markets for the factors of production (where firms are buyers and households are sellers). The outer set of arrows shows the flow of dollars, and the inner set of arrows shows the corresponding flow of inputs and outputs.

production. The firms then use these factors to produce goods and services, which in turn are sold to households in the markets for goods and services. The outer loop of the diagram represents the corresponding flow of dollars. The households spend money to buy goods and services from the firms. The firms use some of the revenue from these sales to pay for the factors of production, such as the wages of their workers. What's left is the profit of the firm owners, who themselves are members of households.

Let's take a tour of the circular flow by following a dollar bill as it makes its way from person to person through the economy. Imagine that the dollar begins at a household, say, in your wallet. If you want to buy a cup of coffee, you take the dollar to one of the economy's markets for goods and services, such as your local Starbucks coffee shop. There, you spend it on your favorite drink. When the dollar moves into the Starbucks cash register, it becomes revenue for the firm. The dollar doesn't stay at Starbucks for long, however, because the firm uses it to buy inputs in the markets for the factors of production. Starbucks might use the dollar to pay rent to its landlord for the space it occupies or to pay the wages of its workers. In either case, the dollar enters the income of some household and, once again, is back in someone's wallet. At that point, the story of the economy's circular flow starts once again.

The circular-flow diagram in Figure 1 is a very simple model of the economy. It dispenses with details that, for some purposes, are significant. A more complex and realistic circular-flow model would include, for instance, the roles of government and international trade. (A portion of that dollar you gave to Starbucks might be used to pay taxes or to buy coffee beans from a farmer in Brazil.) Yet these details are not crucial for a basic understanding of how the economy is organized. Because of its simplicity, this circular-flow diagram is useful to keep in mind when thinking about how the pieces of the economy fit together.

2-1e Our Second Model: The Production Possibilities Frontier

Most economic models, unlike the circular-flow diagram, are built using the tools of mathematics. Here we use one of the simplest such models, called the production possibilities frontier, to illustrate some basic economic ideas.

production possibilities frontier
a graph that shows the combinations of output that the economy can possibly produce given the available factors of production and the available production technology

Although real economies produce thousands of goods and services, let's consider an economy that produces only two goods—cars and computers. Together, the car industry and the computer industry use all of the economy's factors of production. The **production possibilities frontier** is a graph that shows the various combinations of output—in this case, cars and computers—that the economy can possibly produce given the available factors of production and the available production technology that firms use to turn these factors into output.

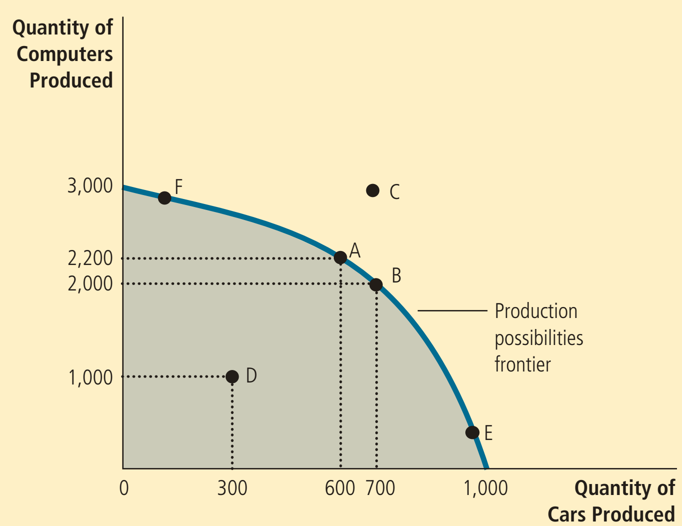
Figure 2 shows this economy's production possibilities frontier. If the economy uses all its resources in the car industry, it produces 1,000 cars and no computers. If it uses all its resources in the computer industry, it produces 3,000 computers and no cars. The two endpoints of the production possibilities frontier represent these extreme possibilities.

More likely, the economy divides its resources between the two industries, producing some cars and some computers. For example, it can produce 600 cars and 2,200 computers, as shown in Figure 2 by point A. Or, by moving some of the factors of production to the car industry from the computer industry, the economy can produce 700 cars and 2,000 computers, represented by point B.

FIGURE 2

The Production Possibilities Frontier

The production possibilities frontier shows the combinations of output—in this case, cars and computers—that the economy can possibly produce. The economy can produce any combination on or inside the frontier. Points outside the frontier are not feasible given the economy's resources. The slope of the production possibilities frontier measures the opportunity cost of a car in terms of computers. This opportunity cost varies, depending on how much of the two goods the economy is producing.



Because resources are scarce, not every conceivable outcome is feasible. For example, no matter how resources are allocated between the two industries, the economy cannot produce the amount of cars and computers represented by point C. Given the technology available for manufacturing cars and computers, the economy does not have enough of the factors of production to support that level of output. With the resources it has, the economy can produce at any point on or inside the production possibilities frontier, but it cannot produce at points outside the frontier.

An outcome is said to be *efficient* if the economy is getting all it can from the scarce resources it has available. Points on (rather than inside) the production possibilities frontier represent efficient levels of production. When the economy is producing at such a point, say point A, there is no way to produce more of one good without producing less of the other. Point D represents an *inefficient* outcome. For some reason, perhaps widespread unemployment, the economy is producing less than it could from the resources it has available: It is producing only 300 cars and 1,000 computers. If the source of the inefficiency is eliminated, the economy can increase its production of both goods. For example, if the economy moves from point D to point A, its production of cars increases from 300 to 600, and its production of computers increases from 1,000 to 2,200.

One of the *Ten Principles of Economics* discussed in Chapter 1 is that people face trade-offs. The production possibilities frontier shows one trade-off that society faces. Once we have reached an efficient point on the frontier, the only way of producing more of one good is to produce less of the other. When the economy moves from point A to point B, for instance, society produces 100 more cars but at the expense of producing 200 fewer computers.

This trade-off helps us understand another of the *Ten Principles of Economics:* The cost of something is what you give up to get it. This is called the *opportunity cost*. The production possibilities frontier shows the opportunity cost of one good as measured in terms of the other good. When society moves from point A to point B, it gives up 200 computers to get 100 additional cars. That is, at point A, the opportunity cost of 100 cars is 200 computers. Put another way, the opportunity cost of each car is two computers. Notice that the opportunity cost of a car equals the slope of the production possibilities frontier. (If you don't recall what slope is, you can refresh your memory with the graphing appendix to this chapter.)

The opportunity cost of a car in terms of the number of computers is not constant in this economy but depends on how many cars and computers the economy is producing. This is reflected in the shape of the production possibilities frontier. Because the production possibilities frontier in Figure 2 is bowed outward, the opportunity cost of a car is highest when the economy is producing many cars and few computers, such as at point E, where the frontier is steep. When the economy is producing few cars and many computers, such as at point F, the frontier is flatter, and the opportunity cost of a car is lower.

Economists believe that production possibilities frontiers often have this bowed shape. When the economy is using most of its resources to make computers, such as at point F, the resources best suited to car production, such as skilled autoworkers, are being used in the computer industry. Because these workers probably aren't very good at making computers, increasing car production by one unit will cause only a slight reduction in the number of computers produced.

At point F, the opportunity cost of a car in terms of computers is small, and the frontier is relatively flat. By contrast, when the economy is using most of its resources to make cars, such as at point E, the resources best suited to making cars are already at work in the car industry. Producing an additional car means moving some of the best computer technicians out of the computer industry and turning them into autoworkers. As a result, producing an additional car will mean a substantial loss of computer output. The opportunity cost of a car is high, and the frontier is steep.

The production possibilities frontier shows the trade-off between the outputs of different goods at a given time, but the trade-off can change over time. For example, suppose a technological advance in the computer industry raises the number of computers that a worker can produce per week. This advance expands society's set of opportunities. For any given number of cars, the economy can now make more computers. If the economy does not produce any computers, it can still produce 1,000 cars, so one endpoint of the frontier stays the same. But if the economy devotes some of its resources to the computer industry, it will produce more computers from those resources. As a result, the production possibilities frontier shifts outward, as in Figure 3.

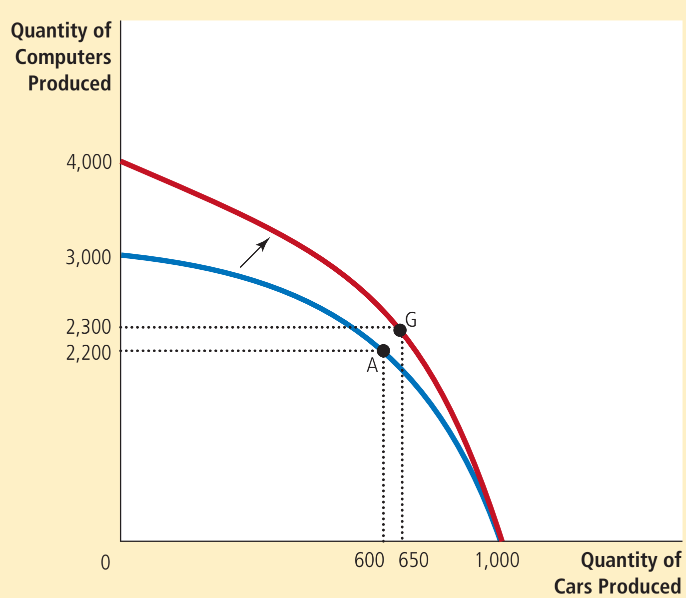
This figure illustrates what happens when an economy grows. Society can move production from a point on the old frontier to a point on the new frontier. Which point it chooses depends on its preferences for the two goods. In this example, society moves from point A to point G, enjoying more computers (2,300 instead of 2,200) and more cars (650 instead of 600).

The production possibilities frontier simplifies a complex economy to highlight some basic but powerful ideas: scarcity, efficiency, trade-offs, opportunity cost, and economic growth. As you study economics, these ideas will recur in various forms. The production possibilities frontier offers one simple way of thinking about them.

FIGURE 3

A Shift in the Production Possibilities Frontier

A technological advance in the computer industry enables the economy to produce more computers for any given number of cars. As a result, the production possibilities frontier shifts outward. If the economy moves from point A to point G, then the production of both cars and computers increases.



2-1f Microeconomics and Macroeconomics

Many subjects are studied on various levels. Consider biology, for example. Molecular biologists study the chemical compounds that make up living things. Cellular biologists study cells, which are made up of many chemical compounds and, at the same time, are themselves the building blocks of living organisms. Evolutionary biologists study the many varieties of animals and plants and how species change gradually over the centuries.

Economics is also studied on various levels. We can study the decisions of individual households and firms. Or we can study the interaction of households and firms in markets for specific goods and services. Or we can study the operation of the economy as a whole, which is the sum of the activities of all these decision makers in all these markets.

The field of economics is traditionally divided into two broad subfields. **Microeconomics** is the study of how households and firms make decisions and how they interact in specific markets. **Macroeconomics** is the study of economy-wide phenomena. A microeconomist might study the effects of rent control on housing in New York City, the impact of foreign competition on the U.S. auto industry, or the effects of compulsory school attendance on workers' earnings. A macroeconomist might study the effects of borrowing by the federal government, the changes over time in the economy's rate of unemployment, or alternative policies to promote growth in national living standards.

microeconomics
the study of how households and firms make decisions and how they interact in markets

macroeconomics
the study of economy-wide phenomena, including inflation, unemployment, and economic growth

Microeconomics and macroeconomics are closely intertwined. Because changes in the overall economy arise from the decisions of millions of individuals, it is impossible to understand macroeconomic developments without considering the associated microeconomic decisions. For example, a macroeconomist might study the effect of a federal income tax cut on the overall production of goods and services. But to analyze this issue, he must consider how the tax cut affects households' decisions about how much to spend on goods and services.

Despite the inherent link between microeconomics and macroeconomics, the two fields are distinct. Because they address different questions, each field has its own set of models, which are often taught in separate courses.

Quick Quiz *In what sense is economics like a science? • Draw a production possibilities frontier for a society that produces food and clothing. Show an efficient point, an inefficient point, and an infeasible point. Show the effects of a drought. • Define* microeconomics *and* macroeconomics.

2-2 The Economist as Policy Adviser

Often, economists are asked to explain the causes of economic events. Why, for example, is unemployment higher for teenagers than for older workers? Sometimes, economists are asked to recommend policies to improve economic outcomes. What, for instance, should the government do to improve the economic well-being of teenagers? When economists are trying to explain the world, they are scientists. When they are trying to help improve it, they are policy advisers.

2-2a Positive versus Normative Analysis

To help clarify the two roles that economists play, let's examine the use of language. Because scientists and policy advisers have different goals, they use language in different ways.

For example, suppose that two people are discussing minimum-wage laws. Here are two statements you might hear:

Polly: Minimum-wage laws cause unemployment.
Norm: The government should raise the minimum wage.

Ignoring for now whether you agree with these statements, notice that Polly and Norm differ in what they are trying to do. Polly is speaking like a scientist: She is making a claim about how the world works. Norm is speaking like a policy adviser: He is making a claim about how he would like to change the world.

positive statements
claims that attempt to describe the world as it is

normative statements
claims that attempt to prescribe how the world should be

In general, statements about the world come in two types. One type, such as Polly's, is positive. **Positive statements** are descriptive. They make a claim about how the world *is*. A second type of statement, such as Norm's, is normative. **Normative statements** are prescriptive. They make a claim about how the world *ought to be*.

A key difference between positive and normative statements is how we judge their validity. We can, in principle, confirm or refute positive statements by examining evidence. An economist might evaluate Polly's statement by analyzing data on changes in minimum wages and changes in unemployment over time. By contrast, evaluating normative statements involves values as well as facts. Norm's statement cannot be judged using data alone. Deciding what is good or bad policy is not just a matter of science. It also involves our views on ethics, religion, and political philosophy.

Positive and normative statements are fundamentally different, but they are often intertwined in a person's set of beliefs. In particular, positive views about how the world works affect normative views about what policies are desirable. Polly's claim that the minimum wage causes unemployment, if true, might lead her to reject Norm's conclusion that the government should raise the minimum wage. Yet normative conclusions cannot come from positive analysis alone; they involve value judgments as well.

As you study economics, keep in mind the distinction between positive and normative statements because it will help you stay focused on the task at hand. Much of economics is positive: It just tries to explain how the economy works. Yet those who use economics often have normative goals: They want to learn how to improve the economy. When you hear economists making normative statements, you know they are speaking not as scientists but as policy advisers.

2-2b Economists in Washington

President Harry Truman once said that he wanted to find a one-armed economist. When he asked his economists for advice, they always answered, "On the one hand, ... On the other hand, ..."

Truman was right in realizing that economists' advice is not always straightforward. This tendency is rooted in one of the *Ten Principles of Economics*: People face trade-offs. Economists are aware that trade-offs are involved in most policy decisions. A policy might increase efficiency at the cost of equality. It might help future generations but hurt current generations. An economist who says that all policy decisions are easy or clear-cut is an economist not to be trusted.

Truman was not the only president who relied on the advice of economists. Since 1946, the president of the United States has received guidance from the Council of Economic Advisers, which consists of three members and a staff of a few dozen economists. The council, whose offices are just a few steps from the White House, has no duty other than to advise the president and to write the annual *Economic Report of the President*, which discusses recent developments in the economy and presents the council's analysis of current policy issues.

The president also receives input from economists in many administrative departments. Economists at the Office of Management and Budget help formulate spending plans and regulatory policies. Economists at the Department of the Treasury help design tax policy. Economists at the Department of Labor analyze data on workers and those looking for work to help formulate labor-market policies. Economists at the Department of Justice help enforce the nation's antitrust laws.

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"Let's switch. I'll make the policy, you implement it, and he'll explain it."

Economists are also found outside the administrative branch of government. To obtain independent evaluations of policy proposals, Congress relies on the advice of the Congressional Budget Office, which is staffed by economists. The Federal Reserve, the institution that sets the nation's monetary policy, employs hundreds of economists to analyze economic developments in the United States and throughout the world.

The influence of economists on policy goes beyond their role as advisers: Their research and writings often affect policy indirectly. Economist John Maynard Keynes offered this observation:

> The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed, the world is ruled by little else. Practical men, who believe themselves to be quite exempt from intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back.

These words were written in 1935, but they remain true today. Indeed, the "academic scribbler" now influencing public policy is often Keynes himself.

2-2c Why Economists' Advice Is Not Always Followed

Any economist who advises presidents or other elected leaders knows that his recommendations are not always heeded. Frustrating as this can be, it is easy to understand. The process by which economic policy is actually made differs in many ways from the idealized policy process assumed in economics textbooks.

Throughout this text, whenever we discuss economic policy, we often focus on one question: What is the best policy for the government to pursue? We act as if policy were set by a benevolent king. Once the king figures out the right policy, he has no trouble putting his ideas into action.

In the real world, figuring out the right policy is only part of a leader's job, sometimes the easiest part. After a president hears from his economic advisers about what policy is best from their perspective, he turns to other advisers for related input. His communications advisers will tell him how best to explain the proposed policy to the public, and they will try to anticipate any misunderstandings that might make the challenge more difficult. His press advisers will tell him how the news media will report on his proposal and what opinions will likely be expressed on the nation's editorial pages. His legislative affairs advisers will tell him how Congress will view the proposal, what amendments members of Congress will suggest, and the likelihood that Congress will pass some version of the president's proposal into law. His political advisers will tell him which groups will organize to support or oppose the proposed policy, how this proposal will affect his standing among different groups in the electorate, and whether it will affect support for any of the president's other policy initiatives. After hearing and weighing all this advice, the president then decides how to proceed.

Making economic policy in a representative democracy is a messy affair—and there are often good reasons why presidents (and other politicians) do not advance the policies that economists advocate. Economists offer crucial input into the policy process, but their advice is only one ingredient of a complex recipe.

Quick Quiz *Give an example of a positive statement and an example of a normative statement that somehow relates to your daily life. • Name three parts of government that regularly rely on advice from economists.*

2-3 Why Economists Disagree

"If all economists were laid end to end, they would not reach a conclusion." This quip from George Bernard Shaw is revealing. Economists as a group are often criticized for giving conflicting advice to policymakers. President Ronald Reagan once joked that if the game Trivial Pursuit were designed for economists, it would have 100 questions and 3,000 answers.

Why do economists so often appear to give conflicting advice to policymakers? There are two basic reasons:

- Economists may disagree about the validity of alternative positive theories about how the world works.
- Economists may have different values and therefore different normative views about what government policy should aim to accomplish.

Let's discuss each of these reasons.

2-3a Differences in Scientific Judgments

Several centuries ago, astronomers debated whether the earth or the sun was at the center of the solar system. More recently, meteorologists have debated whether the earth is experiencing global warming and, if so, why. Science is an ongoing search to understand the world around us. It is not surprising that as the search continues, scientists sometimes disagree about the direction in which truth lies.

Economists often disagree for the same reason. Economics is a young science, and there is still much to be learned. Economists sometimes disagree because they have different hunches about the validity of alternative theories or about the size of important parameters that measure how economic variables are related.

For example, economists disagree about whether the government should tax a household's income or its consumption (spending). Advocates of a switch from the current income tax to a consumption tax believe that the change would encourage households to save more because income that is saved would not be taxed. Higher saving, in turn, would free resources for capital accumulation, leading to more rapid growth in productivity and living standards. Advocates of the current income tax system believe that household saving would not respond much to a change in the tax laws. These two groups of economists hold different normative views about the tax system because they have different positive views about saving's responsiveness to tax incentives.

2-3b Differences in Values

Suppose that Peter and Paula both take the same amount of water from the town well. To pay for maintaining the well, the town taxes its residents. Peter has income of $100,000 and is taxed $10,000, or 10 percent of his income. Paula has income of $20,000 and is taxed $4,000, or 20 percent of her income.

Is this policy fair? If not, who pays too much and who pays too little? Does it matter whether Paula's low income is due to a medical disability or to her decision to pursue an acting career? Does it matter whether Peter's high income is due to a large inheritance or to his willingness to work long hours at a dreary job?

These are difficult questions on which people are likely to disagree. If the town hired two experts to study how the town should tax its residents to pay for the well, we would not be surprised if they offered conflicting advice.

This simple example shows why economists sometimes disagree about public policy. As we know from our discussion of normative and positive analysis, policies cannot be judged on scientific grounds alone. Sometimes, economists give conflicting advice because they have different values. Perfecting the science of economics will not tell us whether Peter or Paula pays too much.

2-3c Perception versus Reality

Because of differences in scientific judgments and differences in values, some disagreement among economists is inevitable. Yet one should not overstate the amount of disagreement. Economists agree with one another to a much greater extent than is sometimes understood.

Table 1 contains twenty propositions about economic policy. In surveys of professional economists, these propositions were endorsed by an overwhelming majority of respondents. Most of these propositions would fail to command a similar consensus among the public.

The first proposition in the table is about rent control, a policy that sets a legal maximum on the amount landlords can charge for their apartments. Almost all economists believe that rent control adversely affects the availability and quality of housing and is a costly way of helping the neediest members of society. Nonetheless, many city governments ignore the advice of economists and place ceilings on the rents that landlords may charge their tenants.

The second proposition in the table concerns tariffs and import quotas, two policies that restrict trade among nations. For reasons we discuss more fully later in this text, almost all economists oppose such barriers to free trade. Nonetheless, over the years, presidents and Congress have chosen to restrict the import of certain goods.

Why do policies such as rent control and trade barriers persist if the experts are united in their opposition? It may be that the realities of the political process stand as immovable obstacles. But it also may be that economists have not yet convinced enough of the public that these policies are undesirable. One purpose of this book is to help you understand the economist's view of these and other subjects and, perhaps, to persuade you that it is the right one.

Quick Quiz *Why might economic advisers to the president disagree about a question of policy?*

TABLE 1

Propositions about Which Most Economists Agree

Proposition (and percentage of economists who agree)

1. A ceiling on rents reduces the quantity and quality of housing available. (93%)
2. Tariffs and import quotas usually reduce general economic welfare. (93%)
3. Flexible and floating exchange rates offer an effective international monetary arrangement. (90%)
4. Fiscal policy (e.g., tax cut and/or government expenditure increase) has a significant stimulative impact on a less than fully employed economy. (90%)
5. The United States should not restrict employers from outsourcing work to foreign countries. (90%)
6. Economic growth in developed countries like the United States leads to greater levels of well-being. (88%)
7. The United States should eliminate agricultural subsidies. (85%)
8. An appropriately designed fiscal policy can increase the long-run rate of capital formation. (85%)
9. Local and state governments should eliminate subsidies to professional sports franchises. (85%)
10. If the federal budget is to be balanced, it should be done over the business cycle rather than yearly. (85%)
11. The gap between Social Security funds and expenditures will become unsustainably large within the next 50 years if current policies remain unchanged. (85%)
12. Cash payments increase the welfare of recipients to a greater degree than do transfers-in-kind of equal cash value. (84%)
13. A large federal budget deficit has an adverse effect on the economy. (83%)
14. The redistribution of income in the United States is a legitimate role for the government. (83%)
15. Inflation is caused primarily by too much growth in the money supply. (83%)
16. The United States should not ban genetically modified crops. (82%)
17. A minimum wage increases unemployment among young and unskilled workers. (79%)
18. The government should restructure the welfare system along the lines of a "negative income tax." (79%)
19. Effluent taxes and marketable pollution permits represent a better approach to pollution control than the imposition of pollution ceilings. (78%)
20. Government subsidies on ethanol in the United States should be reduced or eliminated. (78%)

Source: Richard M. Alston, J. R. Kearl, and Michael B. Vaughn, "Is There Consensus among Economists in the 1990s?" *American Economic Review* (May 1992): 203–209; Dan Fuller and Doris Geide-Stevenson, "Consensus among Economists Revisited," *Journal of Economics Education* (Fall 2003): 369–387; Robert Whaples, "Do Economists Agree on Anything? Yes!" *Economists' Voice* (November 2006): 1–6; Robert Whaples, "The Policy Views of American Economic Association Members: The Results of a New Survey," *Econ Journal Watch* (September 2009): 337–348.

IN THE NEWS

Actual Economists and Virtual Realities

For professional economists, video games may be the next frontier.

The Economics of Video Games

By Brad Plumer

Inflation can be a headache for any central banker. But it takes a certain type of economist to know what to do when a belligerent spaceship fleet attacks an interstellar trading post, causing mineral prices to surge across the galaxy.

Eyjólfur Guðmundsson is just that economist. Working for the Icelandic company CCP Games, he oversees the virtual economy of the massively multiplayer video game Eve Online. Within this world, players build their own spaceships and traverse a galaxy of 7,500 star systems. They buy and sell raw materials, creating their own fluctuating markets. They speculate on commodities. They form trade coalitions and banks.

It's a sprawling economy, with more than 400,000 players participating in its virtual market—more people, in fact, than live in Iceland. Inflation, deflation and even recessions can occur. Which is why, from his office in Reykjavik, Guðmundsson leads a team of eight analysts poring over reams of data to make sure everything in Eve Online is running smoothly. His job bears more than a passing resemblance to that of Ben Bernanke, who oversees the U.S. economy from the Federal Reserve.

"For all intents and purposes, this is an economy that has activity equal to a small country in real life," Guðmundsson says. "There's nothing 'virtual' about this world."

Nowadays, many massively multiplayer online video games have become so complex that game companies are turning to economists for help. Without oversight, the games' economies can go badly awry—as when a gambling ban triggered a virtual bank run in the online world of Second Life in 2007, with one bank alone costing players $750,000 in real-life money.

But there's a flip side, too. Just as video game designers are in dire need of economic advice, many academic economists are keen on studying video games. A virtual world, after all, allows economists to study concepts that rarely occur in real life, such as full-reserve banking, a popular libertarian alternative to the current banking system that cropped up in Eve Online. The data is richer. And it's easier to run economy-wide experiments in a video game—experiments that, for obvious reasons, can't be run on countries.

That ability to experiment on a massive scale, academics say, could revolutionize economics.

"Economic theory has come to a dead end—the last real breakthroughs were in the 1960s," says Yanis Varoufakis, a Greek economist recently hired by the video-game company Valve. "But that's not because we stopped being clever. We came up against a hard barrier. The future is going to be in experimentation and simulation—and video game communities give us a chance to do all that."

At least, that's the dream. The reality, as always, is more complicated. Game companies are often wary of meddling economists trying to conduct experiments that suck the fun out of their virtual worlds. And some academics scoff at the notion that there's anything to learn from universes filled with warlocks and starfleets. Game companies and economists may need each other. Now if only they could learn to share the controller.

In June, Varoufakis announced on his blog that he had been hired as an in-house economist by Valve, the maker of the popular Half-Life games. Varoufakis wasn't an obscure number-cruncher. From his perch at the University of Athens, he had become famous for his trenchant analyses of Greece's debt woes and the euro crisis.

It was clear why Valve was interested. The company oversees a network of games such as Team Fortress 2 that run on its online gaming platform, called Steam.

Valve wanted to link different Steam games together so players could trade virtual items. As Gabe Newell, the chief executive of Valve, explained in an e-mail to Varoufakis: "We are discussing an issue of linking economies in two virtual environments (creating a shared currency), and wrestling with some of the thornier problems of balance of payments."

Whom better to ask, Newell figured, than an expert on the difficulties that Germany and Greece faced after joining the euro?

To date, only two companies—CCP and Valve—have gone so far as to hire in-house economists. But several academics who study virtual worlds say they have consulted with game designers.

"If you're creating a game with 100,000 users, with things that they can buy and sell, you need an economist just to help you tweak that system so that it doesn't spin out of control," says Robert Bloomfield, an economist who studies virtual worlds at Cornell's Johnson School of Management.

Source: *The Washington Post*, September 28, 2012.

2-4 Let's Get Going

The first two chapters of this book have introduced you to the ideas and methods of economics. We are now ready to get to work. In the next chapter, we start learning in more detail the principles of economic behavior and economic policy.

As you proceed through this book, you will be asked to draw on many of your intellectual skills. You might find it helpful to keep in mind some advice from the great economist John Maynard Keynes:

> The study of economics does not seem to require any specialized gifts of an unusually high order. Is it not … a very easy subject compared with the higher branches of philosophy or pure science? An easy subject, at which very few excel! The paradox finds its explanation, perhaps, in that the master-economist must possess a rare *combination* of gifts. He must be mathematician, historian, statesman, philosopher—in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general, and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purposes of the future. No part of man's nature or his institutions must lie entirely outside his regard. He must be purposeful and disinterested in a simultaneous mood; as aloof and incorruptible as an artist, yet sometimes as near the earth as a politician.

This is a tall order. But with practice, you will become more and more accustomed to thinking like an economist.

Summary

- Economists try to address their subject with a scientist's objectivity. Like all scientists, they make appropriate assumptions and build simplified models to understand the world around them. Two simple economic models are the circular-flow diagram and the production possibilities frontier.
- The field of economics is divided into two subfields: microeconomics and macroeconomics. Microeconomists study decision making by households and firms and the interaction among households and firms in the marketplace. Macroeconomists study the forces and trends that affect the economy as a whole.
- A positive statement is an assertion about how the world *is*. A normative statement is an assertion about how the world *ought to be*. When economists make normative statements, they are acting more as policy advisers than as scientists.
- Economists who advise policymakers sometimes offer conflicting advice either because of differences in scientific judgments or because of differences in values. At other times, economists are united in the advice they offer, but policymakers may choose to ignore the advice because of the many forces and constraints imposed by the political process.

Key Concepts

Questions for Review

1. How is economics a science?
2. Why do economists make assumptions?
3. Should an economic model describe reality exactly?
4. Name a way that your family interacts in the factor market and a way that it interacts in the product market.
5. Name one economic interaction that isn't covered by the simplified circular-flow diagram.
6. Draw and explain a production possibilities frontier for an economy that produces milk and cookies. What happens to this frontier if disease kills half of the economy's cows?
7. Use a production possibilities frontier to describe the idea of "efficiency."
8. What are the two subfields into which economics is divided? Explain what each subfield studies.
9. What is the difference between a positive and a normative statement? Give an example of each.
10. Why do economists sometimes offer conflicting advice to policymakers?

Quick Check Multiple Choice

1. An economic model is
   a. a mechanical machine that replicates the functioning of the economy.
   b. a fully detailed, realistic description of the economy.
   c. a simplified representation of some aspect of the economy.
   d. a computer program that predicts the future of the economy.
2. The circular-flow diagram illustrates that, in markets for the factors of production,
   a. households are sellers, and firms are buyers.
   b. households are buyers, and firms are sellers.
   c. households and firms are both buyers.
   d. households and firms are both sellers.
3. A point inside the production possibilities frontier is
   a. efficient, but not feasible.
   b. feasible, but not efficient.
   c. both efficient and feasible.
   d. neither efficient nor feasible.
4. An economy produces hot dogs and hamburgers. If a discovery of the remarkable health benefits of hot dogs were to change consumers' preferences, it would
   a. expand the production possibilities frontier.
   b. contract the production possibilities frontier.
   c. move the economy along the production possibilities frontier.
   d. move the economy inside the production possibilities frontier.
5. All of the following topics fall within the study of microeconomics EXCEPT
   a. the impact of cigarette taxes on the smoking behavior of teenagers.
   b. the role of Microsoft's market power in the pricing of software.
   c. the effectiveness of antipoverty programs in reducing homelessness.
   d. the influence of the government budget deficit on economic growth.
6. Which of the following is a positive, rather than a normative, statement?
   a. Law X will reduce national income.
   b. Law X is a good piece of legislation.
   c. Congress ought to pass law X.
   d. The president should veto law X.

Problems and Applications

1. Draw a circular-flow diagram. Identify the parts of the model that correspond to the flow of goods and services and the flow of dollars for each of the following activities.
   a. Selena pays a storekeeper $1 for a quart of milk.
   b. Stuart earns $4.50 per hour working at a fast-food restaurant.
   c. Shanna spends $30 to get a haircut.
   d. Salma earns $10,000 from her 10 percent ownership of Acme Industrial.
2. Imagine a society that produces military goods and consumer goods, which we'll call "guns" and "butter."
   a. Draw a production possibilities frontier for guns and butter. Using the concept of opportunity cost, explain why it most likely has a bowed-out shape.

b. Show a point that is impossible for the economy to achieve. Show a point that is feasible but inefficient.
c. Imagine that the society has two political parties, called the Hawks (who want a strong military) and the Doves (who want a smaller military). Show a point on your production possibilities frontier that the Hawks might choose and a point that the Doves might choose.
d. Imagine that an aggressive neighboring country reduces the size of its military. As a result, both the Hawks and the Doves reduce their desired production of guns by the same amount. Which party would get the bigger "peace dividend," measured by the increase in butter production? Explain.

3. The first principle of economics discussed in Chapter 1 is that people face trade-offs. Use a production possibilities frontier to illustrate society's trade-off between two "goods"—a clean environment and the quantity of industrial output. What do you suppose determines the shape and position of the frontier? Show what happens to the frontier if engineers develop a new way of producing electricity that emits fewer pollutants.

4. An economy consists of three workers: Larry, Moe, and Curly. Each works 10 hours a day and can produce two services: mowing lawns and washing cars. In an hour, Larry can either mow one lawn or wash one car; Moe can either mow one lawn or wash two cars; and Curly can either mow two lawns or wash one car.
   a. Calculate how much of each service is produced under the following circumstances, which we label A, B, C, and D:
      - All three spend all their time mowing lawns. (A)
      - All three spend all their time washing cars. (B)
      - All three spend half their time on each activity. (C)
      - Larry spends half his time on each activity, while Moe only washes cars and Curly only mows lawns. (D)
   b. Graph the production possibilities frontier for this economy. Using your answers to part (a), identify points A, B, C, and D on your graph.
   c. Explain why the production possibilities frontier has the shape it does.
   d. Are any of the allocations calculated in part (a) inefficient? Explain.

5. Classify the following topics as relating to microeconomics or macroeconomics.
   a. a family's decision about how much income to save
   b. the effect of government regulations on auto emissions
   c. the impact of higher national saving on economic growth
   d. a firm's decision about how many workers to hire
   e. the relationship between the inflation rate and changes in the quantity of money

6. Classify each of the following statements as positive or normative. Explain.
   a. Society faces a short-run trade-off between inflation and unemployment.
   b. A reduction in the rate of money growth will reduce the rate of inflation.
   c. The Federal Reserve should reduce the rate of money growth.
   d. Society ought to require welfare recipients to look for jobs.
   e. Lower tax rates encourage more work and more saving.

Appendix

Graphing: A Brief Review

Many of the concepts that economists study can be expressed with numbers—the price of bananas, the quantity of bananas sold, the cost of growing bananas, and so on. Often, these economic variables are related to one another: When the price of bananas rises, people buy fewer bananas. One way of expressing the relationships among variables is with graphs.

Graphs serve two purposes. First, when developing economic theories, graphs offer a way to visually express ideas that might be less clear if described with equations or words. Second, when analyzing economic data, graphs provide a powerful way of finding and interpreting patterns. Whether we are working with theory or with data, graphs provide a lens through which a recognizable forest emerges from a multitude of trees.

Numerical information can be expressed graphically in many ways, just as there are many ways to express a thought in words. A good writer chooses words that will make an argument clear, a description pleasing, or a scene dramatic. An effective economist chooses the type of graph that best suits the purpose at hand.

In this appendix, we discuss how economists use graphs to study the mathematical relationships among variables. We also discuss some of the pitfalls that can arise in the use of graphical methods.

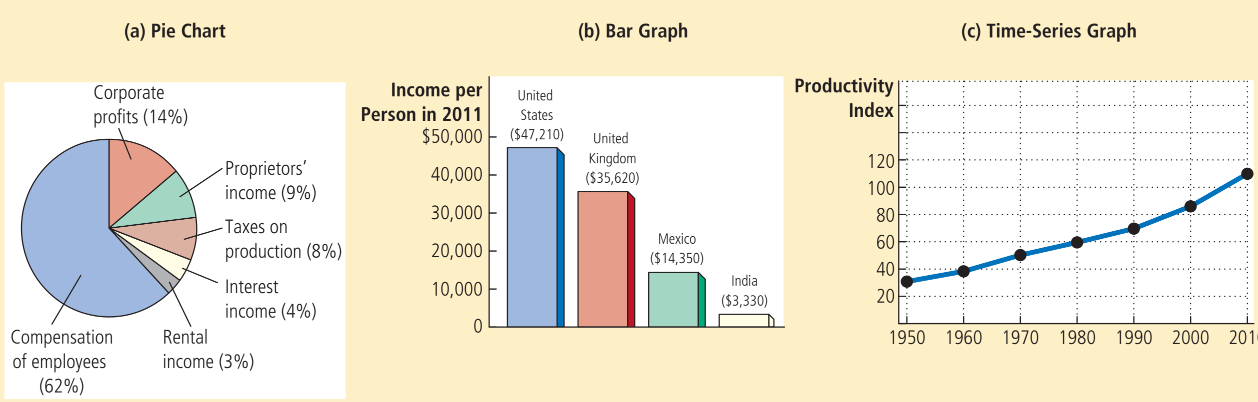
Graphs of a Single Variable

Three common graphs are shown in Figure A-1. The *pie chart* in panel (a) shows how total income in the United States is divided among the sources of income, including compensation of employees, corporate profits, and so on. A slice of the pie represents each source's share of the total. The *bar graph* in panel (b) compares income for four countries. The height of each bar represents the average

FIGURE A-1

Types of Graphs

The pie chart in panel (a) shows how the U.S. national income in 2011 was derived from various sources. The bar graph in panel (b) compares the 2011 average income in four countries. The time-series graph in panel (c) shows the productivity of labor in U.S. businesses from 1950 to 2010.



© Sample Name

income in each country. The *time-series graph* in panel (c) traces the rising productivity in the U.S. business sector over time. The height of the line shows output per hour in each year. You have probably seen similar graphs in newspapers and magazines.

Graphs of Two Variables: The Coordinate System

The three graphs in Figure A-1 are useful in showing how a variable changes over time or across individuals, but they are limited in how much they can tell us. These graphs display information only about a single variable. Economists are often concerned with the relationships between variables. Thus, they need to display two variables on a single graph. The *coordinate system* makes this possible.

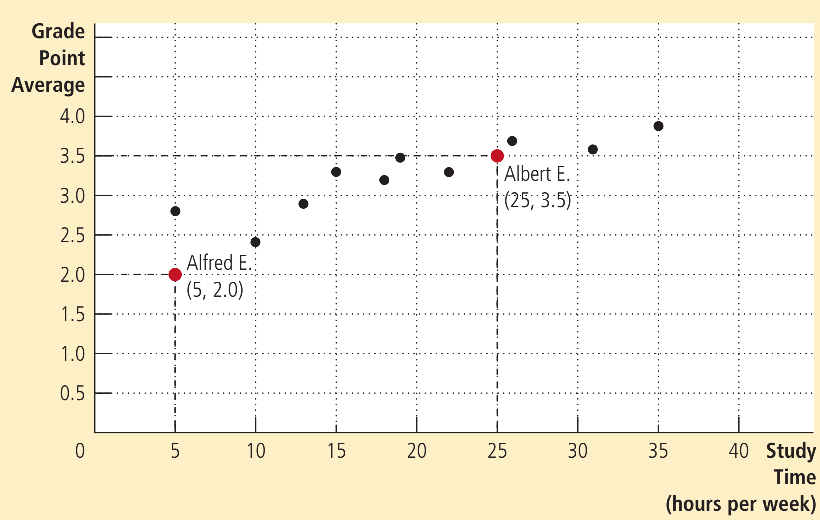
Suppose you want to examine the relationship between study time and grade point average. For each student in your class, you could record a pair of numbers: hours per week spent studying and grade point average. These numbers could then be placed in parentheses as an *ordered pair* and appear as a single point on the graph. Albert E., for instance, is represented by the ordered pair (25 hours/week, 3.5 GPA), while his "what-me-worry?" classmate Alfred E. is represented by the ordered pair (5 hours/week, 2.0 GPA).

We can graph these ordered pairs on a two-dimensional grid. The first number in each ordered pair, called the *x-coordinate*, tells us the horizontal location of the point. The second number, called the *y-coordinate*, tells us the vertical location of the point. The point with both an x-coordinate and a y-coordinate of zero is known as the *origin*. The two coordinates in the ordered pair tell us where the point is located in relation to the origin: x units to the right of the origin and y units above it.

Figure A-2 graphs grade point average against study time for Albert E., Alfred E., and their classmates. This type of graph is called a *scatterplot* because it plots scattered points. Looking at this graph, we immediately notice that points farther to the right (indicating more study time) also tend to be higher (indicating a better grade point average). Because study time and grade point average typically move in the same direction, we say that these two variables have a *positive correlation*.

FIGURE A-2

Using the Coordinate System
Grade point average is measured on the vertical axis and study time on the horizontal axis. Albert E., Alfred E., and their classmates are represented by various points. We can see from the graph that students who study more tend to get higher grades.



By contrast, if we were to graph party time and grades, we would likely find that higher party time is associated with lower grades; because these variables typically move in opposite directions, we say that they have a *negative correlation*. In either case, the coordinate system makes the correlation between the two variables easy to see.

Curves in the Coordinate System

Students who study more do tend to get higher grades, but other factors also influence a student's grades. Previous preparation is an important factor, for instance, as are talent, attention from teachers, even eating a good breakfast. A scatterplot like Figure A-2 does not attempt to isolate the effect that studying has on grades from the effects of other variables. Often, however, economists prefer looking at how one variable affects another, holding everything else constant.

To see how this is done, let's consider one of the most important graphs in economics: the *demand curve*. The demand curve traces out the effect of a good's price on the quantity of the good consumers want to buy. Before showing a demand curve, however, consider Table A-1, which shows how the number of novels that Emma buys depends on her income and on the price of novels. When novels are cheap, Emma buys them in large quantities. As they become more expensive, she instead borrows books from the library or chooses to go to the movies rather than read. Similarly, at any given price, Emma buys more novels when she has a higher income. That is, when her income increases, she spends part of the additional income on novels and part on other goods.

We now have three variables—the price of novels, income, and the number of novels purchased—which are more than we can represent in two dimensions. To put the information from Table A-1 in graphical form, we need to hold one of the three variables constant and trace out the relationship between the other two. Because the demand curve represents the relationship between price and quantity demanded, we hold Emma's income constant and show how the number of novels she buys varies with the price of novels.

Suppose that Emma's income is \$30,000 per year. If we place the number of novels Emma purchases on the x-axis and the price of novels on the y-axis, we can graphically represent the middle column of Table A-1. When the points that represent these entries from the table—(5 novels, \$10), (9 novels, \$9), and so on—are

TABLE A-1

Novels Purchased by Emma

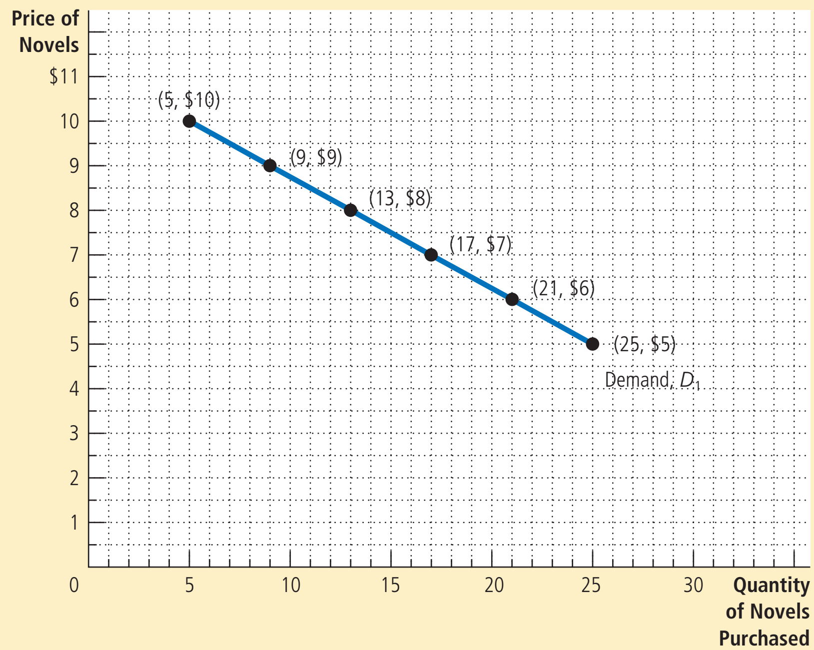
This table shows the number of novels Emma buys at various incomes and prices. For any given level of income, the data on price and quantity demanded can be graphed to produce Emma's demand curve for novels, as shown in Figures A-3 and A-4.

Price	For \$20,000 Income:	For \$30,000 Income:	For \$40,000 Income:
\$10	2 novels	5 novels	8 novels
9	6	9	12
8	10	13	16
7	14	17	20
6	18	21	24
5	22	25	28
	Demand curve, D_3	Demand curve, D_1	Demand curve, D_2

FIGURE A-3

Demand Curve

The line D_1 shows how Emma's purchases of novels depend on the price of novels when her income is held constant. Because the price and the quantity demanded are negatively related, the demand curve slopes downward.



connected, they form a line. This line, pictured in Figure A-3, is known as Emma's demand curve for novels; it tells us how many novels Emma purchases at any given price. The demand curve is downward sloping, indicating that a higher price reduces the quantity of novels demanded. Because the quantity of novels demanded and the price move in opposite directions, we say that the two variables are *negatively related*. (Conversely, when two variables move in the same direction, the curve relating them is upward sloping, and we say that the variables are *positively related*.)

Now suppose that Emma's income rises to $40,000 per year. At any given price, Emma will purchase more novels than she did at her previous level of income. Just as earlier we drew Emma's demand curve for novels using the entries from the middle column of Table A-1, we now draw a new demand curve using the entries from the right column of the table. This new demand curve (curve D_2) is pictured alongside the old one (curve D_1) in Figure A-4; the new curve is a similar line drawn farther to the right. We therefore say that Emma's demand curve for novels *shifts* to the right when her income increases. Likewise, if Emma's income were to fall to $20,000 per year, she would buy fewer novels at any given price and her demand curve would shift to the left (to curve D_3).

In economics, it is important to distinguish between *movements along a curve* and *shifts of a curve*. As we can see from Figure A-3, if Emma earns $30,000 per year and novels cost $8 apiece, she will purchase 13 novels per year. If the price of novels falls to $7, Emma will increase her purchases of novels to 17 per year. The demand curve, however, stays fixed in the same place. Emma still buys the same number of novels *at each price*, but as the price falls, she moves along her demand curve from left to right. By contrast, if the price of novels remains fixed at $8 but her income rises to $40,000, Emma increases her purchases of novels from 13 to 16 per year. Because Emma buys more novels *at each price*, her demand curve shifts out, as shown in Figure A-4.

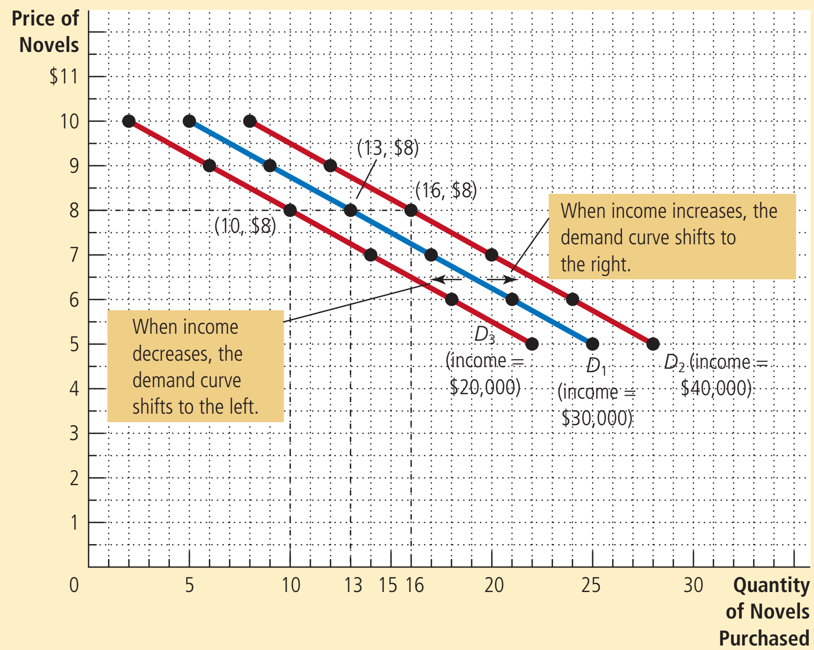


FIGURE A-4

Shifting Demand Curves

The location of Emma's demand curve for novels depends on how much income she earns. The more she earns, the more novels she will purchase at any given price, and the farther to the right her demand curve will lie. Curve D_1 represents Emma's original demand curve when her income is $30,000 per year. If her income rises to $40,000 per year, her demand curve shifts to D_2. If her income falls to $20,000 per year, her demand curve shifts to D_3.

There is a simple way to tell when it is necessary to shift a curve: *When a relevant variable that is not named on either axis changes, the curve shifts*. Income is on neither the x-axis nor the y-axis of the graph, so when Emma's income changes, her demand curve must shift. The same is true for any change that affects Emma's purchasing habits, with the sole exception of a change in the price of novels. If, for instance, the public library closes and Emma must buy all the books she wants to read, she will demand more novels at each price, and her demand curve will shift to the right. Or if the price of movies falls and Emma spends more time at the movies and less time reading, she will demand fewer novels at each price, and her demand curve will shift to the left. By contrast, when a variable on an axis of the graph changes, the curve does not shift. We read the change as a movement along the curve.

Slope

One question we might want to ask about Emma is how much her purchasing habits respond to price. Look at the demand curve pictured in Figure A-5. If this curve is very steep, Emma purchases nearly the same number of novels regardless of whether they are cheap or expensive. If this curve is much flatter, the number of novels Emma purchases is more sensitive to changes in the price. To answer questions about how much one variable responds to changes in another variable, we can use the concept of *slope*.

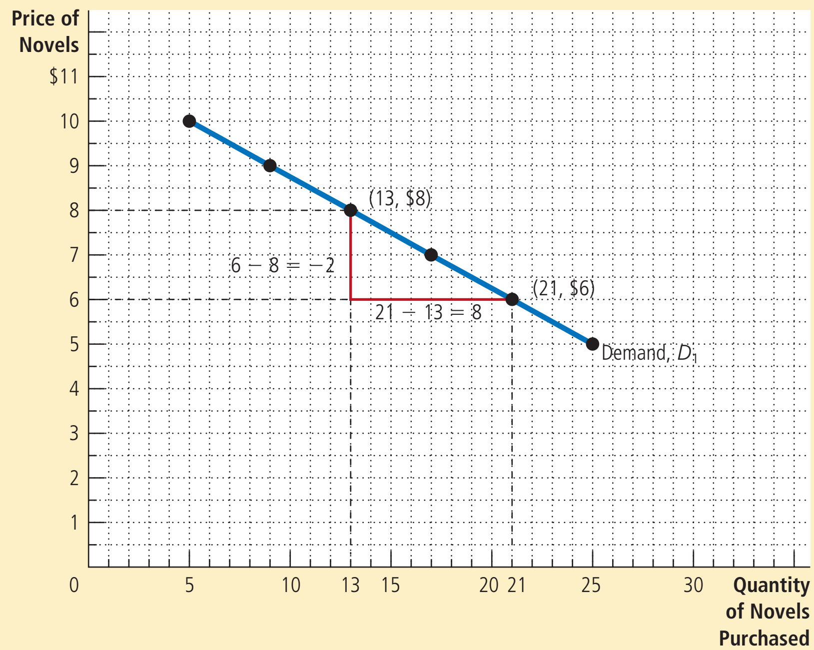
The slope of a line is the ratio of the vertical distance covered to the horizontal distance covered as we move along the line. This definition is usually written out in mathematical symbols as follows:

$$\text{slope} = \frac{\Delta y}{\Delta x},$$

FIGURE A-5

Calculating the Slope of a Line

To calculate the slope of the demand curve, we can look at the changes in the *x*- and *y*-coordinates as we move from the point (21 novels, \$6) to the point (13 novels, \$8). The slope of the line is the ratio of the change in the *y*-coordinate (–2) to the change in the *x*-coordinate (+8), which equals –¼.



where the Greek letter Δ (delta) stands for the change in a variable. In other words, the slope of a line is equal to the "rise" (change in *y*) divided by the "run" (change in *x*). The slope will be a small positive number for a fairly flat upward-sloping line, a large positive number for a steep upward-sloping line, and a negative number for a downward-sloping line. A horizontal line has a slope of zero because in this case the *y*-variable never changes; a vertical line is said to have an infinite slope because the *y*-variable can take any value without the *x*-variable changing at all.

What is the slope of Emma's demand curve for novels? First of all, because the curve slopes down, we know the slope will be negative. To calculate a numerical value for the slope, we must choose two points on the line. With Emma's income at \$30,000, she will purchase 21 novels at a price of \$6 or 13 novels at a price of \$8. When we apply the slope formula, we are concerned with the change between these two points; in other words, we are concerned with the difference between them, which lets us know that we will have to subtract one set of values from the other, as follows:

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{\text{first } y\text{-coordinate} - \text{second } y\text{-coordinate}}{\text{first } x\text{-coordinate} - \text{second } x\text{-coordinate}} = \frac{6-8}{21-13} = \frac{-2}{8} = \frac{-1}{4}$$

Figure A-5 shows graphically how this calculation works. Try computing the slope of Emma's demand curve using two different points. You should get exactly the same result, −1/4. One of the properties of a straight line is that it has the same slope everywhere. This is not true of other types of curves, which are steeper in some places than in others.

The slope of Emma's demand curve tells us something about how responsive her purchases are to changes in the price. A small slope (a number close to zero) means that Emma's demand curve is relatively flat; in this case, she adjusts the number of novels she buys substantially in response to a price change. A larger slope (a number farther from zero) means that Emma's demand curve is relatively steep; in this case, she adjusts the number of novels she buys only slightly in response to a price change.

Cause and Effect

Economists often use graphs to advance an argument about how the economy works. In other words, they use graphs to argue about how one set of events *causes* another set of events. With a graph like the demand curve, there is no doubt about cause and effect. Because we are varying price and holding all other variables constant, we know that changes in the price of novels cause changes in the quantity Emma demands. Remember, however, that our demand curve came from a hypothetical example. When graphing data from the real world, it is often more difficult to establish how one variable affects another.

The first problem is that it is difficult to hold everything else constant when studying the relationship between two variables. If we are not able to hold other variables constant, we might decide that one variable on our graph is causing changes in the other variable when those changes are actually being caused by a third *omitted variable* not pictured on the graph. Even if we have identified the correct two variables to look at, we might run into a second problem—*reverse causality*. In other words, we might decide that A causes B when in fact B causes A. The omitted-variable and reverse-causality traps require us to proceed with caution when using graphs to draw conclusions about causes and effects.

Omitted Variables To see how omitting a variable can lead to a deceptive graph, let's consider an example. Imagine that the government, spurred by public concern about the large number of deaths from cancer, commissions an exhaustive study from Big Brother Statistical Services, Inc. Big Brother examines many of the items found in people's homes to see which of them are associated with the risk of cancer. Big Brother reports a strong relationship between two variables: the number of cigarette lighters that a household owns and the probability that someone in the household will develop cancer. Figure A-6 shows this relationship.

What should we make of this result? Big Brother advises a quick policy response. It recommends that the government discourage the ownership of cigarette lighters by taxing their sale. It also recommends that the government require warning labels: "Big Brother has determined that this lighter is dangerous to your health."

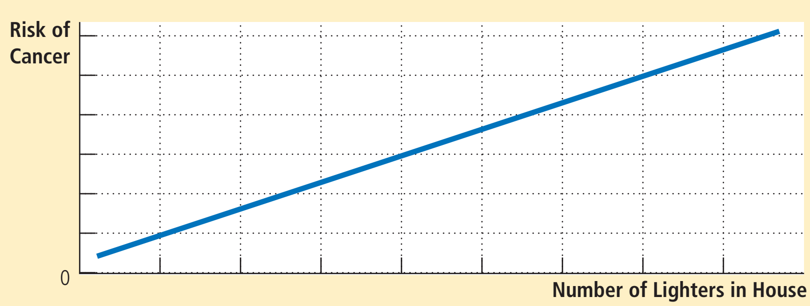
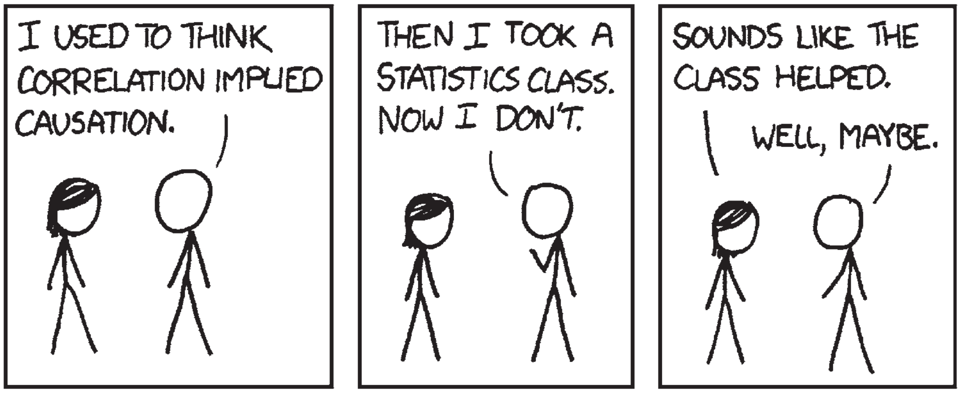


FIGURE A-6

Graph with an Omitted Variable The upward-sloping curve shows that members of households with more cigarette lighters are more likely to develop cancer. Yet we should not conclude that ownership of lighters causes cancer because the graph does not take into account the number of cigarettes smoked.



Courtesy of Randall Munroe/XKCD.com

In judging the validity of Big Brother's analysis, one question is key: Has Big Brother held constant every relevant variable except the one under consideration? If the answer is no, the results are suspect. An easy explanation for Figure A-6 is that people who own more cigarette lighters are more likely to smoke cigarettes and that cigarettes, not lighters, cause cancer. If Figure A-6 does not hold constant the amount of smoking, it does not tell us the true effect of owning a cigarette lighter.

This story illustrates an important principle: When you see a graph used to support an argument about cause and effect, it is important to ask whether the movements of an omitted variable could explain the results you see.

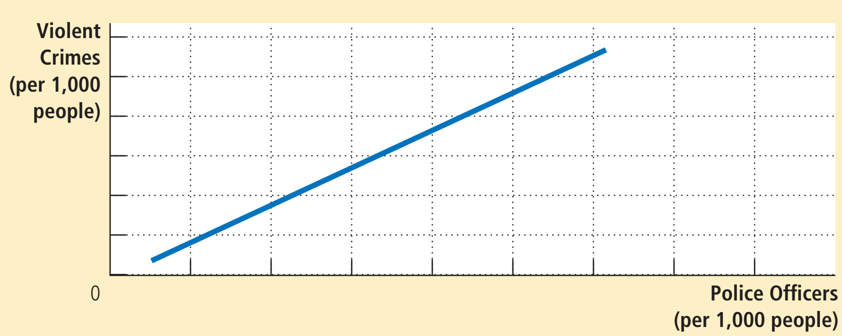
Reverse Causality Economists can also make mistakes about causality by misreading its direction. To see how this is possible, suppose the Association of American Anarchists commissions a study of crime in America and arrives at Figure A-7, which plots the number of violent crimes per thousand people in major cities against the number of police officers per thousand people. The anarchists note the curve's upward slope and argue that because police increase rather than decrease the amount of urban violence, law enforcement should be abolished.

If we could run a controlled experiment, we would avoid the danger of reverse causality. To run an experiment, we would randomly assign different numbers of police to different cities and then examine the correlation between police and crime. Figure A-7, however, is not based on such an experiment. We simply observe that more dangerous cities have more police officers. The explanation for

FIGURE A-7

Graph Suggesting Reverse Causality

The upward-sloping curve shows that cities with a higher concentration of police are more dangerous. Yet the graph does not tell us whether police cause crime or crime-plagued cities hire more police.



this may be that more dangerous cities hire more police. In other words, rather than police causing crime, crime may cause police. Nothing in the graph itself allows us to establish the direction of causality.

It might seem that an easy way to determine the direction of causality is to examine which variable moves first. If we see crime increase and then the police force expand, we reach one conclusion. If we see the police force expand and then crime increase, we reach the other. Yet there is also a flaw with this approach: Often, people change their behavior not in response to a change in their present conditions but in response to a change in their *expectations* of future conditions. A city that expects a major crime wave in the future, for instance, might hire more police now. This problem is even easier to see in the case of babies and minivans. Couples often buy a minivan in anticipation of the birth of a child. The minivan comes before the baby, but we wouldn't want to conclude that the sale of minivans causes the population to grow!

There is no complete set of rules that says when it is appropriate to draw causal conclusions from graphs. Yet just keeping in mind that cigarette lighters don't cause cancer (omitted variable) and minivans don't cause larger families (reverse causality) will keep you from falling for many faulty economic arguments.