

# 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 single most important purpose of this book is to help you learn the economist’s way of thinking. Of course, 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?

## THE ECONOMIST AS SCIENTIST



"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."

Economists try to address their subject with a scientist's objectivity. They approach the study of the economy in much the same way as 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.

To beginners, it can seem odd to claim that economics is a science. 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 the eyes of a scientist. Let's discuss some of the ways in which economists apply the logic of science to examine how an economy works.

### 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 today in undergraduate physics courses around the world.

This interplay between theory and observation also occurs in the field of economics. An economist might live in a country experiencing rapid increases in 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. (As you may recall, this was one of the *Ten Principles of Economics* in Chapter 1.) 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 not at all related to the rate at which prices are rising, 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 do face an obstacle that makes their task especially challenging: Experiments are often difficult in economics. 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, and this opportunity persists long after the wartime increase in oil prices is over. 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.

## The Role of Assumptions

If you ask a physicist how long it would take for a marble to fall from the top of a ten-story building, she will 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 correctly point out that friction on the marble is so small that its effect is negligible. Assuming the marble falls in a vacuum greatly 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 may assume that the world consists of only two countries and that each country produces only two goods. Of course, the real world consists of dozens of countries, each of which produces thousands of different types of goods. But by assuming two countries and two goods, we can focus our thinking on the essence of the problem. Once we understand international trade in an imaginary world with two countries and two goods, 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 we were dropping a beachball rather than a marble from the top of the building. Our physicist would realize that the assumption of no friction is far less accurate in this case: Friction exerts a greater force on a beachball than on a marble because a beachball is much larger. The assumption that gravity works in a vacuum is reasonable for studying a falling marble but not for studying a falling beachball.

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 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 beachballs,

economists use different assumptions when studying the short-run and long-run effects of a change in the quantity of money.

## 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. The models allow teachers to show their students in a simple way how the important parts of the body fit together. Of course, no one would mistake these plastic models for a real person. These models are stylized, and they omit many details. Yet 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 instead of being made of plastic, they are most often composed 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 of 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.

## Our First Model: The Circular-Flow Diagram

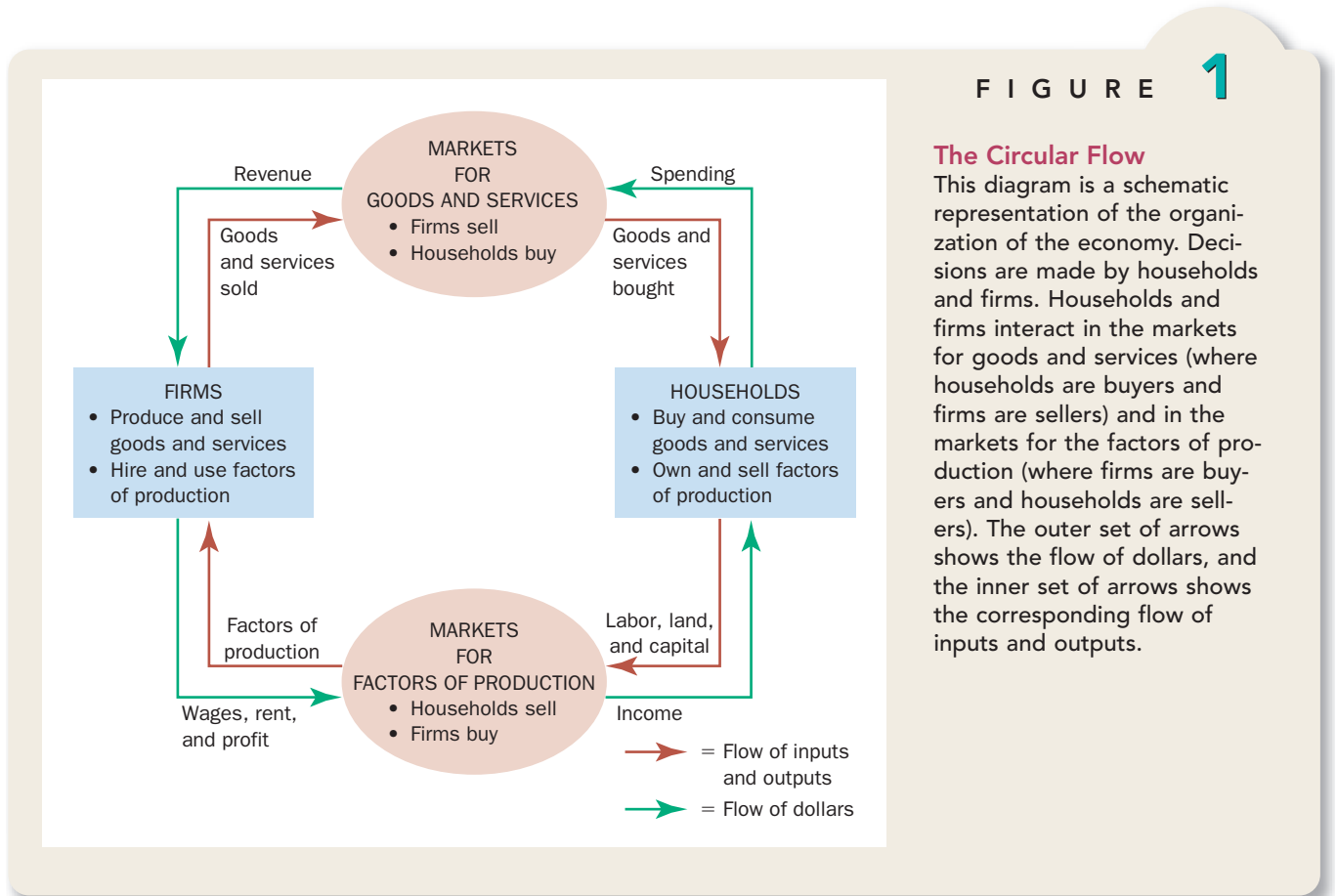
The economy consists of millions of people engaged in many activities—buying, selling, working, hiring, manufacturing, and so on. To understand how the economy works, we must find some way to simplify our thinking about all these activities. In other words, we need a model that explains, in general terms,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

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 all the economic transactions that occur between households and firms in the economy.

The inner loop of the circular-flow diagram 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 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. Hence, the factors of production flow from households to firms, and goods and services flow from firms to households.

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



The outer loop of the circular-flow 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. Hence, spending on goods and services flows from households to firms, and income in the form of wages, rent, and profit flows from firms to 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. For instance, 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 one 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. 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.

## 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 assume 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 can use to turn these factors into output.

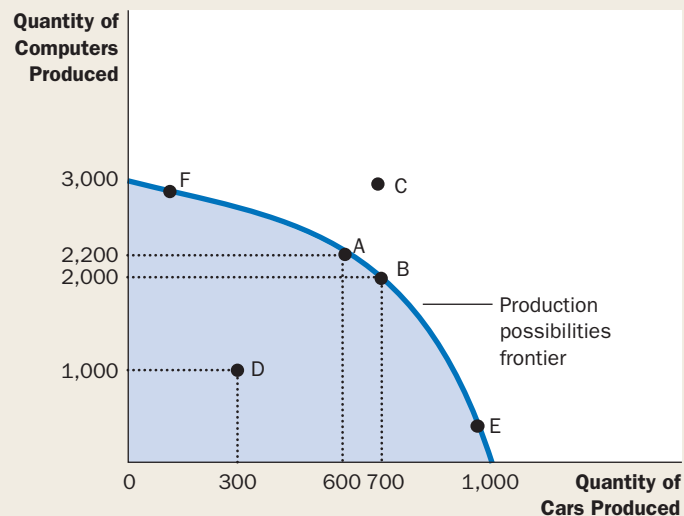
Figure 2 shows this economy's production possibilities frontier. If the economy uses all its resources in the car industry, it can produce 1,000 cars and no computers. If it uses all its resources in the computer industry, it can produce 3,000 computers and no cars. The two endpoints of the production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

More likely, the economy divides its resources between the two industries, and this yields other points on the production possibilities frontier. For example, it can produce 600 cars and 2,200 computers, shown in the figure 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.

## 2 FIGURE

### 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.



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 simply 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 the efficient points on the frontier, the only way of getting more of one good is to get 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 a 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 fewer 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, the economy won't have to lose much computer production to increase car production by one unit. 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 in the car industry. Producing an additional car means moving some of the best computer



technicians out of the computer industry and making them 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 quite 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 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 the rest of the production possibilities frontier shifts outward, as in Figure 3.

This figure illustrates economic growth. 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.

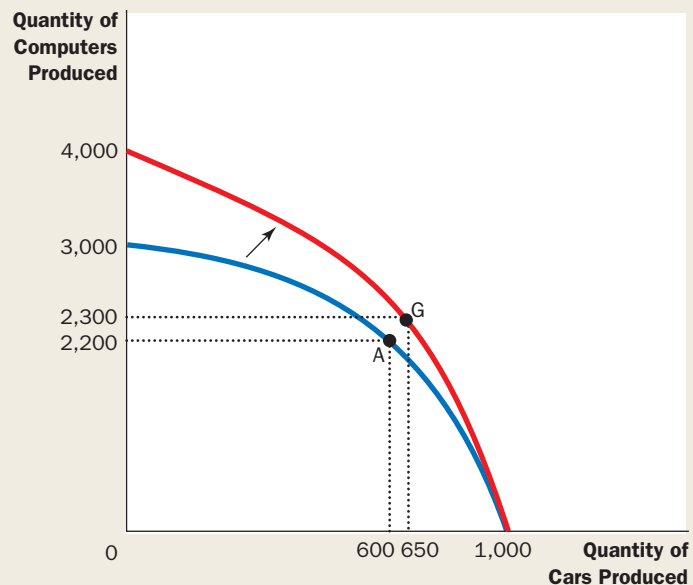
### Microeconomics and Macroeconomics

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

## 3 FIGURE

### 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.





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,

### 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



## FYI

### Who Studies Economics?

As a college student, you might be asking your-

self: How many economics classes should I take? How useful will this stuff be to me later in life? Economics can seem abstract at first, but the field is fundamentally very practical, and the study of economics is useful in many different career paths. Here is a small sampling of some well-known people who majored in economics when they were in college.

Meg Witman	Chief Executive Officer, Ebay
Ronald Reagan	Former President of the United States
William F. Buckley	Journalist
Danny Glover	Actor
Barbara Boxer	U.S. Senator
John Elway	NFL Quarterback
Ted Turner	Founder of CNN and Owner of Atlanta Braves
Kofi Annan	Secretary General, United Nations
Lionel Richie	Singer
Michael Kinsley	Journalist
Ben Stein	Political Speechwriter, Actor, and Game Show Host
Cate Blanchett	Actor
Anthony Zinni	General, U.S. Marine Corps

Tiger Woods

Steve Ballmer

Arnold Schwarzenegger

Sandra Day-O'Connor

Mick Jagger

Golfer

Chief Executive Officer, Microsoft

Governor of California

Former Supreme Court Justice

Singer for The Rolling Stones

Having studied at the London School of Economics may not help Mick Jagger hit the high notes, but it has probably given him some insight about how to invest the substantial sums he has earned during his rock-'n'-roll career.



When asked in 2005 why The Rolling Stones were going on tour again, former economics major Mick Jagger replied, "Supply and demand." Keith Richards added, "If the demand's there, we'll supply."

the changes over time in the economy's rate of unemployment, or alternative policies to raise growth in national living standards.

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 cut in the federal income tax on the overall production of goods and services. To analyze this issue, he or she must consider how the tax cut affects the decisions of households 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.

## 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.

### Positive versus Normative Analysis

To help clarify the two roles that economists play, we begin by examining 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.

NORMA: The government should raise the minimum wage.

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

In general, statements about the world are of 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 Norma'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

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

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

time. By contrast, evaluating normative statements involves values as well as facts. Norma's statement cannot be judged using data alone. Deciding what is good or bad policy is not merely 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 closely 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 Norma'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 goals that are normative: 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.

## 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 equity. It might help future generations but hurt current generations. An economist who says that all policy decisions are easy is an economist not to be trusted.

Truman was also not alone among presidents in relying 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 several 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 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.

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. Table 1 lists the websites of some of these agencies.

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.



"LET'S SWITCH. I'LL MAKE THE POLICY, YOU IMPLEMENT IT, AND HE'LL EXPLAIN IT."



# In The News

## Super Bowl Economics

Economists often offer advice to policymakers. Sometimes those policymakers are football coaches.

### Incremental Analysis, with Two Yards to Go

By David Leonhardt

The academic paper that David Romer began writing two years ago did not look like something that could determine the outcome of a Super Bowl. Sure, it was an analysis of whether professional football teams punt more often than is rational, but it seemed intended mainly for the amusement of sports fans who happen to be professors.

Professor Romer, an economist at the University of California at Berkeley, used the phrases “Bellman equation” and “dynamic-programming analysis”—in the paper’s title, no less. His footnotes cited work published in *Econometrica*, *Cognitive Science*, and other publications that are not exactly must-reads in N.F.L. locker rooms.

But when his conclusion—teams punt too much—began getting attention last summer, a reporter asked Bill Belichick, the coach of the New England

Patriots, about the paper. “I read it,” he said, according to *The Boston Herald*. “I don’t know much of the math involved, but I think I understand the conclusions and he has some valid points.”

Upon hearing that, Professor Romer’s jaw dropped, he said. His paper was available only on his Berkeley Internet site, [emlab.berkeley.edu/users/dromer](http://emlab.berkeley.edu/users/dromer), and the site of a group called the National Bureau of Economic Research.

But the most interesting development was yet to come. Two weeks ago, facing a fourth down in the Patriots’ own territory on the very first drive of the game—a sure punting situation in the N.F.L.—Belichick decided to go for a first down and made it. The Patriots soon scored a touchdown and were on their way to today’s Super Bowl, against the Carolina Panthers.

Football analysts immediately called the decision an instance of a coach’s instinct triumphing over cold analysis. In fact, Professor Romer said last week, Belichick seemed to be “throwing gut

instinct out the window and going on analysis.” The information is right there in Figure 5 of the economist’s paper: on fourth and 1 on your own 44-yard line, the potential benefit of keeping the drive going outweighs the cost of giving the opponents good field position.

The coach may not have been thinking about Professor Romer’s paper at that moment, but he has clearly adopted the methods of a social scientist in a way that few other sports coaches have. Belichick, who majored in economics at Wesleyan University, approaches his job much the way a financial analyst pores over a balance sheet. He seems to view every decision as a chance to perform better cost-benefit analysis than his peers do. Richard Miller, a Wesleyan economist with whom the coach remains in touch, calls the approach “incremental analysis.” In plain English, it involves looking for subtle differences in one small area that can affect an entire system, whether that system is a company, a stock market, or a football game.

Source: *The New York Times*, Week in Review, February 1, 2004, page 12.

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.

Although these words were written in 1935, they remain true today. Indeed, the “academic scribbler” now influencing public policy is often Keynes himself.

Here are the websites for a few of the government agencies that are responsible for collecting economic data and making economic policy.

Department of Commerce	<a href="http://www.commerce.gov">http://www.commerce.gov</a>
Bureau of Labor Statistics	<a href="http://www.bls.gov">http://www.bls.gov</a>
Congressional Budget Office	<a href="http://www.cbo.gov">http://www.cbo.gov</a>
Federal Reserve Board	<a href="http://www.federalreserve.gov">http://www.federalreserve.gov</a>

## T A B L E 1

### Websites

## CASE STUDY

### MR. MANKIW GOES TO WASHINGTON

The author of the textbook you are now reading is, I will readily admit, a typical, nerdy college professor, more comfortable in the world of dusty books than in the world of glad-handing politicians. But from 2003 to 2005, I had the opportunity to leave the ivory tower and become the chairman of Council of Economic Advisers. For two years, I was President Bush's chief economist.

As chair of the CEA, I met with the President about twice a week. Some of these meetings were briefings on the state of the economy; most were discussions of current issues in economic policy. I worked closely with other members of the White House staff to analyze policy options and brief the President on a wide range of topics, such as tax policy, the federal budget, Social Security, and international trade. I also met regularly with economic officials outside the White House, such as Secretary of the Treasury John Snow and Federal Reserve Chairman Alan Greenspan, and with leaders of the business community.

For anyone used to the measured pace and quiet reflection of university life, taking such a job is exhilarating. Sitting in the Oval Office, flying on *Air Force One*, and spending the weekend with the President at Camp David are unforgettable experiences. Testifying as the President's representative before congressional committees, which include members who are usually partisan and sometimes hostile, is also an experience a person does not easily forget—no matter how hard one might try.

During my two years in Washington, I learned a lot about the process by which economic policy is made. It 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 the 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 arise to 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.

My two years in Washington were a vivid reminder of an important lesson: Making economic policy in a representative democracy is a messy affair—and there are often good reasons 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. • Name three parts of government that regularly rely on advice from economists.

## 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 policy should try to accomplish.

Let's discuss each of these reasons.

### 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 a search for understanding about the world around us. It is not surprising that as the search continues, scientists can 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 lead 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 the responsiveness of saving to tax incentives.

## 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 \$50,000 and is taxed \$5,000, or 10 percent of his income. Paula has income of \$10,000 and is taxed \$2,000, 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 a career in acting? 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 learned earlier in our discussion of normative and positive analysis, policies cannot be judged on scientific grounds alone. Economists give conflicting advice sometimes because they have different values. Perfecting the science of economics will not tell us whether Peter or Paula pays too much.

## 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. There are many cases in which economists agree.

Table 2 contains ten propositions about economic policy. In a survey of economists in business, government, and academia, these propositions were endorsed by an overwhelming majority of respondents. Most of these propositions would fail to command a similar consensus among the general 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 very costly way of helping the neediest members of society. Nonetheless, many city governments choose to 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 will 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. In 2002, for example, the Bush administration imposed temporary tariffs on steel to protect domestic steel producers from foreign competition. In this case, economists did offer united advice, but policymakers chose to ignore it.

Why do policies such as rent control and trade barriers persist if the experts are united in their opposition? The reason may be that economists have not yet convinced the general 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.

## 2 TABLE

### Ten 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. If the federal budget is to be balanced, it should be done over the business cycle rather than yearly. (85%)
6. Cash payments increase the welfare of recipients to a greater degree than do transfers-in-kind of equal cash value. (84%)
7. A large federal budget deficit has an adverse effect on the economy. (83%)
8. A minimum wage increases unemployment among young and unskilled workers. (79%)
9. The government should restructure the welfare system along the lines of a "negative income tax." (79%)
10. Effluent taxes and marketable pollution permits represent a better approach to pollution control than imposition of pollution ceilings. (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. Reprinted by permission.

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

## 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.

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





# In The News

## Why You Should Study Economics

In this excerpt from a commencement address, the former president of the Federal Reserve Bank of Dallas makes the case for studying economics.

### The Dismal Science? Hardly!

By Robert D. McTeer, Jr.

Weeks ago, I had lunch with the smartest woman in the world: Marilyn vos Savant, the “Ask Marilyn” columnist in *Parade* magazine.

According to the folks at the *Guinness Book*, Marilyn has the world’s highest recorded I.Q. She is interested in economics education, of all things, and we met at a board meeting of the National Council on Economic Education. I told her I think economics is a good major for smart students, but if they are really, really smart, I’d rather they become doctors so they could do somebody some good. She said, “Yes, but doctors help people one at a time, while an Alan Greenspan can help millions of people at a time.” She has a point. Mr. Greenspan is an excellent example of someone making a big difference by applying good economics.

My take on training in economics is that it becomes increasingly valuable as you move up the career ladder. I can’t imagine a better major for corporate CEOs, congressmen, or American presidents. . . . Economics training will help you understand fallacies and unintended

consequences. In fact, I am inclined to define economics as the study of how to anticipate unintended consequences. . . .

Little in the literature seems more relevant to contemporary economic debates than what usually is called the broken window fallacy. Whenever a government program is justified not on its merits but by the jobs it will create, remember the broken window: Some teenagers, being the little beasts that they are, toss a brick through a bakery window. A crowd gathers and laments, “What a shame.” But before you know it, someone suggests a silver lining to the situation: Now the baker will have to spend money to have the window repaired. This will add to the income of the repairman, who will spend his additional income, which will add to another seller’s income, and so on. You know the drill. The chain of spending will multiply and generate higher income and employment. If the broken window is large enough, it might produce an economic boom! . . .

Most voters fall for the broken window fallacy, but not economics majors. They will say, “Hey, wait a minute!” If the baker hadn’t spent his money on window repair, he would have spent it on the new suit he was saving to buy.

Then the tailor would have the new income to spend, and so on. The broken window didn’t create net new spending; it just diverted spending from somewhere else. The broken window does not create new activity, just different activity. People see the activity that takes place. They don’t see the activity that *would* have taken place.

The broken window fallacy is perpetuated in many forms. Whenever job creation or retention is the primary objective I call it the job-counting fallacy. Economics majors understand the non-intuitive reality that real progress comes from job destruction. It once took 90 percent of our population to grow our food. Now it takes 3 percent. Pardon me, Willie, but are we worse off because of the job losses in agriculture? The would-have-been farmers are now college professors and computer gurus. . . .

So instead of counting jobs, we should make every job count. We will occasionally hit a soft spot when we have a mismatch of supply and demand in the labor market. But that is temporary. Don’t become a Luddite and destroy the machinery, or become a protectionist and try to grow bananas in New York City.

Source: *The Wall Street Journal*, June 4, 2003, p. A18. Copyright © 2003 by Robert D. McTeer, Jr.

## 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 scientists.
- Economists who advise policymakers 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 it.

## KEY CONCEPTS

circular-flow diagram, p. 22  
production possibilities frontier,  
p. 24

microeconomics, p. 27  
macroeconomics, p. 27

positive statements, p. 28  
normative statements, p. 28

## QUESTIONS FOR REVIEW

1. How is economics like a science?
2. Why do economists make assumptions?
3. Should an economic model describe reality exactly?
4. 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 cow population?
5. Use a production possibilities frontier to describe the idea of "efficiency."
6. What are the two subfields into which economics is divided? Explain what each subfield studies.
7. What is the difference between a positive and a normative statement? Give an example of each.
8. What is the Council of Economic Advisers?
9. Why do economists sometimes offer conflicting advice to policymakers?

## 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 \$7 to see a movie.
  - d. Sally earns \$10,000 from his 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 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 growth of money will reduce the rate of inflation.
  - c. The Federal Reserve should reduce the rate of growth of money.
  - d. Society ought to require welfare recipients to look for jobs.
  - e. Lower tax rates encourage more work and more saving.
7. Classify each of the statements in Table 2 as positive, normative, or ambiguous. Explain.
8. If you were president, would you be more interested in your economic advisers' positive views or their normative views? Why?
9. Find a recent copy of the *Economic Report of the President* at your library or on the Internet. Read a chapter about an issue that interests you. Summarize the economic problem at hand and describe the council's recommended policy.
10. Look up one of the websites listed in Table 1. What recent economic trends or issues are addressed there?



For further information on topics in this chapter, additional problems, examples, applications, online quizzes, and more, please visit our website at <http://mankiw.swlearning.com>.

## 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 way of finding how variables are in fact related in the world. 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 a thought can be expressed in words in many ways. 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

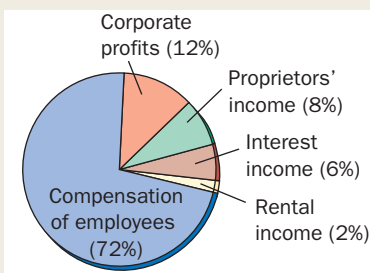
A-1

FIGURE

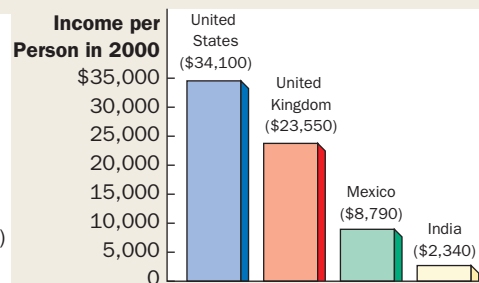
The pie chart in panel (a) shows how U.S. national income is derived from various sources. The bar graph in panel (b) compares the average income in four countries. The time-series graph in panel (c) shows the productivity of labor in U.S. businesses from 1950 to 2000.

## Types of Graphs

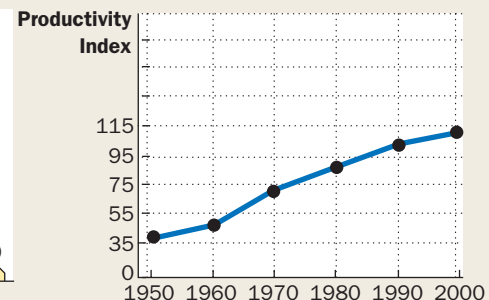
(a) Pie Chart



(b) Bar Graph



(c) Time-Series Graph



income for four countries. The height of each bar represents the average 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

Although the three graphs in Figure A-1 are useful in showing how a variable changes over time or across individuals, such graphs are limited in how much they can tell us. These graphs display information only on 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

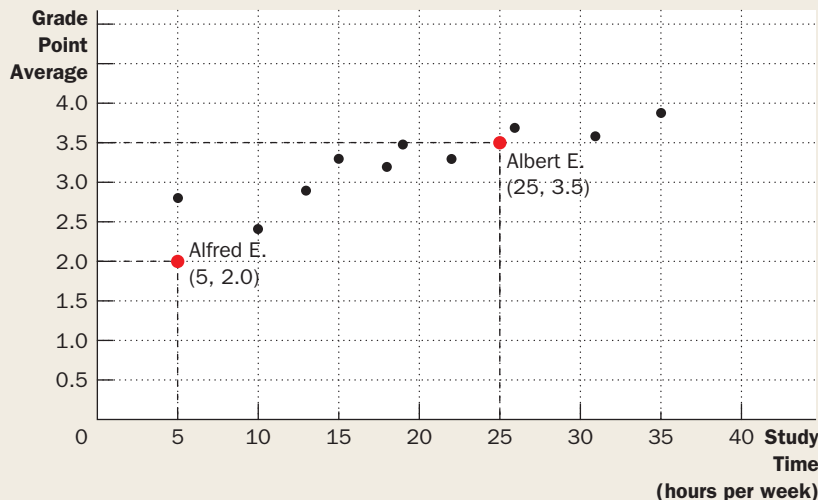


FIGURE A-2

### 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.

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*. 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 call this 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 grade. 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 study 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 borrows books from the library instead of buying them or chooses to go to the movies instead of reading. 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.

### A-1 TABLE

#### 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	Income		
	\$20,000	\$30,000	\$40,000
\$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, $D_2$

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 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 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

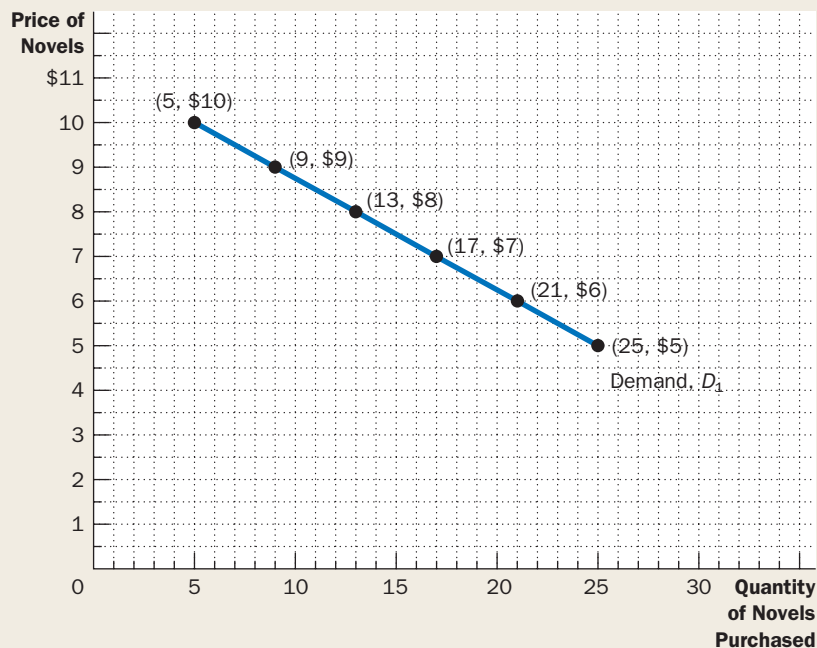


FIGURE A-3

### 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.

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.

There is a simple way to tell when it is necessary to shift a curve. When a 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. Any change that affects Emma's purchasing habits besides a change in the price of novels will result in a shift in her demand curve. 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.

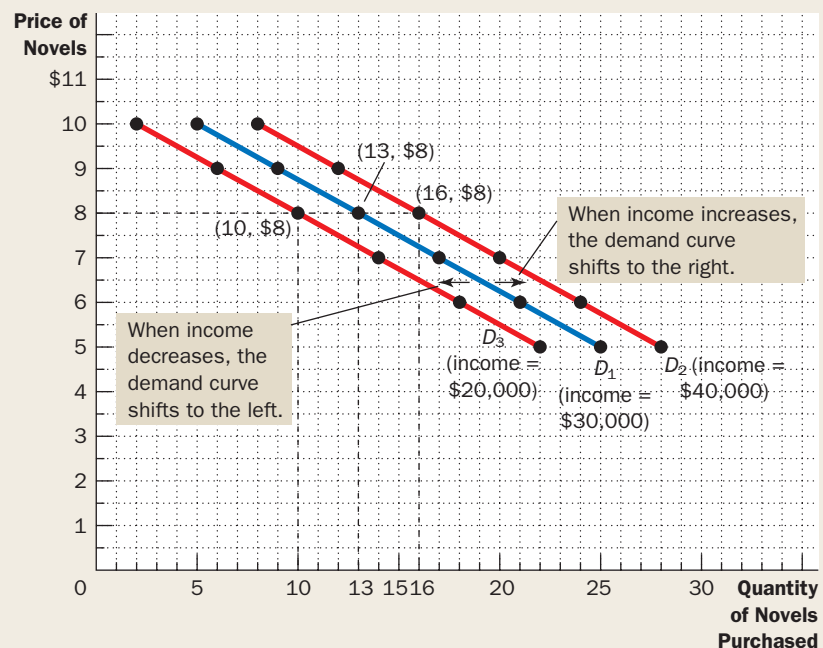
## Slope

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 regard-

### A-4 FIGURE

#### 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  $D_3$ .





less of whether they are cheap or expensive. If this curve is much flatter, Emma purchases many fewer novels when the price rises. 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:

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

where the Greek letter  $\Delta$  (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

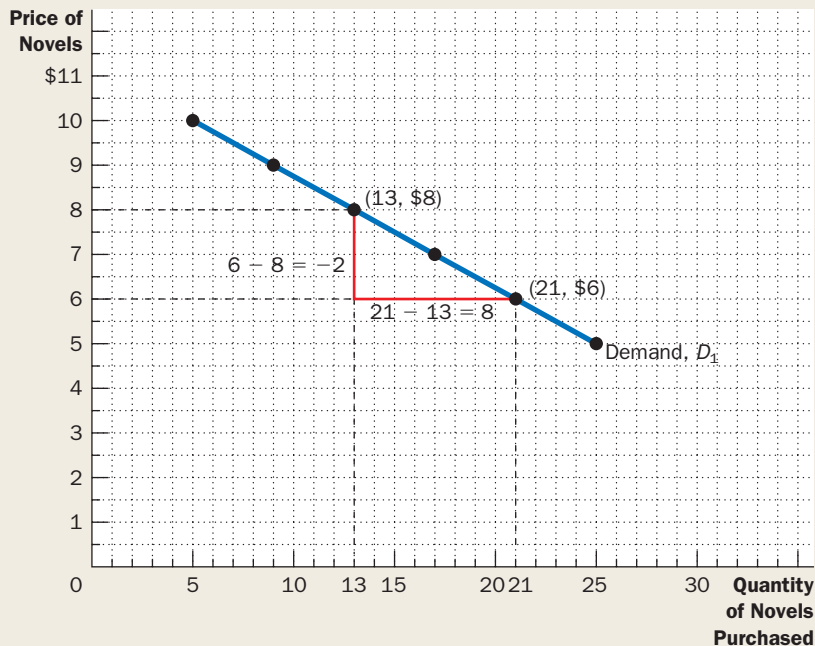


FIGURE A-5

### 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  $-1/4$ .

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 measuring how one variable affects another. If we are not able to hold variables constant, we might decide that one variable on our graph is causing changes in the other variable when actually those changes are 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."

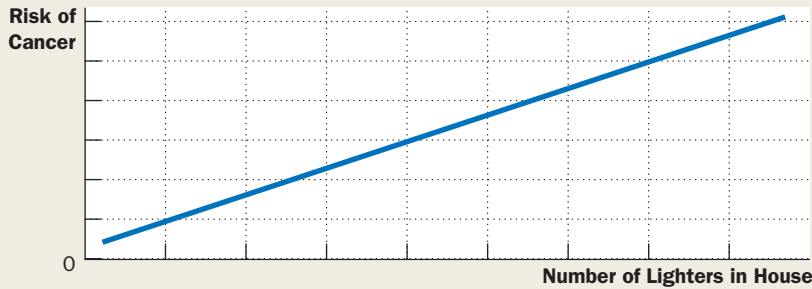


FIGURE A-6

### 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.

In judging the validity of Big Brother's analysis, one question is paramount: 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

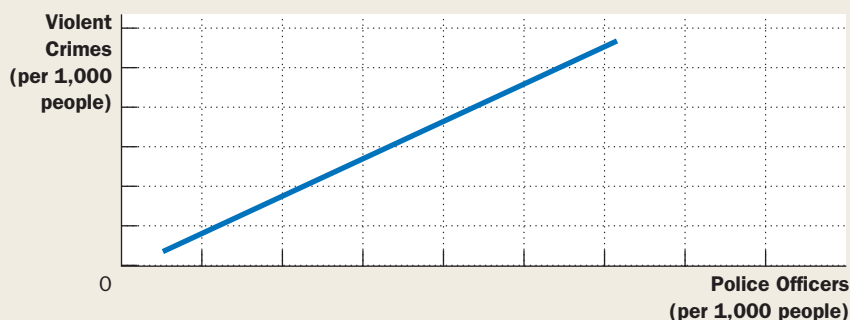


FIGURE A-7

### 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.

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 set the number of police officers in different cities randomly 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 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.