You are studying economics at a time of extraordinary challenge and change. The United States, Europe, and Japan, the world’s richest nations, are still not fully recovered from a deep recession in which incomes shrank and millions of jobs were lost. Brazil, China, India, and Russia, poorer nations with a combined population that dwarfs our own, are growing rapidly and playing ever-greater roles in an expanding global economy.

The economic events of the past few years stand as a stark reminder that we live in a changing and sometimes turbulent world. New businesses are born and old ones die. New jobs are created and old ones disappear. Nations, businesses, and individuals must find ways of coping with economic change.

Your life will be shaped by the challenges that you face and the opportunities that you create. But to face those challenges and seize the opportunities they present, you must understand the powerful forces at play. The economics that you’re about to learn will become your most reliable guide. This chapter gets you started. It describes the questions that economists try to answer and the ways in which they think as they search for the answers.

After studying this chapter, you will be able to:

- Define economics and distinguish between microeconomics and macroeconomics
- Explain the two big questions of economics
- Explain the key ideas that define the economic way of thinking
- Explain how economists go about their work as social scientists and policy advisers
Definition of Economics

A fundamental fact dominates our lives: We want more than we can get. Our inability to get everything we want is called scarcity. Scarcity is universal. It confronts all living things. Even parrots face scarcity!

Because we can't get everything we want, we must make choices. You can't afford both a laptop and an iPhone, so you must choose which one to buy. You can't spend tonight both studying for your next test and going to the movies, so again, you must choose which one to do. Governments can't spend a tax dollar on both national defense and environmental protection, so they must choose how to spend that dollar.

Your choices must somehow be made consistent with the choices of others. If you choose to buy a laptop, someone else must choose to sell it. Incentives reconcile choices. An incentive is a reward that encourages an action or a penalty that discourages one. Prices act as incentives. If the price of a laptop is too high, more will be offered for sale than people want to buy. And if the price is too low, fewer will be offered for sale than people want to buy. But there is a price at which choices to buy and sell are consistent.

Economics is the social science that studies the choices that individuals, businesses, governments, and entire societies make as they cope with scarcity and the incentives that influence and reconcile those choices.

The subject has two parts:

- Microeconomics
- Macroeconomics

Microeconomics is the study of the choices that individuals and businesses make, the way these choices interact in markets, and the influence of governments. Some examples of microeconomic questions are: Why are people downloading more movies? How would a tax on e-commerce affect eBay?

Macroeconomics is the study of the performance of the national economy and the global economy. Some examples of macroeconomic questions are: Why is the U.S. unemployment rate so high? Can the Federal Reserve make our economy expand by cutting interest rates?

REVIEW QUIZ

1. List some examples of the scarcity that you face.
2. Find examples of scarcity in today's headlines.
3. Find an illustration of the distinction between microeconomics and macroeconomics in today's headlines.

You can work these questions in Study Plan 1.1 and get instant feedback.
Two Big Economic Questions

Two big questions summarize the scope of economics:

- How do choices end up determining what, how, and for whom goods and services are produced?
- Can the choices that people make in the pursuit of their own self-interest also promote the broader social interest?

What, How, and For Whom?

Goods and services are the objects that people value and produce to satisfy human wants. Goods are physical objects such as cell phones and automobiles. Services are tasks performed for people such as cell-phone service and auto-repair service.

What? What we produce varies across countries and changes over time. In the United States today, agriculture accounts for 1 percent of total production, manufactured goods for 22 percent, and services (retail and wholesale trade, health care, and education are the biggest ones) for 77 percent. In contrast, in China today, agriculture accounts for 11 percent of total production, manufactured goods for 49 percent, and services for 40 percent. Figure 1.1 shows these numbers and also the percentages for Brazil, which fall between those for the United States and China.

What determines these patterns of production? How do choices end up determining the quantities of cell phones, automobiles, cell-phone service, auto-repair service, and the millions of other items that are produced in the United States and around the world?

How? Goods and services are produced by using productive resources that economists call factors of production. Factors of production are grouped into four categories:

- Land
- Labor
- Capital
- Entrepreneurship

Land The “gifts of nature” that we use to produce goods and services are called land. In economics, land is what in everyday language we call natural resources. It includes land in the everyday sense together with minerals, oil, gas, coal, water, air, forests, and fish.

Our land surface and water resources are renewable and some of our mineral resources can be recycled. But the resources that we use to create energy are nonrenewable—they can be used only once.

Labor The work time and work effort that people devote to producing goods and services is called labor. Labor includes the physical and mental efforts of all the people who work on farms and construction sites and in factories, shops, and offices.

The quality of labor depends on human capital, which is the knowledge and skill that people obtain from education, on-the-job training, and work experience. You are building your own human capital right now as you work on your economics course, and your human capital will continue to grow as you gain work experience.

Human capital expands over time. Today, 87 percent of the adult population of the United States have completed high school and 29 percent have a college or university degree. Figure 1.2 shows these measures of the growth of human capital in the United States over the past century.
CHAPTER 1 What Is Economics?

Capital

The tools, instruments, machines, buildings, and other constructions that businesses use to produce goods and services are called capital. In everyday language, we talk about money, stocks, and bonds as being “capital.” These items are financial capital. Financial capital plays an important role in enabling businesses to borrow the funds that they use to buy physical capital. But because financial capital is not used to produce goods and services, it is not a productive resource.

Entrepreneurship

The human resource that organizes labor, land, and capital is called entrepreneurship. Entrepreneurs come up with new ideas about what and how to produce, make business decisions, and bear the risks that arise from these decisions.

What determines the quantities of factors of production that are used to produce goods and services?

For Whom?

Who consumes the goods and services that are produced depends on the incomes that people earn. People with large incomes can buy a wide range of goods and services. People with small incomes have fewer options and can afford a smaller range of goods and services.

People earn their incomes by selling the services of the factors of production they own:

- Land earns rent.
- Labor earns wages.
- Capital earns interest.
- Entrepreneurship earns profit.

Which factor of production earns the most income? The answer is labor. Wages and fringe benefits are around 70 percent of total income. Land, capital, and entrepreneurship share the rest. These percentages have been remarkably constant over time.

Knowing how income is shared among the factors of production doesn’t tell us how it is shared among individuals. And the distribution of income among individuals is extremely unequal. You know of some people who earn very large incomes: Angelina Jolie earns $10 million per movie; and the New York Yankees pays Alex Rodriguez $27.5 million a year.

You know of even more people who earn very small incomes. Servers at McDonald’s average around $7.25 an hour; checkout clerks, cleaners, and textile and leather workers all earn less than $10 an hour.

You probably know about other persistent differences in incomes. Men, on average, earn more than women; whites earn more than minorities; college graduates earn more than high-school graduates.

We can get a good sense of who consumes the goods and services produced by looking at the percentages of total income earned by different groups of people. The 20 percent of people with the lowest incomes earn about 5 percent of total income, while the richest 20 percent earn close to 50 percent of total income. So on average, people in the richest 20 percent earn more than 10 times the incomes of those in the poorest 20 percent.

Why is the distribution of income so unequal? Why do women and minorities earn less than white males?

Economics provides some answers to all these questions about what, how, and for whom goods and services are produced and much of the rest of this book will help you to understand those answers.

We’re now going to look at the second big question of economics: Can the pursuit of self-interest promote the social interest? This question is a difficult one both to appreciate and to answer.
Can the Pursuit of Self-Interest Promote the Social Interest?

Every day, you and 311 million other Americans, along with 6.9 billion people in the rest of the world, make economic choices that result in what, how, and for whom goods and services are produced.

Self-Interest A choice is in your self-interest if you think that choice is the best one available for you. You make most of your choices in your self-interest. You use your time and other resources in the ways that make the most sense to you, and you don’t think too much about how your choices affect other people. You order a home delivery pizza because you’re hungry and want to eat. You don’t order it thinking that the delivery person needs an income. And when the pizza delivery person shows up at your door, he’s not doing you a favor. He’s pursuing his self-interest and hoping for a good tip.

Social Interest A choice is in the social interest if it leads to an outcome that is the best for society as a whole. The social interest has two dimensions: efficiency and equity (or fairness). What is best for society is an efficient and fair use of resources.

Economists say that efficiency is achieved when the available resources are used to produce goods and services at the lowest possible cost and in the quantities that give the greatest possible value or benefit. We will make the concept of efficiency precise and clear in Chapter 2. For now, just think of efficiency as a situation in which resources are put to their best possible use.

Equity or fairness doesn’t have a crisp definition. Reasonable people, both economists and others, have a variety of views about what is fair. There is always room for disagreement and a need to be careful and clear about the notion of fairness being used.

The Big Question Can we organize our economic lives so that when each one of us makes choices that are in our self-interest, we promote the social interest? Can trading in free markets achieve the social interest? Do we need government action to achieve the social interest? Do we need international cooperation and treaties to achieve the global social interest?

Questions about the social interest are hard ones to answer and they generate discussion, debate, and disagreement. Let’s put a bit of flesh on these questions with four examples.

The examples are:

- Globalization
- The information-age economy
- Climate change
- Economic instability

Globalization The term globalization means the expansion of international trade, borrowing and lending, and investment.

Globalization is in the self-interest of those consumers who buy low-cost goods and services produced in other countries; and it is in the self-interest of the multinational firms that produce in low-cost regions and sell in high-price regions. But is globalization in the self-interest of the low-wage worker in Malaysia who sews your new running shoes and the displaced shoemaker in Atlanta? Is it in the social interest?

Economics in Action

Life in a Small and Ever-Shrinking World

When Nike produces sports shoes, people in Malaysia get work; and when China Airlines buys new airplanes, Americans who work at Boeing in Seattle build them. While globalization brings expanded production and job opportunities for some workers, it destroys many American jobs. Workers across the manufacturing industries must learn new skills, take service jobs, which are often lower-paid, or retire earlier than previously planned.
The Information-Age Economy  The technological change of the past forty years has been called the Information Revolution.

The information revolution has clearly served your self-interest: It has provided your cell phone, laptop, loads of handy applications, and the Internet. It has also served the self-interest of Bill Gates of Microsoft and Gordon Moore of Intel, both of whom have seen their wealth soar.

But did the information revolution best serve the social interest? Did Microsoft produce the best possible Windows operating system and sell it at a price that was in the social interest? Did Intel make the right quality of chips and sell them in the right quantities for the right prices? Or was the quality too low and the price too high? Would the social interest have been better served if Microsoft and Intel had faced competition from other firms?

Climate Change  Climate change is a huge political issue today. Every serious political leader is acutely aware of the problem and of the popularity of having proposals that might lower carbon emissions.

Every day, when you make self-interested choices to use electricity and gasoline, you contribute to carbon emissions; you leave your carbon footprint. You can lessen your carbon footprint by walking, riding a bike, taking a cold shower, or planting a tree.

But can each one of us be relied upon to make decisions that affect the Earth's carbon-dioxide concentration in the social interest? Must governments change the incentives we face so that our self-interested choices are also in the social interest? How can governments change incentives? How can we encourage the use of wind and solar power to replace the burning of fossil fuels that brings climate change?

Economics in Action  Chips and Windows

Gordon Moore, who founded the chip-maker Intel, and Bill Gates, a co-founder of Microsoft, held privileged positions in the Information Revolution.

For many years, Intel chips were the only available chips and Windows was the only available operating system for the original IBM PC and its clones. The PC and Apple’s Mac competed, but the PC had a huge market share.

An absence of competition gave Intel and Microsoft the power and ability to sell their products at prices far above the cost of production. If the prices of chips and Windows had been lower, many more people would have been able to afford a computer and would have chosen to buy one.

Economics in Action  Greenhouse Gas Emissions

Burning fossil fuels to generate electricity and to power airplanes, automobiles, and trucks pours a staggering 28 billions tons—4 tons per person—of carbon dioxide into the atmosphere each year.

Two thirds of the world’s carbon emissions comes from the United States, China, the European Union, Russia, and India. The fastest growing emissions are coming from India and China.

The amount of global warming caused by economic activity and its effects are uncertain, but the emissions continue to grow and pose huge risks.
Economic Instability

The years between 1993 and 2007 were a period of remarkable economic stability, so much so that they’ve been called the Great Moderation. During those years, the U.S. and global economies were on a roll. Incomes in the United States increased by 30 percent and incomes in China tripled. Even the economic shockwaves of 9/11 brought only a small dip in the strong pace of U.S. and global economic growth.

But in August 2007, a period of financial stress began. A bank in France was the first to feel the pain that soon would grip the entire global financial system.

Banks take in people’s deposits and get more funds by borrowing from each other and from other firms. Banks use these funds to make loans. All the banks’ choices to borrow and lend and the choices of people and businesses to lend to and borrow from banks are made in self-interest. But does this lending and borrowing serve the social interest? Is there too much borrowing and lending that needs to be reined in, or is there too little and a need to stimulate more?

When the banks got into trouble, the Federal Reserve (the Fed) bailed them out with big loans backed by taxpayer dollars. Did the Fed’s bailout of troubled banks serve the social interest? Or might the Fed’s rescue action encourage banks to repeat their dangerous lending in the future?

Banks weren’t the only recipients of public funds. General Motors was saved by a government bailout. GM makes its decisions in its self-interest. The government bailout of GM also served the firm’s self-interest. Did the bailout also serve the social interest?

We’ve looked at four topics and asked many questions that illustrate the big question: Can choices made in the pursuit of self-interest also promote the social interest? We’ve asked questions but not answered them because we’ve not yet explained the economic principles needed to do so.

By working through this book, you will discover the economic principles that help economists figure out when the social interest is being served, when it is not, and what might be done when it is not being served. We will return to each of the unanswered questions in future chapters.
The Economic Way of Thinking

The questions that economics tries to answer tell us about the scope of economics, but they don’t tell us how economists think and go about seeking answers to these questions. You’re now going to see how economists go about their work.

We’re going to look at six key ideas that define the economic way of thinking. These ideas are:

- A choice is a tradeoff.
- People make rational choices by comparing benefits and costs.
- Benefit is what you gain from something.
- Cost is what you must give up to get something.
- Most choices are “how-much” choices made at the margin.
- Choices respond to incentives.

A Choice Is a Tradeoff

Because we face scarcity, we must make choices. And when we make a choice, we select from the available alternatives. For example, you can spend Saturday night studying for your next economics test or having fun with your friends, but you can’t do both of these activities at the same time. You must choose how much time to devote to each. Whatever choice you make, you could have chosen something else.

You can think about your choices as tradeoffs. A tradeoff is an exchange—giving up one thing to get something else. When you choose how to spend your Saturday night, you face a tradeoff between studying and hanging out with your friends.

Making a Rational Choice

Economists view the choices that people make as rational. A rational choice is one that compares costs and benefits and achieves the greatest benefit over cost for the person making the choice.

Only the wants of the person making a choice are relevant to determine its rationality. For example, you might like your coffee black and strong but your friend prefers his milky and sweet. So it is rational for you to choose espresso and for your friend to choose cappuccino.

The idea of rational choice provides an answer to the first question: What goods and services will be produced and in what quantities? The answer is those that people rationally choose to buy!

But how do people choose rationally? Why do more people choose an iPod rather than a Zune? Why has the U.S. government chosen to build an interstate highway system and not an interstate high-speed railroad system? The answers turn on comparing benefits and costs.

Benefit: What You Gain

The benefit of something is the gain or pleasure that it brings and is determined by preferences—by what a person likes and dislikes and the intensity of those feelings. If you get a huge kick out of “Guitar Hero,” that video game brings you a large benefit. And if you have little interest in listening to Yo Yo Ma playing a Vivaldi cello concerto, that activity brings you a small benefit.

Some benefits are large and easy to identify, such as the benefit that you get from being in school. A big piece of that benefit is the goods and services that you will be able to enjoy with the boost to your earning power when you graduate. Some benefits are small, such as the benefit you get from a slice of pizza.

Economists measure benefit as the most that a person is willing to give up to get something. You are willing to give up a lot to be in school. But you would give up only an iTunes download for a slice of pizza.

Cost: What You Must Give Up

The opportunity cost of something is the highest-valued alternative that must be given up to get it.

To make the idea of opportunity cost concrete, think about your opportunity cost of being in school. It has two components: the things you can’t afford to buy and the things you can’t do with your time.

Start with the things you can’t afford to buy. You’ve spent all your income on tuition, residence fees, books, and a laptop. If you weren’t in school, you would have spent this money on tickets to ball games and movies and all the other things that you enjoy. But that’s only the start of your opportunity cost. You’ve also given up the opportunity to get a job. Suppose that the best job you could get if you weren’t in school is working at Citibank as a teller earning $25,000 a year. Another part of your opportunity cost of being in school is all the things that you could buy with the extra $25,000 you would have.
As you well know, being a student eats up many hours in class time, doing homework assignments, preparing for tests, and so on. To do all these school activities, you must give up many hours of what would otherwise be leisure time spent with your friends.

So the opportunity cost of being in school is all the good things that you can’t afford and don’t have the spare time to enjoy. You might want to put a dollar value on that cost or you might just list all the items that make up the opportunity cost.

The examples of opportunity cost that we’ve just considered are all-or-nothing costs—you’re either in school or not in school. Most situations are not like this one. They involve choosing how much of an activity to do.

How Much? Choosing at the Margin

You can allocate the next hour between studying and instant messaging your friends, but the choice is not all or nothing. You must decide how many minutes to allocate to each activity. To make this decision, you compare the benefit of a little bit more study time with its cost—you make your choice at the margin.

The benefit that arises from an increase in an activity is called marginal benefit. For example, your marginal benefit from one more night of study before a test is the boost it gives to your grade. Your marginal benefit doesn’t include the grade you’re already achieving without that extra night of work.

The opportunity cost of an increase in an activity is called marginal cost. For you, the marginal cost of studying one more night is the cost of not spending that night on your favorite leisure activity.

To make your decisions, you compare marginal benefit and marginal cost. If the marginal benefit from an extra night of study exceeds its marginal cost, you study the extra night. If the marginal cost exceeds the marginal benefit, you don’t study the extra night.

Choices Respond to Incentives

Economists take human nature as given and view people as acting in their self-interest. All people—you, other consumers, producers, politicians, and public servants—pursue their self-interest.

Self-interested actions are not necessarily selfish actions. You might decide to use your resources in ways that bring pleasure to others as well as to yourself. But a self-interested act gets the most benefit for you based on your view about benefit.

The central idea of economics is that we can predict the self-interested choices that people make by looking at the incentives they face. People undertake those activities for which marginal benefit exceeds marginal cost; and they reject options for which marginal cost exceeds marginal benefit.

For example, your economics instructor gives you a problem set and tells you these problems will be on the next test. Your marginal benefit from working these problems is large, so you diligently work them. In contrast, your math instructor gives you a problem set on a topic that she says will never be on a test. You get little marginal benefit from working these problems, so you decide to skip most of them.

Economists see incentives as the key to reconciling self-interest and social interest. When our choices are not in the social interest, it is because of the incentives we face. One of the challenges for economists is to figure out the incentives that result in self-interested choices being in the social interest.

Economists emphasize the crucial role that institutions play in influencing the incentives that people face as they pursue their self-interest. Laws that protect private property and markets that enable voluntary exchange are the fundamental institutions. You will learn as you progress with your study of economics that where these institutions exist, self-interest can indeed promote the social interest.

REVIEW QUIZ

1 Explain the idea of a tradeoff and think of three tradeoffs that you have made today.
2 Explain what economists mean by rational choice and think of three choices that you’ve made today that are rational.
3 Explain why opportunity cost is the best for-gone alternative and provide examples of some opportunity costs that you have faced today.
4 Explain what it means to choose at the margin and illustrate with three choices at the margin that you have made today.
5 Explain why choices respond to incentives and think of three incentives to which you have responded today.

You can work these questions in Study Plan 1.3 and get instant feedback.
Economics is both a social science and a toolkit for advising on policy decisions.

Economist as Social Scientist

As social scientists, economists seek to discover how the economic world works. In pursuit of this goal, like all scientists, economists distinguish between positive and normative statements.

Positive Statements  A positive statement is about what is. It says what is currently believed about the way the world operates. A positive statement might be right or wrong, but we can test it by checking it against the facts. “Our planet is warming because of the amount of coal that we’re burning” is a positive statement. We can test whether it is right or wrong.

A central task of economists is to test positive statements about how the economic world works and to weed out those that are wrong. Economics first got off the ground in the late 1700s, so it is a young science compared with, for example, physics, and much remains to be discovered.

Normative Statements  A normative statement is about what ought to be. It depends on values and cannot be tested. Policy goals are normative statements. For example, “We ought to cut our use of coal by 50 percent” is a normative policy statement. You may agree or disagree with it, but you can’t test it. It doesn’t assert a fact that can be checked.

Unscrambling Cause and Effect  Economists are particularly interested in positive statements about cause and effect. Are computers getting cheaper because people are buying them in greater quantities? Or are people buying computers in greater quantities because they are getting cheaper? Or is some third factor causing both the price of a computer to fall and the quantity of computers bought to increase?

To answer such questions, economists create and test economic models. An economic model is a description of some aspect of the economic world that includes only those features that are needed for the purpose at hand. For example, an economic model of a cell-phone network might include features such as the prices of calls, the number of cell-phone users, and the volume of calls. But the model would ignore cell-phone colors and ringtones.

A model is tested by comparing its predictions with the facts. But testing an economic model is difficult because we observe the outcomes of the simultaneous change of many factors. To cope with this problem, economists look for natural experiments (situations in the ordinary course of economic life in which the one factor of interest is different and other things are equal or similar); conduct statistical investigations to find correlations; and perform economic experiments by putting people in decision-making situations and varying the influence of one factor at a time to discover how they respond.

Economist as Policy Adviser

Economics is useful. It is a toolkit for advising governments and businesses and for making personal decisions. Some of the most famous economists work partly as policy advisers.

For example, Jagdish Bhagwati of Columbia University, whom you will meet on pp. 52–54, has advised governments and international organizations on trade and economic development issues.

Christina Romer of the University of California, Berkeley, is on leave and serving as the chief economic adviser to President Barack Obama and head of the President’s Council of Economic Advisers.

All the policy questions on which economists provide advice involve a blend of the positive and the normative. Economics can’t help with the normative part—the policy goal. But for a given goal, economics provides a method of evaluating alternative solutions—comparing marginal benefits and marginal costs and finding the solution that makes the best use of the available resources.

### REVIEW QUIZ

1. Distinguish between a positive statement and a normative statement and provide examples.
2. What is a model? Can you think of a model that you might use in your everyday life?
3. How do economists try to disentangle cause and effect?
4. How is economics used as a policy tool?

You can work these questions in Study Plan 1.4 and get instant feedback.
### The Economic Way of Thinking (pp. 8–9)
- Every choice is a tradeoff—exchanging more of something for less of something else.
- People make rational choices by comparing benefit and cost.
- Cost—opportunity cost—is what you must give up to get something.
- Most choices are “how much” choices made at the margin by comparing marginal benefit and marginal cost.
- Choices respond to incentives.

Working Problems 4 and 5 will give you a better understanding of the economic way of thinking.

### Economics as Social Science and Policy Tool (p. 10)
- Economists distinguish between positive statements—what is—and normative statements—what ought to be.
- To explain the economic world, economists create and test economic models.
- Economics is a toolkit used to provide advice on government, business, and personal economic decisions.

Working Problem 6 will give you a better understanding of economics as social science and policy tool.

### Key Terms
- Benefit, 8
- Capital, 4
- Economic model, 10
- Economics, 2
- Efficiency, 5
- Entrepreneurship, 4
- Factors of production, 3
- Goods and services, 3
- Human capital, 3
- Incentive, 2
- Interest, 4
- Labor, 3
- Land, 3
- Macroeconomics, 2
- Margin, 9
- Marginal benefit, 9
- Marginal cost, 9
- Microeconomics, 2
- Opportunity cost, 8
- Preferences, 8
- Profit, 4
- Rational choice, 8
- Rent, 4
- Scarcity, 2
- Self-interest, 5
- Social interest, 5
- Tradeoff, 8
- Wages, 4
CHAPTER 1 What Is Economics?

Definition of Economics

1. Apple Inc. decides to make iTunes freely available in unlimited quantities.
   a. Does Apple’s decision change the incentives that people face?
   b. Is Apple’s decision an example of a microeconomic or a macroeconomic issue?

Two Big Economic Questions

2. Which of the following pairs does not match?
   a. Labor and wages
   b. Land and rent
   c. Entrepreneurship and profit
   d. Capital and profit

3. Explain how the following news headlines concern self-interest and the social interest.
   a. Starbucks Expands in China
   b. McDonald’s Moves into Salads
   c. Food Must Be Labeled with Nutrition Data

The Economic Way of Thinking

4. The night before an economics test, you decide to go to the movies instead of staying home and working your MyEconLab Study Plan. You get 50 percent on your test compared with the 70 percent that you normally score.
   a. Did you face a tradeoff?
   b. What was the opportunity cost of your evening at the movies?

5. Costs Soar for London Olympics
   The regeneration of East London, the site of the 2012 Olympic Games, is set to add extra £1.5 billion to taxpayers’ bill.
   Is the cost of regenerating East London an opportunity cost of hosting the 2012 Olympic Games? Explain why or why not.

Economics as Social Science and Policy Tool

6. Which of the following statements is positive, which is normative, and which can be tested?
   a. The United States should cut its imports.
   b. China is the largest trading partner of the United States.
   c. If the price of antiretroviral drugs increases, HIV/AIDS sufferers will decrease their consumption of the drugs.

ADDITIONAL PROBLEMS AND APPLICATIONS

Definition of Economics

7. Hundreds Line up for 5 p.m. Ticket Giveaway
   By noon, hundreds of Eminem fans had lined up for a chance to score free tickets to the concert.
   Source: Detroit Free Press, May 18, 2009
   When Eminem gave away tickets, what was free and what was scarce? Explain your answer.

Two Big Economic Questions

8. How does the creation of a successful movie influence what, how, and for whom goods and services are produced?

9. How does a successful movie illustrate self-interested choices that are also in the social interest?

The Economic Way of Thinking

   a. How do you expect the success of Iron Man to influence the opportunity cost of hiring Robert Downey Jr.?
   b. How have the incentives for a movie producer to hire Robert Downey Jr. changed?

11. What might be an incentive for you to take a class in summer school? List some of the benefits and costs involved in your decision. Would your choice be rational?

Economics as Social Science and Policy Tool

12. Look at today’s Wall Street Journal. What is the leading economic news story? With which of the big economic questions does it deal and what tradeoffs does it discuss or imply?

13. Provide two microeconomic statements and two macroeconomic statements. Classify your statements as positive or normative. Explain why.
After studying this appendix, you will be able to:

- Make and interpret a scatter diagram
- Identify linear and nonlinear relationships and relationships that have a maximum and a minimum
- Define and calculate the slope of a line
- Graph relationships among more than two variables

**Graphing Data**

A graph represents a quantity as a distance on a line. In Fig. A1.1, a distance on the horizontal line represents temperature, measured in degrees Fahrenheit. A movement from left to right shows an increase in temperature. The point 0 represents zero degrees Fahrenheit. To the right of 0, the temperature is positive. To the left of 0 the temperature is negative (as indicated by the minus sign). A distance on the vertical line represents height, measured in thousands of feet. The point 0 represents sea level. Points above 0 represent feet above sea level. Points below 0 represent feet below sea level (indicated by a minus sign).

In Fig. A1.1, the two scale lines are perpendicular to each other and are called axes. The vertical line is the y-axis, and the horizontal line is the x-axis. Each axis has a zero point, which is shared by the two axes and called the origin.

To make a two-variable graph, we need two pieces of information: the value of the variable x and the value of the variable y. For example, off the coast of Alaska, the temperature is 32 degrees—the value of x. A fishing boat is located at 0 feet above sea level—the value of y. These two bits of information appear as point A in Fig. A1.1. A climber at the top of Mount McKinley on a cold day is 20,320 feet above sea level in a zero-degree gale. These two pieces of information appear as point B. On a warmer day, a climber might be at the peak of Mt. McKinley when the temperature is 32 degrees, at point C.

We can draw two lines, called coordinates, from point C. One, called the x-coordinate, runs from C to the vertical axis. This line is called “the x-coordinate” because its length is the same as the value marked off on the x-axis. The other, called the y-coordinate, runs from C to the horizontal axis. This line is called “the y-coordinate” because its length is the same as the value marked off on the y-axis.

We describe a point on a graph by the values of its x-coordinate and its y-coordinate. For example, at point C, x is 32 degrees and y is 20,320 feet.

A graph like that in Fig. A1.1 can be made using any quantitative data on two variables. The graph can show just a few points, like Fig. A1.1, or many points. Before we look at graphs with many points, let’s reinforce what you’ve just learned by looking at two graphs made with economic data.

Economists measure variables that describe what, how, and for whom goods and services are produced. These variables are quantities produced and prices. Figure A1.2 shows two examples of economic graphs.
Figure A1.2(a) is a graph about iTunes song downloads in January 2010. The x-axis measures the quantity of songs downloaded per day and the y-axis measures the price of a song. Point A tells us what the quantity and price were. You can “read” this graph as telling you that in January 2010, 8.3 million songs a day were downloaded at a price of 99¢ per song.

Figure A1.2(b) is a graph about iTunes song and album downloads in January 2010. The x-axis measures the quantity of songs downloaded per day and the y-axis measures the quantity of albums downloaded per day. Point B tells us what these quantities were. You can “read” this graph as telling you that in January 2010, 8.3 million songs a day and 0.4 million albums were downloaded.

The three graphs that you’ve just seen tell you how to make a graph and how to read a data point on a graph, but they don’t improve on the raw data. Graphs become interesting and revealing when they contain a number of data points because then you can visualize the data.

Economists create graphs based on the principles in Figs. A1.1 and A1.2 to reveal, describe, and visualize the relationships among variables. We’re now going to look at some examples. These graphs are called scatter diagrams.

**Scatter Diagrams**

A scatter diagram is a graph that plots the value of one variable against the value of another variable for a number of different values of each variable. Such a graph reveals whether a relationship exists between two variables and describes their relationship.

The table in Fig. A1.3 shows some data on two variables: the number of tickets sold at the box office and the number of DVDs sold for eight of the most popular movies in 2009.

What is the relationship between these two variables? Does a big box office success generate a large volume of DVD sales? Or does a box office success mean that fewer DVDs are sold?

We can answer these questions by making a scatter diagram. We do so by graphing the data in the table. In the graph in Fig. A1.3, each point shows the number of box office tickets sold (the x variable) and the number of DVDs sold (the y variable) of one of the movies. There are eight movies, so there are eight points “scattered” within the graph.

The point labeled A tells us that Star Trek sold 34 million tickets at the box office and 30 million DVDs. The points in the graph form a pattern, which reveals that larger box office sales are associated with larger DVD sales. But the points also tell us that this association is weak. You can’t predict DVD sales with any confidence by knowing only the number of tickets sold at the box office.

Figure A1.4 shows two scatter diagrams of economic variables. Part (a) shows the relationship between income and expenditure, on average, during a ten-year period. Each point represents income and expenditure in a given year. For example, point A shows that in 2006, income was $31 thousand and expenditure was $30 thousand. This graph shows that as income increases, so does expenditure, and the relationship is a close one.
Figure A1.4(b) shows a scatter diagram of U.S. inflation and unemployment during the 2000s. Here, the points for 2000 to 2008 show no relationship between the two variables, but the high unemployment rate of 2009 brought a low inflation rate that year.

You can see that a scatter diagram conveys a wealth of information, and it does so in much less space than we have used to describe only some of its features. But you do have to “read” the graph to obtain all this information.

Figure A1.4 shows two economic scatter diagrams.

(a) Income and expenditure

(b) Unemployment and inflation

The scatter diagram in part (a) shows the relationship between income and expenditure from 2000 to 2009. Point A shows that in 2006, income was $31 (thousand) on the x-axis and expenditure was $30 (thousand) on the y-axis. This graph shows that as income rises, so does expenditure and the relationship is a close one.

The scatter diagram in part (b) shows a weak relationship between unemployment and inflation in the United States during most of the 2000s.
Breaks in the Axes  The graph in Fig. A1.4(a) has breaks in its axes, as shown by the small gaps. The breaks indicate that there are jumps from the origin, 0, to the first values recorded.

The breaks are used because the lowest values of income and expenditure exceed $20,000. If we made this graph with no breaks in its axes, there would be a lot of empty space, all the points would be crowded into the top right corner, and it would be difficult to see whether a relationship exists between these two variables. By breaking the axes, we are able to bring the relationship into view.

Putting a break in one or both axes is like using a zoom lens to bring the relationship into the center of the graph and magnify it so that the relationship fills the graph.

Misleading Graphs  Breaks can be used to highlight a relationship, but they can also be used to mislead—to make a graph that lies. The most common way of making a graph lie is to put a break in the axis and either to stretch or compress the scale. For example, suppose that in Fig. A1.4(a), the y-axis that measures expenditure ran from zero to $35,000 while the x-axis was the same as the one shown. The graph would now create the impression that despite a huge increase in income, expenditure had barely changed.

To avoid being misled, it is a good idea to get into the habit of always looking closely at the values and the labels on the axes of a graph before you start to interpret it.

Correlation and Causation  A scatter diagram that shows a clear relationship between two variables, such as Fig. A1.4(a), tells us that the two variables have a high correlation. When a high correlation is present, we can predict the value of one variable from the value of the other variable. But correlation does not imply causation.

Sometimes a high correlation is a coincidence, but sometimes it does arise from a causal relationship. It is likely, for example, that rising income causes rising expenditure (Fig. A1.4a) and that high unemployment makes for a slack economy in which prices don’t rise quickly, so the inflation rate is low (Fig. A1.4b).

You’ve now seen how we can use graphs in economics to show economic data and to reveal relationships. Next, we’ll learn how economists use graphs to construct and display economic models.

**Graphs Used in Economic Models**

The graphs used in economics are not always designed to show real-world data. Often they are used to show general relationships among the variables in an economic model.

An economic model is a stripped-down, simplified description of an economy or of a component of an economy such as a business or a household. It consists of statements about economic behavior that can be expressed as equations or as curves in a graph. Economists use models to explore the effects of different policies or other influences on the economy in ways that are similar to the use of model airplanes in wind tunnels and models of the climate.

You will encounter many different kinds of graphs in economic models, but there are some repeating patterns. Once you’ve learned to recognize these patterns, you will instantly understand the meaning of a graph. Here, we’ll look at the different types of curves that are used in economic models, and we’ll see some everyday examples of each type of curve. The patterns to look for in graphs are the four cases in which

- Variables move in the same direction.
- Variables move in opposite directions.
- Variables have a maximum or a minimum.
- Variables are unrelated.

Let’s look at these four cases.

**Variables That Move in the Same Direction**

Figure A1.5 shows graphs of the relationships between two variables that move up and down together. A relationship between two variables that move in the same direction is called a **positive relationship** or a **direct relationship**. A line that slopes upward shows such a relationship.

Figure A1.5 shows three types of relationships: one that has a straight line and two that have curved lines. All the lines in these three graphs are called curves. Any line on a graph—no matter whether it is straight or curved—is called a **curve**.

A relationship shown by a straight line is called a **linear relationship**. Figure A1.5(a) shows a linear relationship between the number of miles traveled in
5 hours and speed. For example, point A shows that we will travel 200 miles in 5 hours if our speed is 40 miles an hour. If we double our speed to 80 miles an hour, we will travel 400 miles in 5 hours.

Figure A1.5(b) shows the relationship between distance sprinted and recovery time (the time it takes the heart rate to return to its normal resting rate). This relationship is an upward-sloping one that starts out quite flat but then becomes steeper as we move along the curve away from the origin. The reason this curve becomes steeper is that the additional recovery time needed from sprinting an additional 100 yards increases. It takes less than 5 minutes to recover from sprinting 100 yards but more than 10 minutes to recover from 200 yards.

Figure A1.5(c) shows the relationship between the number of problems worked by a student and the amount of study time. This relationship is an upward-sloping one that starts out quite steep and becomes flatter as we move along the curve away from the origin. Study time becomes less productive as the student spends more hours studying and becomes more tired.

Variables That Move in Opposite Directions

Figure A1.6 shows relationships between things that move in opposite directions. A relationship between variables that move in opposite directions is called a negative relationship or an inverse relationship.

Figure A1.6(a) shows the relationship between the hours spent playing squash and the hours spent playing tennis when the total time available is 5 hours. One extra hour spent playing tennis means one hour less spent playing squash and vice versa. This relationship is negative and linear.

Figure A1.6(b) shows the relationship between the cost per mile traveled and the length of a journey. The longer the journey, the lower is the cost per mile. But as the journey length increases, even though the cost per mile decreases, the fall in the cost is smaller the longer the journey. This feature of the relationship is shown by the fact that the curve slopes downward, starting out steep at a short journey length and then becoming flatter as the journey length increases. This relationship arises because some of the costs are fixed, such as auto insurance, and the fixed costs are spread over a longer journey.
Figure A1.6(c) shows the relationship between the amount of leisure time and the number of problems worked by a student. Increasing leisure time produces an increasingly large reduction in the number of problems worked. This relationship is a negative one that starts out with a gentle slope at a small number of leisure hours and becomes steeper as the number of leisure hours increases. This relationship is a different view of the idea shown in Fig. A1.5(c).

Variables That Have a Maximum or a Minimum

Many relationships in economic models have a maximum or a minimum. For example, firms try to make the maximum possible profit and to produce at the lowest possible cost. Figure A1.7 shows relationships that have a maximum or a minimum.

Figure A1.7(a) shows the relationship between rainfall and wheat yield. When there is no rainfall, wheat will not grow, so the yield is zero. As the rainfall increases up to 10 days a month, the wheat yield increases. With 10 rainy days each month, the wheat yield reaches its maximum at 40 bushels an acre (point A). Rain in excess of 10 days a month starts to lower the yield of wheat. If every day is rainy, the wheat suffers from a lack of sunshine and the yield decreases to zero. This relationship is one that starts out sloping upward, reaches a maximum, and then slopes downward.

Figure A1.7(b) shows the reverse case—a relationship that begins sloping downward, falls to a minimum, and then slopes upward. Most economic costs are like this relationship. An example is the relationship between the cost per mile and speed for a car trip. At low speeds, the car is creeping in a traffic snarl-up. The number of miles per gallon is low, so the cost per mile is high. At high speeds, the car is traveling faster than its efficient speed, using a large quantity of gasoline, and again the number of miles per gallon is low and the cost per mile is high. At a speed of 55 miles an hour, the cost per mile is at its minimum (point B). This relationship is one that starts out sloping downward, reaches a minimum, and then slopes upward.
Variables That Are Unrelated

There are many situations in which no matter what happens to the value of one variable, the other variable remains constant. Sometimes we want to show the independence between two variables in a graph, and Fig. A1.8 shows two ways of achieving this.

In describing the graphs in Fig. A1.5 through Fig. A1.7, we have talked about curves that slope upward or slope downward, and curves that become less steep or steeper. Let’s spend a little time discussing exactly what we mean by slope and how we measure the slope of a curve.

FIGURE A1.7  Maximum and Minimum Points

Part (a) shows a relationship that has a maximum point, A. The curve slopes upward as it rises to its maximum point, is flat at its maximum, and then slopes downward.

Part (b) shows a relationship with a minimum point, B. The curve slopes downward as it falls to its minimum, is flat at its minimum, and then slopes upward.

FIGURE A1.8  Variables That Are Unrelated

This figure shows how we can graph two variables that are unrelated. In part (a), a student’s grade in economics is plotted at 75 percent on the y-axis regardless of the price of bananas on the x-axis. The curve is horizontal.

In part (b), the output of the vineyards of France on the x-axis does not vary with the rainfall in California on the y-axis. The curve is vertical.
The Slope of a Relationship

We can measure the influence of one variable on another by the slope of the relationship. The slope of a relationship is the change in the value of the variable measured on the y-axis divided by the change in the value of the variable measured on the x-axis. We use the Greek letter Δ (delta) to represent “change in.” Thus Δy means the change in the value of the variable measured on the y-axis, and Δx means the change in the value of the variable measured on the x-axis. Therefore the slope of the relationship is

\[ \text{Slope} = \frac{\Delta y}{\Delta x} \]

If a large change in the variable measured on the y-axis (Δy) is associated with a small change in the variable measured on the x-axis (Δx), the slope is large and the curve is steep. If a small change in the variable measured on the y-axis (Δy) is associated with a large change in the variable measured on the x-axis (Δx), the slope is small and the curve is flat.

We can make the idea of slope clearer by doing some calculations.

The Slope of a Straight Line

The slope of a straight line is the same regardless of where on the line you calculate it. The slope of a straight line is constant. Let's calculate the slope of the positive relationship in Fig. A1.9. In part (a),

![FIGURE A1.9 The Slope of a Straight Line](image)

To calculate the slope of a straight line, we divide the change in the value of the variable measured on the y-axis (Δy) by the change in the value of the variable measured on the x-axis (Δx) as we move along the line.

Part (a) shows the calculation of a positive slope. When x increases from 2 to 6, Δx equals 4. That change in x brings about an increase in y from 3 to 6, so Δy equals 3. The slope (Δy/Δx) equals 3/4.

Part (b) shows the calculation of a negative slope. When x increases from 2 to 6, Δx equals 4. That increase in x brings about a decrease in y from 6 to 3, so Δy equals -3. The slope (Δy/Δx) equals -3/4.
when $x$ increases from 2 to 6, $y$ increases from 3 to 6. The change in $x$ is +4—that is, $\Delta x$ is 4. The change in $y$ is +3—that is, $\Delta y$ is 3. The slope of that line is

$$\frac{\Delta y}{\Delta x} = \frac{3}{4}.$$

In part (b), when $x$ increases from 2 to 6, $y$ decreases from 6 to 3. The change in $y$ is minus 3—that is, $\Delta y$ is –3. The change in $x$ is plus 4—that is, $\Delta x$ is 4. The slope of the curve is

$$\frac{\Delta y}{\Delta x} = \frac{-3}{4}.$$

Notice that the two slopes have the same magnitude (3/4), but the slope of the line in part (a) is positive (+3/+4 = 3/4) while that in part (b) is negative (–3/+4 = –3/4). The slope of a positive relationship is positive; the slope of a negative relationship is negative.

The Slope of a Curved Line

The slope of a curved line is trickier. The slope of a curved line is not constant, so the slope depends on where on the curved line we calculate it. There are two ways to calculate the slope of a curved line: You can calculate the slope at a point, or you can calculate the slope across an arc of the curve. Let’s look at the two alternatives.

**Slope at a Point** To calculate the slope at a point on a curve, you need to construct a straight line that has the same slope as the curve at the point in question. Figure A1.10 shows how this is done. Suppose you want to calculate the slope of the curve at point $A$. Place a ruler on the graph so that the ruler touches point $A$ and no other point on the curve, then draw a straight line along the edge of the ruler. The straight red line is this line, and it is the tangent to the curve at point $A$. If the ruler touches the curve only at point $A$, then the slope of the curve at point $A$ must be the same as the slope of the edge of the ruler. If the curve and the ruler do not have the same slope, the line along the edge of the ruler will cut the curve instead of just touching it.

Now that you have found a straight line with the same slope as the curve at point $A$, you can calculate the slope of the curve at point $A$ by calculating the slope of the straight line. Along the straight line, as $x$ increases from 0 to 4 ($\Delta x$ is 4) $y$ increases from 2 to 5 ($\Delta y$ is 3). Therefore the slope of the straight line is

$$\frac{\Delta y}{\Delta x} = \frac{3}{4}.$$

So the slope of the curve at point $A$ is 3/4.

**Slope Across an Arc** An arc of a curve is a piece of a curve. Fig. A1.11 shows the same curve as in Fig. A1.10, but instead of calculating the slope at point $A$, we are now going to calculate the slope across the arc from point $B$ to point $C$. You can see that the slope of the curve at point $B$ is greater than at point $C$. When we calculate the slope across an arc, we are calculating the average slope between two points. As we move along the arc from $B$ to $C$, $x$ increases from 3 to 5 and $y$ increases from 4.0 to 5.5. The change in $x$ is 2 ($\Delta x$ is 2), and the change in $y$ is 1.5 ($\Delta y$ is 1.5).
Therefore the slope is

\[ \frac{\Delta y}{\Delta x} = \frac{1.5}{2} = \frac{3}{4} \]

So the slope of the curve across the arc BC is 3/4.

This calculation gives us the slope of the curve between points B and C. The actual slope calculated is the slope of the straight line from B to C. This slope approximates the average slope of the curve along the arc BC. In this particular example, the slope across the arc BC is identical to the slope of the curve at point A, but the calculation of the slope of a curve does not always work out so neatly. You might have fun constructing some more examples and a few counter examples.

You now know how to make and interpret a graph. So far, we’ve limited our attention to graphs of two variables. We’re now going to learn how to graph more than two variables.

**Graphing Relationships Among More Than Two Variables**

We have seen that we can graph the relationship between two variables as a point formed by the x- and y-coordinates in a two-dimensional graph. You might be thinking that although a two-dimensional graph is informative, most of the things in which you are likely to be interested involve relationships among many variables, not just two. For example, the amount of ice cream consumed depends on the price of ice cream and the temperature. If ice cream is expensive and the temperature is low, people eat much less ice cream than when ice cream is inexpensive and the temperature is high. For any given price of ice cream, the quantity consumed varies with the temperature; and for any given temperature, the quantity of ice cream consumed varies with its price.

Figure A1.12 shows a relationship among three variables. The table shows the number of gallons of ice cream consumed each day at two different temperatures and at a number of different prices of ice cream. How can we graph these numbers?

To graph a relationship that involves more than two variables, we use the *ceteris paribus* assumption.

**Ceteris Paribus**

*Ceteris paribus* (often shortened to *cet par*) means “if all other relevant things remain the same.” To isolate the relationship of interest in a laboratory experiment, a scientist holds everything constant except for the variable whose effect is being studied. Economists use the same method to graph a relationship that has more than two variables.

Figure A1.12 shows an example. There, you can see what happens to the quantity of ice cream consumed when the price of ice cream varies but the temperature is held constant.

The curve labeled 70°F shows the relationship between ice cream consumption and the price of ice cream if the temperature remains at 70°F. The numbers used to plot that curve are those in the first two columns of the table. For example, if the temperature is 70°F, 10 gallons are consumed when the price is $2.75 a scoop and 18 gallons are consumed when the price is $2.25 a scoop.

The curve labeled 90°F shows the relationship between ice cream consumption and the price of ice cream if the temperature remains at 90°F. The
When the price of ice cream changes but the temperature is constant, you can think of what happens in the graph as a movement along one of the curves. At 70°F there is a movement along the blue curve and at 90°F there is a movement along the red curve.

**When Other Things Change**

The temperature is held constant along each of the curves in Fig. A1.12, but in reality the temperature changes. When that event occurs, you can think of what happens in the graph as a shift of the curve. When the temperature rises from 70°F to 90°F, the curve that shows the relationship between ice cream consumption and the price of ice cream shifts rightward from the blue curve to the red curve.

You will encounter these ideas of movements along and shifts of curves at many points in your study of economics. Think carefully about what you’ve just learned and make up some examples (with assumed numbers) about other relationships.

With what you have learned about graphs, you can move forward with your study of economics. There are no graphs in this book that are more complicated than those that have been explained in this appendix.
ERROR: rangecheck
OFFENDING COMMAND: .buildshading2
STACK:
  -dictionary-
  -dictionary-
To calculate the slope of the line, subtract equation (1) from equation (2) to obtain
\[ \Delta y = b \Delta x \] (3)
and now divide equation (3) by \( \Delta x \) to obtain
\[ \frac{\Delta y}{\Delta x} = b. \]
So the slope of the line is \( b \).

**Position of Line**

The \( y \)-axis intercept determines the position of the line on the graph. Figure 3 illustrates the relationship between the \( y \)-axis intercept and the position of the line. In this graph, the \( y \)-axis measures saving and the \( x \)-axis measures income.

When the \( y \)-axis intercept, \( a \), is positive, the line hits the \( y \)-axis at a positive value of \( y \)–as the blue line does. Its \( y \)-axis intercept is 100. When the \( y \)-axis intercept, \( a \), is zero, the line hits the \( y \)-axis at the origin—as the purple line does. Its \( y \)-axis intercept is 0. When the \( y \)-axis intercept, \( a \), is negative, the line hits the \( y \)-axis at a negative value of \( y \)–as the red line does. Its \( y \)-axis intercept is \(-100\).

As the equations of the three lines show, the value of the \( y \)-axis intercept does not influence the slope of the line. All three lines have a slope equal to 0.5.

**Positive Relationships**

Figure 1 shows a positive relationship—the two variables \( x \) and \( y \) move in the same direction. All positive relationships have a slope that is positive. In the equation of the line, the constant \( b \) is positive. In this example, the \( y \)-axis intercept, \( a \), is 100. The slope \( b \) equals \( \Delta y/\Delta x \), which in Fig. 2 is 100/200 or 0.5. The equation of the line is
\[ y = 100 + 0.5x. \]

**Negative Relationships**

Figure 4 shows a negative relationship—the two variables \( x \) and \( y \) move in the opposite direction. All negative relationships have a slope that is negative. In the equation of the line, the constant \( b \) is negative. In the example in Fig. 4, the \( y \)-axis intercept, \( a \), is 30. The slope, \( b \), equals \( \Delta y/\Delta x \), which is \(-20/2 \) or \(-10\). The equation of the line is
\[ y = 30 + (-10)x \]
or
\[ y = 30 - 10x. \]

**Example**

A straight line has a \( y \)-axis intercept of 50 and a slope of 2. What is the equation of this line?

The equation of a straight line is
\[ y = a + bx \]
where \( a \) is the \( y \)-axis intercept and \( b \) is the slope. So the equation is
\[ y = 50 + 2x. \]
REVIEW QUIZ

1. Explain how we “read” the three graphs in Figs A1.1 and A1.2.
2. Explain what scatter diagrams show and why we use them.
3. Explain how we “read” the three scatter diagrams in Figs A1.3 and A1.4.
4. Draw a graph to show the relationship between two variables that move in the same direction.
5. Draw a graph to show the relationship between two variables that move in opposite directions.
6. Draw a graph to show the relationship between two variables that have a maximum and a minimum.
7. Which of the relationships in Questions 4 and 5 is a positive relationship and which is a negative relationship?
8. What are the two ways of calculating the slope of a curved line?
9. How do we graph a relationship among more than two variables?
10. Explain what change will bring a movement along a curve.
11. Explain what change will bring a shift of a curve.

You can work these questions in Study Plan 1.A and get instant feedback.

SUMMARY

Key Points

Graphing Data (pp. 13–16)
- A graph is made by plotting the values of two variables $x$ and $y$ at a point that corresponds to their values measured along the $x$-axis and the $y$-axis.
- A scatter diagram is a graph that plots the values of two variables for a number of different values of each.
- A scatter diagram shows the relationship between the two variables. It shows whether they are positively related, negatively related, or unrelated.

Graphs Used in Economic Models (pp. 16–19)
- Graphs are used to show relationships among variables in economic models.
- Relationships can be positive (an upward-sloping curve), negative (a downward-sloping curve), positive and then negative (have a maximum point), negative and then positive (have a minimum point), or unrelated (a horizontal or vertical curve).

The Slope of a Relationship (pp. 20–22)
- The slope of a relationship is calculated as the change in the value of the variable measured on the $y$-axis divided by the change in the value of the variable measured on the $x$-axis—that is, $\Delta y/\Delta x$.
- A straight line has a constant slope.
- A curved line has a varying slope. To calculate the slope of a curved line, we calculate the slope at a point or across an arc.

Graphing Relationships Among More Than Two Variables (pp. 22–23)
- To graph a relationship among more than two variables, we hold constant the values of all the variables except two.
- We then plot the value of one of the variables against the value of another.
- A ceteris paribus change in the value of a variable on an axis of a graph brings a movement along the curve.
- A change in the value of a variable held constant along the curve brings a shift of the curve.

Key Terms

Ceteris paribus, 22
Direct relationship, 16
Inverse relationship, 17
Linear relationship, 16
Negative relationship, 17
Positive relationship, 16
Scatter diagram, 14
Slope, 20
STUDY PLAN PROBLEMS AND APPLICATIONS

You can work Problems 1 to 11 in MyEconLab Chapter 1A Study Plan and get instant feedback.

Use the following spreadsheet to work Problems 1 to 3. The spreadsheet provides data on the U.S. economy: Column A is the year, column B is the inflation rate, column C is the interest rate, column D is the growth rate, and column E is the unemployment rate.

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<td>4.7</td>
<td>2.7</td>
</tr>
<tr>
<td>9</td>
<td>2007</td>
<td>2.8</td>
<td>4.4</td>
<td>2.1</td>
</tr>
<tr>
<td>10</td>
<td>2008</td>
<td>3.8</td>
<td>1.4</td>
<td>0.4</td>
</tr>
<tr>
<td>11</td>
<td>2009</td>
<td>-0.4</td>
<td>0.2</td>
<td>-2.4</td>
</tr>
</tbody>
</table>

1. Draw a scatter diagram of the inflation rate and the interest rate. Describe the relationship.
2. Draw a scatter diagram of the growth rate and the unemployment rate. Describe the relationship.
3. Draw a scatter diagram of the interest rate and the unemployment rate. Describe the relationship.

Use the following news clip to work Problems 4 to 6. 

Clash of the Titans Tops Box Office With Sales of $61.2 Million:

<table>
<thead>
<tr>
<th>Movie</th>
<th>Theaters (number)</th>
<th>Revenue (dollars per theater)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clash of the Titans</td>
<td>3,777</td>
<td>16,213</td>
</tr>
<tr>
<td>Tyler Perry’s Why Did I Get Married</td>
<td>2,155</td>
<td>13,591</td>
</tr>
<tr>
<td>How To Train Your Dragon</td>
<td>4,060</td>
<td>7,145</td>
</tr>
<tr>
<td>The Last Song</td>
<td>2,673</td>
<td>5,989</td>
</tr>
</tbody>
</table>

Source: Bloomberg.com, April 5, 2010

4. Draw a graph of the relationship between the revenue per theater on the y-axis and the number of theaters on the x-axis. Describe the relationship.
5. Calculate the slope of the relationship between 4,060 and 2,673 theaters.
6. Calculate the slope of the relationship between 2,155 and 4,060 theaters.

7. Calculate the slope of the following relationship.

![Graph](image)

Use the following relationship to work Problems 8 and 9.

8. Calculate the slope of the relationship at point A and at point B.
9. Calculate the slope across the arc AB.

Use the following table to work Problems 10 and 11. The table gives the price of a balloon ride, the temperature, and the number of rides a day.

<table>
<thead>
<tr>
<th>Price (dollars per ride)</th>
<th>50°F</th>
<th>70°F</th>
<th>90°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>32</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>27</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>15</td>
<td>18</td>
<td>27</td>
<td>32</td>
</tr>
</tbody>
</table>

10. Draw a graph to show the relationship between the price and the number of rides, when the temperature is 70°F. Describe this relationship.
11. What happens in the graph in Problem 10 if the temperature rises to 90°F?
Use the following spreadsheet to work Problems 12 to 14. The spreadsheet provides data on oil and gasoline: Column A is the year, column B is the price of oil (dollars per barrel), column C is the price of gasoline (cents per gallon), column D is U.S. oil production, and column E is the U.S. quantity of gasoline refined (both in millions of barrels per day).

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1999</td>
<td>24</td>
<td>118</td>
<td>5.9</td>
</tr>
<tr>
<td>2</td>
<td>2000</td>
<td>30</td>
<td>152</td>
<td>5.8</td>
</tr>
<tr>
<td>3</td>
<td>2001</td>
<td>24</td>
<td>146</td>
<td>5.8</td>
</tr>
<tr>
<td>4</td>
<td>2002</td>
<td>24</td>
<td>139</td>
<td>5.7</td>
</tr>
<tr>
<td>5</td>
<td>2003</td>
<td>27</td>
<td>160</td>
<td>5.7</td>
</tr>
<tr>
<td>6</td>
<td>2004</td>
<td>37</td>
<td>190</td>
<td>5.4</td>
</tr>
<tr>
<td>7</td>
<td>2005</td>
<td>49</td>
<td>231</td>
<td>5.2</td>
</tr>
<tr>
<td>8</td>
<td>2006</td>
<td>56</td>
<td>262</td>
<td>5.1</td>
</tr>
<tr>
<td>9</td>
<td>2007</td>
<td>86</td>
<td>284</td>
<td>5.1</td>
</tr>
<tr>
<td>10</td>
<td>2008</td>
<td>43</td>
<td>330</td>
<td>5.0</td>
</tr>
<tr>
<td>11</td>
<td>2009</td>
<td>76</td>
<td>241</td>
<td>4.9</td>
</tr>
</tbody>
</table>


Use the following data to work Problems 15 to 17. Draw a graph that shows the relationship between the two variables $x$ and $y$:

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>25</td>
<td>24</td>
<td>22</td>
<td>18</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>

15. a. Is the relationship positive or negative?
   b. Does the slope of the relationship become steeper or flatter as the value of $x$ increases?
   c. Think of some economic relationships that might be similar to this one.

16. Calculate the slope of the relationship between $x$ and $y$ when $x$ equals 3.

17. Calculate the slope of the relationship across the arc as $x$ increases from 4 to 5.

18. Calculate the slope of the curve at point A.

19. Calculate the slope at point A and at point B.

20. Calculate the slope across the arc $AB$.

Use the following table to work Problems 21 to 23. The table gives information about umbrellas: price, the number purchased, and rainfall in inches.

<table>
<thead>
<tr>
<th>Umbrellas (number purchased per day)</th>
<th>Price (dollars per umbrella)</th>
<th>0 inches</th>
<th>1 inch</th>
<th>2 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
<td>4</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>2</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

21. Draw a graph to show the relationship between the price and the number of umbrellas purchased, holding the amount of rainfall constant at 1 inch. Describe this relationship.

22. What happens in the graph in Problem 21 if the price rises and rainfall is constant?

23. What happens in the graph in Problem 21 if the rainfall increases from 1 inch to 2 inches?
After studying this chapter, you will be able to:

- Define the production possibilities frontier and use it to calculate opportunity cost
- Distinguish between production possibilities and preferences and describe an efficient allocation of resources
- Explain how current production choices expand future production possibilities
- Explain how specialization and trade expand production possibilities
- Describe the economic institutions that coordinate decisions

Why does food cost much more today than it did a few years ago? One reason is that we now use part of our corn crop to produce ethanol, a clean biofuel substitute for gasoline. Another reason is that drought in some parts of the world has decreased global grain production. In this chapter, you will study an economic model—the production possibilities frontier—and you will learn why ethanol production and drought have increased the cost of producing food. You will also learn how to assess whether it is a good idea to increase corn production to produce fuel; how we can expand our production possibilities; and how we gain by trading with others.

At the end of the chapter, in Reading Between the Lines, we’ll apply what you’ve learned to understanding why ethanol production is raising the cost of food.
Every working day, in mines, factories, shops, and offices and on farms and construction sites across the United States, 138 million people produce a vast variety of goods and services valued at $50 billion. But the quantities of goods and services that we can produce are limited both by our available resources and by technology. And if we want to increase our production of one good, we must decrease our production of something else—we face a tradeoff. You are going to learn about the production possibilities frontier, which describes the limit to what we can produce and provides a neat way of thinking about and illustrating the idea of a tradeoff.

The production possibilities frontier (PPF) is the boundary between those combinations of goods and services that can be produced and those that cannot. To illustrate the PPF, we focus on two goods at a time and hold the quantities produced of all the other goods and services constant. That is, we look at a model economy in which everything remains the same except for the production of the two goods we are considering.

Let’s look at the production possibilities frontier for cola and pizza, which represent any pair of goods or services.

Production Possibilities Frontier

The production possibilities frontier for cola and pizza shows the limits to the production of these two goods, given the total resources and technology available to produce them. Figure 2.1 shows this production possibilities frontier. The table lists some combinations of the quantities of pizza and cola that can be produced in a month given the resources available. The figure graphs these combinations. The x-axis shows the quantity of pizzas produced, and the y-axis shows the quantity of cola produced.

The PPF illustrates scarcity because we cannot attain the points outside the frontier. These points describe wants that can’t be satisfied. We can produce at any point inside the PPF or on the PPF. These points are attainable. Suppose that in a typical month, we produce 4 million pizzas and 5 million cans of cola. Figure 2.1 shows this combination as point E and as possibility E in the table. The figure

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Pizzas (millions)</th>
<th>Cola (millions of cans)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

The table lists six production possibilities for cola and pizzas. Row A tells us that if we produce no pizzas, the maximum quantity of cola we can produce is 15 million cans. Points A, B, C, D, E, and F in the figure represent the rows of the table. The curve passing through these points is the production possibilities frontier (PPF).

The PPF separates the attainable from the unattainable. Production is possible at any point inside the orange area or on the frontier. Points outside the frontier are unattainable. Points inside the frontier, such as point Z, are inefficient because resources are wasted or misallocated. At such points, it is possible to use the available resources to produce more of either or both goods.
also shows other production possibilities. For example, we might stop producing pizza and move all the people who produce it into producing cola. Point \( A \) in the figure and possibility \( A \) in the table show this case. The quantity of cola produced increases to 15 million cans, and pizza production dries up. Alternatively, we might close the cola factories and switch all the resources into producing pizza. In this situation, we produce 5 million pizzas. Point \( F \) in the figure and possibility \( F \) in the table show this case.

**Production Efficiency**

We achieve production efficiency if we produce goods and services at the lowest possible cost. This outcome occurs at all the points on the PPF. At points inside the PPF, production is inefficient because we are giving up more than necessary of one good to produce a given quantity of the other good.

For example, at point \( Z \) in Fig. 2.1, we produce 3 million pizzas and 5 million cans of cola. But we have enough resources to produce 3 million pizzas and 9 million cans of cola. Our pizzas cost more cola than necessary. We can get them for a lower cost. Only when we produce on the PPF do we incur the lowest possible cost of production.

Production is inefficient inside the PPF because resources are either unused or misallocated or both.

Resources are unused when they are idle but could be working. For example, we might leave some of the factories idle or some workers unemployed.

Resources are misallocated when they are assigned to tasks for which they are not the best match. For example, we might assign skilled pizza chefs to work in a cola factory and skilled cola producers to work in a pizza shop. We could get more pizzas and more cola from these same workers if we reassigned them to the tasks that more closely match their skills.

**Tradeoff Along the PPF**

Every choice along the PPF involves a tradeoff. On the PPF in Fig. 2.1, we trade off cola for pizzas.

Tradeoffs arise in every imaginable real-world situation in which a choice must be made. At any given point in time, we have a fixed amount of labor, land, capital, and entrepreneurship. By using our available technologies, we can employ these resources to produce goods and services, but we are limited in what we can produce. This limit defines a boundary between what we can attain and what we cannot attain. This boundary is the real-world’s production possibilities frontier, and it defines the tradeoffs that we must make. On our real-world PPF, we can produce more of any one good or service only if we produce less of some other goods or services.

When doctors want to spend more on AIDS and cancer research, they face a tradeoff: more medical research for less of some other things. When Congress wants to spend more on education and health care, it faces a tradeoff: more education and health care for less national defense or less homeland security. When an environmental group argues for less logging, it is suggesting a tradeoff: greater conservation of endangered wildlife for less paper. When you want to study more, you face a tradeoff: more study time for less leisure or sleep.

All tradeoffs involve a cost—an opportunity cost.

**Opportunity Cost**

The opportunity cost of an action is the highest-valued alternative forgone. The PPF makes this idea precise and enables us to calculate opportunity cost. Along the PPF, there are only two goods, so there is only one alternative forgone: some quantity of the other good. Given our current resources and technology, we can produce more pizzas only if we produce less cola. The opportunity cost of producing an additional pizza is the cola we must forgo. Similarly, the opportunity cost of producing an additional can of cola is the quantity of pizza we must forgo.

In Fig. 2.1, if we move from point \( C \) to point \( D \), we get 1 million more pizzas but 3 million fewer cans of cola. The additional 1 million pizzas cost 3 million cans of cola. One pizza costs 3 cans of cola.

We can also work out the opportunity cost of moving in the opposite direction. In Fig. 2.1, if we move from point \( D \) to point \( C \), the quantity of cola produced increases by 3 million cans and the quantity of pizzas produced decreases by 1 million. So if we choose point \( C \) over point \( D \), the additional 3 million cans of cola cost 1 million pizzas. One can of cola costs 1/3 of a pizza.

**Opportunity Cost Is a Ratio**

Opportunity cost is a ratio. It is the decrease in the quantity produced of one good divided by the increase in the quantity produced of another good as we move along the production possibilities frontier.
Because opportunity cost is a ratio, the opportunity cost of producing an additional can of cola is equal to the inverse of the opportunity cost of producing an additional pizza. Check this proposition by returning to the calculations we’ve just worked through. When we move along the PPF from C to D, the opportunity cost of a pizza is 3 cans of cola. The inverse of 3 is 1/3. If we decrease the production of pizza and increase the production of cola by moving from D to C, the opportunity cost of a can of cola must be 1/3 of a pizza. That is exactly the number that we calculated for the move from D to C.

**Increasing Opportunity Cost** The opportunity cost of a pizza increases as the quantity of pizzas produced increases. The outward-bowed shape of the PPF reflects increasing opportunity cost. When we produce a large quantity of cola and a small quantity of pizza—between points A and B in Fig. 2.1—the frontier has a gentle slope. An increase in the quantity of pizzas costs a small decrease in the quantity of cola—the opportunity cost of a pizza is a small quantity of cola. When we produce a large quantity of pizzas and a small quantity of cola—between points E and F in Fig. 2.1—the frontier is steep. A given increase in the quantity of pizzas costs a large decrease in the quantity of cola, so the opportunity cost of a pizza is a large quantity of cola.

The PPF is bowed outward because resources are not all equally productive in all activities. People with many years of experience working for PepsiCo are good at producing cola but not very good at making pizzas. So if we move some of these people from PepsiCo to Domino’s, we get a small increase in the quantity of pizzas but a large decrease in the quantity of cola.

Similarly, people who have spent years working at Domino’s are good at producing pizzas, but they have no idea how to produce cola. So if we move some of these people from Domino’s to PepsiCo, we get a small increase in the quantity of cola but a large decrease in the quantity of pizzas. The more of either good we try to produce, the less productive are the additional resources we use to produce that good and the larger is the opportunity cost of a unit of that good.

**Economics in Action**

**Increasing Opportunity Cost on the Farm**

Sanders Wright, a homesick Mississippi native, is growing cotton in Iowa. The growing season is short, so his commercial success is unlikely. Cotton does not grow well in Iowa, but corn does. A farm with irrigation can produce 300 bushels of corn per acre—twice the U.S. average.

Ronnie Gerik, a Texas cotton farmer, has started to grow corn. Ronnie doesn’t have irrigation and instead relies on rainfall. That’s not a problem for cotton, which just needs a few soakings a season. But it’s a big problem for corn, which needs an inch of water a week. Also, corn can’t take the heat like cotton, and if the temperature rises too much, Ronnie will be lucky to get 100 bushels an acre.

An Iowa corn farmer gives up almost no cotton to produce his 300 bushels of corn per acre—corn has a low opportunity cost. But Ronnie Gerick gives up a huge amount of cotton to produce his 100 bushels of corn per acre. By switching some land from cotton to corn, Ronnie has increased the production of corn, but the additional corn has a high opportunity cost.

When we produce a large quantity of pizzas and a small quantity of cola—between points $E$ and $F$ in Fig. 2.1—the frontier is steep. A given increase in the quantity of pizzas costs a large decrease in the quantity of cola, so the opportunity cost of a pizza is a large quantity of cola.

We’ve seen that what we can produce is limited by the production possibilities frontier. We’ve also seen that production on the PPF is efficient. But we can produce many different quantities on the PPF. How do we choose among them? How do we know which point on the PPF is the best one?
**Using Resources Efficiently**

We achieve production efficiency at every point on the PPF, but which point is best? The answer is the point on the PPF at which goods and services are produced in the quantities that provide the greatest possible benefit. When goods and services are produced at the lowest possible cost and in the quantities that provide the greatest possible benefit, we have achieved allocative efficiency.

The questions that we raised when we reviewed the four big issues in Chapter 1 are questions about allocative efficiency. To answer such questions, we must measure and compare costs and benefits.

**The PPF and Marginal Cost**

The marginal cost of a good is the opportunity cost of producing one more unit of it. We calculate marginal cost from the slope of the PPF. As the quantity of pizzas produced increases, the PPF gets steeper and the marginal cost of a pizza increases. Figure 2.2 illustrates the calculation of the marginal cost of a pizza.

Begin by finding the opportunity cost of pizza in blocks of 1 million pizzas. The cost of the first million pizzas is 1 million cans of cola; the cost of the second million pizzas is 2 million cans of cola; the cost of the third million pizzas is 3 million cans of cola, and so on. The bars in part (a) illustrate these calculations.

The bars in part (b) show the cost of an average pizza in each of these 1 million blocks. The red curve, labeled $MC$, shows the marginal cost of a pizza at each point along the PPF. This curve passes through the center of each of the bars in part (b).

Marginal cost is calculated from the slope of the PPF. As the quantity of pizzas produced increases, the PPF gets steeper and the marginal cost of a pizza increases. The bars in part (a) show the opportunity cost of pizza in blocks of 1 million pizzas. The bars in part (b) show the cost of an average pizza in each of these 1 million blocks. The red curve, $MC$, shows the marginal cost of a pizza at each point along the PPF. This curve passes through the center of each of the bars in part (b).
Preferences and Marginal Benefit

The marginal benefit from a good or service is the benefit received from consuming one more unit of it. This benefit is subjective. It depends on people’s preferences—people’s likes and dislikes and the intensity of those feelings.

Marginal benefit and preferences stand in sharp contrast to marginal cost and production possibilities. Preferences describe what people like and want and the production possibilities describe the limits or constraints on what is feasible.

We need a concrete way of illustrating preferences that parallels the way we illustrate the limits to production using the PPF.

The device that we use to illustrate preferences is the marginal benefit curve, which is a curve that shows the relationship between the marginal benefit from a good and the quantity consumed of that good. Note that the marginal benefit curve is unrelated to the PPF and cannot be derived from it.

We measure the marginal benefit from a good or service by the most that people are willing to pay for an additional unit of it. The idea is that you are willing to pay less for a good than it is worth to you but you are not willing to pay more: The most you are willing to pay for something is its marginal benefit.

It is a general principle that the more we have of any good or service, the smaller is its marginal benefit and the less we are willing to pay for an additional unit of it. This tendency is so widespread and strong that we call it a principle—the principle of decreasing marginal benefit.

The basic reason why marginal benefit decreases is that we like variety. The more we consume of any one good or service, the more we tire of it and would prefer to switch to something else.

Think about your willingness to pay for a pizza. If pizza is hard to come by and you can buy only a few slices a year, you might be willing to pay a high price to get an additional slice. But if pizza is all you’ve eaten for the past few days, you are willing to pay almost nothing for another slice.

You’ve learned to think about cost as opportunity cost, not as a dollar cost. You can think about marginal benefit and willingness to pay in the same way. The marginal benefit, measured by what you are willing to pay for something, is the quantity of other goods and services that you are willing to forgo. Let’s continue with the example of cola and pizza and illustrate preferences this way.

Figure 2.3 illustrates preferences as the willingness to pay for pizza in terms of cola. In row A, with 0.5 million pizzas available, people are willing to pay 5 cans of cola per pizza. As the quantity of pizzas increases, the amount that people are willing to pay for a pizza falls. With 4.5 million pizzas available, people are willing to pay only 1 can of cola per pizza.

Let’s now use the concepts of marginal cost and marginal benefit to describe allocative efficiency.
Using Resources Efficiently

Allocative Efficiency

At any point on the PPF, we cannot produce more of one good without giving up some other good. At the best point on the PPF, we cannot produce more of one good without giving up some other good that provides greater benefit. We are producing at the point of allocative efficiency—the point on the PPF that we prefer above all other points.

Suppose in Fig. 2.4, we produce 1.5 million pizzas. The marginal cost of a pizza is 2 cans of cola, and the marginal benefit from a pizza is 4 cans of cola. Because someone values an additional pizza more highly than it costs to produce, we can get more value from our resources by moving some of them out of producing cola and into producing pizza.

Now suppose we produce 3.5 million pizzas. The marginal cost of a pizza is now 4 cans of cola, but the marginal benefit from a pizza is only 2 cans of cola. Because the additional pizza costs more to produce than anyone thinks it is worth, we can get more value from our resources by moving some of them away from producing pizza and into producing cola.

Suppose we produce 2.5 million pizzas. Marginal cost and marginal benefit are now equal at 3 cans of cola. This allocation of resources between pizzas and cola is efficient. If more pizzas are produced, the forgone cola is worth more than the additional pizzas. If fewer pizzas are produced, the forgone pizzas are worth more than the additional cola.

## REVIEW QUIZ

1. What is marginal cost? How is it measured?
2. What is marginal benefit? How is it measured?
3. How does the marginal benefit from a good change as the quantity produced of that good increases?
4. What is allocative efficiency and how does it relate to the production possibilities frontier?
5. What conditions must be satisfied if resources are used efficiently?

You can work these questions in Study Plan 2.2 and get instant feedback.

You now understand the limits to production and the conditions under which resources are used efficiently. Your next task is to study the expansion of production possibilities.
Economic Growth

During the past 30 years, production per person in the United States has doubled. The expansion of production possibilities is called economic growth. Economic growth increases our standard of living, but it doesn’t overcome scarcity and avoid opportunity cost. To make our economy grow, we face a trade-off—the faster we make production grow, the greater is the opportunity cost of economic growth.

The Cost of Economic Growth

Economic growth comes from technological change and capital accumulation. Technological change is the development of new goods and of better ways of producing goods and services. Capital accumulation is the growth of capital resources, including human capital. Technological change and capital accumulation have vastly expanded our production possibilities. We can produce automobiles that provide us with more transportation than was available when we had only horses and carriages. We can produce satellites that provide global communications on a much larger scale than that available with the earlier cable technology. But if we use our resources to develop new technologies and produce capital, we must decrease our production of consumption goods and services. New technologies and new capital have an opportunity cost. Let’s look at this opportunity cost.

Instead of studying the PPF of pizzas and cola, we’ll hold the quantity of cola produced constant and examine the PPF for pizzas and pizza ovens. Figure 2.5 shows this PPF as the blue curve PPF₀. If we devote no resources to producing pizza ovens, we produce at point A. If we produce 3 million pizzas, we can produce 6 pizza ovens at point B. If we produce no pizza, we can produce 10 ovens at point C.

The amount by which our production possibilities expand depends on the resources we devote to technological change and capital accumulation. If we devote no resources to this activity (point A), our PPF remains the blue curve PPF₀ in Fig. 2.5. If we cut the current pizza production and produce 6 ovens (point B), then in the future, we’ll have more capital and our PPF will rotate outward to the position shown by the red curve PPF₁. The fewer resources we use for producing pizza and the more resources we use for producing ovens, the greater is the expansion of our future production possibilities.

Economic growth brings enormous benefits in the form of increased consumption in the future, but it is not free and it doesn’t abolish scarcity.

In Fig. 2.5, to make economic growth happen we must use some resources to produce new ovens, which leaves fewer resources to produce pizzas. To move to B’ in the future, we must move from A to B today. The opportunity cost of more pizzas in the future is fewer pizzas today. Also, on the new PPF, we still face a tradeoff and opportunity cost.

The ideas about economic growth that we have explored in the setting of the pizza industry also apply to nations. Hong Kong and the United States provide a striking case study.
Economics in Action

Hong Kong Catching Up to the United States

In 1969, the production possibilities per person in the United States were more than four times those in Hong Kong (see the figure). The United States devotes one fifth of its resources to accumulating capital and in 1969 was at point A on its PPF. Hong Kong devotes one third of its resources to accumulating capital and in 1969, Hong Kong was at point A on its PPF.

Since 1969, both countries have experienced economic growth, but because Hong Kong devotes a bigger fraction of its resources to accumulating capital, its production possibilities have expanded more quickly.

By 2009, production possibilities per person in Hong Kong had reached 94 percent of those in the United States. If Hong Kong continues to devote more resources to accumulating capital than we do (at point B on its 2009 PPF), it will continue to grow more rapidly. But if Hong Kong decreases capital accumulation (moving to point D on its 2009 PPF), then its rate of economic growth will slow.

Hong Kong is typical of the fast-growing Asian economies, which include Taiwan, Thailand, South Korea, China, and India. Production possibilities expand in these countries by between 5 and almost 10 percent a year.

If such high economic growth rates are maintained, these other Asian countries will continue to close the gap between themselves and the United States, as Hong Kong is doing.

A Nation’s Economic Growth

The experiences of the United States and Hong Kong make a striking example of the effects of our choices about consumption and capital goods on the rate of economic growth.

If a nation devotes all its factors of production to producing consumption goods and services and none to advancing technology and accumulating capital, its production possibilities in the future will be the same as they are today.

To expand production possibilities in the future, a nation must devote fewer resources to producing current consumption goods and services and some resources to accumulating capital and developing new technologies. As production possibilities expand, consumption in the future can increase. The decrease in today’s consumption is the opportunity cost of tomorrow’s increase in consumption.

REVIEW QUIZ

1. What generates economic growth?
2. How does economic growth influence the production possibilities frontier?
3. What is the opportunity cost of economic growth?
4. Why has Hong Kong experienced faster economic growth than the United States?
5. Does economic growth overcome scarcity?

You can work these questions in Study Plan 2.3 and get instant feedback.

Next, we’re going to study another way in which we expand our production possibilities—the amazing fact that both buyers and sellers gain from specialization and trade.
Gains from Trade

People can produce for themselves all the goods and services that they consume, or they can produce one good or a few goods and trade with others. Producing only one good or a few goods is called specialization. We are going to learn how people gain by specializing in the production of the good in which they have a comparative advantage and trading with others.

Comparative Advantage and Absolute Advantage

A person has a comparative advantage in an activity if that person can perform the activity at a lower opportunity cost than anyone else. Differences in opportunity costs arise from differences in individual abilities and from differences in the characteristics of other resources.

No one excels at everything. One person is an outstanding pitcher but a poor catcher; another person is a brilliant lawyer but a poor teacher. In almost all human endeavors, what one person does easily, someone else finds difficult. The same applies to land and capital. One plot of land is fertile but has no mineral deposits; another plot of land has outstanding views but is infertile. One machine has great precision but is difficult to operate; another is fast but often breaks down.

Although no one excels at everything, some people excel and can outperform others in a large number of activities—perhaps even in all activities. A person who is more productive than others has an absolute advantage.

Absolute advantage involves comparing productivities—production per hour—whereas comparative advantage involves comparing opportunity costs.

A person who has an absolute advantage does not have a comparative advantage in every activity. John Grisham is a better lawyer and a better author of fast-paced thrillers than most people. He has an absolute advantage in these two activities. But compared to others, he is a better writer than lawyer, so his comparative advantage is in writing.

Because ability and resources vary from one person to another, people have different opportunity costs of producing various goods. These differences in opportunity cost are the source of comparative advantage.

Let’s explore the idea of comparative advantage by looking at two smoothie bars: one operated by Liz and the other operated by Joe.

Liz’s Smoothie Bar

Liz produces smoothies and salads. In Liz’s high-tech bar, she can turn out either a smoothie or a salad every 2 minutes—see Table 2.1. If Liz spends all her time making smoothies, she can produce 30 an hour. And if she spends all her time making salads, she can also produce 30 an hour. If she splits her time equally between the two, she can produce 15 smoothies and 15 salads an hour. For each additional smoothie Liz produces, she must decrease her production of salads by one, and for each additional salad she produces, she must decrease her production of smoothies by one. So

Liz’s opportunity cost of producing 1 smoothie is 1 salad,

and

Liz’s opportunity cost of producing 1 salad is 1 smoothie.

Liz’s customers buy smoothies and salads in equal quantities, so she splits her time equally between the two items and produces 15 smoothies and 15 salads an hour.

Joe’s Smoothie Bar

Joe also produces smoothies and salads, but his bar is smaller than Liz’s. Also, Joe has only one blender, and it’s a slow, old machine. Even if Joe uses all his resources to produce smoothies, he can produce only 6 an hour—see Table 2.2. But Joe is good at making salads. If he uses all his resources to make salads, he can produce 30 an hour.

Joe’s ability to make smoothies and salads is the same regardless of how he splits an hour between the two tasks. He can make a salad in 2 minutes or a smoothie in 10 minutes. For each additional smoothie

<table>
<thead>
<tr>
<th>Item</th>
<th>Minutes to produce 1</th>
<th>Quantity per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Salads</td>
<td>2</td>
<td>30</td>
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</tbody>
</table>
TABLE 2.2 Joe’s Production Possibilities

<table>
<thead>
<tr>
<th>Item</th>
<th>Minutes to produce 1</th>
<th>Quantity per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Salads</td>
<td>2</td>
<td>30</td>
</tr>
</tbody>
</table>

Joe produces, he must decrease his production of salads by 5. And for each additional salad he produces, he must decrease his production of smoothies by 1/5 of a smoothie. So

Joe’s opportunity cost of producing 1 smoothie is 5 salads,

and

Joe’s opportunity cost of producing 1 salad is 1/5 of a smoothie.

Joe’s customers, like Liz’s, buy smoothies and salads in equal quantities. So Joe spends 50 minutes of each hour making smoothies and 10 minutes of each hour making salads. With this division of his time, Joe produces 5 smoothies and 5 salads an hour.

Liz’s Comparative Advantage In which of the two activities does Liz have a comparative advantage? Recall that comparative advantage is a situation in which one person’s opportunity cost of producing a good is lower than another person’s opportunity cost of producing that same good. Liz has a comparative advantage in producing smoothies. Her opportunity cost of a smoothie is 1 salad, whereas Joe’s opportunity cost of a smoothie is 5 salads.

Joe’s Comparative Advantage If Liz has a comparative advantage in producing smoothies, Joe must have a comparative advantage in producing salads. Joe’s opportunity cost of a salad is 1/5 of a smoothie, whereas Liz’s opportunity cost of a salad is 1 smoothie.

Achieving the Gains from Trade

Liz and Joe run into each other one evening in a singles bar. After a few minutes of getting acquainted, Liz tells Joe about her amazing smoothie business. Her only problem, she tells Joe, is that she would like to produce more because potential customers leave when her lines get too long.

Joe is hesitant to risk spoiling his chances by telling Liz about his own struggling business, but he takes the risk. Joe explains to Liz that he spends 50 minutes of every hour making 5 smoothies and 10 minutes making 5 salads. Liz’s eyes pop. “Have I got a deal for you!” she exclaims.

Here’s the deal that Liz sketches on a paper napkin. Joe stops making smoothies and allocates all his time to producing salads; Liz stops making salads and allocates all her time to producing smoothies. That is, they both specialize in producing the good in which they have a comparative advantage. Together they produce 30 smoothies and 30 salads—see Table 2.3(b).

They then trade. Liz sells Joe 10 smoothies and Joe sells Liz 20 salads—the price of a smoothie is 2 salads—see Table 2.3(c).

After the trade, Joe has 10 salads—the 30 he produces minus the 20 he sells to Liz. He also has the 10 smoothies that he buys from Liz. So Joe now has increased the quantities of smoothies and salads that he can sell to his customers—see Table 2.3(d).

TABLE 2.3 Liz and Joe Gain from Trade

<table>
<thead>
<tr>
<th>(a) Before trade</th>
<th>Liz</th>
<th>Joe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Salads</td>
<td>15</td>
<td>5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>(b) Specialization</th>
<th>Liz</th>
<th>Joe</th>
</tr>
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<tbody>
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<td>Smoothies</td>
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<td>0</td>
</tr>
<tr>
<td>Salads</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(c) Trade</th>
<th>Liz</th>
<th>Joe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>sell 10</td>
<td>buy 10</td>
</tr>
<tr>
<td>Salads</td>
<td>buy 20</td>
<td>sell 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(d) After trade</th>
<th>Liz</th>
<th>Joe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Salads</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(e) Gains from trade</th>
<th>Liz</th>
<th>Joe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>+5</td>
<td>+5</td>
</tr>
<tr>
<td>Salads</td>
<td>+5</td>
<td>+5</td>
</tr>
</tbody>
</table>
Liz has 20 smoothies—the 30 she produces minus the 10 she sells to Joe. She also has the 20 salads that she buys from Joe. Liz has increased the quantities of smoothies and salads that she can sell to her customers—see Table 2.3(d). Liz and Joe both gain 5 smoothies and 5 salads an hour—see Table 2.3(e).

To illustrate her idea, Liz grabs a fresh napkin and draws the graphs in Fig. 2.6. The blue PPF in part (a) shows Joe’s production possibilities. Before trade, he is producing 5 smoothies and 5 salads an hour at point A. The blue PPF in part (b) shows Liz’s production possibilities. Before trade, she is producing 15 smoothies and 15 salads an hour at point A.

Liz’s proposal is that they each specialize in producing the good in which they have a comparative advantage. Joe produces 30 salads and no smoothies at point B on his PPF. Liz produces 30 smoothies and no salads at point B on her PPF.

Liz and Joe then trade smoothies and salads at a price of 2 salads per smoothie or 1/2 a smoothie per salad. Joe gets smoothies for 2 salads each, which is less than the 5 salads it costs him to produce a smoothie. Liz gets salads for 1/2 a smoothie each, which is less than the 1 smoothie that it costs her to produce a salad.

With trade, Joe has 10 smoothies and 10 salads at point C—a gain of 5 smoothies and 5 salads. Joe moves to a point outside his PPF.

With trade, Liz has 20 smoothies and 20 salads at point C—a gain of 5 smoothies and 5 salads. Liz moves to a point outside her PPF.

Despite Liz being more productive than Joe, both of them gain from specializing—producing the good in which they have a comparative advantage—and trading.

![FIGURE 2.6 The Gains from Trade](image-url)
Economic Coordination

People gain by specializing in the production of those goods and services in which they have a comparative advantage and then trading with each other. Liz and Joe, whose production of salads and smoothies we studied earlier in this chapter, can get together and make a deal that enables them to enjoy the gains from specialization and trade. But for billions of individuals to specialize and produce millions of different goods and services, their choices must somehow be coordinated.

Two competing economic coordination systems have been used: central economic planning and decentralized markets.

Central economic planning was tried in Russia and China and is still used in Cuba and North Korea. This system works badly because government economic planners don’t know people’s production possibilities and preferences. Resources get wasted, production ends up inside the PPF, and the wrong things get produced.

Economics in Action

The United States and China
Gain From Trade

In Chapter 1 (see p. 5), we asked whether globalization is in the social interest. What you have just learned about the gains from trade provides a big part of the answer. We gain from specialization and trade.

The gains that we achieve from international trade are similar to those achieved by Joe and Liz. When Americans buy clothes that are manufactured in China and when China buys Boeing airplanes manufactured in the United States, the people of both countries gain.

We could slide along our PPF producing fewer airplanes and more jackets. Similarly, China could slide along its PPF producing more airplanes and fewer jackets. But everyone would lose. The opportunity cost of our jackets and China’s opportunity cost of airplanes would rise.

By specializing in airplanes and trading with China, we get our jackets at a lower cost than that at which we can produce them, and China gets its aircraft at a lower cost than that at which it can produce them.

Decentralized coordination works best but to do so it needs four complementary social institutions. They are

- Firms
- Markets
- Property rights
- Money

Firms

A firm is an economic unit that hires factors of production and organizes those factors to produce and sell goods and services. Examples of firms are your local gas station, Wal-Mart, and General Motors.

Firms coordinate a huge amount of economic activity. For example, Wal-Mart buys or rents large buildings, equips them with storage shelves and checkout lanes, and hires labor. Wal-Mart directs the labor and decides what goods to buy and sell.

But Sam Walton would not have become one of the wealthiest people in the world if Wal-Mart

REVIEW QUIZ

1. What gives a person a comparative advantage?
2. Distinguish between comparative advantage and absolute advantage.
3. Why do people specialize and trade?
4. What are the gains from specialization and trade?
5. What is the source of the gains from trade?

You can work these questions in Study Plan 2.4 and get instant feedback.
produced all the goods that it sells. He became rich by specializing in providing retail services and buying from other firms that specialize in producing goods (just as Liz and Joe did). This trade between firms takes place in markets.

**Markets**

In ordinary speech, the word *market* means a place where people buy and sell goods such as fish, meat, fruits, and vegetables. In economics, a *market* has a more general meaning. A *market* is any arrangement that enables buyers and sellers to get information and to do business with each other. An example is the market in which oil is bought and sold—the world oil market. The world oil market is not a place. It is the network of oil producers, oil users, wholesalers, and brokers who buy and sell oil. In the world oil market, decision makers do not meet physically. They make deals by telephone, fax, and direct computer link.

Markets have evolved because they facilitate trade. Without organized markets, we would miss out on a substantial part of the potential gains from trade. Enterprising individuals and firms, each pursuing their own self-interest, have profited from making markets—standing ready to buy or sell the items in which they specialize. But markets can work only when property rights exist.

**Property Rights**

The social arrangements that govern the ownership, use, and disposal of anything that people value are called *property rights*. *Real property* includes land and buildings—the things we call property in ordinary speech—and durable goods such as plant and equipment. *Financial property* includes stocks and bonds and money in the bank. *Intellectual property* is the intangible product of creative effort. This type of property includes books, music, computer programs, and inventions of all kinds and is protected by copyrights and patents.

Where property rights are enforced, people have the incentive to specialize and produce the goods in which they have a comparative advantage. Where people can steal the production of others, resources are devoted not to production but to protecting possessions. Without property rights, we would still be hunting and gathering like our Stone Age ancestors.

**Money**

*Money* is any commodity or token that is generally acceptable as a means of payment. Liz and Joe didn’t use money in the example above. They exchanged salads and smoothies. In principle, trade in markets can exchange any item for any other item. But you can perhaps imagine how complicated life would be if we exchanged goods for other goods. The “invention” of money makes trading in markets much more efficient.

**Circular Flows Through Markets**

Figure 2.7 shows the flows that result from the choices that households and firms make. Households specialize and choose the quantities of labor, land, capital, and entrepreneurial services to sell or rent to firms. Firms choose the quantities of factors of production to hire. These (red) flows go through the *factor markets*. Households choose the quantities of goods and services to buy, and firms choose the quantities to produce. These (red) flows go through the *goods markets*. Households receive incomes and make expenditures on goods and services (the green flows).

**How do markets coordinate all these decisions?**

**Coordinating Decisions**

Markets coordinate decisions through price adjustments. To see how, think about your local market for hamburgers. Suppose that too few hamburgers are available and some people who want to buy hamburgers are not able to do so. To make buying and selling plans the same, either more hamburgers must be offered for sale or buyers must scale down their appetites (or both). A rise in the price of a hamburger produces this outcome. A higher price encourages producers to offer more hamburgers for sale. It also encourages some people to change their lunch plans. Fewer people buy hamburgers, and more buy hot dogs. More hamburgers (and more hot dogs) are offered for sale.

Alternatively, suppose that more hamburgers are available than people want to buy. In this case, to make the choices of buyers and sellers compatible, more hamburgers must be bought or fewer hamburgers must be offered for sale (or both). A fall in the price of a hamburger achieves this outcome. A lower price encourages producers to offer more hamburgers. It also encourages firms to produce a smaller quantity of hamburgers.
You have now begun to see how economists approach economic questions. Scarcity, choice, and divergent opportunity costs explain why we specialize and trade and why firms, markets, property rights, and money have developed. You can see all around you the lessons you’ve learned in this chapter.

Reading Between the Lines on pp. 44–45 provides an opportunity to apply the PPF model to deepen your understanding of the reasons for the increase in the cost of food associated with the increase in corn production.

Households and firms make economic choices and markets coordinate these choices.

Households choose the quantities of labor, land, capital, and entrepreneurial services to sell or rent to firms in exchange for wages, rent, interest, and profits. Households also choose how to spend their incomes on the various types of goods and services available.

Firms choose the quantities of factors of production to hire and the quantities of goods and services to produce.

Goods markets and factor markets coordinate these choices of households and firms.

The counterclockwise red flows are real flows—the flow of factors of production from households to firms and the flow of goods and services from firms to households.

The clockwise green flows are the payments for the red flows. They are the flow of incomes from firms to households and the flow of expenditure on goods and services from households to firms.

**REVIEW QUIZ**

1. Why are social institutions such as firms, markets, property rights, and money necessary?
2. What are the main functions of markets?
3. What are the flows in the market economy that go from firms to households and the flows from households to firms?

You can work these questions in Study Plan 2.5 and get instant feedback.
Fuel Choices, Food Crises, and Finger-Pointing

http://www.nytimes.com
April 15, 2008

The idea of turning farms into fuel plants seemed, for a time, like one of the answers to high global oil prices and supply worries. That strategy seemed to reach a high point last year when Congress mandated a fivefold increase in the use of biofuels.

But now a reaction is building against policies in the United States and Europe to promote ethanol and similar fuels, with political leaders from poor countries contending that these fuels are driving up food prices and starving poor people. …

In some countries, the higher prices are leading to riots, political instability, and growing worries about feeding the poorest people. …

Many specialists in food policy consider government mandates for biofuels to be ill advised, agreeing that the diversion of crops like corn into fuel production has contributed to the higher prices. But other factors have played big roles, including droughts that have limited output and rapid global economic growth that has created higher demand for food.

That growth, much faster over the last four years than the historical norm, is lifting millions of people out of destitution and giving them access to better diets. But farmers are having trouble keeping up with the surge in demand.

While there is agreement that the growth of biofuels has contributed to higher food prices, the amount is disputed. …

C. Ford Runge, an economist at the University of Minnesota, said it is “extremely difficult to disentangle” the effect of biofuels on food costs. Nevertheless, he said there was little that could be done to mitigate the effect of droughts and the growing appetite for protein in developing countries.

“Ethanol is the one thing we can do something about,” he said. “It’s about the only lever we have to pull, but none of the politicians have the courage to pull the lever.” …

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Ethanol is made from corn in the United States, so biofuel and food compete to use the same resources.

To produce more ethanol and meet the Congress’s mandate, farmers increased the number of acres devoted to corn production.

In 2008, the amount of land devoted to corn production increased by 20 percent in the United States and by 2 percent in the rest of the world.

Figure 1 shows the U.S. production possibilities frontier, *PPF*, for corn and other goods and services.

The increase in the production of corn is illustrated by a movement along the *PPF* in Fig. 1 from point A in 2007 to point B in 2008.

In moving from point A to point B, the United States incurs a higher opportunity cost of producing corn, as the greater slope of the *PPF* at point B indicates.

In other regions of the world, despite the fact that more land was devoted to corn production, the amount of corn produced didn’t change.

The reason is that droughts in South America and Eastern Europe lowered the crop yield per acre in those regions.

Figure 2 shows the rest of the world’s *PPF* for corn and other goods and services in 2007 and 2008.

The increase in the amount of land devoted to producing corn is illustrated by a movement along *PPF*₂₀₀₇.

With a decrease in the crop yield, production possibilities decreased and the *PPF* rotated inward.

The rotation from *PPF*ₐₙₐ₅₉ to *PPF*₂₀₀₈ illustrates this decrease in production possibilities.

The opportunity cost of producing corn in the rest of the world increased for two reasons: the movement along its *PPF* and the inward rotation of the *PPF*.

With a higher opportunity cost of producing corn, the cost of both biofuel and food increases.
**CHAPTER 2 The Economic Problem**

**SUMMARY**

**Key Points**

**Production Possibilities and Opportunity Cost** (pp. 30–32)
- The production possibilities frontier is the boundary between production levels that are attainable and those that are not attainable when all the available resources are used to their limit.
- Production efficiency occurs at points on the production possibilities frontier.
- Along the production possibilities frontier, the opportunity cost of producing more of one good is the amount of the other good that must be given up.
- The opportunity cost of all goods increases as the production of the good increases.

**Economic Growth** (pp. 36–37)
- Economic growth, which is the expansion of production possibilities, results from capital accumulation and technological change.
- The opportunity cost of economic growth is forgone current consumption.
- The benefit of economic growth is increased future consumption.

**Working Problem 11 will give you a better understanding of economic growth.**

**Gains from Trade** (pp. 38–41)
- A person has a comparative advantage in producing a good if that person can produce the good at a lower opportunity cost than everyone else.
- People gain by specializing in the activity in which they have a comparative advantage and trading with others.

**Working Problems 12 and 13 will give you a better understanding of the gains from trade.**

**Economic Coordination** (pp. 41–43)
- Firms coordinate a large amount of economic activity, but there is a limit to the efficient size of a firm.
- Markets coordinate the economic choices of people and firms.
- Markets can work efficiently only when property rights exist.
- Money makes trading in markets more efficient.

**Working Problem 14 will give you a better understanding of economic coordination.**

**Using Resources Efficiently** (pp. 33–35)
- Allocative efficiency occurs when goods and services are produced at the least possible cost and in the quantities that bring the greatest possible benefit.
- The marginal cost of a good is the opportunity cost of producing one more unit of it.
- The marginal benefit from a good is the benefit received from consuming one more unit of it and is measured by the willingness to pay for it.
- The marginal benefit of a good decreases as the amount of the good available increases.
- Resources are used efficiently when the marginal cost of each good is equal to its marginal benefit.

**Working Problems 4 to 10 will give you a better understanding of the efficient use of resources.**

**Key Terms**

<table>
<thead>
<tr>
<th>Absolute advantage, 38</th>
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<th>Preferences, 34</th>
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<tr>
<td>Firm, 41</td>
<td>Opportunity cost, 31</td>
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</table>
Production Possibilities and Opportunity Cost

(Study Plan 2.1)

Use the following information to work Problems 1 to 3. Brazil produces ethanol from sugar, and the land used to grow sugar can be used to grow food crops. Suppose that Brazil’s production possibilities for ethanol and food crops are as follows:

<table>
<thead>
<tr>
<th>Ethanol (barrels per day)</th>
<th>Food crops (tons per day)</th>
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<tbody>
<tr>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>64</td>
<td>1</td>
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<td>54</td>
<td>2</td>
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<td>4</td>
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<td>0</td>
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</table>

1. a. Draw a graph of Brazil’s PPF and explain how your graph illustrates scarcity.
   b. If Brazil produces 40 barrels of ethanol a day, how much food must it produce to achieve production efficiency?
   c. Why does Brazil face a tradeoff on its PPF?

2. a. If Brazil increases its production of ethanol from 40 barrels per day to 54 barrels per day, what is the opportunity cost of the additional ethanol?
   b. If Brazil increases its production of food crops from 2 tons per day to 3 tons per day, what is the opportunity cost of the additional food?
   c. What is the relationship between your answers to parts (a) and (b)?

3. Does Brazil face an increasing opportunity cost of ethanol? What feature of Brazil’s PPF illustrates increasing opportunity cost?

Using Resources Efficiently (Study Plan 2.2)

Use the above table to work Problems 4 and 5.

4. Define marginal cost and calculate Brazil’s marginal cost of producing a ton of food when the quantity produced is 2.5 tons per day.

5. Define marginal benefit, explain how it is measured, and explain why the data in the table does not enable you to calculate Brazil’s marginal benefit from food.

6. Distinguish between production efficiency and allocative efficiency. Explain why many production possibilities achieve production efficiency but only one achieves allocative efficiency.

7. What is Harry’s marginal cost of tennis if he plays for (i) 3 hours a week; (ii) 5 hours a week; and (iii) 7 hours a week?

8. a. If Harry uses his time to achieve allocative efficiency, what is his economics grade and how many hours of tennis does he play?
   b. Explain why Harry would be worse off getting a grade higher than your answer to part (a).

9. If Harry becomes a tennis superstar with big earnings from tennis, what happens to his PPF, MB curve, and his efficient time allocation?

10. If Harry suddenly finds high grades in economics easier to attain, what happens to his PPF, his MB curve, and his efficient time allocation?
Economic Growth (Study Plan 2.3)

11. A farm grows wheat and produces pork. The marginal cost of producing each of these products increases as more of it is produced.
   a. Make a graph that illustrates the farm's PPF.
   b. The farm adopts a new technology that allows it to use fewer resources to fatten pigs. Use your graph to illustrate the impact of the new technology on the farm's PPF.
   c. With the farm using the new technology described in part (b), has the opportunity cost of producing a ton of wheat increased, decreased, or remained the same? Explain and illustrate your answer.
   d. Is the farm more efficient with the new technology than it was with the old one? Why?

Gains from Trade (Study Plan 2.4)

12. In an hour, Sue can produce 40 caps or 4 jackets and Tessa can produce 80 caps or 4 jackets.
   a. Calculate Sue's opportunity cost of producing a cap.
   b. Calculate Tessa's opportunity cost of producing a cap.
   c. Who has a comparative advantage in producing caps?
   d. If Sue and Tessa specialize in producing the good in which each of them has a comparative advantage, and they trade 1 jacket for 15 caps, who gains from the specialization and trade?

13. Suppose that Tessa buys a new machine for making jackets that enables her to make 20 jackets an hour. (She can still make only 80 caps per hour.)
   a. Who now has a comparative advantage in producing jackets?
   b. Can Sue and Tessa still gain from trade?
   c. Would Sue and Tessa still be willing to trade 1 jacket for 15 caps? Explain your answer.

Economic Coordination (Study Plan 2.5)

14. For 50 years, Cuba has had a centrally planned economy in which the government makes the big decisions on how resources will be allocated.
   a. Why would you expect Cuba's production possibilities (per person) to be smaller than those of the United States?
   b. What are the social institutions that Cuba might lack that help the United States to achieve allocative efficiency?

Economics in the News (Study Plan 2.N)

Use the following data to work Problems 15 to 17.
Brazil produces ethanol from sugar at a cost of 83 cents per gallon. The United States produces ethanol from corn at a cost of $1.14 per gallon. Sugar grown on one acre of land produces twice the quantity of ethanol as the corn grown on an acre. The United States imports 5 percent of the ethanol it uses and produces the rest itself. Since 2003, U.S. ethanol production has more than doubled and U.S. corn production has increased by 45 percent.

15. a. Does Brazil or the United States have a comparative advantage in producing ethanol?
   b. Sketch the PPF for ethanol and other goods and services for the United States.
   c. Sketch the PPF for ethanol and other goods and services for Brazil.

16. a. Do you expect the opportunity cost of producing ethanol in the United States to have increased since 2003? Explain why.
   b. Do you think the United States has achieved production efficiency in its manufacture of ethanol? Explain why or why not.
   c. Do you think the United States has achieved allocative efficiency in its manufacture of ethanol? Explain why or why not.

17. Sketch a figure similar to Fig. 2.6 on p. 40 to show how both the United States and Brazil can gain from specialization and trade.

Use this news clip to work Problems 18 to 20.

Time For Tea

Americans are switching to loose-leaf tea for its health benefits. Tea could be grown in the United States, but picking tea leaves would be costly because it can only be done by workers and not by machine.

Source: The Economist, July 8, 2005

18. a. Sketch PPFs for the production of tea and other goods and services in India and in the United States.
   b. Sketch marginal cost curves for the production of tea in India and in the United States.

19. a. Sketch the marginal benefit curves for tea in the United States before and after Americans began to appreciate the health benefits of loose tea.
   b. Explain how the quantity of loose tea that achieves allocative efficiency has changed.
   c. Does the change in preferences toward tea affect the opportunity cost of producing tea?

20. Explain why the United States does not produce tea and instead imports it from India.
Production Possibilities and Opportunity Cost

Use the following table to work Problems 21 to 22.

Suppose that Yucatan's production possibilities are

<table>
<thead>
<tr>
<th>Food (pounds per month)</th>
<th>Sunscreen (gallons per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 and 0</td>
<td></td>
</tr>
<tr>
<td>200 and 50</td>
<td></td>
</tr>
<tr>
<td>100 and 100</td>
<td></td>
</tr>
<tr>
<td>0 and 150</td>
<td></td>
</tr>
</tbody>
</table>

21. a. Draw a graph of Yucatan’s PPF and explain how your graph illustrates a tradeoff.
b. If Yucatan produces 150 pounds of food per month, how much sunscreen must it produce if it achieves production efficiency?
c. What is Yucatan's opportunity cost of producing 1 pound of food?
d. What is Yucatan's opportunity cost of producing 1 gallon of sunscreen?
e. What is the relationship between your answers to parts (c) and (d)?

22. What feature of a PPF illustrates increasing opportunity cost? Explain why Yucatan’s opportunity cost does or does not increase.

Using Resources Efficiently

23. In problem 21, what is the marginal cost of a pound of food in Yucatan when the quantity produced is 150 pounds per day? What is special about the marginal cost of food in Yucatan?

24. The table describes the preferences in Yucatan.

<table>
<thead>
<tr>
<th>Sunscreen (gallons per month)</th>
<th>Willingness to pay (pounds of food per gallon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>75</td>
<td>2</td>
</tr>
<tr>
<td>125</td>
<td>1</td>
</tr>
</tbody>
</table>

a. What is the marginal benefit from sunscreen and how is it measured?
b. Draw a graph of Yucatan's marginal benefit from sunscreen.

Economic Growth

25. Capital accumulation and technological change bring economic growth, which means that the PPF keeps shifting outward: Production that was unattainable yesterday becomes attainable today; production that is unattainable today will become attainable tomorrow. Why doesn’t this process of economic growth mean that scarcity is being defeated and will one day be gone?

Gains from Trade

Use the following data to work Problems 26 and 27.

Kim can produce 40 pies or 400 cakes an hour. Liam can produce 100 pies or 200 cakes an hour.

26. a. Calculate Kim's opportunity cost of a pie and Liam's opportunity cost of a pie.
b. If each spends 30 minutes of each hour producing pies and 30 minutes producing cakes, how many pies and cakes does each produce?
c. Who has a comparative advantage in producing pies? Who has a comparative advantage in producing cakes?

27. a. Draw a graph of Kim's PPF and Liam's PPF.
b. On your graph, show the point at which each produces when they spend 30 minutes of each hour producing pies and 30 minutes producing cakes.
c. On your graph, show what Kim produces and what does Liam produces when they specialize.
d. When they specialize and trade, what are the total gains from trade?
e. If Kim and Liam share the total gains equally, what trade takes place between them?

Economic Coordination

28. Indicate on a graph of the circular flows in the market economy, the real and money flows in which the following items belong:
a. You buy an iPad from the Apple Store.
b. Apple Inc. pays the designers of the iPad.
c. Apple Inc. decides to expand and rents an adjacent building.
d. You buy a new e-book from Amazon.
e. Apple Inc. hires a student as an intern during the summer.

Economics in the News

29. After you have studied Reading Between the Lines on pp. 44–45, answer the following questions.
a. How has an Act of the United States Congress increased U.S. production of corn?
b. Why would you expect an increase in the quantity of corn produced to raise the opportunity cost of corn?
c. Why did the cost of producing corn increase in the rest of the world?

d. Is it possible that the increased quantity of corn produced, despite the higher cost of production, moves the United States closer to allocative efficiency?

30. Malaria Eradication Back on the Table

In response to the Gates Malaria Forum in October 2007, countries are debating the pros and cons of eradication. Dr. Arata Kochi of the World Health Organization believes that with enough money malaria cases could be cut by 90 percent, but he believes that it would be very expensive to eliminate the remaining 10 percent of cases. He concluded that countries should not strive to eradicate malaria.


a. Is Dr. Kochi talking about production efficiency or allocative efficiency or both?
b. Make a graph with the percentage of malaria cases eliminated on the x-axis and the marginal cost and marginal benefit of driving down malaria cases on the y-axis. On your graph:
   (i) Draw a marginal cost curve that is consistent with Dr. Kochi’s opinion.
   (ii) Draw a marginal benefit curve that is consistent with Dr. Kochi’s opinion.
   (iii) Identify the quantity of malaria eradicated that achieves allocative efficiency.

31. Lots of Little Screens

Inexpensive broadband access has created a generation of television producers for whom the Internet is their native medium. As they redirect the focus from TV to computers, cell phones, and iPods, the video market is developing into an open digital network.


a. How has inexpensive broadband changed the production possibilities of video entertainment and other goods and services?
b. Sketch a PPF for video entertainment and other goods and services before broadband.
c. Show how the arrival of inexpensive broadband has changed the PPF.
d. Sketch a marginal benefit curve for video entertainment.
e. Show how the new generation of TV producers for whom the Internet is their native medium might have changed the marginal benefit from video entertainment.

f. Explain how the efficient quantity of video entertainment has changed.

Use the following information to work Problems 32 and 33.

Before the Civil War, the South traded with the North and with England. The South sold cotton and bought manufactured goods and food. During the war, one of President Lincoln’s first actions was to blockade the ports and prevent this trade. The South increased its production of munitions and food.

32. In what did the South have a comparative advantage?

33. a. Draw a graph to illustrate production, consumption, and trade in the South before the Civil War.
b. Was the South consuming inside, on, or outside its PPF? Explain your answer.
c. Draw a graph to show the effects of the Civil War on consumption and production in the South.
d. Did the Civil War change any opportunity costs in the South? If so, did the opportunity cost of everything increase? Did the opportunity cost of any items decrease? Illustrate your answer with appropriate graphs.

Use the following information to work Problems 34 and 35.

He Shoots! He Scores! He Makes Movies!

NBA All-star Baron Davis and his school friend, Cash Warren, premiered their first movie *Made in America* at the Sundance Festival in January 2008. The movie, based on gang activity in South Central Los Angeles, received good reviews.


34. a. Does Baron Davis have an absolute advantage in basketball and movie directing and is this the reason for his success in both activities?
b. Does Baron Davis have a comparative advantage in basketball or movie directing or both and is this the reason for his success in both activities?

35. a. Sketch a PPF between playing basketball and producing other goods and services for Baron Davis and for yourself.
b. How do you (and people like you) and Baron Davis (and people like him) gain from specialization and trade?
After studying this chapter, you will be able to:

- Describe a competitive market and think about a price as an opportunity cost
- Explain the influences on demand
- Explain the influences on supply
- Explain how demand and supply determine prices and quantities bought and sold
- Use the demand and supply model to make predictions about changes in prices and quantities

What makes the price of oil double and the price of gasoline almost double in just one year? Will these prices keep on rising? Are the oil companies taking advantage of people? This chapter enables you to answer these and similar questions about prices—prices that rise, prices that fall, and prices that fluctuate.

You already know that economics is about the choices people make to cope with scarcity and how those choices respond to incentives. Prices act as incentives. You’re going to see how people respond to prices and how prices get determined by demand and supply. The demand and supply model that you study in this chapter is the main tool of economics. It helps us to answer the big economic question: What, how, and for whom goods and services are produced?

At the end of the chapter, in Reading Between the Lines, we’ll apply the model to the market for coffee and explain why its price increased sharply in 2010 and why it was expected to rise again.

DEMAND AND SUPPLY
Markets and Prices

When you need a new pair of running shoes, want a bagel and a latte, plan to upgrade your cell phone, or need to fly home for Thanksgiving, you must find a place where people sell those items or offer those services. The place in which you find them is a market. You learned in Chapter 2 (p. 42) that a market is any arrangement that enables buyers and sellers to get information and to do business with each other.

A market has two sides: buyers and sellers. There are markets for goods such as apples and hiking boots, for services such as haircuts and tennis lessons, for factors of production such as computer programmers and earthmovers, and for other manufactured inputs such as memory chips and auto parts. There are also markets for money such as Japanese yen and for financial securities such as Yahoo! stock. Only our imagination limits what can be traded in markets.

Some markets are physical places where buyers and sellers meet and where an auctioneer or a broker helps to determine the prices. Examples of this type of market are the New York Stock Exchange and the wholesale fish, meat, and produce markets.

Some markets are groups of people spread around the world who never meet and know little about each other but are connected through the Internet or by telephone and fax. Examples are the e-commerce markets and the currency markets.

But most markets are unorganized collections of buyers and sellers. You do most of your trading in this type of market. An example is the market for basketball shoes. The buyers in this $3 billion-a-year market are the 45 million Americans who play basketball (or who want to make a fashion statement). The sellers are the tens of thousands of retail sports equipment and footwear stores. Each buyer can visit several different stores, and each seller knows that the buyer has a choice of stores.

Markets vary in the intensity of competition that buyers and sellers face. In this chapter, we're going to study a competitive market—a market that has many buyers and many sellers, so no single buyer or seller can influence the price.

Producers offer items for sale only if the price is high enough to cover their opportunity cost. And consumers respond to changing opportunity cost by seeking cheaper alternatives to expensive items.

We are going to study how people respond to prices and the forces that determine prices. But to pursue these tasks, we need to understand the relationship between a price and an opportunity cost.

In everyday life, the price of an object is the number of dollars that must be given up in exchange for it. Economists refer to this price as the money price.

The opportunity cost of an action is the highest-valued alternative forgone. If, when you buy a cup of coffee, the highest-valued thing you forgo is some gum, then the opportunity cost of the coffee is the quantity of gum forgone. We can calculate the quantity of gum forgone from the money prices of the coffee and the gum.

If the money price of coffee is $1 a cup and the money price of gum is 50¢ a pack, then the opportunity cost of one cup of coffee is two packs of gum. To calculate this opportunity cost, we divide the price of a cup of coffee by the price of a pack of gum and find the ratio of one price to the other. The ratio of one price to another is called a relative price, and a relative price is an opportunity cost.

We can express the relative price of coffee in terms of gum or any other good. The normal way of expressing a relative price is in terms of a “basket” of all goods and services. To calculate this relative price, we divide the money price of a good by the money price of a “basket” of all goods (called a price index). The resulting relative price tells us the opportunity cost of the good in terms of how much of the “basket” we must give up to buy it.

The demand and supply model that we are about to study determines relative prices, and the word “price” means relative price. When we predict that a price will fall, we do not mean that its money price will fall—although it might. We mean that its relative price will fall. That is, its price will fall relative to the average price of other goods and services.

**REVIEW QUIZ**

1. What is the distinction between a money price and a relative price?
2. Explain why a relative price is an opportunity cost.
3. Think of examples of goods whose relative price has risen or fallen by a large amount.

You can work these questions in Study Plan 3.1 and get instant feedback.

Let’s begin our study of demand and supply, starting with demand.
Demand

If you demand something, then you
1. Want it,
2. Can afford it, and
3. Plan to buy it.

Wants are the unlimited desires or wishes that people have for goods and services. How many times have you thought that you would like something “if only you could afford it” or “if it weren’t so expensive”? Scarcity guarantees that many—perhaps most—of our wants will never be satisfied. Demand reflects a decision about which wants to satisfy.

The quantity demanded of a good or service is the amount that consumers plan to buy during a given time period at a particular price. The quantity demanded is not necessarily the same as the quantity actually bought. Sometimes the quantity demanded exceeds the amount of goods available, so the quantity bought is less than the quantity demanded.

The quantity demanded is measured as an amount per unit of time. For example, suppose that you buy one cup of coffee a day. The quantity of coffee that you demand can be expressed as 1 cup per day, 7 cups per week, or 365 cups per year.

Many factors influence buying plans, and one of them is the price. We look first at the relationship between the quantity demanded of a good and its price. To study this relationship, we keep all other influences on buying plans the same and we ask: How, other things remaining the same, does the quantity demanded of a good change as its price changes?

The law of demand provides the answer.

The Law of Demand

The law of demand states

Other things remaining the same, the higher the price of a good, the smaller is the quantity demanded; and the lower the price of a good, the greater is the quantity demanded.

Why does a higher price reduce the quantity demanded? For two reasons:

- Substitution effect
- Income effect

Substitution Effect  When the price of a good rises, other things remaining the same, its relative price—its opportunity cost—rises. Although each good is unique, it has substitutes—other goods that can be used in its place. As the opportunity cost of a good rises, the incentive to economize on its use and switch to a substitute becomes stronger.

Income Effect  When a price rises, other things remaining the same, the price rises relative to income. Faced with a higher price and an unchanged income, people cannot afford to buy all the things they previously bought. They must decrease the quantities demanded of at least some goods and services. Normally, the good whose price has increased will be one of the goods that people buy less of.

To see the substitution effect and the income effect at work, think about the effects of a change in the price of an energy bar. Several different goods are substitutes for an energy bar. For example, an energy drink could be consumed instead of an energy bar.

Suppose that an energy bar initially sells for $3 and then its price falls to $1.50. People now substitute energy bars for energy drinks—the substitution effect. And with a budget that now has some slack from the lower price of an energy bar, people buy even more energy bars—the income effect. The quantity of energy bars demanded increases for these two reasons.

Now suppose that an energy bar initially sells for $3 and then the price doubles to $6. People now buy fewer energy bars and more energy drinks—the substitution effect. And faced with a tighter budget, people buy even fewer energy bars—the income effect. The quantity of energy bars demanded decreases for these two reasons.

Demand Curve and Demand Schedule

You are now about to study one of the two most used curves in economics: the demand curve. You are also going to encounter one of the most critical distinctions: the distinction between demand and quantity demanded.

The term demand refers to the entire relationship between the price of a good and the quantity demanded of that good. Demand is illustrated by the demand curve and the demand schedule. The term quantity demanded refers to a point on a demand curve—the quantity demanded at a particular price.
Figure 3.1 shows the demand curve for energy bars. A demand curve shows the relationship between the quantity demanded of a good and its price when all other influences on consumers’ planned purchases remain the same.

The table in Fig. 3.1 is the demand schedule for energy bars. A demand schedule lists the quantities demanded at each price when all the other influences on consumers’ planned purchases remain the same. For example, if the price of a bar is 50¢, the quantity demanded is 22 million a week. If the price is $2.50, the quantity demanded is 5 million a week. The other rows of the table show the quantities demanded at prices of $1.00, $1.50, and $2.00.

We graph the demand schedule as a demand curve with the quantity demanded on the x-axis and the price on the y-axis. The points on the demand curve labeled A through E correspond to the rows of the demand schedule. For example, point A on the graph shows a quantity demanded of 22 million energy bars a week at a price of 50¢ a bar.

Willingness and Ability to Pay Another way of looking at the demand curve is as a willingness-and-ability-to-pay curve. The willingness and ability to pay is a measure of marginal benefit.

If a small quantity is available, the highest price that someone is willing and able to pay for one more unit is high. But as the quantity available increases, the marginal benefit of each additional unit falls and the highest price that someone is willing and able to pay also falls along the demand curve.

In Fig. 3.1, if only 5 million energy bars are available each week, the highest price that someone is willing to pay for the 5 millionth bar is $2.50. But if 22 million energy bars are available each week, someone is willing to pay 50¢ for the last bar bought.

A Change in Demand

When any factor that influences buying plans changes, other than the price of the good, there is a change in demand. Figure 3.2 illustrates an increase in demand. When demand increases, the demand curve shifts rightward and the quantity demanded at each price is greater. For example, at $2.50 a bar, the quantity demanded on the original (blue) demand curve is 5 million energy bars a week. On the new (red) demand curve, at $2.50 a bar, the quantity demanded is 15 million bars a week. Look closely at the numbers in the table and check that the quantity demanded at each price is greater.
Six main factors bring changes in demand. They are changes in:

- The prices of related goods
- Expected future prices
- Income
- Expected future income and credit
- Population
- Preferences

**Prices of Related Goods** The quantity of energy bars that consumers plan to buy depends in part on the prices of substitutes for energy bars. A substitute is a good that can be used in place of another good. For example, a bus ride is a substitute for a train ride; a hamburger is a substitute for a hot dog; and an energy drink is a substitute for an energy bar. If the price of a substitute for an energy bar rises, people buy less of the substitute and more energy bars. For example, if the price of an energy drink rises, people buy fewer energy drinks and more energy bars. The demand for energy bars increases.

The quantity of energy bars that people plan to buy also depends on the prices of complements with energy bars. A complement is a good that is used in conjunction with another good. Hamburgers and fries are complements, and so are energy bars and exercise. If the price of an hour at the gym falls, people buy more gym time and more energy bars.

**Expected Future Prices** If the expected future price of a good rises and if the good can be stored, the opportunity cost of obtaining the good for future use is lower today than it will be in the future when people expect the price to be higher. So people retime their purchases—they substitute over time. They buy more of the good now before its price is expected to rise (and less afterward), so the demand for the good today increases.

For example, suppose that a Florida frost damages the season’s orange crop. You expect the price of orange juice to rise, so you fill your freezer with enough frozen juice to get you through the next six months. Your current demand for frozen orange juice has increased, and your future demand has decreased.

Similarly, if the expected future price of a good falls, the opportunity cost of buying the good today is high relative to what it is expected to be in the future. So again, people retime their purchases. They buy less of the good now before its price is expected...
ERROR: rangecheck
OFFENDING COMMAND: .buildshading2

STACK:

-dictionary-
-dictionary-
to fall, so the demand for the good decreases today and increases in the future.

Computer prices are constantly falling, and this fact poses a dilemma. Will you buy a new computer now, in time for the start of the school year, or will you wait until the price has fallen some more? Because people expect computer prices to keep falling, the current demand for computers is less (and the future demand is greater) than it otherwise would be.

**Income** Consumers’ income influences demand. When income increases, consumers buy more of most goods; and when income decreases, consumers buy less of most goods. Although an increase in income leads to an increase in the demand for most goods, it does not lead to an increase in the demand for all goods. A normal good is one for which demand increases as income increases. An inferior good is one for which demand decreases as income increases. As incomes increase, the demand for air travel (a normal good) increases and the demand for long-distance bus trips (an inferior good) decreases.

**Expected Future Income and Credit** When expected future income increases or credit becomes easier to get, demand for the good might increase now. For example, a salesperson gets the news that she will receive a big bonus at the end of the year, so she goes into debt and buys a new car right now, rather than wait until she receives the bonus.

**Population** Demand also depends on the size and the age structure of the population. The larger the population, the greater is the demand for all goods and services; the smaller the population, the smaller is the demand for all goods and services.

For example, the demand for parking spaces or movies or just about anything that you can imagine is much greater in New York City (population 7.5 million) than it is in Boise, Idaho (population 150,000).

Also, the larger the proportion of the population in a given age group, the greater is the demand for the goods and services used by that age group.

For example, during the 1990s, a decrease in the college-age population decreased the demand for college places. During those same years, the number of Americans aged 85 years and over increased by more than 1 million. As a result, the demand for nursing home services increased.

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**TABLE 3.1 The Demand for Energy Bars**

<table>
<thead>
<tr>
<th><strong>The Law of Demand</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The quantity of energy bars demanded</td>
<td></td>
</tr>
<tr>
<td>Decreases if:</td>
<td>Increases if:</td>
</tr>
<tr>
<td>The price of an energy bar rises</td>
<td>The price of an energy bar falls</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Changes in Demand</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The demand for energy bars</td>
<td></td>
</tr>
<tr>
<td>Decreases if:</td>
<td>Increases if:</td>
</tr>
<tr>
<td>The price of a substitute falls</td>
<td>The price of a substitute rises</td>
</tr>
<tr>
<td>The price of a complement rises</td>
<td>The price of a complement falls</td>
</tr>
<tr>
<td>The expected future price of an energy bar falls</td>
<td>The expected future price of an energy bar rises</td>
</tr>
<tr>
<td>Income falls*</td>
<td>Income rises*</td>
</tr>
<tr>
<td>Expected future income falls or credit becomes harder to get*</td>
<td>Expected future income rises or credit becomes easier to get*</td>
</tr>
<tr>
<td>The population decreases</td>
<td>The population increases</td>
</tr>
</tbody>
</table>

*An energy bar is a normal good.

**Preferences** Demand depends on preferences. Preferences determine the value that people place on each good and service. Preferences depend on such things as the weather, information, and fashion. For example, greater health and fitness awareness has shifted preferences in favor of energy bars, so the demand for energy bars has increased.

Table 3.1 summarizes the influences on demand and the direction of those influences.

**A Change in the Quantity Demanded Versus a Change in Demand**

Changes in the influences on buying plans bring either a change in the quantity demanded or a change in demand. Equivalently, they bring either a movement along the demand curve or a shift of the demand curve. The distinction between a change in
the quantity demanded and a change in demand is the same as that between a movement along the demand curve and a shift of the demand curve.

A point on the demand curve shows the quantity demanded at a given price, so a movement along the demand curve shows a **change in the quantity demanded**. The entire demand curve shows demand, so a shift of the demand curve shows a **change in demand**. Figure 3.3 illustrates these distinctions.

**Movement Along the Demand Curve**  If the price of the good changes but no other influence on buying plans changes, we illustrate the effect as a movement along the demand curve.

A fall in the price of a good increases the quantity demanded of it. In Fig. 3.3, we illustrate the effect of a fall in price as a movement down along the demand curve $D_0$.

A rise in the price of a good decreases the quantity demanded of it. In Fig. 3.3, we illustrate the effect of a rise in price as a movement up along the demand curve $D_0$.

**A Shift of the Demand Curve**  If the price of a good remains constant but some other influence on buying plans changes, there is a change in demand for that good. We illustrate a change in demand as a shift of the demand curve. For example, if more people work out at the gym, consumers buy more energy bars regardless of the price of a bar. That is what a rightward shift of the demand curve shows—more energy bars are demanded at each price.

In Fig. 3.3, there is a **change in demand** and the demand curve shifts when any influence on buying plans changes, other than the price of the good. Demand **increases** and the demand curve **shifts rightward** (to the red demand curve $D_1$) if the price of a substitute rises, the price of a complement falls, the expected future price of the good rises, income increases (for a normal good), expected future income or credit increases, or the population increases. Demand **decreases** and the demand curve **shifts leftward** (to the red demand curve $D_2$) if the price of a substitute falls, the price of a complement rises, the expected future price of the good falls, income decreases (for a normal good), expected future income or credit decreases, or the population decreases. (For an inferior good, the effects of changes in income are in the opposite direction to those described above.)

---

**FIGURE 3.3**  A Change in the Quantity Demanded Versus a Change in Demand

When the price of the good changes, there is a movement along the demand curve and a **change in the quantity demanded**, shown by the blue arrows on demand curve $D_0$. When any other influence on buying plans changes, there is a shift of the demand curve and a **change in demand**. An increase in demand shifts the demand curve rightward ([from $D_0$ to $D_1$]). A decrease in demand shifts the demand curve leftward ([from $D_0$ to $D_2$]).

---

**REVIEW QUIZ**

1. Define the quantity demanded of a good or service.
2. What is the law of demand and how do we illustrate it?
3. What does the demand curve tell us about the price that consumers are willing to pay?
4. List all the influences on buying plans that change demand, and for each influence, say whether it increases or decreases demand.
5. Why does demand not change when the price of a good changes with no change in the other influences on buying plans?

You can work these questions in Study Plan 3.2 and get instant feedback.
Supply

If a firm supplies a good or service, the firm
1. Has the resources and technology to produce it,
2. Can profit from producing it, and
3. Plans to produce it and sell it.

A supply is more than just having the resources and the technology to produce something. Resources and technology are the constraints that limit what is possible.

Many useful things can be produced, but they are not produced unless it is profitable to do so. Supply reflects a decision about which technologically feasible items to produce.

The quantity supplied of a good or service is the amount that producers plan to sell during a given time period at a particular price. The quantity supplied is not necessarily the same amount as the quantity actually sold. Sometimes the quantity supplied is greater than the quantity demanded, so the quantity sold is less than the quantity supplied.

Like the quantity demanded, the quantity supplied is measured as an amount per unit of time. For example, suppose that GM produces 1,000 cars a day. The quantity of cars supplied by GM can be expressed as 1,000 a day, 7,000 a week, or 365,000 a year. Without the time dimension, we cannot tell whether a particular quantity is large or small.

Many factors influence selling plans, and again one of them is the price of the good. We look first at the relationship between the quantity supplied of a good and its price. Just as we did when we studied demand, to isolate the relationship between the quantity supplied of a good and its price, we keep all other influences on selling plans the same and ask: How does the quantity supplied of a good change as its price changes when other things remain the same?

The law of supply provides the answer.

The Law of Supply

The law of supply states:

Other things remaining the same, the higher the price of a good, the greater is the quantity supplied; and the lower the price of a good, the smaller is the quantity supplied.

Why does a higher price increase the quantity supplied? It is because marginal cost increases. As the quantity produced of any good increases, the marginal cost of producing the good increases. (See Chapter 2, p. 33 to review marginal cost.)

It is never worth producing a good if the price received for the good does not at least cover the marginal cost of producing it. When the price of a good rises, other things remaining the same, producers are willing to incur a higher marginal cost, so they increase production. The higher price brings forth an increase in the quantity supplied.

Let's now illustrate the law of supply with a supply curve and a supply schedule.

Supply Curve and Supply Schedule

You are now going to study the second of the two most used curves in economics: the supply curve. You're also going to learn about the critical distinction between supply and quantity supplied.

The term supply refers to the entire relationship between the price of a good and the quantity supplied of it. Supply is illustrated by the supply curve and the supply schedule. The term quantity supplied refers to a point on a supply curve—the quantity supplied at a particular price.

Figure 3.4 shows the supply curve of energy bars. A supply curve shows the relationship between the quantity supplied of a good and its price when all other influences on producers' planned sales remain the same. The supply curve is a graph of a supply schedule.

The table in Fig. 3.4 sets out the supply schedule for energy bars. A supply schedule lists the quantities supplied at each price when all the other influences on producers' planned sales remain the same. For example, if the price of an energy bar is 50¢, the quantity supplied is zero—in row A of the table. If the price of an energy bar is $1.00, the quantity supplied is 6 million energy bars a week—in row B. The other rows of the table show the quantities supplied at prices of $1.50, $2.00, and $2.50.

To make a supply curve, we graph the quantity supplied on the x-axis and the price on the y-axis. The points on the supply curve labeled A through E correspond to the rows of the supply schedule. For example, point A on the graph shows a quantity supplied of zero at a price of 50¢ an energy bar. Point E shows a quantity supplied of 15 million bars at $2.50 an energy bar.
The supply curve can be interpreted as a minimum-supply-price curve—a curve that shows the lowest price at which someone is willing to sell. This lowest price is the marginal cost. If a small quantity is produced, the lowest price at which someone is willing to sell one more unit is low. But as the quantity produced increases, the marginal cost of each additional unit rises, so the lowest price at which someone is willing to sell an additional unit rises along the supply curve.

In Fig. 3.4, if 15 million bars are produced each week, the lowest price at which someone is willing to sell the 15 millionth bar is $2.50. But if 10 million bars are produced each week, someone is willing to accept $1.50 for the last bar produced.

**A Change in Supply**

When any factor that influences selling plans other than the price of the good changes, there is a change in supply. Six main factors bring changes in supply. They are changes in

- The prices of factors of production
- The prices of related goods produced
- Expected future prices
- The number of suppliers
- Technology
- The state of nature

**Prices of Factors of Production**

The prices of the factors of production used to produce a good influence its supply. To see this influence, think about the supply curve as a minimum-supply-price curve. If the price of a factor of production rises, the lowest price that a producer is willing to accept for that good rises, so supply decreases. For example, during 2008, as the price of jet fuel increased, the supply of air travel decreased. Similarly, a rise in the minimum wage decreases the supply of hamburgers.

**Prices of Related Goods Produced**

The prices of related goods that firms produce influence supply. For example, if the price of energy gel rises, firms switch production from bars to gel. The supply of energy bars decreases. Energy bars and energy gel are substitutes in production—goods that can be produced by using the same resources. If the price of beef rises, the supply of cowhide increases. Beef and cowhide are complements in production—goods that must be produced together.
**Expected Future Prices** If the expected future price of a good rises, the return from selling the good in the future increases and is higher than it is today. So supply decreases today and increases in the future.

**The Number of Suppliers** The larger the number of firms that produce a good, the greater is the supply of the good. As new firms enter an industry, the supply in that industry increases. As firms leave an industry, the supply in that industry decreases.

**Technology** The term “technology” is used broadly to mean the way that factors of production are used to produce a good. A technology change occurs when a new method is discovered that lowers the cost of producing a good. For example, new methods used in the factories that produce computer chips have lowered the cost and increased the supply of chips.

**The State of Nature** The state of nature includes all the natural forces that influence production. It includes the state of the weather and, more broadly, the natural environment. Good weather can increase the supply of many agricultural products and bad weather can decrease their supply. Extreme natural events such as earthquakes, tornadoes, and hurricanes can also influence supply.

Figure 3.5 illustrates an increase in supply. When supply increases, the supply curve shifts rightward and the quantity supplied at each price is larger. For example, at $1.50 per bar, on the original (blue) supply curve, the quantity supplied is 6 million bars a week. On the new (red) supply curve, the quantity supplied is 15 million bars a week. Look closely at the numbers in the table in Fig. 3.5 and check that the quantity supplied is larger at each price.

Table 3.2 summarizes the influences on supply and the directions of those influences.

**A Change in the Quantity Supplied Versus a Change in Supply**

Changes in the influences on selling plans bring either a change in the quantity supplied or a change in supply. Equivalently, they bring either a movement along the supply curve or a shift of the supply curve.

A point on the supply curve shows the quantity supplied at a given price. A movement along the supply curve shows a change in the quantity supplied. The entire supply curve shows supply. A shift of the supply curve shows a change in supply.

<table>
<thead>
<tr>
<th>Original supply schedule</th>
<th>New supply schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Old technology</strong></td>
<td><strong>New technology</strong></td>
</tr>
<tr>
<td>Price (dollars per bar)</td>
<td>Quantity supplied (millions of bars per week)</td>
</tr>
<tr>
<td>A 0.50</td>
<td>0</td>
</tr>
<tr>
<td>B 1.00</td>
<td>6</td>
</tr>
<tr>
<td>C 1.50</td>
<td>10</td>
</tr>
<tr>
<td>D 2.00</td>
<td>13</td>
</tr>
<tr>
<td>E 2.50</td>
<td>15</td>
</tr>
</tbody>
</table>

A change in any influence on selling plans other than the price of the good itself results in a new supply schedule and a shift of the supply curve. For example, a new, cost-saving technology for producing energy bars changes the supply of energy bars. At a price of $1.50 a bar, 10 million bars a week are supplied when producers use the old technology (row C of the table) and 20 million energy bars a week are supplied when producers use the new technology (row $C'$). An advance in technology increases the supply of energy bars. The supply curve shifts rightward, as shown by the shift arrow and the resulting red curve.
Figure 3.6 illustrates and summarizes these distinctions. If the price of the good changes and other things remain the same, there is a change in the quantity supplied of that good. If the price of the good falls, the quantity supplied decreases and there is a movement down along the supply curve $S_0$. If the price of the good rises, the quantity supplied increases and there is a movement up along the supply curve $S_0$. When any other influence on selling plans changes, the supply curve shifts and there is a change in supply. If supply increases, the supply curve shifts rightward to $S_1$. If supply decreases, the supply curve shifts leftward to $S_2$.

Now we’re going to combine demand and supply and see how prices and quantities are determined.
ERROR: rangecheck
OFFENDING COMMAND: .buildshading2

STACK:
-dictionary-
-dictionary-
Market Equilibrium

We have seen that when the price of a good rises, the quantity demanded decreases and the quantity supplied increases. We are now going to see how the price adjusts to coordinate buying plans and selling plans and achieve an equilibrium in the market.

An equilibrium is a situation in which opposing forces balance each other. Equilibrium in a market occurs when the price balances buying plans and selling plans. The equilibrium price is the price at which the quantity demanded equals the quantity supplied. The equilibrium quantity is the quantity bought and sold at the equilibrium price. A market moves toward its equilibrium because

- Price regulates buying and selling plans.
- Price adjusts when plans don’t match.

Price as a Regulator

The price of a good regulates the quantities demanded and supplied. If the price is too high, the quantity supplied exceeds the quantity demanded. If the price is too low, the quantity demanded exceeds the quantity supplied. There is one price at which the quantity demanded equals the quantity supplied. Let’s work out what that price is.

Figure 3.7 shows the market for energy bars. The table shows the demand schedule (from Fig. 3.1) and the supply schedule (from Fig. 3.4). If the price is 50¢ a bar, the quantity demanded is 22 million bars a week but no bars are supplied. There is a shortage of 22 million bars a week. The final column of the table shows this shortage. At a price of $1.00 a bar, there is still a shortage but only of 9 million bars a week.

If the price is $2.50 a bar, the quantity supplied is 15 million bars a week but the quantity demanded is only 5 million. There is a surplus of 10 million bars a week.

The one price at which there is neither a shortage nor a surplus is $1.50 a bar. At that price, the quantity demanded equals the quantity supplied: 10 million bars a week. The equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week.

Figure 3.7 shows that the demand curve and the supply curve intersect at the equilibrium price of $1.50 a bar. At each price above $1.50 a bar, there is a surplus of bars. For example, at $2.00 a bar, the surplus is 6 million bars a week. At each price below $1.50 a bar, there is a shortage of bars. For example, at $1.00 a bar, there is a shortage of 9 million bars a week.
million bars a week, as shown by the blue arrow. At each price below $1.50 a bar, there is a shortage of bars. For example, at $1.00 a bar, the shortage is 9 million bars a week, as shown by the red arrow.

**Price Adjustments**
You’ve seen that if the price is below equilibrium, there is a shortage and that if the price is above equilibrium, there is a surplus. But can we count on the price to change and eliminate a shortage or a surplus? We can, because such price changes are beneficial to both buyers and sellers. Let’s see why the price changes when there is a shortage or a surplus.

**A Shortage Forces the Price Up** Suppose the price of an energy bar is $1. Consumers plan to buy 15 million bars a week, and producers plan to sell 6 million bars a week. Consumers can’t force producers to sell more than they plan, so the quantity that is actually offered for sale is 6 million bars a week. In this situation, powerful forces operate to increase the price and move it toward the equilibrium price. Some producers, noticing lines of unsatisfied consumers, raise the price. Some producers increase their output. As producers push the price up, the price rises toward its equilibrium. The rising price reduces the shortage because it decreases the quantity demanded and increases the quantity supplied. When the price has increased to the point at which there is no longer a shortage, the forces moving the price stop operating and the price comes to rest at its equilibrium.

**A Surplus Forces the Price Down** Suppose the price of a bar is $2. Producers plan to sell 13 million bars a week, and consumers plan to buy 7 million bars a week. Producers cannot force consumers to buy more than they plan, so the quantity that is actually bought is 7 million bars a week. In this situation, powerful forces operate to lower the price and move it toward the equilibrium price. Some producers, unable to sell the quantities of energy bars they planned to sell, cut their prices. In addition, some producers scale back production. As producers cut the price, the price falls toward its equilibrium. The falling price decreases the surplus because it increases the quantity demanded and decreases the quantity supplied. When the price has fallen to the point at which there is no longer a surplus, the forces moving the price stop operating and the price comes to rest at its equilibrium.

**The Best Deal Available for Buyers and Sellers** When the price is below equilibrium, it is forced upward. Why don’t buyers resist the increase and refuse to buy at the higher price? The answer is because they value the good more highly than its current price and they can’t satisfy their demand at the current price. In some markets—for example, the markets that operate on eBay—the buyers might even be the ones who force the price up by offering to pay a higher price.

When the price is above equilibrium, it is bid downward. Why don’t sellers resist this decrease and refuse to sell at the lower price? The answer is because their minimum supply price is below the current price and they cannot sell all they would like to at the current price. Sellers willingly lower the price to gain market share.

At the price at which the quantity demanded and the quantity supplied are equal, neither buyers nor sellers can do business at a better price. Buyers pay the highest price they are willing to pay for the last unit bought, and sellers receive the lowest price at which they are willing to supply the last unit sold.

When people freely make offers to buy and sell and when demanders try to buy at the lowest possible price and suppliers try to sell at the highest possible price, the price at which trade takes place is the equilibrium price—the price at which the quantity demanded equals the quantity supplied. The price coordinates the plans of buyers and sellers, and no one has an incentive to change it.

**REVIEW QUIZ**

1. What is the equilibrium price of a good or service?
2. Over what range of prices does a shortage arise?
3. Over what range of prices does a surplus arise?
4. Why is the price at which the quantity demanded equals the quantity supplied the equilibrium price?
5. Why is the equilibrium price the best deal available for both buyers and sellers?

You can work these questions in Study Plan 3.4 and get instant feedback.
Predicting Changes in Price and Quantity

The demand and supply model that we have just studied provides us with a powerful way of analyzing influences on prices and the quantities bought and sold. According to the model, a change in price stems from a change in demand, a change in supply, or a change in both demand and supply. Let’s look first at the effects of a change in demand.

An Increase in Demand

If more people join health clubs, the demand for energy bars increases. The table in Fig. 3.8 shows the original and new demand schedules for energy bars as well as the supply schedule of energy bars.

The increase in demand creates a shortage at the original price and to eliminate the shortage, the price must rise.

Figure 3.8 shows what happens. The figure shows the original demand for and supply of energy bars. The original equilibrium price is $1.50 an energy bar, and the equilibrium quantity is 10 million energy bars a week. When demand increases, the demand curve shifts rightward. The equilibrium price rises to $2.50 an energy bar, and the quantity supplied increases to 15 million energy bars a week, as highlighted in the figure. There is an increase in the quantity supplied but no change in supply—a movement along, but no shift of, the supply curve.

A Decrease in Demand

We can reverse this change in demand. Start at a price of $2.50 a bar with 15 million energy bars a week being bought and sold, and then work out what happens if demand decreases to its original level. Such a decrease in demand might arise if people switch to energy gel (a substitute for energy bars). The decrease in demand shifts the demand curve leftward. The equilibrium price falls to $1.50 a bar, and the quantity supplied decreases, and the equilibrium quantity decreases to 10 million bars a week.

We can now make our first two predictions:

1. When demand increases, the price rises and the quantity increases.
2. When demand decreases, the price falls and the quantity decreases.

Initially, the demand for energy bars is the blue demand curve. The equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week. When more health-conscious people do more exercise, the demand for energy bars increases and the demand curve shifts rightward to become the red curve.

At $1.50 a bar, there is now a shortage of 10 million bars a week. The price of a bar rises to a new equilibrium of $2.50. As the price rises to $2.50, the quantity supplied increases—shown by the blue arrow on the supply curve—to the new equilibrium quantity of 15 million bars a week.

Following an increase in demand, the quantity supplied increases but supply does not change—the supply curve does not shift.
Predicting Changes in Price and Quantity

Economics in Action
The Global Market for Crude Oil

The demand and supply model provides insights into all competitive markets. Here, we’ll apply what you’ve learned about the effects of an increase in demand to the global market for crude oil.

Crude oil is like the life-blood of the global economy. It is used to fuel our cars, airplanes, trains, and buses, to generate electricity, and to produce a wide range of plastics. When the price of crude oil rises, the cost of transportation, power, and materials all increase.

In 2001, the price of a barrel of oil was $20 (using the value of money in 2010). In 2008, before the global financial crisis ended a long period of economic expansion, the price peaked at $127 a barrel.

While the price of oil was rising, the quantity of oil produced and consumed also increased. In 2001, the world produced 65 million barrels of oil a day. By 2008, that quantity was 72 million barrels.

Who or what has been raising the price of oil? Is it the action of greedy oil producers? Oil producers might be greedy, and some of them might be big enough to withhold supply and raise the price, but it wouldn’t be in their self-interest to do so. The higher price would bring forth a greater quantity supplied from other producers and the profit of the producer limiting supply would fall.

Oil producers could try to cooperate and jointly withhold supply. The Organization of Petroleum Exporting Countries, OPEC, is such a group of producers. But OPEC doesn’t control the world supply and its members’ self-interest is to produce the quantities that give them the maximum attainable profit.

So even though the global oil market has some big players, they don’t fix the price. Instead, the actions of thousands of buyers and sellers and the forces of demand and supply determine the price of oil.

So how have demand and supply changed? Because both the price and the quantity have increased, the demand for oil must have increased. Supply might have changed too, but here we’ll suppose that supply has remained the same.

The global demand for oil has increased for one major reason: World income has increased. The increase has been particularly large in the emerging economies of Brazil, China, and India. Increased world income has increased the demand for oil-using goods such as electricity, gasoline, and plastics, which in turn has increased the demand for oil.

The figure illustrates the effects of the increase in demand on the global oil market. The supply of oil remained constant along supply curve $S$. The demand for oil in 2001 was $D_{2001}$, so in 2001 the price was $20 a barrel and the quantity was 65 million barrels per day. The demand for oil increased and by 2008 it had reached $D_{2008}$. The price of oil increased to $127 a barrel and the quantity increased to 72 million barrels a day. The increase in the quantity is an increase in the quantity supplied, not an increase in supply.

The Global Market for Crude Oil
An Increase in Supply

When Nestlé (the producer of PowerBar) and other energy bar producers switch to a new cost-saving technology, the supply of energy bars increases. Figure 3.9 shows the new supply schedule (the same one that was shown in Fig. 3.5). What are the new equilibrium price and quantity? The price falls to $1.00 a bar, and the quantity increases to 15 million bars a week. You can see why by looking at the quantities demanded and supplied at the old price of $1.50 a bar. The new quantity supplied at that price is 20 million bars a week, and there is a surplus. The price falls. Only when the price is $1.00 a bar does the quantity supplied equal the quantity demanded.

Figure 3.9 illustrates the effect of an increase in supply. It shows the demand curve for energy bars and the original and new supply curves. The initial equilibrium price is $1.50 a bar, and the equilibrium quantity is 10 million bars a week. When supply increases, the supply curve shifts rightward. The equilibrium price falls to $1.00 a bar, and the quantity demanded increases to 15 million bars a week, highlighted in the figure. There is an increase in the quantity demanded but no change in demand—a movement along, but no shift of, the demand curve.

A Decrease in Supply

Start out at a price of $1.00 a bar with 15 million bars a week being bought and sold. Then suppose that the cost of labor or raw materials rises and the supply of energy bars decreases. The decrease in supply shifts the supply curve leftward. The equilibrium price rises to $1.50 a bar, the quantity demanded decreases, and the equilibrium quantity decreases to 10 million bars a week.

We can now make two more predictions:

1. When supply increases, the price falls and the quantity increases.
2. When supply decreases, the price rises and the quantity decreases.

You’ve now seen what happens to the price and the quantity when either demand or supply changes while the other one remains unchanged. In real markets, both demand and supply can change together. When this happens, to predict the changes in price and quantity, we must combine the effects that you’ve just seen. That is your final task in this chapter.
Economics in Action

The Market for Strawberries

California produces 85 percent of the nation’s strawberries and its crop, which starts to increase in March, is in top flight by April. During the winter months of January and February, Florida is the main strawberry producer.

In a normal year, the supplies from these two regions don’t overlap much. As California’s production steps up in March and April, Florida’s production falls off. The result is a steady supply of strawberries and not much seasonal fluctuation in the price of strawberries.

But 2010 wasn’t a normal year. Florida had exceptionally cold weather, which damaged the strawberry fields, lowered crop yields, and delayed the harvests. The result was unusually high strawberry prices.

With higher than normal prices, Florida farmers planted strawberry varieties that mature later than their normal crop and planned to harvest this fruit during the spring. Their plan worked perfectly and good growing conditions delivered a bumper crop by late March.

On the other side of the nation, while Florida was freezing, Southern California was drowning under unusually heavy rains. This wet weather put the strawberries to sleep and delayed their growth. But when the rains stopped and the temperature began to rise, California joined Florida with a super abundance of fruit.

With an abundance of strawberries, the price tumbled. Strawberry farmers in both regions couldn’t hire enough labor to pick the super-sized crop, so some fruit was left in the fields to rot.

The figure explains what was happening in the market for strawberries.

Demand, shown by the demand curve, $D$, didn’t change. In January, the failed Florida crop kept supply low and the supply curve was $S_{January}$. The price was high at $3.80 per pound and production was 5.0 million pounds per day.

In April, the bumper crops in both regions increased supply to $S_{April}$. This increase in supply lowered the price to $1.20 per pound and increased the quantity demanded—a movement along the demand curve—to 5.5 million pounds per day.

You can also see in the figure why farmers left fruit in the field to rot. At the January price of $3.80 a pound, farmers would have been paying top wages to hire the workers needed to pick fruit at the rate of 6.0 million pounds per day. This is the quantity on supply curve $S_{April}$ at $3.80 a pound.

But with the fall in price to $1.20 a pound, growers were not able to earn a profit by picking more than 5.5 million pounds.

For some growers, the price wasn’t high enough to cover the cost of hiring labor, so they opened their fields to anyone who wanted to pick their own strawberries for free.

The events we’ve described here in the market for strawberries illustrate the effects of a change in supply with no change in demand.
Decrease in Both Demand and Supply

Figure 3.10(i) shows the case in which demand and supply both decrease. For the same reasons as those we’ve just reviewed, when both demand and supply decrease, the quantity decreases, and again the direction of the price change is uncertain.

Decrease in Demand and Increase in Supply

You’ve seen that a decrease in demand lowers the price and decreases the quantity. And you’ve seen that an increase in supply lowers the price and increases the quantity. Fig. 3.10(f) combines these two changes. Both the decrease in demand and the increase in supply lower the price, so the price falls. But a decrease in demand decreases the quantity and an increase in supply increases the quantity, so we can’t predict the direction in which the quantity will change unless we know the magnitudes of the changes in demand and supply. In the example in Fig. 3.10(f), the quantity does not change. But notice that if demand decreases by slightly more than the amount shown in the figure, the quantity will decrease; if supply increases by slightly more than the amount shown in the figure, the quantity will increase.

Increase in Demand and Decrease in Supply

Figure 3.10(h) shows the case in which demand increases and supply decreases. Now, the price rises, and again the direction of the quantity change is uncertain.

**All the Possible Changes in Demand and Supply**

Figure 3.10 brings together and summarizes the effects of all the possible changes in demand and supply. With what you’ve learned about the effects of a change in either demand or supply, you can predict what happens if both demand and supply change together. Let’s begin by reviewing what you already know.

**Change in Demand with No Change in Supply**

The first row of Fig. 3.10, parts (a), (b), and (c), summarizes the effects of a change in demand with no change in supply. In part (a), with no change in either demand or supply, neither the price nor the quantity changes. With an increase in demand and no change in supply in part (b), both the price and quantity increase. And with a decrease in demand and no change in supply in part (c), both the price and the quantity decrease.

**Change in Supply with No Change in Demand**

The first column of Fig. 3.10, parts (a), (d), and (g), summarizes the effects of a change in supply with no change in demand. With an increase in supply and no change in demand in part (d), the price falls and quantity increases. And with a decrease in supply and no change in demand in part (g), the price rises and the quantity decreases.

**Increase in Both Demand and Supply**

You’ve seen that an increase in demand raises the price and increases the quantity. And you’ve seen that an increase in supply lowers the price and increases the quantity. Fig. 3.10(e) combines these two changes. Because either an increase in demand or an increase in supply increases the quantity, the quantity also increases when both demand and supply increase. But the effect on the price is uncertain. An increase in demand raises the price and an increase in supply lowers the price, so we can’t say whether the price will rise or fall when both demand and supply increase. We need to know the magnitudes of the changes in demand and supply to predict the effects on price. In the example in Fig. 3.10(e), the price does not change. But notice that if demand increases by slightly more than the amount shown in the figure, the price will rise. And if supply increases by slightly more than the amount shown in the figure, the price will fall.

**Review Quiz**

What is the effect on the price and quantity of MP3 players (such as the iPod) if

1. The price of a PC falls or the price of an MP3 download rises? (Draw the diagrams!)
2. More firms produce MP3 players or electronics workers’ wages rise? (Draw the diagrams!)
3. Any two of the events in questions 1 and 2 occur together? (Draw the diagrams!)

You can work these questions in Study Plan 3.5 and get instant feedback.

To complete your study of demand and supply, take a look at Reading Between the Lines on pp. 70–71, which explains why the price of coffee increased in 2010. Try to get into the habit of using the demand and supply model to understand the movements in prices in your everyday life.
Predicting Changes in Price and Quantity

**FIGURE 3.10** The Effects of All the Possible Changes in Demand and Supply

(a) No change in demand or supply

(b) Increase in demand

(c) Decrease in demand

(d) Increase in supply

(e) Increase in both demand and supply

(f) Decrease in demand; increase in supply

(g) Decrease in supply

(h) Increase in demand; decrease in supply

(i) Decrease in both demand and supply
Coffee prices hit a 12-year high on Friday on the back of low supplies of premium Arabica coffee from Colombia after a string of poor crops in the Latin American country.

The strong fundamental picture has also encouraged hedge funds to reverse their previous bearish views on coffee prices.

In New York, ICE September Arabica coffee jumped 3.2 percent to 178.75 cents per pound, the highest since February 1998. It traded later at 177.25 cents, up 6.8 percent on the week.

The London-based International Coffee Organization on Friday warned that the “current tight demand and supply situation” was “likely to persist in the near to medium term.”

Coffee industry executives believe prices could rise toward 200 cents per pound in New York before the arrival of the new Brazilian crop later this year.

“Until October it is going to be tight on high quality coffee,” said a senior executive at one of Europe’s largest coffee roasters. He said: “The industry has been surprised by the scarcity of high quality beans.”

Colombia coffee production, key for supplies of premium beans, last year plunged to a 33-year low of 7.8m bags, each of 60kg, down nearly a third from 11.1m bags in 2008, tightening supplies worldwide. ...
This news article reports two sources of changes in supply and demand that changed the price of coffee.

The first source of change is the sequence of poor harvests in Columbia. These events decreased the world supply of Arabica coffee. (Arabica is the type that Starbucks uses.)

Before the reported events, the world production of Arabica was 120 million bags per year and its price was 174 cents per pound.

The decrease in the Columbian harvest decreased world production to about 116 million bags, which is about 3 percent of world production.

Figure 1 shows the situation before the poor Columbia harvests and the effects of those poor harvests. The demand curve is D and initially, the supply curve was S0. The market equilibrium is at 120 million bags per year and a price of 174 cents per pound.

The poor Columbian harvests decreased supply and the supply curve shifted leftward to S1. The price increased to 180 cents per pound and the quantity decreased to 116 million bags.

The second source of change influenced both supply and demand. It is a change in the expected future price of coffee.

The hedge funds referred to in the news article are speculators that try to profit from buying at a low price and selling at a high price.

With the supply of coffee expected to remain low, the price was expected to rise further—a rise in the expected future price of coffee.

When the expected future price of coffee rises, some people want to buy more coffee (so they can sell it later)—an increase in the demand today. And some people offer less coffee for sale (so they can sell it later for a higher price)—a decrease in the supply today.

Figure 2 shows the effects of these changes in the demand and supply today.

Demand increased and the demand curve shifted from D0 to D1. Supply decreased and the supply curve shifted from S1 to S2.

Because demand increases and supply decreases, the price rises. In this example, it rises to 200 cents per pound.

Also, because demand increases and supply decreases, the change in the equilibrium quantity can go in either direction.

In this example, the increase in demand equals the decrease in supply, so the equilibrium quantity remains constant at 116 million bags per year.
**MATHEMATICAL NOTE**

Demand, Supply, and Equilibrium

**Demand Curve**

The law of demand says that as the price of a good or service falls, the quantity demanded of that good or service increases. We can illustrate the law of demand by drawing a graph of the demand curve or writing down an equation. When the demand curve is a straight line, the following equation describes it:

\[ P = a - bQ_D, \]

where \( P \) is the price and \( Q_D \) is the quantity demanded. The \( a \) and \( b \) are positive constants.

The demand equation tells us three things:

1. The price at which no one is willing to buy the good (\( Q_D \) is zero). That is, if the price is \( a \), then the quantity demanded is zero. You can see the price \( a \) in Fig. 1. It is the price at which the demand curve hits the \( y \)-axis—what we call the demand curve’s “\( y \)-intercept.”

2. As the price falls, the quantity demanded increases. If \( Q_D \) is a positive number, then the price \( P \) must be less than \( a \). As \( Q_D \) gets larger, the price \( P \) becomes smaller. That is, as the quantity increases, the maximum price that buyers are willing to pay for the last unit of the good falls.

3. The constant \( b \) tells us how fast the maximum price that someone is willing to pay for the good falls as the quantity increases. That is, the constant \( b \) tells us about the steepness of the demand curve. The equation tells us that the slope of the demand curve is \(-b\).

Figure 1  Demand curve

**Supply Curve**

The law of supply says that as the price of a good or service rises, the quantity supplied of that good or service increases. We can illustrate the law of supply by drawing a graph of the supply curve or writing down an equation. When the supply curve is a straight line, the following equation describes it:

\[ P = c + dQ_S, \]

where \( P \) is the price and \( Q_S \) is the quantity supplied. The \( c \) and \( d \) are positive constants.

The supply equation tells us three things:

1. The price at which sellers are not willing to supply the good (\( Q_S \) is zero). That is, if the price is \( c \), then no one is willing to sell the good. You can see the price \( c \) in Fig. 2. It is the price at which the supply curve hits the \( y \)-axis—what we call the supply curve’s “\( y \)-intercept.”

2. As the price rises, the quantity supplied increases. If \( Q_S \) is a positive number, then the price \( P \) must be greater than \( c \). As \( Q_S \) increases, the price \( P \) becomes larger. That is, as the quantity increases, the minimum price that sellers are willing to accept for the last unit rises.

3. The constant \( d \) tells us how fast the minimum price at which someone is willing to sell the good rises as the quantity increases. That is, the constant \( d \) tells us about the steepness of the supply curve. The equation tells us that the slope of the supply curve is \( d \).

Figure 2  Supply curve
Market Equilibrium

Demand and supply determine market equilibrium. Figure 3 shows the equilibrium price \((P^*)\) and equilibrium quantity \((Q^*)\) at the intersection of the demand curve and the supply curve.

We can use the equations to find the equilibrium price and equilibrium quantity. The price of a good adjusts until the quantity demanded \(Q_D\) equals the quantity supplied \(Q_S\). So at the equilibrium price \((P^*)\) and equilibrium quantity \((Q^*)\),

\[ Q_D = Q_S = Q^*. \]

To find the equilibrium price and equilibrium quantity, substitute \(Q^*\) for \(Q_D\) in the demand equation and \(Q^*\) for \(Q_S\) in the supply equation. Then the price is the equilibrium price \((P^*)\), which gives

\[ P^* = a - bQ^* \]
\[ P^* = c + dQ^*. \]

Notice that

\[ a - bQ^* = c + dQ^*. \]

Now solve for \(Q^*\):

\[ a - c = bQ^* + dQ^* \]
\[ a - c = (b + d)Q^* \]
\[ Q^* = \frac{a - c}{b + d}. \]

To find the equilibrium price, \((P^*)\), substitute for \(Q^*\) in either the demand equation or the supply equation.

Using the demand equation, we have

\[ P^* = a - b\left(\frac{a - c}{b + d}\right) \]
\[ P^* = \frac{a(b + d) - b(a - c)}{b + d} \]
\[ P^* = \frac{ad + bc}{b + d}. \]

Alternatively, using the supply equation, we have

\[ P^* = c + d\left(\frac{a - c}{b + d}\right) \]
\[ P^* = \frac{c(b + d) + d(a - c)}{b + d} \]
\[ P^* = \frac{ad + bc}{b + d}. \]

An Example

The demand for ice-cream cones is

\[ P = 800 - 2Q_D. \]

The supply of ice-cream cones is

\[ P = 200 + 1Q_S. \]

The price of a cone is expressed in cents, and the quantities are expressed in cones per day.

To find the equilibrium price \((P^*)\) and equilibrium quantity \((Q^*)\), substitute \(Q^*\) for \(Q_D\) and \(Q_S\) for \(P^*\) for \(P\). That is,

\[ P^* = 800 - 2Q^* \]
\[ P^* = 200 + 1Q^*. \]

Now solve for \(Q^*\):

\[ 800 - 2Q^* = 200 + 1Q^* \]
\[ 600 = 3Q^* \]
\[ Q^* = 200. \]

And

\[ P^* = 800 - 2(200) \]
\[ = 400. \]

The equilibrium price is $4 a cone, and the equilibrium quantity is 200 cones per day.
I Supply depends on the prices of factors of production used to produce a good, the prices of related goods produced, expected future prices, the number of suppliers, technology, and the state of nature.

Working Problems 6 to 9 will give you a better understanding of supply.

Market Equilibrium (pp. 62–63)
- At the equilibrium price, the quantity demanded equals the quantity supplied.
- At any price above the equilibrium price, there is a surplus and the price falls.
- At any price below the equilibrium price, there is a shortage and the price rises.

Working Problems 10 and 11 will give you a better understanding of market equilibrium.

Predicting Changes in Price and Quantity (pp. 64–69)
- An increase in demand brings a rise in the price and an increase in the quantity supplied. A decrease in demand brings a fall in the price and a decrease in the quantity supplied.
- An increase in supply brings a fall in the price and an increase in the quantity demanded. A decrease in supply brings a rise in the price and a decrease in the quantity demanded.
- An increase in demand and an increase in supply bring an increased quantity but an uncertain price change. An increase in demand and a decrease in supply bring a higher price but an uncertain change in quantity.

Working Problems 12 and 13 will give you a better understanding of predicting changes in price and quantity.

Key Points

Markets and Prices (p. 52)
- A competitive market is one that has so many buyers and sellers that no single buyer or seller can influence the price.
- Opportunity cost is a relative price.
- Demand and supply determine relative prices.

Working Problem 1 will give you a better understanding of markets and prices.

Demand (pp. 53–57)
- Demand is the relationship between the quantity demanded of a good and its price when all other influences on buying plans remain the same.
- The higher the price of a good, other things remaining the same, the smaller is the quantity demanded—the law of demand.
- Demand depends on the prices of related goods (substitutes and complements), expected future prices, income, expected future income and credit, the population, and preferences.

Working Problems 2 to 5 will give you a better understanding of demand.

Supply (pp. 58–61)
- Supply is the relationship between the quantity supplied of a good and its price when all other influences on selling plans remain the same.
- The higher the price of a good, other things remaining the same, the greater is the quantity supplied—the law of supply.

Working Problems 6 to 9 will give you a better understanding of supply.

Key Terms

| Change in demand, 54 | Demand curve, 54 | Quantity demanded, 53 |
| Change in supply, 59 | Equilibrium price, 62 | Quantity supplied, 58 |
| Change in the quantity demanded, 57 | Equilibrium quantity, 62 | Relative price, 52 |
| Change in the quantity supplied, 60 | Inferior good, 56 | Substitute, 55 |
| Competitive market, 52 | Law of demand, 53 | Supply, 58 |
| Complement, 55 | Law of supply, 58 | Supply curve, 58 |
| Demand, 53 | Money price, 52 | Normal good, 56 |
Study Plan Problems and Applications

Markets and Prices (Study Plan 3.1)
1. William Gregg owned a mill in South Carolina. In December 1862, he placed a notice in the Edgehill Advertiser announcing his willingness to exchange cloth for food and other items. Here is an extract:
   1 yard of cloth for 1 pound of bacon
   2 yards of cloth for 1 pound of butter
   4 yards of cloth for 1 pound of wool
   8 yards of cloth for 1 bushel of salt
   a. What is the relative price of butter in terms of wool?
   b. If the money price of bacon was 20¢ a pound, what do you predict was the money price of butter?
   c. If the money price of bacon was 20¢ a pound and the money price of salt was $2.00 a bushel, do you think anyone would accept Mr. Gregg’s offer of cloth for salt?

Demand (Study Plan 3.2)
2. The price of food increased during the past year.
   a. Explain why the law of demand applies to food just as it does to all other goods and services.
   b. Explain how the substitution effect influences food purchases and provide some examples of substitutions that people might make when the price of food rises and other things remain the same.
   c. Explain how the income effect influences food purchases and provide some examples of the income effect that might occur when the price of food rises and other things remain the same.
3. Place the following goods and services into pairs of likely substitutes and pairs of likely complements. (You may use an item in more than one pair.) The goods and services are:
   coal, oil, natural gas, wheat, corn, rye, pasta, pizza, sausage, skateboard, roller blades, video game, laptop, iPod, cell phone, text message, email, phone call, voice mail
4. During 2010, the average income in China increased by 10 percent. Compared to 2009, how do you expect the following would change:
   a. The demand for beef? Explain your answer.
   b. The demand for rice? Explain your answer.
5. In January 2010, the price of gasoline was $2.70 a gallon. By spring 2010, the price had increased to $3.00 a gallon. Assume that there were no changes in average income, population, or any other influence on buying plans. Explain how the rise in the price of gasoline would affect
   a. The demand for gasoline.
   b. The quantity of gasoline demanded.

Supply (Study Plan 3.3)
6. In 2008, the price of corn increased by 35 percent and some cotton farmers in Texas stopped growing cotton and started to grow corn.
   a. Does this fact illustrate the law of demand or the law of supply? Explain your answer.
   b. Why would a cotton farmer grow corn?

Use the following information to work Problems 7 to 9.

Dairies make low-fat milk from full-cream milk. In the process of making low-fat milk, the dairies produce cream, which is made into ice cream. In the market for low-fat milk, the following events occur one at a time:
   (i) The wage rate of dairy workers rises.
   (ii) The price of cream rises.
   (iii) The price of low-fat milk rises.
   (iv) With the period of low rainfall extending, dairies raise their expected price of low-fat milk next year.
   (v) With advice from health-care experts, dairy farmers decide to switch from producing full-cream milk to growing vegetables.
   (vi) A new technology lowers the cost of producing ice cream.
7. Explain the effect of each event on the supply of low-fat milk.
8. Use a graph to illustrate the effect of each event.
9. Does any event (or events) illustrate the law of supply?
Market Equilibrium (Study Plan 3.4)

10. “As more people buy computers, the demand for Internet service increases and the price of Internet service decreases. The fall in the price of Internet service decreases the supply of Internet service.” Explain what is wrong with this statement.

11. The demand and supply schedules for gum are

<table>
<thead>
<tr>
<th>Price (cents per pack)</th>
<th>Quantity demanded (millions of packs a week)</th>
<th>Quantity supplied (millions of packs a week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>180</td>
<td>60</td>
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<tr>
<td>40</td>
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<tr>
<td>100</td>
<td>20</td>
<td>220</td>
</tr>
</tbody>
</table>

a. Draw a graph of the market for gum and mark in the equilibrium price and quantity.
b. Suppose that the price of gum is 70¢ a pack. Describe the situation in the gum market and explain how the price adjusts.
c. Suppose that the price of gum is 30¢ a pack. Describe the situation in the gum market and explain how the price adjusts.

Predicting Changes in Price and Quantity (Study Plan 3.5)

12. The following events occur one at a time:
   (i) The price of crude oil rises.
   (ii) The price of a car rises.
   (iii) All speed limits on highways are abolished.
   (iv) Robots cut car production costs.
Which of these events will increase or decrease (state which occurs)
   a. The demand for gasoline?
   b. The supply of gasoline?
   c. The quantity of gasoline demanded?
   d. The quantity of gasoline supplied?

13. In Problem 11, a fire destroys some factories that produce gum and the quantity of gum supplied decreases by 40 million packs a week at each price.
   a. Explain what happens in the market for gum and draw a graph to illustrate the changes.
   b. If at the time the fire occurs there is an increase in the teenage population, which increases the quantity of gum demanded by 40 million packs a week at each price, what are the new equilibrium price and quantity of gum? Illustrate these changes on your graph.

Economics in the News (Study Plan 3.N)

14. American to Cut Flights, Charge for Luggage
American Airlines announced yesterday that it will begin charging passengers $15 for their first piece of checked luggage, in addition to raising other fees and cutting domestic flights as it grapples with record-high fuel prices.

Source: Boston Herald, May 22, 2008

a. According to the news clip, what is the influence on the supply of American Airlines flights?
b. Explain how supply changes.

15. Of Gambling, Grannies, and Good Sense
Nevada has plenty of jobs for the over 50s and its elderly population is growing faster than that in other states.

Source: The Economist, July 26, 2006

Explain how grannies have influenced:
   a. The demand in some Las Vegas markets.
   b. The supply in other Las Vegas markets.

16. Frigid Florida Winter is Bad News for Tomato Lovers
An unusually cold January in Florida destroyed entire fields of tomatoes and forced many farmers to delay their harvest. Florida’s growers are shipping only a quarter of their usual 5 million pounds a week. The price has risen from $6.50 for a 25-pound box a year ago to $30 now.

Source: USA Today, March 3, 2010

a. Make a graph to illustrate the market for tomatoes in January 2009 and January 2010.
b. On the graph, show how the events in the news clip influence the market for tomatoes.
c. Why is the news “bad for tomato lovers”?

17. Pump Prices on Pace to Top 2009 High by Weekend
The cost of filling up the car is rising as the crude oil price soars and pump prices may exceed the peak price of 2009.

Source: USA Today, January 7, 2010

a. Does demand for gasoline or the supply of gasoline or both change when the price of oil soars?
b. Use a demand-supply graph to illustrate what happens to the equilibrium price of gasoline and the equilibrium quantity of gasoline bought when the price of oil soars.
Markets and Prices

18. What features of the world market for crude oil make it a competitive market?

19. The money price of a textbook is $90 and the money price of the Wii game Super Mario Galaxy is $45.
   a. What is the opportunity cost of a textbook in terms of the Wii game?
   b. What is the relative price of the Wii game in terms of textbooks?

Demand

20. The price of gasoline has increased during the past year.
   a. Explain why the law of demand applies to gasoline just as it does to all other goods and services.
   b. Explain how the substitution effect influences gasoline purchases and provide some examples of substitutions that people might make when the price of gasoline rises and other things remain the same.
   c. Explain how the income effect influences gasoline purchases and provide some examples of the income effects that might occur when the price of gasoline rises and other things remain the same.

21. Think about the demand for the three game consoles: Xbox, PS3, and Wii. Explain the effect of the following events on the demand for Xbox games and the quantity of Xbox games demanded, other things remaining the same.
   a. The price of an Xbox falls.
   b. The prices of a PS3 and a Wii fall.
   c. The number of people writing and producing Xbox games increases.
   d. Consumers’ incomes increase.
   e. Programmers who write code for Xbox games become more costly to hire.
   f. The expected future price of an Xbox game falls.
   g. A new game console that is a close substitute for Xbox comes onto the market.

Supply

22. Classify the following pairs of goods and services as substitutes in production, complements in production, or neither.
   a. Bottled water and health club memberships
   b. French fries and baked potatoes
   c. Leather purses and leather shoes
   d. Hybrids and SUVs
   e. Diet coke and regular coke

23. As the prices of homes fell across the United States in 2008, the number of homes offered for sale decreased.
   a. Does this fact illustrate the law of demand or the law of supply? Explain your answer.
   b. Why would home owners decide not to sell?

24. G.M. Cuts Production for Quarter
   General Motors cut its fourth-quarter production schedule by 10 percent because Ford Motor, Chrysler, and Toyota sales declined in August.
   Explain whether this news clip illustrates a change in the supply of cars or a change in the quantity supplied of cars.

Market Equilibrium

Use the following figure to work Problems 25 and 26.

25. a. Label the curves. Which curve shows the willingness to pay for a pizza?
   b. If the price of a pizza is $16, is there a shortage or a surplus and does the price rise or fall?

26. Explain why the equilibrium price and quantity of pizzas is at the intersection of the supply and demand curves.
c. Sellers want to receive the highest possible price, so why would they be willing to accept less than $16 a pizza?

26. a. If the price of a pizza is $12, is there a shortage or a surplus and does the price rise or fall?
b. Buyers want to pay the lowest possible price, so why would they be willing to pay more than $12 for a pizza?

27. The demand and supply schedules for potato chips are

<table>
<thead>
<tr>
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<th>Quantity supplied (millions of bags per week)</th>
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<td>100</td>
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<td>180</td>
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</tbody>
</table>

a. Draw a graph of the potato chip market and mark in the equilibrium price and quantity.
b. If the price is 60¢ a bag, is there a shortage or a surplus, and how does the price adjust?

Predicting Changes in Price and Quantity

28. In Problem 27, a new dip increases the quantity of potato chips that people want to buy by 30 million bags per week at each price.
   a. How does the demand and/or supply of chips change?
b. How does the price and quantity of chips change?

29. In Problem 27, if a virus destroys potato crops and the quantity of potato chips produced decreases by 40 million bags a week at each price, how does the supply of chips change?

30. If the virus in Problem 29 hits just as the new dip in Problem 28 comes onto the market, how does the price and quantity of chips change?

Economics in the News

31. After you have studied Reading Between the Lines on pp. 70–71 answer the following questions.
   a. What happened to the price of coffee in 2010?
b. What substitutions do you expect might have been made to decrease the quantity of coffee demanded?
c. What influenced the demand for coffee in 2010 and what influenced the quantity of coffee demanded?
d. What influenced the supply of coffee during 2010 and how did the supply of coffee change?
e. How did the combination of the factors you have noted in parts (c) and (d) influence the price and quantity of coffee?
f. Was the change in quantity of coffee a change in the quantity demanded or a change in the quantity supplied?

32. Strawberry Prices Drop as Late Harvest Hits Market

Shoppers bought strawberries in March for $1.25 a pound rather than the $3.49 a pound they paid last year. With the price so low, some growers plowed over their strawberry plants to make way for spring melons; others froze their harvests and sold them to juice and jam makers.

Source: USA Today, April 5, 2010

a. Explain how the market for strawberries would have changed if growers had not plowed in their plants but offered locals “you pick for free.”
b. Describe the changes in demand and supply in the market for strawberry jam.

33. “Popcorn Movie” Experience Gets Pricier

Cinemas are raising the price of popcorn.

Demand for field corn, which is used for animal feed, corn syrup, and ethanol, has increased and its price has exploded. That’s caused some farmers to shift from growing popcorn to easier-to-grow field corn.

Source: USA Today, May 24, 2008

Explain and illustrate graphically the events described in the news clip in the market for
   a. Popcorn
   b. Movie tickets

Use the following news clip to work Problems 34 and 35.

Sony’s Blu-Ray Wins High-Definition War

Toshiba Corp. yesterday withdrew from the race to be the next-generation home movie format, leaving Sony Corp.’s Blu-ray technology the winner. The move could finally jump-start a high-definition home DVD market.


34. a. How would you expect the price of a used Toshiba player on eBay to change? Will the price change result from a change in demand, supply, or both, and in which directions?
b. How would you expect the price of a Blu-ray player to change?

35. Explain how the market for Blu-ray format movies will change.
Your Economic Revolution

Three periods in human history stand out as ones of economic revolution. The first, the Agricultural Revolution, occurred 10,000 years ago. In what is today Iraq, people learned to domesticate animals and plant crops. People stopped roaming in search of food and settled in villages, towns, and cities where they specialized in the activities in which they had a comparative advantage and developed markets in which to exchange their products. Wealth increased enormously.

You are studying economics at a time that future historians will call the Information Revolution. Over the entire world, people are embracing new information technologies and prospering on an unprecedented scale.

Economics was born during the Industrial Revolution, which began in England during the 1760s. For the first time, people began to apply science and create new technologies for the manufacture of textiles and iron, to create steam engines, and to boost the output of farms.

During all three economic revolutions, many have prospered but many have been left behind. It is the range of human progress that poses the greatest question for economics and the one that Adam Smith addressed in the first work of economic science: What causes the differences in wealth among nations?

Many people had written about economics before Adam Smith, but he made economics a science. Born in 1723 in Kirkcaldy, a small fishing town near Edinburgh, Scotland, Smith was the only child of the town’s customs officer. Lured from his professorship (he was a full professor at 28) by a wealthy Scottish duke who gave him a pension of £300 a year—ten times the average income at that time—Smith devoted ten years to writing his masterpiece: An Inquiry into the Nature and Causes of the Wealth of Nations, published in 1776.

Why, Adam Smith asked, are some nations wealthy while others are poor? He was pondering these questions at the height of the Industrial Revolution, and he answered by emphasizing the role of the division of labor and free markets.

To illustrate his argument, Adam Smith described two pin factories. In the first, one person, using the hand tools available in the 1770s, could make 20 pins a day. In the other, by using those same hand tools but breaking the process into a number of individually small operations in which people specialize—by the division of labor—ten people could make a staggering 48,000 pins a day. One draws

“There is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest.”

ADAM SMITH
The Wealth of Nations

out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it. Three specialists make the head, and a fourth attaches it. Finally, the pin is polished and packaged.

But a large market is needed to support the division of labor: One factory employing ten workers would need to sell more than 15 million pins a year to stay in business!
Professor Bhagwati, what attracted you to economics?
When you come from India, where poverty hits the eye, it is easy to be attracted to economics, which can be used to bring prosperity and create jobs to pull up the poor into gainful employment.

I learned later that there are two broad types of economist: those who treat the subject as an arid mathematical toy and those who see it as a serious social science.

If Cambridge, where I went as an undergraduate, had been interested in esoteric mathematical economics, I would have opted for something else. But the Cambridge economists from whom I learned—many among the greatest figures in the discipline—saw economics as a social science. I therefore saw the power of economics as a tool to address India’s poverty and was immediately hooked.

Who had the greatest impact on you at Cambridge?
Most of all, it was Harry Johnson, a young Canadian of immense energy and profound analytical gifts. Quite unlike the shy and reserved British dons, Johnson was friendly, effusive, and supportive of students who flocked around him. He would later move to Chicago, where he became one of the most influential members of the market-oriented Chicago school. Another was Joan Robinson, arguably the world’s most impressive female economist.

When I left Cambridge for MIT, going from one Cambridge to the other, I was lucky to transition from one phenomenal set of economists to another. At MIT, I learned much from future Nobel laureates Paul Samuelson and Robert Solow. Both would later become great friends and colleagues when I joined the MIT faculty in 1968.

After Cambridge and MIT, you went to Oxford and then back to India. What did you do in India?
I joined the Planning Commission in New Delhi, where my first big job was to find ways of raising the bottom 30 percent of India’s population out of poverty to a “minimum income” level.

And what did you prescribe?
My main prescription was to “grow the pie.” My research suggested that the share of the bottom 30 percent of the pie did not seem to vary dramatically with differences in economic and political systems.

So growth in the pie seemed to be the principal (but not the only) component of an anti-poverty strategy. To supplement growth’s good effects on the poor, the Indian planners were also dedicated to education, health, social reforms, and land reforms. Also, the access of the lowest-income and socially disadvantaged groups to the growth process and its benefits was to be improved in many ways, such as extension of credit without collateral.

Today, this strategy has no rivals. Much empirical work shows that where growth has occurred, poverty has lessened.
JAGDISH BHAGWATI is University Professor at Columbia University. Born in India in 1934, he studied at Cambridge University in England, MIT, and Oxford University before returning to India. He returned to teach at MIT in 1968 and moved to Columbia in 1980. A prolific scholar, Professor Bhagwati also writes in leading newspapers and magazines throughout the world. He has been much honored for both his scientific work and his impact on public policy. His greatest contributions are in international trade but extend also to developmental problems and the study of political economy.

Michael Parkin talked with Jagdish Bhagwati about his work and the progress that economists have made in understanding the benefits of economic growth and international trade since the pioneering work of Adam Smith.

We hear a lot in the popular press about fair trade and level playing fields. What’s the distinction between free trade and fair trade? How can the playing field be unequal?

Free trade simply means allowing no trade barriers such as tariffs, subsidies, and quotas. Trade barriers make domestic prices different from world prices for traded goods. When this happens, resources are not being used efficiently. Basic economics from the time of Adam Smith tells us why free trade is good for us and why barriers to trade harm us, though our understanding of this doctrine today is far more nuanced and profound than it was at its creation.

Fair trade, on the other hand, is almost always a sneaky way of objecting to free trade. If your rivals are hard to compete with, you are not likely to get protection simply by saying that you cannot hack it. But if you say that your rival is an “unfair” trader, that is an easier sell! As international competition has grown fiercer, cries of “unfair trade” have therefore multiplied. The lesser rogues among the protectionists ask for “free and fair trade,” whereas the worst ones ask for “fair, not free, trade.”

At the end of World War II, the General Agreement on Tariffs and Trade (GATT) was established and there followed several rounds of multilateral trade negotiations and reductions in barriers to trade. How do you assess the contribution of GATT and its successor, the World Trade Organization (WTO)?

The GATT has made a huge contribution by overseeing massive trade liberalization in industrial goods among the developed countries. GATT rules, which “bind” tariffs to negotiated ceilings, prevent the raising of tariffs and have prevented tariff wars like those of the 1930s in which mutual and retaliatory tariff barriers were raised, to the detriment of everyone.

The GATT was folded into the WTO at the end of the Uruguay Round of trade negotiations, and the WTO is institutionally stronger. For instance, it has a binding dispute settlement mechanism, whereas the GATT had no such teeth. It is also more ambitious in its scope, extending to new areas such as the environment, intellectual property protection, and investment rules.

Running alongside the pursuit of multilateral free trade has been the emergence of bilateral trade agreements such as NAFTA and the European Union (EU). How do you view the bilateral free trade areas in today’s world?

Unfortunately, there has been an explosion of bilateral free trade areas today. By some estimates, the ones in place and others being plotted approach 400! Each bilateral agreement gives preferential treatment to its trading partner over others. Because there are now so many bilateral agreements, such as those between the United States and Israel and between the United States and Jordan, the result is a chaotic pattern of different tariffs depending on where a product comes from. Also, “rules of origin” must be agreed upon to
determine whether a product is, say, Jordanian or Taiwanese if Jordan qualifies for a preferential tariff but Taiwan does not and Taiwanese inputs enter the Jordanian manufacture of the product.

I have called the resulting crisscrossing of preferences and rules of origin the “spaghetti bowl” problem. The world trading system is choking under these proliferating bilateral deals. Contrast this complexity with the simplicity of a multilateral system with common tariffs for all WTO members.

We now have a world of uncoordinated and inefficient trade policies. The EU makes bilateral free trade agreements with different non-EU countries, so the United States follows with its own bilateral agreements; and with Europe and the United States doing it, the Asian countries, long wedded to multilateralism, have now succumbed to the mania.

Instead, if the United States had provided leadership by rewriting rules to make the signing of such bilateral agreements extremely difficult, this plague on the trading system today might well have been averted.

Is the “spaghetti bowl” problem getting better or worse? Unquestionably it is getting worse. Multilateralism is retreating and bilateralism is advancing. The 2010 G-20 meeting in Canada was a disappointment. At the insistence of the United States, a definite date for completing the Doha Round was dropped and instead, unwittingly rubbing salt into the wound, President Barack Obama announced his administration’s willingness to see the U.S.-South Korea free trade agreement through. There are distressing recent reports that the U.S. Commerce Department is exploring ways to strengthen the bite of anti-dumping actions, which are now generally agreed to be a form of discriminatory protectionism aimed selectively at successful exporting nations and firms. Equally distressing is Obama’s decision to sign a bill that raises fees on some temporary work visas in order to pay for higher border-enforcement expenditures. Further, it was asserted that a tax on foreign workers would reduce the numbers coming in and “taking jobs away” from U.S. citizens. Many supporters of the proposal claimed, incoherently, that it would simultaneously discourage foreign workers from entering the United States and increase revenues. Obama’s surrender exemplified the doctrine that one retreat often leads to another, with new lobbyists following in others’ footsteps. Perhaps the chief mistake, as with recent “Buy American” provisions in U.S. legislation, was to allow the Employ American Workers Act (EAWA) to be folded into the stimulus bill. This act makes it harder for companies to get government support to hire skilled immigrants with H1(b) visas: They must first show that they have not laid off or plan to lay off U.S. workers in similar occupations. Whatever the shortcomings of such measures in economic-policy terms, the visa-fee-enhancement provision is de facto discriminatory, and thus violates WTO rules against discrimination between domestic and foreign firms, or between foreign firms from different WTO countries. While the visa-fee legislation is what lawyers call “facially” non-discriminatory, its design confers an advantage on U.S. firms vis-à-vis foreign firms. Such acts of discrimination in trade policies find succor in the media and in some of America’s prominent think tanks. For example, in the wake of the vast misery brought by flooding to the people of Pakistan, the U.S. and other governments have risen to the occasion with emergency aid. But there have also been proposals to grant duty-free access to Pakistan’s exports. But this would be discriminatory toward developing countries that do not have duty-free access, helping Pakistan at their expense.

What advice do you have for a student who is just starting to study economics? Is economics a good subject in which to major?

I would say: enormously so. In particular, we economists bring three unique insights to good policy making.

First, economists look for second- and subsequent-round effects of actions.

Second, we correctly emphasize that a policy cannot be judged without using a counterfactual. It is a witticism that an economist, when asked how her husband was, said, “compared to what?”

Third, we uniquely and systematically bring the principle of social cost and social benefit to our policy analysis.
MEASURING GDP AND ECONOMIC GROWTH

Will our economy expand more rapidly in 2011 or will it sink into another recession—a “double-dip”? Many U.S. corporations wanted to know the answers to these questions at the beginning of 2011. Google wanted to know whether to expand its server network and introduce new services or hold off on any new launches. Amazon.com wanted to know whether to increase its warehousing facilities. To assess the state of the economy and to make big decisions about business expansion, firms such as Google and Amazon use forecasts of GDP. What exactly is GDP and what does it tell us about the state of the economy?

Some countries are rich while others are poor. How do we compare economic well-being in one country with that in another? How can we make international comparisons of production?

In this chapter, you will find out how economic statisticians at the Bureau of Economic Analysis measure GDP and the economic growth rate. You will also learn about the uses and the limitations of these measures. In Reading Between the Lines at the end of the chapter, we’ll look at some future scenarios for the U.S. economy.
CHAPTER 4 Measuring GDP and Economic Growth

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**Gross Domestic Product**

What exactly is GDP, how is it calculated, what does it mean, and why do we care about it? You are going to discover the answers to these questions in this chapter. First, what is GDP?

**GDP Defined**

GDP, or *gross domestic product*, is the market value of the final goods and services produced within a country in a given time period. This definition has four parts:

- Market value
- Final goods and services
- Produced within a country
- In a given time period

We’ll examine each in turn.

**Market Value** To measure total production, we must add together the production of apples and oranges, computers and popcorn. Just counting the items doesn’t get us very far. For example, which is the greater total production: 100 apples and 50 oranges or 50 apples and 100 oranges?

GDP answers this question by valuing items at their *market values*—the prices at which items are traded in markets. If the price of an apple is 10 cents, then the market value of 50 apples is $5. If the price of an orange is 20 cents, then the market value of 100 oranges is $20. By using market prices to value production, we can add the apples and oranges together. The market value of 50 apples and 100 oranges is $5 plus $20, or $25.

**Final Goods and Services** To calculate GDP, we value the *final goods and services* produced. A *final good* (or service) is an item that is bought by its final user during a specified time period. It contrasts with an *intermediate good* (or service), which is an item that is produced by one firm, bought by another firm, and used as a component of a final good or service.

For example, a Ford truck is a final good, but a Firestone tire on the truck is an intermediate good. A Dell computer is a final good, but an Intel Pentium chip inside it is an intermediate good.

If we were to add the value of intermediate goods and services produced to the value of final goods and services, we would count the same thing many times—a problem called double counting. The value of a truck already includes the value of the tires, and the value of a Dell PC already includes the value of the Pentium chip inside it.

Some goods can be an intermediate good in some situations and a final good in other situations. For example, the ice cream that you buy on a hot summer day is a final good, but the ice cream that a restaurant buys and uses to make sundaes is an intermediate good. The sundae is the final good. So whether a good is an intermediate good or a final good depends on what it is used for, not what it is.

Some items that people buy are neither final goods nor intermediate goods and they are not part of GDP. Examples of such items include financial assets—stocks and bonds—and secondhand goods—used cars or existing homes. A secondhand good was part of GDP in the year in which it was produced, but not in GDP this year.

**Produced Within a Country** Only goods and services that are produced *within a country* count as part of that country’s GDP. Nike Corporation, a U.S. firm, produces sneakers in Vietnam, and the market value of those shoes is part of Vietnam’s GDP, not part of U.S. GDP. Toyota, a Japanese firm, produces automobiles in Georgetown, Kentucky, and the value of this production is part of U.S. GDP, not part of Japan’s GDP.

**In a Given Time Period** GDP measures the value of production *in a given time period*—normally either a quarter of a year—called the quarterly GDP data—or a year—called the annual GDP data.

GDP measures not only the value of total production but also total income and total expenditure. The equality between the value of total production and total income is important because it shows the direct link between productivity and living standards. Our standard of living rises when our incomes rise and we can afford to buy more goods and services. But we must produce more goods and services if we are to be able to buy more goods and services.

Rising incomes and a rising value of production go together. They are two aspects of the same phenomenon: increasing productivity. To see why, we study the circular flow of expenditure and income.
GDP and the Circular Flow of Expenditure and Income

Figure 4.1 illustrates the circular flow of expenditure and income. The economy consists of households, firms, governments, and the rest of the world (the rectangles), which trade in factor markets and goods (and services) markets. We focus first on households and firms.

Households and Firms  Households sell and firms buy the services of labor, capital, and land in factor markets. For these factor services, firms pay income to households: wages for labor services, interest for the use of capital, and rent for the use of land. A fourth factor of production, entrepreneurship, receives profit.

Firms’ retained earnings—profits that are not distributed to households—are part of the household sector’s income. You can think of retained earnings as being income that households save and lend back to firms. Figure 4.1 shows the total income—aggregate income—received by households, including retained earnings, as the blue flow labeled \( Y \).

Firms sell and households buy consumer goods and services—such as inline skates and haircuts—in the goods market. The total payment for these goods and services is consumption expenditure, shown by the red flow labeled \( C \).

Firms buy and sell new capital equipment—such as computer systems, airplanes, trucks, and assembly line equipment—in the goods market. Some of what firms produce is not sold but is added to inventory. For example, if GM produces 1,000 cars and sells 950 of them, the other 50 cars remain in GM’s inventory of unsold cars, which increases by 50 cars. When a firm adds unsold output to inventory, we can think of the firm as buying goods from itself. The

\[
\begin{align*}
\text{Billions of dollars in 2010} \\
C &= 10,285 \\
I &= 1,842 \\
G &= 2,991 \\
X - M &= -539 \\
Y &= 14,579
\end{align*}
\]

Source of data: U.S. Department of Commerce, Bureau of Economic Analysis. [The data are for the second quarter of 2010 annual rate.]
purchase of new plant, equipment, and buildings and the additions to inventories are investment, shown by the red flow labeled \( I \).

**Governments** Governments buy goods and services from firms and their expenditure on goods and services is called government expenditure. In Fig. 4.1, government expenditure is shown as the red flow \( G \).

Governments finance their expenditure with taxes. But taxes are not part of the circular flow of expenditure and income. Governments also make financial transfers to households, such as Social Security benefits and unemployment benefits, and pay subsidies to firms. These financial transfers, like taxes, are not part of the circular flow of expenditure and income.

**Rest of the World** Firms in the United States sell goods and services to the rest of the world—exports—and buy goods and services from the rest of the world—imports. The value of exports \( (X) \) minus the value of imports \( (M) \) is called net exports, the red flow \( X - M \) in Fig 4.1. If net exports are positive, the net flow of goods and services is from U.S. firms to the rest of the world. If net exports are negative, the net flow of goods and services is from the rest of the world to U.S. firms.

**GDP Equals Expenditure Equals Income** Gross domestic product can be measured in two ways: By the total expenditure on goods and services or by the total income earned producing goods and services.

The total expenditure—aggregate expenditure—is the sum of the red flows in Fig. 4.1. Aggregate expenditure equals consumption expenditure plus investment plus government expenditure plus net exports.

Aggregate income is equal to the total amount paid for the services of the factors of production used to produce final goods and services—wages, interest, rent, and profit. The blue flow in Fig. 4.1 shows aggregate income. Because firms pay out as incomes (including retained profits) everything they receive from the sale of their output, aggregate income (the blue flow) equals aggregate expenditure (the sum of the red flows). That is,

\[ Y = C + I + G + X - M. \]

The table in Fig. 4.1 shows the values of the expenditures for 2010 and that their sum is $14,579 billion, which also equals aggregate income.

Because aggregate expenditure equals aggregate income, the two methods of measuring GDP give the same answer. So

GDP equals aggregate expenditure and equals aggregate income.

The circular flow model is the foundation on which the national economic accounts are built.

**Why Is Domestic Product “Gross”?**

“Gross” means before subtracting the depreciation of capital. The opposite of “gross” is “net,” which means after subtracting the depreciation of capital.

Depreciation is the decrease in the value of a firm’s capital that results from wear and tear and obsolescence. The total amount spent both buying new capital and replacing depreciated capital is called gross investment. The amount by which the value of capital increases is called net investment. Net investment equals gross investment minus depreciation.

For example, if an airline buys 5 new airplanes and retires 2 old airplanes from service, its gross investment is the value of the 5 new airplanes, depreciation is the value of the 2 old airplanes retired, and net investment is the value of 3 new airplanes.

Gross investment is one of the expenditures included in the expenditure approach to measuring GDP. So the resulting value of total product is a gross measure.

Gross profit, which is a firm’s profit before subtracting depreciation, is one of the incomes included in the income approach to measuring GDP. So again, the resulting value of total product is a gross measure.

**REVIEW QUIZ**

1. Define GDP and distinguish between a final good and an intermediate good. Provide examples.
2. Why does GDP equal aggregate income and also equal aggregate expenditure?
3. What is the distinction between gross and net?

You can work these questions in Study Plan 4.1 and get instant feedback.

Let’s now see how the ideas that you’ve just studied are used in practice. We’ll see how GDP and its components are measured in the United States today.
Measuring U.S. GDP

The Bureau of Economic Analysis (BEA) uses the concepts in the circular flow model to measure GDP and its components in the National Income and Product Accounts. Because the value of aggregate production equals aggregate expenditure and aggregate income, there are two approaches available for measuring GDP, and both are used. They are

- The expenditure approach
- The income approach

The Expenditure Approach

The expenditure approach measures GDP as the sum of consumption expenditure \((C)\), investment \((I)\), government expenditure on goods and services \((G)\), and net exports of goods and services \((X - M)\). These expenditures correspond to the red flows through the goods markets in the circular flow model in Fig. 4.1. Table 4.1 shows these expenditures and GDP for 2010. The table uses the terms in the National Income and Product Accounts.

Personal consumption expenditures are the expenditures by U.S. households on goods and services produced in the United States and in the rest of the world. They include goods such as soda and books and services such as banking and legal advice. They also include the purchase of consumer durable goods, such as TVs and microwave ovens. But they do not include the purchase of new homes, which the BEA counts as part of investment.

Gross private domestic investment is expenditure on capital equipment and buildings by firms and the additions to business inventories. It also includes expenditure on new homes by households.

Government expenditure on goods and services is the expenditure by all levels of government on goods and services, such as national defense and garbage collection. It does not include transfer payments, such as unemployment benefits, because they are not expenditures on goods and services.

Net exports of goods and services are the value of exports minus the value of imports. This item includes airplanes that Boeing sells to British Airways (a U.S. export), and Japanese DVD players that Circuit City buys from Sony (a U.S. import).

Table 4.1 shows the relative magnitudes of the four items of aggregate expenditure.

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Amount in 2010 (billions of dollars)</th>
<th>Percentage of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal consumption expenditures</td>
<td>(C)</td>
<td>10,285</td>
<td>70.5</td>
</tr>
<tr>
<td>Gross private domestic investment</td>
<td>(I)</td>
<td>1,842</td>
<td>12.6</td>
</tr>
<tr>
<td>Government expenditure on goods and services</td>
<td>(G)</td>
<td>2,991</td>
<td>20.5</td>
</tr>
<tr>
<td>Net exports of goods and services</td>
<td>(X - M)</td>
<td>-539</td>
<td>-3.7</td>
</tr>
<tr>
<td>Gross domestic product</td>
<td>(Y)</td>
<td>14,579</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The expenditure approach measures GDP as the sum of personal consumption expenditures \((C)\), gross private domestic investment \((I)\), government expenditure on goods and services \((G)\), and net exports \((X - M)\). In 2010, GDP measured by the expenditure approach was $14,579 billion. More than two thirds of aggregate expenditure is on personal consumption goods and services.

Source of data: U.S. Department of Commerce, Bureau of Economic Analysis.

The Income Approach

The income approach measures GDP by summing the incomes that firms pay households for the services of the factors of production they hire—wages for labor, interest for capital, rent for land, and profit for entrepreneurship. These incomes correspond to the blue flow through the factor markets in the circular flow model in Fig. 4.1.

The National Income and Product Accounts divide incomes into two big categories:

1. Compensation of employees
2. Net operating surplus

Compensation of employees is the payment for labor services. It includes net wages and salaries (called “take-home pay”) that workers receive plus taxes withheld on earnings plus fringe benefits such as Social Security and pension fund contributions.

Net operating surplus is the sum of all other factor incomes. It has four components: net interest, rental

Table 4.1 GDP: The Expenditure Approach
income, corporate profits, and proprietors' income.

*Net interest* is the interest households receive on loans they make minus the interest households pay on their own borrowing.

*Rental income* is the payment for the use of land and other rented resources.

*Corporate profits* are the profits of corporations, some of which are paid to households in the form of dividends and some of which are retained by corporations as undistributed profits. They are all income.

*Proprietors' income* is the income earned by the owner-operator of a business, which includes compensation for the owner’s labor, the use of the owner’s capital, and profit.

Table 4.2 shows the two big categories of factor incomes and their relative magnitudes. You can see that compensation of employees—labor income—is approximately twice the magnitude of the other factor incomes that make up the net operating surplus.

The factor incomes sum to *net domestic income at factor cost*. The term “factor cost” is used because it is the cost of the factors of production used to produce final goods. When we sum the expenditures on final goods, we arrive at a total called *domestic product at market prices*. Market prices and factor cost diverge because of indirect taxes and subsidies.

An *indirect tax* is a tax paid by consumers when they buy goods and services. (In contrast, a *direct tax* is a tax on income.) State sales taxes and taxes on alcohol, gasoline, and tobacco products are indirect taxes. Because of indirect taxes, consumers pay more for some goods and services than producers receive. Market price exceeds factor cost. For example, if the sales tax is 7 percent, you pay $1.07 when you buy a $1 chocolate bar. The factor cost of the chocolate bar including profit is $1. The market price is $1.07.

A *subsidy* is a payment by the government to a producer. Payments made to grain growers and dairy farmers are subsidies. Because of subsidies, consumers pay less for some goods and services than producers receive. Factor cost exceeds market price.

To get from factor cost to market price, we add indirect taxes and subtract subsidies. Making this adjustment brings us to *net domestic income at market prices*. We still must get from a net to a gross measure.

Total expenditure is a *gross* number because it includes *gross* investment. Net domestic income at market prices is a net income measure because corporate profits are measured after *deducting depreciation*. They are a *net* income measure. To get from net income to gross income, we must *add depreciation*.

### TABLE 4.2 GDP: The Income Approach

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount in 2010 (billions of dollars)</th>
<th>Percentage of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation of employees</td>
<td>7,929</td>
<td>54.4</td>
</tr>
<tr>
<td>Net interest</td>
<td>924</td>
<td>6.3</td>
</tr>
<tr>
<td>Rental income</td>
<td>299</td>
<td>2.1</td>
</tr>
<tr>
<td>Corporate profits</td>
<td>1,210</td>
<td>8.3</td>
</tr>
<tr>
<td>Proprietors' income</td>
<td>1,050</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Net domestic income</strong></td>
<td><strong>11,412</strong></td>
<td><strong>78.3</strong></td>
</tr>
<tr>
<td>Indirect taxes less subsidies</td>
<td>1,127</td>
<td>7.7</td>
</tr>
<tr>
<td><strong>Net domestic income</strong></td>
<td><strong>12,539</strong></td>
<td><strong>86.0</strong></td>
</tr>
<tr>
<td>Depreciation</td>
<td>1,860</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>GDP (income approach)</strong></td>
<td><strong>14,399</strong></td>
<td><strong>98.8</strong></td>
</tr>
<tr>
<td>Statistical discrepancy</td>
<td>180</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>GDP (expenditure approach)</strong></td>
<td><strong>14,579</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

The sum of factor incomes equals *net domestic income at factor cost*. GDP equals net domestic income at factor cost plus indirect taxes less subsidies plus depreciation.

In 2010, GDP measured by the income approach was $14,399 billion. This amount is $180 billion less than GDP measured by the expenditure approach—a statistical discrepancy of $151 billion or 1.2 percent of GDP.

Compensation of employees—labor income—is by far the largest part of aggregate income.

Source of data: U.S. Department of Commerce, Bureau of Economic Analysis.

We’ve now arrived at GDP using the income approach. This number is not exactly the same as GDP using the expenditure approach. For example, if a waiter doesn’t report all his tips when he fills out his income tax return, they get missed in the income approach but they show up in the expenditure approach when he spends his income. So the sum of expenditures might exceed the sum of incomes. Also the sum of expenditures might exceed the sum of incomes because some expenditure items are estimated rather than directly measured.

The gap between the expenditure approach and the income approach is called the *statistical discrepancy* and it is calculated as the GDP expenditure total minus the GDP income total. The discrepancy is never large. In 2010, it was 1.2 percent of GDP.
Nominal GDP and Real GDP

Often, we want to compare GDP in two periods, say 2000 and 2010. In 2000, GDP was $9,952 billion and in 2010, it was $14,579 billion—46 percent higher than in 2000. This increase in GDP is a combination of an increase in production and a rise in prices. To isolate the increase in production from the rise in prices, we distinguish between real GDP and nominal GDP.

Real GDP is the value of final goods and services produced in a given year when valued at the prices of a reference base year. By comparing the value of production in the two years at the same prices, we reveal the change in production.

Currently, the reference base year is 2005 and we describe real GDP as measured in 2005 dollars—in terms of what the dollar would buy in 2005.

Nominal GDP is the value of final goods and services produced in a given year when valued at the prices of that year. Nominal GDP is just a more precise name for GDP.

Economists at the Bureau of Economic Analysis calculate real GDP using the method described in the Mathematical Note on pp. 100–101. Here, we’ll explain the basic idea but not the technical details.

Calculating Real GDP

We’ll calculate real GDP for an economy that produces one consumption good, one capital good, and one government service. Net exports are zero.

Table 4.3 shows the quantities produced and the prices in 2005 (the base year) and in 2010. In part (a), we calculate nominal GDP in 2005. For each item, we multiply the quantity produced in 2005 by its price in 2005 to find the total expenditure on the item. We sum the expenditures to find nominal GDP, which in 2005 is $100 million. Because 2005 is the base year, both real GDP and nominal GDP equal $100 million.

In Table 4.3(b), we calculate nominal GDP in 2010, which is $300 million. Nominal GDP in 2010 is three times its value in 2005. But by how much has production increased? Real GDP will tell us.

In Table 4.3(c), we calculate real GDP in 2010. The quantities of the goods and services produced are those of 2010, as in part (b). The prices are those in the reference base year—2005, as in part (a).

For each item, we multiply the quantity produced in 2010 by its price in 2005. We then sum these expenditures to find real GDP in 2010, which is $160 million. This number is what total expenditure would have been in 2010 if prices had remained the same as they were in 2005.

Nominal GDP in 2010 is three times its value in 2005, but real GDP in 2010 is only 1.6 times its 2005 value—a 60 percent increase in production.

REVIEW QUIZ

1. What is the expenditure approach to measuring GDP?
2. What is the income approach to measuring GDP?
3. What adjustments must be made to total income to make it equal GDP?
4. What is the distinction between nominal GDP and real GDP?
5. How is real GDP calculated?

You can work these questions in Study Plan 4.2 and get instant feedback.
The Uses and Limitations of Real GDP

Economists use estimates of real GDP for two main purposes:
- To compare the standard of living over time
- To compare the standard of living across countries

The Standard of Living Over Time

One method of comparing the standard of living over time is to calculate real GDP per person in different years. **Real GDP per person** is real GDP divided by the population. Real GDP per person tells us the value of goods and services that the average person can enjoy. By using real GDP, we remove any influence that rising prices and a rising cost of living might have had on our comparison.

We’re interested in both the long-term trends and the shorter-term cycles in the standard of living.

**Long-Term Trend** A handy way of comparing real GDP per person over time is to express it as a ratio of some reference year. For example, in 1960, real GDP per person was $15,850 and in 2010, it was $42,800. So real GDP per person in 2010 was 2.7 times its 1960 level—that is, $42,800 ÷ $15,850 = 2.7. To the extent that real GDP per person measures the standard of living, people were 2.7 times as well off in 2010 as their grandparents had been in 1960.

Figure 4.2 shows the path of U.S. real GDP per person for the 50 years from 1960 to 2010 and highlights two features of our expanding living standard:
- The growth of potential GDP per person
- Fluctuations of real GDP per person

**The Growth of Potential GDP** Potential GDP is the maximum level of real GDP that can be produced while avoiding shortages of labor, capital, land, and entrepreneurial ability that would bring rising inflation. Potential GDP per person, the smoother black line in Fig. 4.2, grows at a steady pace because the quantities of the factors of production and their productivities grow at a steady pace.

But potential GDP per person doesn’t grow at a **constant** pace. During the 1960s, it grew at 2.8 percent per year but slowed to only 2.3 percent per year during the 1970s. This slowdown might seem small, but it had big consequences, as you’ll soon see.

**Fluctuations of Real GDP** You can see that real GDP shown by the red line in Fig. 4.2 fluctuates around potential GDP, and sometimes real GDP shrinks.

Let’s take a closer look at the two features of our expanding living standard that we’ve just outlined.

**Productivity Growth Slowdown** How costly was the slowdown in productivity growth after 1970? The answer is provided by the **Lucas wedge**, which is the dollar value of the accumulated gap between what real GDP per person would have been if the 1960s growth rate had persisted and what real GDP per person turned out to be. (Nobel Laureate Robert E. Lucas Jr. drew attention to this gap.)

Figure 4.3 illustrates the Lucas wedge. The wedge started out small during the 1970s, but by 2010 real GDP per person was $28,400 per year lower than it would have been with no growth slowdown, and the accumulated gap was an astonishing $380,000 per person.
A common definition of recession is a period during which real GDP decreases—its growth rate is negative—for at least two successive quarters. The definition used by the National Bureau of Economic Research, which dates the U.S. business cycle phases and turning points, is “a period of significant decline in total output, income, employment, and trade, usually lasting from six months to a year, and marked by contractions in many sectors of the economy.”

An expansion ends and recession begins at a business cycle peak, which is the highest level that real GDP has attained up to that time. A recession ends at a trough, when real GDP reaches a temporary low point and from which the next expansion begins.

In 2008, the U.S. economy went into an unusually severe recession. Starting from a long way below potential GDP, a new expansion began in mid-2009. But the outlook for the expansion in 2011 and beyond was very uncertain (see Reading Between the Lines on pp. 96–97).
The Standard of Living Across Countries

Two problems arise in using real GDP to compare living standards across countries. First, the real GDP of one country must be converted into the same currency units as the real GDP of the other country. Second, the goods and services in both countries must be valued at the same prices. Comparing the United States and China provides a striking example of these two problems.

China and the United States in U.S. Dollars

In 2010, real GDP per person in the United States was $42,800 and in China it was 23,400 yuan. The yuan is the currency of China and the price at which the dollar and the yuan exchanged, the market exchange rate, was 8.2 yuan per $1 U.S. Using this exchange rate, 23,400 yuan converts to $2,850. On these numbers, real GDP per person in the United States was 15 times that in China.

The red line in Fig. 4.5 shows real GDP per person in China from 1980 to 2010 when the market exchange rate is used to convert yuan to U.S. dollars.

China and the United States at PPP

Figure 4.5 shows a second estimate of China’s real GDP per person that values China’s production on the same terms as U.S. production. It uses purchasing power parity or PPP prices, which are the same prices for both countries.

The prices of some goods are higher in the United States than in China, so these items get a smaller weight in China’s real GDP than they get in U.S. real GDP. An example is a Big Mac that costs $3.75 in Chicago. In Shanghai, a Big Mac costs 13.25 yuan which is the equivalent of $1.62. So in China’s real GDP, a Big Mac gets less than half the weight that it gets in U.S. real GDP.

Some prices in China are higher than in the United States but more prices are lower, so Chinese prices put a lower value on China’s production than do U.S. prices.

According to the PPP comparisons, real GDP per person in the United States in 2010 was 6.5 times that of China, not 15 times.

You’ve seen how real GDP is used to make standard of living comparisons over time and across countries. But real GDP isn’t a perfect measure of the standard of living and we’ll now examine its limitations.
The Uses and Limitations of Real GDP

Whose production is more valuable: the chef’s whose work gets counted in GDP ...

... or the busy mother’s whose dinner preparation and child minding don’t get counted?

Limitations of Real GDP

Real GDP measures the value of goods and services that are bought in markets. Some of the factors that influence the standard of living and that are not part of GDP are:

- Household production
- Underground economic activity
- Health and life expectancy
- Leisure time
- Environmental quality
- Political freedom and social justice

Household Production

An enormous amount of production takes place every day in our homes. Preparing meals, cleaning the kitchen, changing a light bulb, cutting grass, washing a car, and caring for a child are all examples of household production. Because these productive activities are not traded in markets, they are not included in GDP.

The omission of household production from GDP means that GDP underestimates total production. But it also means that the growth rate of GDP overestimates the growth rate of total production. The reason is that some of the growth rate of market production (included in GDP) is a replacement for home production. So part of the increase in GDP arises from a decrease in home production.

Two trends point in this direction. One is the number of women who have jobs, which increased from 38 percent in 1960 to 58 percent in 2010. The other is the trend in the market purchase of traditionally home-produced goods and services. For example, more and more families now eat in restaurants—one of the fastest-growing industries in the United States—and use day-care services. This trend means that an increasing proportion of food preparation and child care that were part of household production are now measured as part of GDP. So real GDP grows more rapidly than does real GDP plus home production.

Underground Economic Activity

The underground economy is the part of the economy that is purposely hidden from the view of the government to avoid taxes and regulations or because the goods and services being produced are illegal. Because underground economic activity is unreported, it is omitted from GDP.

The underground economy is easy to describe, even if it is hard to measure. It includes the production and distribution of illegal drugs, production that uses illegal labor that is paid less than the minimum wage, and jobs done for cash to avoid paying income taxes. This last category might be quite large and includes tips earned by cab drivers, hairdressers, and hotel and restaurant workers.

Estimates of the scale of the underground economy in the United States range between 9 and 30 percent of GDP ($1,300 billion to $4,333 billion).

Provided that the underground economy is a stable proportion of the total economy, the growth rate of real GDP still gives a useful estimate of changes in economic well-being and the standard of living. But sometimes production shifts from the underground economy to the rest of the economy, and sometimes it shifts the other way. The underground economy expands relative to the rest of the economy if taxes...
become especially high or if regulations become especially restrictive. And the underground economy shrinks relative to the rest of the economy if the burdens of taxes and regulations are eased. During the 1980s, when tax rates were cut, there was an increase in the reporting of previously hidden income and tax revenues increased. So some part (but probably a very small part) of the expansion of real GDP during the 1980s represented a shift from the underground economy rather than an increase in production.

**Health and Life Expectancy** Good health and a long life—the hopes of everyone—do not show up in real GDP, at least not directly. A higher real GDP enables us to spend more on medical research, health care, a good diet, and exercise equipment. And as real GDP has increased, our life expectancy has lengthened—from 70 years at the end of World War II to approaching 80 years today.

But we face new health and life expectancy problems every year. AIDS and drug abuse are taking young lives at a rate that causes serious concern. When we take these negative influences into account, we see that real GDP growth overstates the improvements in the standard of living.

**Leisure Time** Leisure time is an economic good that adds to our economic well-being and the standard of living. Other things remaining the same, the more leisure we have, the better off we are. Our working time is valued as part of GDP, but our leisure time is not. Yet that leisure time must be at least as valuable to us as the wage that we earn for the last hour worked. If it were not, we would work instead of taking leisure. Over the years, leisure time has steadily increased. The workweek has become shorter, more people take early retirement, and the number of vacation days has increased. These improvements in economic well-being are not reflected in real GDP.

**Environmental Quality** Economic activity directly influences the quality of the environment. The burning of hydrocarbon fuels is the most visible activity that damages our environment. But it is not the only example. The depletion of nonrenewable natural resources, the mass clearing of forests, and the pollution of lakes and rivers are other major environmental consequences of industrial production.

Resources that are used to protect the environment are valued as part of GDP. For example, the value of catalytic converters that help to protect the atmosphere from automobile emissions is part of GDP. But if we did not use such pieces of equipment and instead polluted the atmosphere, we would not count the deteriorating air that we were breathing as a negative part of GDP.

An industrial society possibly produces more atmospheric pollution than an agricultural society does. But pollution does not always increase as we become wealthier. Wealthy people value a clean environment and are willing to pay for one. Compare the pollution in China today with pollution in the United States. China, a poor country, pollutes its rivers, lakes, and atmosphere in a way that is unimaginable in the United States.

**Political Freedom and Social Justice** Most people in the Western world value political freedoms such as those provided by the U.S. Constitution. And they value social justice—equality of opportunity and of access to social security safety nets that protect people from the extremes of misfortune.

A country might have a very large real GDP per person but have limited political freedom and social justice. For example, a small elite might enjoy political liberty and extreme wealth while the vast majority are effectively enslaved and live in abject poverty. Such an economy would generally be regarded as having a lower standard of living than one that had the same amount of real GDP but in which political freedoms were enjoyed by everyone. Today, China has rapid real GDP growth but limited political freedoms, while Poland and Ukraine have moderate real GDP growth but democratic political systems. Economists have no easy way to determine which of these countries is better off.

**The Bottom Line** Do we get the wrong message about the level and growth in economic well-being and the standard of living by looking at the growth of real GDP? The influences that are omitted from real GDP are probably important and could be large. Developing countries have a larger amount of household production and a larger underground economy than do developed countries so the gap between their living standards is exaggerated. Also, as real GDP grows, part of the measured growth might reflect a switch from home production to market production and underground to regular production. This measurement error overstates the growth in economic well-being and the improvement in the standard of living.
Economics in Action

A Broader Indicator of Economic Well-Being

The limitations of real GDP reviewed in this chapter affect the standard of living and general well-being of every country. So to make international comparisons of the general state of economic well-being, we must look at real GDP and other indicators.

The United Nations has constructed a broader measure called the Human Development Index (HDI), which combines real GDP, life expectancy and health, and education. Real GDP per person (measured on the PPP basis) is a major component of the HDI.

The dots in the figure show the relationship between real GDP per person and the HDI. The United States (along with a few other countries) has the highest real GDP per person, but the United States has the thirteenth highest HDI. (Norway has the highest HDI, and Australia, Canada, and Japan have a higher HDI than the United States.)

The HDI of the United States is lower than that of 12 other countries because the people of those countries live longer and have better access to health care and education than do Americans.

Other influences on the standard of living include the amount of leisure time available, the quality of the environment, the security of jobs and homes, and the safety of city streets.

It is possible to construct broader measures that combine the many influences that contribute to human happiness. Real GDP will be one element in those broader measures, but it will by no means be the whole of those measures. The United Nation’s Human Development Index (HDI) is one example of attempts to provide broader measures of economic well-being and the standard of living. This measure places a good deal of weight on real GDP.

Dozens of other measures have been proposed. One includes resource depletion and emissions in a Green GDP measure. Another emphasizes the enjoyment of life rather than the production of goods in a “genuine progress index” or GPI.

Despite all the alternatives, real GDP per person remains the most widely used indicator of economic well-being.

African nations have the lowest levels of economic well-being. The Democratic Republic of Congo has the lowest real GDP per person and Niger has the lowest HDI.

---

REVIEW QUIZ

1. Distinguish between real GDP and potential GDP and describe how each grows over time.
2. How does the growth rate of real GDP contribute to an improved standard of living?
3. What is a business cycle and what are its phases and turning points?
4. What is PPP and how does it help us to make valid international comparisons of real GDP?
5. Explain why real GDP might be an unreliable indicator of the standard of living.

You can work these questions in Study Plan 4.3 and get instant feedback.
Shape of Recovery Long, Slow Growth … a “Square Root” Slog
http://www.denverpost.com
July 26, 2010

Hopes for a "V-shaped" recovery have shifted to fears of a "W-shaped" double dip.

William Greiner, president of Scout Investment Advisors, wants to add another symbol to the mix—the square root.

The square root represents a rebound, a smaller version of the V, followed by an extended period of below-average growth. No double dip, just a long, hard slog.

Greiner ... predicts [a fall in] inflation-adjusted economic growth from 3.3 percent, the average in the post-war period, to about 2 percent, hence the square root.

No big deal? Think again.

"Potentially, the economic implications as to slow growth are monumental," Greiner said. "It is hard to overstate this issue."

Two percent real GDP growth will keep pace with U.S. population growth of 0.89 percent a year. But it won't leave much to form capital, fund research and development, and improve living standards.

Since World War II, the country has grown fast enough to double living standards every 29 years—translating into bigger homes, more cars and consumer goods, and more trips and meals out than previous generations enjoyed.

But at a 2 percent growth rate, living standards double every 64 years. Americans could be forced to shift their hopes for greater prosperity from their children to their grandchildren. …

What will make the slower growth feel even worse is that nominal economic growth, or GDP unadjusted for inflation, will run closer to 4 percent in the near term, far below its 7 percent average in recent decades. …

ESSENCE OF THE STORY

- Investment advisor William Greiner says the recovery will be neither a V nor a W but the shape of the square root symbol.
- Greiner predicts real GDP growth of 2 percent a year, down from a 3.3 percent post-war average.
- A growth rate of 3.3 percent per year doubles the standard of living every 29 years, but at 2 percent a year the standard of living doubles every 64 years.
- The news article says that growth will feel even worse because nominal GDP will grow at only 4 percent a year, down from 7 percent a year in recent decades.
The 2008 recession was an unusually deep one and even by the middle of 2010, recovery was weak.

Figure 1 illustrates the severity of the 2008 recession using the concepts of potential GDP and real GDP that you learned about in this chapter.

At the trough in the second quarter of 2009, real GDP was almost $1 trillion below potential GDP.

When real GDP is below potential GDP, the economy is operating inside the PPF (Chapter 2, pp. 30–31) and production is lost.

To put the magnitude of the gap between potential GDP and real GDP into perspective, each person’s share (your share) of the lost production in 2009 was about $3,250.

The severity of the recession and the slow recovery led economists to speculate about the shape of the future recovery—about whether it will be V-shaped or W-shaped.

A V-shaped recovery, illustrated in Fig. 2, would mean the resumption of rapid real GDP growth.

A W-shaped recovery, also illustrated in Fig. 2, would be bad news. It means a “double-dip” recession. That is, there will be another downturn and recession before a recovery finally gets going.

The news article speculates about a third shape—a “square-root” recovery. Figure 2 illustrates this possibility. A square root symbol has a flat top, which means zero real GDP growth. The real GDP path predicted in the news article is almost flat.

The news article is correct to emphasize that a growth slowdown is a big deal. The Lucas wedge (p. 91) occurred because of a similar slowdown during the 1970s.

But if real GDP growth does slow to 2 percent a year, the Lucas wedge will become extremely large.

The news article is not correct that slow growth will feel even worse because nominal GDP will grow at only 4 percent a year, down from 7 percent a year in recent decades.

The numbers are correct, but the reasoning is wrong. Growth will feel slow because (if the forecast is correct) it really will be slow.

The point of calculating real GDP is to isolate the change in the quantity of goods and services produced—the real things on which the standard of living depends.

A slowdown in nominal GDP growth combines the slowdown in real GDP growth and a slowdown in the inflation rate and obscures what is really happening to the standard of living.
After studying this appendix, you will be able to:
- Make and interpret a time-series graph
- Make and interpret a graph that uses a ratio scale

The Time-Series Graph

In macroeconomics we study the fluctuations and trends in the key variables that describe macroeconomic performance and policy. These variables include GDP and its expenditure and income components that you’ve learned about in this chapter. They also include variables that describe the labor market and consumer prices that you study in Chapter 5.

Regardless of the variable of interest, we want to be able to compare its value today with that in the past; and we want to describe how the variable has changed over time. The most effective way to do these things is to make a time-series graph.

Making a Time-Series Graph

A time-series graph measures time (for example, years, quarters, or months) on the x-axis and the variable or variables in which we are interested on the y-axis. Figure A4.1 is an example of a time-series graph. It provides some information about unemployment in the United States since 1980. In this figure, we measure time in years starting in 1980. We measure the unemployment rate (the variable that we are interested in) on the y-axis.

A time-series graph enables us to visualize how a variable has changed over time and how its value in one period relates to its value in another period. It conveys an enormous amount of information quickly and easily.

Let’s see how to “read” a time-series graph.

Reading a Time-Series Graph

To practice reading a time-series graph, take a close look at Fig. A4.1. The graph shows the level, change and speed of change of the variable.

The level of the variable: It tells us when unemployment is high and low. When the line is a long distance above the x-axis, the unemployment rate is high, as it was, for example, in 1983 and again in 2009. When the line is close to the x-axis, the unemployment rate is low, as it was, for example, in 2001.

The change in the variable: It tells us how unemployment changes—whether it increases or decreases. When the line slopes upward, as it did in 2008 and 2009, the unemployment rate is rising. When the line slopes downward, as it did in 1984 and 1997, the unemployment rate is falling.

The speed of change in the variable: It tells us whether the unemployment rate is rising or falling quickly or slowly. If the line is very steep, then the unemployment rate increases or decreases quickly. If the line is not steep, the unemployment rate increases or decreases slowly. For example, the unemployment rate rose quickly in 2008 and slowly in 2003 and it fell quickly in 1984 and slowly in 1997.
**Ratio Scale Reveals Trend**

A time-series graph also reveals whether a variable has a **cycle**, which is a tendency for a variable to alternate between upward and downward movements, or a **trend**, which is a tendency for a variable to move in one general direction.

The unemployment rate in Fig. A4.1 has a cycle but no trend. When a trend is present, a special kind of time-series graph, one that uses a ratio scale on the y-axis, reveals the trend.

**A Time-Series with a Trend**

Many macroeconomics variables, among them GDP and the average level of prices, have an upward trend. Figure A4.2 shows an example of such a variable: the average prices paid by consumers.

In Fig. A4.2(a), consumer prices since 1970 are graphed on a normal scale. In 1970 the level is 100. In other years, the average level of prices is measured as a percentage of the 1970 level.

The graph clearly shows the upward trend of prices. But it doesn’t tell us when prices were rising fastest or whether there was any change in the trend. Just looking at the upward-sloping line in Fig. A4.2(a) gives the impression that the pace of growth of consumer prices was constant.

**Using a Ratio Scale**

On a graph axis with a normal scale, the gap between 1 and 2 is the same as that between 3 and 4. On a graph axis with a ratio scale, the gap between 1 and 2 is the same as that between 2 and 4. The ratio 2 to 1 equals the ratio 4 to 2. By using a ratio scale, we can “see” when the growth rate (the percentage change per unit of time) changes.

Figure A4.2(b) shows an example of a ratio scale. Notice that the values on the y-axis get closer together but the gap between 400 and 200 equals the gap between 200 and 100: The ratio gaps are equal.

Graphing the data on a ratio scale reveals the trends. In the case of consumer prices, the trend is much steeper during the 1970s and early 1980s than in the later years. The steeper the line in the ratio-scale graph in part (b), the faster are prices rising. Prices rose rapidly during the 1970s and early 1980s and more slowly in the later 1980s and 1990s. The ratio-scale graph reveals this fact. We use ratio-scale graphs extensively in macroeconomics.
In the real GDP calculation on p. 89, real GDP in 2010 is 1.6 times its value in 2005. But suppose that we use 2010 as the reference base year and value real GDP in 2005 at 2010 prices. If you do the math, you will see that real GDP in 2005 is $150 million at 2010 prices. GDP in 2010 is $300 million (in 2010 prices), so now the numbers say that real GDP has doubled. Which is correct: Did real GDP increase 1.6 times or double? Should we use the prices of 2005 or 2010? The answer is that we need to use both sets of prices.

The Bureau of Economic Analysis uses a measure of real GDP called chained-dollar real GDP. Three steps are needed to calculate this measure:

- Value production in the prices of adjacent years
- Find the average of two percentage changes
- Link (chain) back to the reference base year

### Value Production in Prices of Adjacent Years

The first step is to value production in adjacent years at the prices of both years. We’ll make these calculations for 2010 and its preceding year, 2009.

Table 1 shows the quantities produced and prices in the two years. Part (a) shows the nominal GDP calculation for 2009—the quantities produced in 2009 valued at the prices of 2009. Nominal GDP in 2009 is $145 million. Part (b) shows the nominal GDP calculation for 2010—the quantities produced in 2010 valued at the prices of 2010. Nominal GDP in 2010 is $300 million. Part (c) shows the value of the quantities produced in 2010 at the prices of 2009. This total is $160 million. Finally, part (d) shows the value of the quantities produced in 2009 at the prices of 2010. This total is $275 million.

### Find the Average of Two Percentage Changes

The second step is to find the percentage change in the value of production based on the prices in the two adjacent years. Table 2 summarizes these calculations.

Part (a) shows that, valued at the prices of 2009, production increased from $145 million in 2009 to $160 million in 2010, an increase of 10.3 percent.

---

**Table 1** Real GDP Calculation Step 1: Value Production in Adjacent Years at Prices of Both Years

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity (millions)</th>
<th>Price (dollars)</th>
<th>Expenditure (millions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) In 2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-shirts</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>G Security services</td>
<td>5</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Y Real and Nominal GDP in 2009</td>
<td></td>
<td></td>
<td>145</td>
</tr>
<tr>
<td>(b) In 2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-shirts</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>2</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>G Security services</td>
<td>6</td>
<td>40</td>
<td>240</td>
</tr>
<tr>
<td>Y Nominal GDP in 2010</td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>(c) Quantities of 2010 valued at prices of 2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-shirts</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>G Security services</td>
<td>6</td>
<td>20</td>
<td>120</td>
</tr>
<tr>
<td>Y 2010 production at 2009 prices</td>
<td></td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>(d) Quantities of 2009 valued at prices of 2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-shirts</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>I Computer chips</td>
<td>3</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>G Security services</td>
<td>5</td>
<td>40</td>
<td>200</td>
</tr>
<tr>
<td>Y 2009 production at 2010 prices</td>
<td></td>
<td></td>
<td>275</td>
</tr>
</tbody>
</table>

Step 1 is to value the production of adjacent years at the prices of both years. Here, we value the production of 2009 and 2010 at the prices of both 2009 and 2010. The value of 2009 production at 2009 prices, in part (a), is nominal GDP in 2009. The value of 2010 production at 2010 prices, in part (b), is nominal GDP in 2010. Part (c) calculates the value of 2010 production at 2009 prices, and part (d) calculates the value of 2009 production at 2010 prices. We use these numbers in Step 2.

Part (b) shows that, valued at the prices of 2010, production increased from $275 million in 2009 to $300 million in 2010, an increase of 9.1 percent. Part (c) shows that the average of these two percentage changes in the value of production is 9.7. That is, 

\[
(10.3 + 9.1) ÷ 2 = 9.7
\]

By applying this average percentage change to real GDP, we can find the value of real GDP in 2010. Real GDP in 2009 is $145 million, so a 9.7 percent increase is $14 million. Then real GDP in 2010 is...
$145 million plus $14 million, which equals $159 million. Because real GDP in 2009 is in 2009 dollars, real GDP in 2010 is also in 2009 dollars. Although the real GDP of $159 million is expressed in 2009 dollars, the calculation uses the average of the prices of the final goods and services that make up GDP in 2009 and 2010.

**Link (Chain) to the Base Year**

The third step is to express GDP in the prices of the reference base year. To do this, the BEA performs calculations like the ones that you’ve just worked through to find the percentage change in real GDP in each pair of years. It then selects a base year (currently 2005) in which, by definition, real GDP equals nominal GDP. Finally, it uses the percentage changes to calculate real GDP in 2005 prices starting from real GDP in 2005.

To illustrate this third step, we’ll assume that the BEA has calculated the growth rates since 2004 shown in Table 3. The 2010 growth rate that we’ve just calculated is highlighted in the table. The other (assumed) growth rates are calculated in exactly the same way as that for 2010.

<table>
<thead>
<tr>
<th>Year</th>
<th>Growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>7.0</td>
</tr>
<tr>
<td>2006</td>
<td>8.0</td>
</tr>
<tr>
<td>2007</td>
<td>6.0</td>
</tr>
<tr>
<td>2008</td>
<td>7.0</td>
</tr>
<tr>
<td>2009</td>
<td>8.0</td>
</tr>
<tr>
<td>2010</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Figure 1 illustrates the chain link calculations. In the reference base year, 2005, real GDP equals nominal GDP, which we’ll assume is $125 million. Table 3 tells us that the growth rate in 2005 was 7 percent, so real GDP in 2005 is 7 percent higher than it was in 2004, which means that real GDP in 2004 is $117 million (117 × 1.07 = 125).

Table 3 also tells us that the growth rate in 2006 was 8 percent, so real GDP in 2006 is 8 percent higher than it was in 2005, which means that real GDP in 2006 is $135 million (125 × 1.08 = 135).

By repeating these calculations for each year, we obtain chained-dollar real GDP in 2005 dollars for each year. In 2009, chained-dollar real GDP in 2005 dollars is $165 million. So the 9.7 percent growth rate in 2010 that we calculated in Table 2 means that real GDP in 2010 is $181 million.

Notice that the growth rates are independent of the reference base year, so changing the reference base year does not change the growth rates.

<table>
<thead>
<tr>
<th>Value of Production</th>
<th>Millions of dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) At 2009 prices</td>
<td></td>
</tr>
<tr>
<td>Nominal GDP in 2009</td>
<td>145</td>
</tr>
<tr>
<td>2010 production at 2009 prices</td>
<td>160</td>
</tr>
<tr>
<td>Percentage change in production at 2009 prices</td>
<td>10.3</td>
</tr>
<tr>
<td>(b) At 2010 prices</td>
<td></td>
</tr>
<tr>
<td>2009 production at 2010 prices</td>
<td>275</td>
</tr>
<tr>
<td>Nominal GDP in 2010</td>
<td>300</td>
</tr>
<tr>
<td>Percentage change in production at 2010 prices</td>
<td>9.1</td>
</tr>
<tr>
<td>(c) Average percentage change in 2010</td>
<td>9.7</td>
</tr>
</tbody>
</table>
CHAPTER 4 Measuring GDP and Economic Growth

Key Points

**Gross Domestic Product** (pp. 84–86)
- GDP, or gross domestic product, is the market value of all the final goods and services produced in a country during a given period.
- A final good is an item that is bought by its final user, and it contrasts with an intermediate good, which is a component of a final good.
- GDP is calculated by using either the expenditure or income totals in the circular flow model.
- Aggregate expenditure on goods and services equals aggregate income and GDP.

Working Problems 1 to 7 will give you a better understanding of gross domestic product.

**Measuring U.S. GDP** (pp. 87–89)
- Because aggregate expenditure, aggregate income, and the value of aggregate production are equal, we can measure GDP by using the expenditure approach or the income approach.
- The expenditure approach sums consumption expenditure, investment, government expenditure on goods and services, and net exports.
- The income approach sums wages, interest, rent, and profit (plus indirect taxes less subsidies plus depreciation).

Real GDP is measured using a common set of prices to remove the effects of inflation from GDP.

Working Problems 8 to 15 will give you a better understanding of measuring U.S. GDP.

**The Uses and Limitations of Real GDP** (pp. 88–95)
- Real GDP is used to compare the standard of living over time and across countries.
- Real GDP per person grows and fluctuates around the more smoothly growing potential GDP.
- A slowing of the growth rate of real GDP per person during the 1970s has lowered incomes by a large amount.
- International real GDP comparisons use PPP prices.
- Real GDP is not a perfect measure of the standard of living because it excludes household production, the underground economy, health and life expectancy, leisure time, environmental quality, and political freedom and social justice.

Working Problem 16 will give you a better understanding of the uses and limitations of real GDP.

Key Terms

- Business cycle, 91
- Chained-dollar real GDP, 100
- Consumption expenditure, 85
- Cycle, 99
- Depreciation, 86
- Expansion, 91
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- Investment, 86
- Net exports, 86
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- Trend, 99
**Gross Domestic Product (Study Plan 4.1)**

1. Classify each of the following items as a final good or service or an intermediate good or service and identify which is a component of consumption expenditure, investment, or government expenditure on goods and services:
   - Banking services bought by a student.
   - New cars bought by Hertz, the car rental firm.
   - Newsprint bought by USA Today.
   - The purchase of a new limo for the president.
   - New house bought by Al Gore.

2. The firm that printed this textbook bought the paper from XYZ Paper Mills. Was this purchase of paper part of GDP? If not, how does the value of the paper get counted in GDP?

Use the following figure, which illustrates the circular flow model, to work Problems 3 and 4.

3. During 2008, in an economy:
   - Flow B was $9 trillion.
   - Flow C was $2 trillion.
   - Flow D was $3 trillion.
   - Flow E was −$0.7 trillion.

   Name the flows and calculate the value of:
   a. Aggregate income.
   b. GDP.

4. During 2009, flow A was $13.0 trillion, flow B was $9.1 trillion, flow D was $3.3 trillion, and flow E was −$0.8 trillion.

Calculate the 2009 values of:
   a. GDP.
   b. Government expenditure.

5. Use the following data to calculate aggregate expenditure and imports of goods and services:
   - Government expenditure: $20 billion
   - Aggregate income: $100 billion
   - Consumption expenditure: $67 billion
   - Investment: $21 billion
   - Exports of goods and services: $30 billion

6. **U.S. Economy Shrinks Modestly**

   GDP fell 1 percent as businesses cut investment by 8.9 percent, consumers cut spending by 1.2 percent, purchases of new houses fell 38 percent, and exports fell 29.9 percent.

   Source: Reuters, July 31, 2009

   Use the letters on the figure in Problem 3 to indicate the flow in which each item in the news clip occurs. How can GDP have fallen by only 1.0 percent with the big expenditure cuts reported?

7. A U.S. market research firm deconstructed an Apple iPod and studied the manufacturers, costs, and profits of each of the parts and components. The final results are:
   - An Apple iPod sells in the United States for $299.
   - A Japanese firm, Toshiba, makes the hard disk and display screen, which cost $93.
   - Other components produced in South Korea cost $25.
   - Other components produced in the United States cost $21.
   - The iPod is assembled in China at a cost of $5.
   - The costs and profits of retailers, advertisers, and transportation firms in the United States are $75.

   a. What is Apple’s profit?
   b. Where in the national income and product accounts of the United States, Japan, South Korea, and China are these transactions recorded?
   c. What contribution does one iPod make to world GDP?
Measuring U.S. GDP (Study Plan 4.2)

Use the following data to work Problems 8 and 9. The table lists some macroeconomic data for the United States in 2008.

<table>
<thead>
<tr>
<th>Item</th>
<th>Billions of dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages paid to labor</td>
<td>8,000</td>
</tr>
<tr>
<td>Consumption expenditure</td>
<td>10,000</td>
</tr>
<tr>
<td>Net operating surplus</td>
<td>3,200</td>
</tr>
<tr>
<td>Investment</td>
<td>2,000</td>
</tr>
<tr>
<td>Government expenditure</td>
<td>2,800</td>
</tr>
<tr>
<td>Net exports</td>
<td>-700</td>
</tr>
<tr>
<td>Depreciation</td>
<td>1,800</td>
</tr>
</tbody>
</table>

9. Explain the approach (expenditure or income) that you used to calculate GDP.

Use the following data to work Problems 10 and 11.

The national accounts of Parchment Paradise are kept on (you guessed it) parchment. A fire destroys the statistics office. The accounts are now incomplete but they contain the following data:
- GDP (income approach): $2,900
- Consumption expenditure: $2,000
- Indirect taxes less subsidies: $100
- Net operating surplus: $500
- Investment: $800
- Government expenditure: $400
- Wages: $2,000
- Net exports: $-200

10. Calculate GDP (expenditure approach) and depreciation.
11. Calculate net domestic income at factor cost and the statistical discrepancy.

Use the following data to work Problems 12 and 13.

Tropical Republic produces only bananas and coconuts. The base year is 2008, and the table gives the quantities produced and the prices.

<table>
<thead>
<tr>
<th>Quantities</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bananas</td>
<td>800</td>
<td>900</td>
</tr>
<tr>
<td>Coconuts</td>
<td>400</td>
<td>500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prices</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bananas</td>
<td>$2</td>
<td>$4</td>
</tr>
<tr>
<td>Coconuts</td>
<td>$10</td>
<td>$5</td>
</tr>
</tbody>
</table>


Use the following news clip to work Problems 14 and 15.

Toyota to Shift U.S. Manufacturing Efforts

Toyota announced it planned to adjust its U.S. manufacturing operations to meet customer demands for smaller, more fuel-efficient vehicles. In 2008, Toyota started building a plant to produce the 2010 Prius for the U.S. market in Blue Springs, Mississippi. Earlier models of the Prius were produced in Asia.

Source: CNN, July 10, 2008

14. Explain how this change by Toyota will influence U.S. GDP and the components of aggregate expenditure.
15. Explain how this change by Toyota will influence the factor incomes that make up U.S. GDP.

The Uses and Limitations of Real GDP (Study Plan 4.3)

16. Use the following table to work out in which year the U.S. standard of living (i) increases and (ii) decreases? Explain your answer.

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GDP</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>$13.0 trillion</td>
<td>300 million</td>
</tr>
<tr>
<td>2007</td>
<td>$13.2 trillion</td>
<td>302 million</td>
</tr>
<tr>
<td>2008</td>
<td>$13.2 trillion</td>
<td>304 million</td>
</tr>
<tr>
<td>2009</td>
<td>$12.8 trillion</td>
<td>307 million</td>
</tr>
</tbody>
</table>

Mathematical Note (Study Plan 4.MN)

17. The table provides data on the economy of Maritime Republic that produces only fish and crabs.

<table>
<thead>
<tr>
<th>Quantities</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Crabs</td>
<td>500</td>
<td>525</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prices</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>$20</td>
<td>$30</td>
</tr>
<tr>
<td>Crabs</td>
<td>$10</td>
<td>$8. a ton</td>
</tr>
</tbody>
</table>


Data Graphing

Use the Data Grapher in MyEconLab to work Problems 18 and 19.

18. In which country in 2009 was the growth rate of real GDP per person highest: Canada, Japan, or the United States?
19. In which country in 2009 was the growth rate of real GDP per person lowest: France, China, or the United States?
**Gross Domestic Product**

20. Classify each of the following items as a final good or service or an intermediate good or service and identify which is a component of consumption expenditure, investment, or government expenditure on goods and services:

- Banking services bought by Google.
- Security system bought by the New York Stock Exchange.
- Coffee beans bought by Starbucks.
- New coffee grinders bought by Starbucks.
- Starbucks’s grande mocha frappuccino bought by a student.
- New battle ship bought by the U.S. Navy.

Use the figure in Problem 3 to work Problems 21 and 22.

21. In 2009, flow $A$ was $1,000$ billion, flow $C$ was $250$ billion, flow $B$ was $650$ billion, and flow $E$ was $50$ billion. Calculate investment.

22. In 2010, flow $D$ was $2$ trillion, flow $E$ was $–1$ trillion, flow $A$ was $10$ trillion, and flow $C$ was $4$ trillion. Calculate consumption expenditure.

Use the following information to work Problems 23 and 24.

Mitsubishi Heavy Industries makes the wings of the new Boeing 787 Dreamliner in Japan. Toyota assembles cars for the U.S. market in Kentucky.

23. Explain where these activities appear in the U.S. National Income and Product Accounts.

24. Explain where these activities appear in Japan’s National Income and Product Accounts.

Use the following news clip to work Problems 25 and 26, and use the circular flow model to illustrate your answers.

**Boeing Bets the House**

Boeing is producing some components of its new 787 Dreamliner in Japan and is assembling it in the United States. Much of the first year’s production will be sold to ANA (All Nippon Airways), a Japanese airline.


25. Explain how Boeing’s activities and its transactions affect U.S. and Japanese GDP.

26. Explain how ANA’s activities and its transactions affect U.S. and Japanese GDP.

---

**Measuring U.S. GDP**

Use the following data to work Problems 27 and 28. The table lists some macroeconomic data for the United States in 2009.

<table>
<thead>
<tr>
<th>Item</th>
<th>Billions of dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages paid to labor</td>
<td>8,000</td>
</tr>
<tr>
<td>Consumption expenditure</td>
<td>10,000</td>
</tr>
<tr>
<td>Net operating surplus</td>
<td>3,400</td>
</tr>
<tr>
<td>Investment</td>
<td>1,500</td>
</tr>
<tr>
<td>Government expenditure</td>
<td>2,900</td>
</tr>
<tr>
<td>Net exports</td>
<td>−340</td>
</tr>
</tbody>
</table>


28. Explain the approach (expenditure or income) that you used to calculate GDP.

Use the following data to work Problems 29 to 31. An economy produces only apples and oranges. The base year is 2009, and the table gives the quantities produced and the prices.

<table>
<thead>
<tr>
<th>Quantities</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>60</td>
<td>160</td>
</tr>
<tr>
<td>Oranges</td>
<td>80</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prices</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>$0.50</td>
<td>$1.00</td>
</tr>
<tr>
<td>Oranges</td>
<td>$0.25</td>
<td>$2.00</td>
</tr>
</tbody>
</table>


31. **GDP Expands 11.4 Percent, Fastest in 13 Years**

China’s gross domestic product grew 11.4 percent last year and marked a fifth year of double-digit growth. The increase was especially remarkable given that the United States is experiencing a slowdown due to the sub-prime crisis and housing slump. Citigroup estimates that each 1 percent drop in the U.S. economy will shave 1.3 percent off China’s growth, because Americans are heavy users of Chinese products. In spite of the uncertainties, China is expected to post its sixth year of double-digit growth next year.


Use the expenditure approach for calculating China’s GDP to explain why “each 1 percent drop in the U.S. economy will shave 1.3 percent off China’s growth.”
The Uses and Limitations of Real GDP

32. The United Nations’ Human Development Index (HDI) is based on real GDP per person, life expectancy at birth, and indicators of the quality and quantity of education.
   a. Explain why the HDI might be better than real GDP as a measure of economic welfare.
   b. Which items in the HDI are part of real GDP and which items are not in real GDP?
   c. Do you think the HDI should be expanded to include items such as pollution, resource depletion, and political freedom? Explain.
   d. What other influences on economic welfare should be included in a comprehensive measure?

33. U.K. Living Standards Outstrip U.S.
   Oxford analysts report that living standards in Britain are set to rise above those in America for the first time since the nineteenth century. Real GDP per person in Britain will be £23,500 this year, compared with $23,250 in America, reflecting not only the strength of the pound against the dollar but also the UK economy’s record run of growth since 2001. But the Oxford analysts also point out that Americans benefit from lower prices than those in Britain.
   Source: The Sunday Times, January 6, 2008

If real GDP per person is more in the United Kingdom than in the United States but Americans benefit from lower prices, does this comparison of real GDP per person really tell us which country has the higher standard of living?

34. Use the news clip in Problem 31.
   a. Why might China’s recent GDP growth rates overstate the actual increase in the level of production taking place in China?
   b. Explain the complications involved with attempting to compare the economic welfare in China and the United States by using the GDP for each country.

35. Poor India Makes Millionaires at Fastest Pace
   India, with the world’s largest population of poor people created millionaires at the fastest pace in the world in 2007. India added another 23,000 more millionaires in 2007 to its 2006 tally of 100,000 millionaires measured in dollars. That is 1 millionaire for about 7,000 people living on less than $2 a day.
   Source: The Times of India, June 25, 2008

   a. Why might real GDP per person misrepresent the standard of living of the average Indian?
   b. Why might $2 a day underestimate the standard of living of the poorest Indians?

Economics in the News

36. After you have studied Reading Between the Lines on pp. 96–97 answer the following questions.
   a. Which measure of GDP would you use to describe the shape of the recovery from recession: real GDP or nominal GDP? Explain your answer.
   b. Which measure of GDP would you use to describe the rate of growth of the standard of living: real GDP or nominal GDP? Explain your answer.
   c. If the recovery was a precise “square-root” shape, what would the growth rate of real GDP be?
   d. Why is the news article wrong about the effect of a slowdown in nominal GDP growth on how slow the growth rate will “feel”?

37. Totally Gross
   GDP has proved useful in tracking both short-term fluctuations and long-run growth. Which isn’t to say GDP doesn’t miss some things.
   Amartya Sen, at Harvard, helped create the United Nations’ Human Development Index, which combines health and education data with per capita GDP to give a better measure of the wealth of nations. Joseph Stiglitz, at Columbia, advocates a “green net national product” that takes into account the depletion of natural resources. Others want to include happiness in the measure. These alternative benchmarks have merit but can they be measured with anything like the frequency, reliability and impartiality of GDP?
   Source: Time, April 21, 2008

38. Use the information in Problem 29 to calculate the chained-dollar real GDP in 2010 expressed in 2009 dollars.

Mathematical Note

39. Use the information in Problem 29 to calculate the real GDP for 2010 expressed in 2009 dollars.
After studying this chapter, you will be able to:

- Explain why unemployment is a problem, define the unemployment rate, the employment-to-population ratio, and the labor force participation rate, and describe the trends and cycles in these labor market indicators.
- Explain why unemployment is an imperfect measure of underutilized labor, why it is present even at full employment, and how unemployment and real GDP fluctuate together over a business cycle.
- Explain why inflation is a problem, how we measure the price level and the inflation rate, and why the CPI measure of inflation might be biased.

Each month, we chart the course of employment and unemployment as measures of U.S. economic health. How do we count the number of people working and the number unemployed? What do the level of employment and the unemployment rate tell us? Are they reliable vital signs for the economy?

Having a good job that pays a decent wage is only half of the equation that translates into a good standard of living. The other half is the cost of living. We track the cost of the items that we buy with another number that is published every month, the Consumer Price Index, or CPI. What is the CPI? How is it calculated? And does it provide a reliable guide to the changes in our cost of living?

As the U.S. economy expanded after a recession in 2001, job growth was weak and questions about the health of the labor market became of vital importance to millions of American families. Reading Between the Lines, at the end of this chapter, puts the spotlight on the labor market during the expansion of the past few years and the slowdown of 2008.

We begin by looking at unemployment: What it is, why it matters, and how we measure it.
CHAPTER 5 Monitoring Jobs and Inflation

Employment and Unemployment
What kind of job market will you enter when you graduate? Will there be plenty of good jobs to choose among, or will jobs be so hard to find that you end up taking one that doesn’t use your education and pays a low wage? The answer depends, to a large degree, on the total number of jobs available and on the number of people competing for them.

The class of 2009 had an unusually tough time in the jobs market. At the depth of recession in October 2009, 16.5 million Americans wanted a job but couldn’t find one. In a normal year, unemployment is less than half that level. And the U.S. economy is an incredible job-creating machine. Even in 2009 at the depths of recession, 139 million people had jobs—4 million more than in 1999 and 22 million more than in 1989. But in recent years, population growth has outstripped jobs growth, so unemployment is a serious problem.

Why Unemployment Is a Problem
Unemployment is a serious personal and social economic problem for two main reasons. It results in
- Lost incomes and production
- Lost human capital

Lost Incomes and Production The loss of a job brings a loss of income and lost production. These losses are devastating for the people who bear them and they make unemployment a frightening prospect for everyone. Unemployment benefits create a safety net, but they don’t fully replace lost earnings.

Lost production means lower consumption and a lower investment in capital, which lowers the living standard in both the present and the future.

Lost Human Capital Prolonged unemployment permanently damages a person’s job prospects by destroying human capital.

Economics in Action
What Keeps Ben Bernanke Awake at Night
The Great Depression began in October 1929, when the U.S. stock market crashed. It reached its deepest point in 1933, when 25 percent of the labor force was unemployed, and lasted until 1941, when the United States entered World War II. The depression quickly spread globally to engulf most nations.

The 1930s were and remain the longest and worst period of high unemployment in history. Failed banks, shops, farms, and factories left millions of Americans without jobs, homes, and food. Without the support of government and charities, millions would have starved.

The Great Depression was an enormous political event: It fostered the rise of the German and Japanese militarism that were to bring the most devastating war humans have ever fought. It also led to President Franklin D. Roosevelt’s “New Deal,” which enhanced the role of government in economic life and made government intervention in markets popular and the market economy unpopular.

The Great Depression also brought a revolution in economics. British economist John Maynard Keynes published his General Theory of Employment, Interest, and Money and created what we now call macroeconomics.

Many economists have studied the Great Depression and tried to determine why what started out as an ordinary recession became so devastating. Among them is Ben Bernanke, the Chairman of the Federal Reserve.

One of the reasons the Fed was so aggressive in cutting interest rates, saving Bear Stearns, and propping up Fannie Mae and Freddie Mac is because Ben Bernanke is so vividly aware of the horrors of total economic collapse and determined to avoid any risk of a repeat of the Great Depression.
Think about a manager who loses his job when his employer downsizes. The only work he can find is driving a taxi. After a year in this work, he discovers that he can’t compete with new MBA graduates. Eventually, he gets hired as a manager but in a small firm and at a lower wage than before. He has lost some of his human capital.

The cost of unemployment is spread unequally, which makes it a highly charged political problem as well as a serious economic problem.

Governments make strenuous efforts to measure unemployment accurately and to adopt policies to moderate its level and ease its pain. Here, we’ll learn how the U.S. government monitors unemployment.

**Current Population Survey**

Every month, the U.S. Census Bureau surveys 60,000 households and asks a series of questions about the age and job market status of the members of each household. This survey is called the Current Population Survey. The Census Bureau uses the answers to describe the anatomy of the labor force.

Figure 5.1 shows the population categories used by the Census Bureau and the relationships among the categories.

The population divides into two broad groups: the working-age population and others who are too young to work or who live in institutions and are unable to work. The working-age population is the total number of people aged 16 years and over who are not in jail, hospital, or some other form of institutional care.

The Census Bureau divides the working-age population into two groups: those in the labor force and those not in the labor force. It also divides the labor force into two groups: the employed and the unemployed. So the labor force is the sum of the employed and the unemployed.

To be counted as employed in the Current Population Survey, a person must have either a full-time job or a part-time job. To be counted as unemployed, a person must be available for work and must be in one of three categories:

1. Without work but has made specific efforts to find a job within the previous four weeks
2. Waiting to be called back to a job from which he or she has been laid off
3. Waiting to start a new job within 30 days

Anyone surveyed who satisfies one of these three criteria is counted as unemployed. People in the working-age population who are neither employed nor unemployed are classified as not in the labor force.

In June 2010, the population of the United States was 309.6 million; the working-age population was 237.7 million. Of this number, 84 million were not in the labor force. Most of these people were in school full time or had retired from work. The remaining 153.7 million people made up the U.S. labor force. Of these, 139.1 million were employed and 14.6 million were unemployed.

**Three Labor Market Indicators**

The Census Bureau calculates three indicators of the state of the labor market. They are:

- The unemployment rate
- The employment-to-population ratio
- The labor force participation rate
The Unemployment Rate  The amount of unemployment is an indicator of the extent to which people who want jobs can’t find them. The unemployment rate is the percentage of the people in the labor force who are unemployed. That is,

\[
\text{Unemployment rate} = \frac{\text{Number of people unemployed}}{\text{Labor force}} \times 100
\]

and

\[
\text{Labor force} = \text{Number of people employed} + \text{Number of people unemployed}.
\]

In June 2010, the number of people employed was 139.1 million and the number unemployed was 14.6 million. By using the above equations, you can verify that the labor force was 153.7 million (139.1 million plus 14.6 million) and the unemployment rate was 9.5 percent (14.6 million divided by 153.7 million, multiplied by 100).

Figure 5.2 shows the unemployment rate from 1980 to 2010. The average unemployment rate during this period is 6.2 percent—equivalent to 9.5 million people being unemployed in 2010.

The unemployment rate fluctuates over the business cycle and reaches a peak value after a recession ends.


The Employment-to-Population Ratio  The number of people of working age who have jobs is an indicator of both the availability of jobs and the degree of match between people’s skills and jobs. The employment-to-population ratio is the percentage of people of working age who have jobs. That is,

\[
\text{Employment-to-population ratio} = \frac{\text{Number of people employed}}{\text{Working-age population}} \times 100.
\]

In June 2010, the number of people employed was 139.1 million and the working-age population was 237.7 million. By using the above equation, you can verify that the employment-to-population ratio was 58.5 percent (139.1 million divided by 237.7 million, multiplied by 100).

Figure 5.3 shows the employment-to-population ratio. This indicator followed an upward trend before 2000 and then a downward trend. The increase before 2000 means that the U.S. economy created...
jobs at a faster rate than the working-age population grew. This indicator also fluctuates: It falls during a recession and increases during an expansion.

The Labor Force Participation Rate

The number of people in the labor force is an indicator of the willingness of people of working age to take jobs. The labor force participation rate is the percentage of the working-age population who are members of the labor force. That is,

\[
\text{Labor force participation rate} = \frac{\text{Labor force}}{\text{Working-age population}} \times 100.
\]

In June 2010, the labor force was 153.7 million and the working-age population was 237.7 million. By using the above equation, you can verify that the labor force participation rate was 64.7 percent (153.7 million divided by 237.7 million, multiplied by 100).

Figure 5.3 shows the labor force participation rate. Like the employment-to-population ratio, this indicator has an upward trend before 2000 and then a downward trend. It also has mild fluctuations around the trend. These fluctuations result from unsuccessful job seekers leaving the labor force during a recession and reentering during an expansion.

Other Definitions of Unemployment

Do fluctuations in the labor force participation rate over the business cycle mean that people who leave the labor force during a recession should be counted as unemployed? Or are they correctly counted as not-in-the-labor force?

The Bureau of Labor Statistics (BLS) believes that the official unemployment definition gives the correct measure of the unemployment rate. But the BLS provides data on two types of underutilized labor excluded from the official measure. They are:

- Marginally attached workers
- Part-time workers who want full-time jobs

**Marginally Attached Workers** A marginally attached worker is a person who currently is neither working nor looking for work but has indicated that he or she wants and is available for a job and has looked for work sometime in the recent past. A marginally attached worker who has stopped looking for a job because of repeated failure to find one is called a discouraged worker.

The official unemployment measure excludes marginally attached workers because they haven’t made specific efforts to find a job within the past four weeks. In all other respects, they are unemployed.
Part-Time Workers Who Want Full-Time Jobs

Many part-time workers want to work part time. This arrangement fits in with the other demands on their time. But some part-time workers would like full-time jobs and can't find them. In the official statistics, these workers are called economic part-time workers and they are partly unemployed.

Most Costly Unemployment

All unemployment is costly, but the most costly is long-term unemployment that results from job loss.

People who are unemployed for a few weeks and then find another job bear some costs of unemployment. But these costs are low compared to the costs borne by people who remain unemployed for many weeks.

Also, people who are unemployed because they voluntarily quit their jobs to find better ones or because they have just entered or reentered the labor market bear some costs of unemployment. But these costs are lower than those borne by people who lose their job and are forced back into the job market.

The unemployment rate doesn't distinguish among these different categories of unemployment. If most of the unemployed are long-term job losers, the situation is much worse than if most are short-term voluntary job seekers.

Alternative Measures of Unemployment

To provide information about the aspects of unemployment that we've just discussed, the Bureau of Labor Statistics reports six alternative measures of the unemployment rate: two narrower than the official measure and three broader ones. The narrower measures focus on the personal cost of unemployment and the broader measures focus on assessing the full amount of unused labor resources.

Figure 5.4 shows these measures from 1994 (the first year for which they are available) to 2010. U–3 is the official unemployment rate. Long-term unemployment (U–1) and unemployed job losers (U–2) are about 40 percent of the unemployed on average but 60 percent in a deep recession. Adding discouraged workers (U–4) makes very little difference to the unemployment rate, but adding all marginally attached workers (U–5) adds one percentage point. A big difference is made by adding the economic part-time workers (U–6). In June 2010, after adding these workers the unemployment rate was 16 percent.

You've seen how we measure employment and unemployment. Your next task is to see what we mean by full employment and how unemployment and real GDP fluctuate over the business cycle.
Unemployment and Full Employment

There is always someone without a job who is searching for one, so there is always some unemployment. The key reason is that the economy is a complex mechanism that is always changing—it experiences frictions, structural change, and cycles.

Frictional Unemployment

There is an unending flow of people into and out of the labor force as people move through the stages of life—from being in school to finding a job, to working, perhaps to becoming unhappy with a job and looking for a new one, and finally, to retiring from full-time work.

There is also an unending process of job creation and job destruction as new firms are born, firms expand or contract, and some firms fail and go out of business.

The flows into and out of the labor force and the processes of job creation and job destruction create the need for people to search for jobs and for businesses to search for workers. Businesses don’t usually hire the first person who applies for a job, and unemployed people don’t usually take the first job that comes their way. Instead, both firms and workers spend time searching for what they believe will be the best available match. By this process of search, people can match their own skills and interests with the available jobs and find a satisfying job and a good income.

The unemployment that arises from the normal labor turnover we’ve just described—from people entering and leaving the labor force and from the ongoing creation and destruction of jobs—is called frictional unemployment. Frictional unemployment is a permanent and healthy phenomenon in a dynamic, growing economy.

Structural Unemployment

The unemployment that arises when changes in technology or international competition change the skills needed to perform jobs or change the locations of jobs is called structural unemployment. Structural unemployment usually lasts longer than frictional unemployment because workers must retrain and possibly relocate to find a job. When a steel plant in Gary, Indiana, is automated, some jobs in that city disappear. Meanwhile, new jobs for security guards, retail clerks, and life-insurance salespeople are created in Chicago and Indianapolis. The unemployed former steelworkers remain unemployed for several months until they move, retrain, and get one of these jobs. Structural unemployment is painful, especially for older workers for whom the best available option might be to retire early or take a lower-skilled, lower-paying job.

Cyclical Unemployment

The higher than normal unemployment at a business cycle trough and the lower than normal unemployment at a business cycle peak is called cyclical unemployment. A worker who is laid off because the economy is in a recession and who gets rehired some months later when the expansion begins has experienced cyclical unemployment.

“Natural” Unemployment

Natural unemployment is the unemployment that arises from frictions and structural change when there is no cyclical unemployment—when all the unemployment is frictional and structural. Natural unemployment as a percentage of the labor force is called the natural unemployment rate.

Full employment is defined as a situation in which the unemployment rate equals the natural unemployment rate.

What determines the natural unemployment rate? Is it constant or does it change over time?

The natural unemployment rate is influenced by many factors but the most important ones are:

- The age distribution of the population
- The scale of structural change
- The real wage rate
- Unemployment benefits

The Age Distribution of the Population

An economy with a young population has a large number of new job seekers every year and has a high level of frictional unemployment. An economy with an aging population has fewer new job seekers and a low level of frictional unemployment.

The Scale of Structural Change

The scale of structural change is sometimes small. The same jobs using the same machines remain in place for many years. But sometimes there is a technological upheaval. The old
ways are swept aside and millions of jobs are lost and the skill to perform them loses value. The amount of structural unemployment fluctuates with the pace and volume of technological change and the change driven by fierce international competition, especially from fast-changing Asian economies. A high level of structural unemployment is present in many parts of the United States today (as you can see in Economics in Action below).

The Real Wage Rate The natural unemployment rate is influenced by the level of the real wage rate. Real wage rates that bring unemployment are a minimum wage and an efficiency wage. An efficiency wage is a wage set above the going market wage to enables firms to attract the most productive workers, get them to work hard, and discourage them from quitting.

Unemployment Benefits Unemployment benefits increase the natural unemployment rate by lowering the opportunity cost of job search. European countries have more generous unemployment benefits and higher natural unemployment rates than the United States. Extending unemployment benefits increases the natural unemployment rate.

There is no controversy about the existence of a natural unemployment rate. Nor is there disagreement that the natural unemployment rate changes. But economists don’t know its exact size or the extent to which it fluctuates. The Congressional Budget Office estimates the natural unemployment rate and its estimate for 2010 was 4.8 percent—about a half of the unemployment in that year.

Real GDP and Unemployment Over the Cycle

The quantity of real GDP at full employment is potential GDP (p. 90). Over the business cycle, real GDP fluctuates around potential GDP. The gap between real GDP and potential GDP is called the output gap. As the output gap fluctuates over the business cycle, the unemployment rate fluctuates around the natural unemployment rate.

Economics in Action

Structural Unemployment and Labor Reallocation in Michigan

At 13.6 percent, Michigan had the nation’s highest official unemployment rate in 2010. The long-term unemployment rate was 8.4 percent and when marginally attached workers and part-time workers who want full time jobs are added, almost 22 percent of the state’s labor force was unemployed or underemployed.

Michigan’s main problem is structural—a collapse of manufacturing jobs centered on the auto industry. These jobs had been disappearing steadily as robot technologies spread to do ever more of the tasks in the assembly of automobiles. The 2008–2009 recession accelerated this rate of job loss.

But the story is not all negative, and the outlook is not all bleak. Around 11,000 businesses in Michigan produce high-tech scientific instruments and components for defense equipment, energy plants, and medical equipment. These businesses employ almost 400,000 people, which is more than 10 percent of the state’s labor force and two thirds of all manufacturing jobs. Workers in high-tech manufacturing enjoy incomes almost 60 percent higher than the state’s average income. Although the recession hit these firms, they cut employment by only 10 percent, compared with a 24 percent cut in manufacturing jobs in the rest of the Michigan economy.

The structural unemployment rate remains high because job gains in new advanced-manufacturing firms are not yet enough to offset the job losses in the shrinking parts of manufacturing.
Unemployment and Full Employment

Figure 5.5 illustrates these fluctuations in the United States between 1980 and 2010—the output gap in part (a) and the unemployment rate and natural unemployment rate in part (b).

When the economy is at full employment, the unemployment rate equals the natural unemployment rate and real GDP equals potential GDP so the output gap is zero. When the unemployment rate is less than the natural unemployment rate, real GDP is greater than potential GDP and the output gap is positive. And when the unemployment rate is greater than the natural unemployment rate, real GDP is less than potential GDP and the output gap is negative.

Figure 5.5(b) shows the natural unemployment rate estimated by the Congressional Budget Office. This estimate puts the natural unemployment rate at 6.2 percent in 1980 and falling steadily through the 1980s and 1990s to 4.8 percent by 2000. This estimate of the natural unemployment rate in the United States is one that many, but not all, economists agree with.

Your next task is to see how we monitor the price level and the inflation rate. You will learn about the Consumer Price Index (CPI), which is monitored every month. You will also learn about other measures of the price level and the inflation rate.
The Price Level, Inflation, and Deflation

What will it really cost you to pay off your student loan? What will your parent’s life savings buy when they retire? The answers depend on what happens to the **price level**, the average level of prices, and the value of money. A persistently rising price level is called **inflation**; a persistently falling price level is called **deflation**.

We are interested in the price level, inflation, and deflation for two main reasons. First, we want to measure the annual percentage change of the price level—the inflation rate or deflation rate. Second, we want to distinguish between the money values and real values of economic variables such as your student loan and your parent’s savings.

We begin by explaining why inflation and deflation are problems. Then we’ll look at how we measure the price level and the inflation rate. Finally, we’ll return to the task of distinguishing real values from money values.

**Why Inflation and Deflation are Problems**

Low, steady, and anticipated inflation or deflation isn’t a problem, but an unexpected burst of inflation or period of deflation brings big problems and costs. An unexpected inflation or deflation:

- **Redistributes income**
- **Redistributes wealth**
- **Lowers real GDP and employment**
- **Diverts resources from production**

**Redistribution of Income** Workers and employers sign wage contracts that last for a year or more. An unexpected burst of inflation raises prices but doesn’t immediately raise the wages. Workers are worse off because their wages buy less than they bargained for and employers are better off because their profits rise.

An unexpected period of deflation has the opposite effect. Wage rates don’t fall but the prices fall. Workers are better off because their fixed wages buy more than they bargained for and employers are worse off with lower profits.

**Redistribution of Wealth** People enter into loan contracts that are fixed in money terms and that pay an interest rate agreed as a percentage of the money borrowed and lent. With an unexpected burst of inflation, the money that the borrower repays to the lender buys less than the money originally loaned. The borrower wins and the lender loses. The interest paid on the loan doesn’t compensate the lender for the loss in the value of the money loaned. With an unexpected deflation, the money that the borrower repays to the lender buys more than the money originally loaned. The borrower loses and the lender wins.

**Lowers Real GDP and Employment** Unexpected inflation that raises firms’ profits brings a rise in investment and a boom in production and employment. Real GDP rises above potential GDP and the unemployment rate falls below the natural rate. But this situation is temporary. Profitable investment dries up, spending falls, real GDP falls below potential GDP and the unemployment rate rises. Avoiding these swings in production and jobs means avoiding unexpected swings in the inflation rate.

An unexpected deflation has even greater consequences for real GDP and jobs. Businesses and households that are in debt (borrowers) are worse off and they cut their spending. A fall in total spending brings a recession and rising unemployment.

**Diverts Resources from Production** Unpredictable inflation or deflation turns the economy into a casino and diverts resources from productive activities to forecasting inflation. It can become more profitable to forecast the inflation rate or deflation rate correctly than to invent a new product. Doctors, lawyers, accountants, farmers—just about everyone—can make themselves better off, not by specializing in the profession for which they have been trained but by spending more of their time dabbling as amateur economists and inflation forecasters and managing their investments.

From a social perspective, the diversion of talent that results from unpredictable inflation is like throwing scarce resources onto a pile of garbage. This waste of resources is a cost of inflation.

At its worst, inflation becomes **hyperinflation**—an inflation rate of 50 percent a month or higher that grinds the economy to a halt and causes a society to collapse. Hyperinflation is rare, but Zimbabwe in recent years and several European and Latin American countries have experienced it.

We pay close attention to the inflation rate, even when its rate is low, to avoid its consequences. We monitor the price level every month and devote considerable resources to measuring it accurately. You’re now going to see how we do this.
The Price Level, Inflation, and Deflation

The Monthly Price Survey
Each month, BLS employees check the prices of the 80,000 goods and services in the CPI basket in 30 metropolitan areas. Because the CPI aims to measure price changes, it is important that the prices recorded each month refer to exactly the same item. For example, suppose the price of a box of jelly beans has increased but a box now contains more beans. Has the price of jelly beans increased? The BLS employee must record the details of changes in quality or packaging so that price changes can be isolated from other changes.

Once the raw price data are in hand, the next task is to calculate the CPI.

Calculating the CPI
To calculate the CPI, we
1. Find the cost of the CPI basket at base-period prices.
2. Find the cost of the CPI basket at current-period prices.
3. Calculate the CPI for the base period and the current period.

The Consumer Price Index
Every month, the Bureau of Labor Statistics (BLS) measures the price level by calculating the Consumer Price Index (CPI), which is a measure of the average of the prices paid by urban consumers for a fixed basket of consumer goods and services. What you learn here will help you to make sense of the CPI and relate it to your own economic life. The CPI tells you about the value of the money in your pocket.

Reading the CPI Numbers
The CPI is defined to equal 100 for a period called the reference base period. Currently, the reference base period is 1982–1984. That is, for the average of the 36 months from January 1982 through December 1984, the CPI equals 100.

In June 2010, the CPI was 218. This number tells us that the average of the prices paid by urban consumers for a fixed market basket of consumer goods and services was 118 percent higher in 2010 than it was on the average during 1982–1984.

Constructing the CPI
Constructing the CPI involves three stages:
- Selecting the CPI basket
- Conducting the monthly price survey
- Calculating the CPI

The CPI Basket
The first stage in constructing the CPI is to select what is called the CPI basket. This basket contains the goods and services represented in the index, each weighted by its relative importance. The idea is to make the relative importance of the items in the CPI basket the same as that in the budget of an average urban household. For example, because people spend more on housing than on bus rides, the CPI places more weight on the price of housing than on the price of a bus ride.

To determine the CPI basket, the BLS conducts a Consumer Expenditure Survey. Today’s CPI basket is based on data gathered in the Consumer Expenditure Survey of 2008.

Figure 5.6 shows the CPI basket in June 2010. As you look at the relative importance of the items in the CPI basket, remember that it applies to the average household. Individual household’s baskets are spread around the average. Think about what you buy and compare your basket with the CPI basket.

The Monthly Price Survey
Each month, BLS employees check the prices of the 80,000 goods and services in the CPI basket in 30 metropolitan areas.

Because the CPI aims to measure price changes, it is important that the prices recorded each month refer to exactly the same item. For example, suppose the price of a box of jelly beans has increased but a box now contains more beans. Has the price of jelly beans increased? The BLS employee must record the details of changes in quality or packaging so that price changes can be isolated from other changes.

Once the raw price data are in hand, the next task is to calculate the CPI.

Calculating the CPI
To calculate the CPI, we
1. Find the cost of the CPI basket at base-period prices.
2. Find the cost of the CPI basket at current-period prices.
3. Calculate the CPI for the base period and the current period.
We’ll work through these three steps for the simple artificial economy in Table 5.1, which shows the quantities in the CPI basket and the prices in the base period (2010) and current period (2011).

Part (a) contains the data for the base period. In that period, consumers bought 10 oranges at $1 each and 5 haircuts at $8 each. To find the cost of the CPI basket in the base-period prices, multiply the quantities in the CPI basket by the base-period prices. The cost of oranges is $10 (10 at $1 each), and the cost of haircuts is $40 (5 at $8 each). So total cost of the CPI basket in the base period of the CPI basket is $50 ($10 + $40).

Part (b) contains the price data for the current period. The price of an orange increased from $1 to $2, which is a 100 percent increase—($1 ÷ $1) × 100 = 100. The price of a haircut increased from $8 to $10, which is a 25 percent increase—($2 ÷ $8) × 100 = 25.

The CPI provides a way of averaging these price increases by comparing the cost of the basket rather than the price of each item. To find the cost of the CPI basket in the current period, 2011, multiply the quantities in the basket by their 2011 prices. The cost of oranges is $20 (10 at $2 each), and the cost of haircuts is $50 (5 at $10 each). So total cost of the fixed CPI basket at current-period prices is $70 ($20 + $50).

You’ve now taken the first two steps toward calculating the CPI: calculating the cost of the CPI basket in the base period and the current period. The third step uses the numbers you’ve just calculated to find the CPI for 2010 and 2011.

The formula for the CPI is

$$\text{CPI} = \frac{\text{Cost of CPI basket at current prices}}{\text{Cost of CPI basket at base-period prices}} \times 100.$$

In Table 5.1, you established that in 2010 (the base period), the cost of the CPI basket was $50 and in 2011, it was $70. If we use these numbers in the CPI formula, we can find the CPI for 2010 and 2011. For 2010, the CPI is

$$\text{CPI in 2010} = \frac{50}{50} \times 100 = 100.$$

For 2011, the CPI is

$$\text{CPI in 2011} = \frac{70}{50} \times 100 = 140.$$

The principles that you’ve applied in this simplified CPI calculation apply to the more complex calculations performed every month by the BLS.

### Measuring the Inflation Rate

A major purpose of the CPI is to measure changes in the cost of living and in the value of money. To measure these changes, we calculate the inflation rate as the annual percentage change in the CPI. To calculate the inflation rate, we use the formula:

$$\text{Inflation rate} = \frac{\text{CPI this year} - \text{CPI last year}}{\text{CPI last year}} \times 100.$$

We can use this formula to calculate the inflation rate in 2010. The CPI in June 2010 was 218.0, and the CPI in June 2009 was 215.7. So the inflation rate during the twelve months to June 2010 was

$$\text{Inflation rate} = \frac{(218.0 - 215.7)}{215.7} \times 100 = 1.1\%.$$
Distinguishing High Inflation from a High Price Level

Figure 5.7 shows the CPI and the inflation rate in the United States between 1970 and 2010. The two parts of the figure are related and emphasize the distinction between high inflation and high prices.

When the price level in part (a) rises rapidly, (1970 through 1982), the inflation rate in part (b) is high. When the price level in part (a) rises slowly, (after 1982), the inflation rate in part (b) is low.

A high inflation rate means that the price level is rising rapidly. A high price level means that there has been a sustained period of rising prices.

When the price level in part (a) falls (2009), the inflation rate in part (b) is negative—deflation.

The CPI is not a perfect measure of the price level and changes in the CPI probably overstate the inflation rate. Let’s look at the sources of bias.

The Biased CPI

The main sources of bias in the CPI are
- New goods bias
- Quality change bias
- Commodity substitution bias
- Outlet substitution bias

New Goods Bias If you want to compare the price level in 2009 with that in 1969, you must somehow compare the price of a computer today with that of a typewriter in 1969. Because a PC is more expensive than a typewriter was, the arrival of the PC puts an upward bias into the CPI and its inflation rate.

Quality Change Bias Cars, CD players, and many other items get better every year. Part of the rise in the prices of these items is a payment for improved quality and is not inflation. But the CPI counts the entire price rise as inflation and so overstates inflation.

Commodity Substitution Bias Changes in relative prices lead consumers to change the items they buy. For example, if the price of beef rises and the price of chicken remains unchanged, people buy more chicken and less beef. This switch from beef to chicken might provide the same amount of protein and the same enjoyment as before and expenditure is the same as before. The price of protein has not changed. But because the CPI ignores the substitution of chicken for beef, it says the price of protein has increased.

Source of data: Bureau of Labor Statistics.
Outlet Substitution Bias  When confronted with higher prices, people use discount stores more frequently and convenience stores less frequently. This phenomenon is called outlet substitution. The CPI surveys do not monitor outlet substitutions.

The Magnitude of the Bias
You’ve reviewed the sources of bias in the CPI. But how big is the bias? This question was tackled in 1996 by a Congressional Advisory Commission on the Consumer Price Index chaired by Michael Boskin, an economics professor at Stanford University. This commission said that the CPI overstates inflation by 1.1 percentage points a year. That is, if the CPI reports that inflation is 3.1 percent a year, most likely inflation is actually 2 percent a year.

Some Consequences of the Bias
The bias in the CPI distorts private contracts and increases government outlays. Many private agreements, such as wage contracts, are linked to the CPI. For example, a firm and its workers might agree to a three-year wage deal that increases the wage rate by 2 percent a year plus the percentage increase in the CPI. Such a deal ends up giving the workers more real income than the firm intended.

Close to a third of federal government outlays, including Social Security checks, are linked directly to the CPI. And while a bias of 1 percent a year seems small, accumulated over a decade it adds up to almost a trillion dollars of additional expenditures.

Alternative Price Indexes
The CPI is just one of many alternative price level index numbers and because of the bias in the CPI, other measures are used for some purposes. We’ll describe three alternatives to the CPI and explain when and why they might be preferred to the CPI. The alternatives are

- Chained CPI
- Personal consumption expenditure deflator
- GDP deflator

Chained CPI  The chained CPI is a price index that is calculated using a similar method to that used to calculate chained-dollar real GDP described in Chapter 4 (see pp. 98–99).

The chained CPI overcomes the sources of bias in the CPI. It incorporates substitutions and new goods bias by using current and previous period quantities rather than fixed quantities from an earlier period.

The practical difference made by the chained CPI is small. This index has been calculated since 2000 and the average inflation rate since then as measured by the chained CPI is only 0.3 percentage points lower than the standard CPI—2.5 percent versus 2.8 percent per year.

Personal Consumption Expenditure Deflator
The personal consumption expenditure deflator (or PCE deflator) is calculated from data in the national income accounts that you studied in Chapter 4. When the Bureau of Economic Analysis calculates real GDP, it also calculates the real values of its expenditure components: real consumption expenditure, real investment, real government expenditure, and real net exports. These calculations are done in the same way as that for real GDP described in simplified terms on p. 89 and more technically on pp. 98–99 in Chapter 4.

To calculate the PCE deflator, we use the formula:

$$\text{PCE deflator} = \left( \frac{\text{Nominal } C}{\text{Real } C} \right) \times 100,$$

where $C$ is personal consumption expenditure.

The basket of goods and services included in the PCE deflator is broader than that in the CPI because it includes all consumption expenditure, not only the items bought by a typical urban family.

The difference between the PCE deflator and the CPI is small. Since 2000, the inflation rate measured by the PCE deflator is 2.4 percent per year, 0.4 percentage points lower than the CPI inflation rate.

GDP Deflator  The GDP deflator is a bit like the PCE deflator except that it includes all the goods and services that are counted as part of GDP. So it is an index of the prices of the items in consumption, investment, government expenditure, and net exports.

$$\text{GDP deflator} = \left( \frac{\text{Nominal GDP}}{\text{Real GDP}} \right) \times 100.$$

This broader price index is appropriate for macroeconomics because it is a comprehensive measure of the cost of the real GDP basket of goods and services.

Since 2000, the GDP deflator has increased at an average rate of 2.6 percent per year, only 0.2 percentage points below the CPI inflation rate.
Core CPI Inflation

No matter whether we calculate the inflation rate using the CPI, the chained CPI, the personal consumption expenditure deflator, or the GDP deflator, the number bounces around a good deal from month to month or quarter to quarter. To determine the trend in the inflation rate, we need to strip the raw numbers of their volatility. The core CPI inflation rate, which is the CPI inflation rate excluding volatile elements, attempts to do just that and reveal the underlying inflation trend.

As a practical matter, the core CPI inflation rate is calculated as the percentage change in the CPI (or other price index) excluding food and fuel. The prices of these two items are among the most volatile.

While the core CPI inflation rate removes the volatile elements in inflation, it can give a misleading view of the true underlying inflation rate. If the relative prices of the excluded items are changing, the core CPI inflation rate will give a biased measure of the true underlying inflation rate.

Such a misleading account was given during the years between 2003 and 2008 when the relative prices of food and fuel were rising. The result was a core CPI inflation rate that was systematically below the CPI inflation rate. Figure 5.8 shows the two series since 2000. More refined measures of core inflation have been suggested that eliminate the bias.

The Real Variables in Macroeconomics

You saw in Chapter 4 how we measure real GDP. And you’ve seen in this chapter how we can use nominal GDP and real GDP to provide another measure of the price level—the GDP deflator. But viewing real GDP as nominal GDP deflated, opens up the idea of other real variables. By using the GDP deflator, we can deflate other nominal variables to find their real values. For example, the real wage rate is the nominal wage rate divided by the GDP deflator.

We can adjust any nominal quantity or price variable for inflation by deflating it—by dividing it by the price level.

There is one variable that is a bit different—an interest rate. A real interest rate is not a nominal interest rate divided by the price level. You’ll learn how to adjust the nominal interest rate for inflation to find the real interest rate in Chapter 7. But all the other real variables of macroeconomics are calculated by dividing a nominal variable by the price level.

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**REVIEW QUIZ**

1. What is the price level?
2. What is the CPI and how is it calculated?
3. How do we calculate the inflation rate and what is its relationship with the CPI?
4. What are the four main ways in which the CPI is an upward-biased measure of the price level?
5. What problems arise from the CPI bias?
6. What are the alternative measures of the price level and how do they address the problem of bias in the CPI?

You can work these questions in Study Plan 5.3 and get instant feedback.

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You’ve now completed your study of the measurement of macroeconomic performance. Your next task is to learn what determines that performance and how policy actions might improve it. But first, take a close-up look at the labor market in 2009 and 2010 in *Reading Between the Lines* on pp. 122–123.
When the U.S. unemployment rate moved up from 9.7 percent to 9.9 percent in April, economists cheered it as an oddly encouraging sign.

The increase was largely the result of a massive influx of 805,000 workers into the labor force—Americans who were not even looking for a job during the recession and finally felt they had better chances to find employment.

However, over the past three months, that hope seems to have vanished. Since May, the size of the U.S. labor force has shrunk by 1.15m people, with 188,000 of those dropping out last month, according to data released by the U.S. government on Friday.

Although labor force participation data are notoriously volatile, the underlying trend is unmistakable: the majority of the 1.65m people who jumped back into the labor force in the first four months of the year are back on the sidelines, cowed by the sudden slowdown in the U.S. economy and the tepid pace of private-sector job creation. …

Additionally, downward pressure on the size of the labor force could be exacerbated as Americans exhaust their unemployment benefits, which in some states last as long as 99 weeks. To receive jobless checks, workers have to prove that they are searching for a post, keeping them inside the labor force.

Indeed, in the latest government data, there were already signs of long-term unemployed Americans exiting the workforce in desperation after running out of benefits. In July, 179,000 people who had been unemployed for 27 weeks or longer left the labor force, accounting for most of the overall decline. …


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**ESSENCE OF THE STORY**

- The U.S. unemployment rate increased from 9.7 percent to 9.9 percent in April 2010 mainly because 805,000 workers entered the labor force.
- In May, June, and July 2010, the U.S. labor force decreased by 1.15 million people.
- Monthly labor force participation data are volatile, but the underlying trend is downward and is being driven by slow economic growth and a slow pace of job creation in the private sector.
- To receive unemployment benefits, workers must search for work so that they are counted as unemployed and in the labor force.
- As benefits run out, a worker might stop looking for work and leave the labor force, which distorts the true change in unemployment.
- In July 2010, 179,000 people who had been unemployed for 27 weeks or longer left the labor force, accounting for most of the overall decline.
This news article reports and comments on some labor market data for April through July 2010.

During 2010, the economy was expanding following a deep recession. Figure 1 shows real GDP bottomed in mid-2009.

Despite the expanding economy, the labor force participation rate continued on a downward trend (as reported in the news article) and the unemployment rate continued to rise.

Figure 2 shows that the unemployment rate continued to rise until October 2009 when it reached a peak.

The tendency for the turning point in the unemployment rate to lag the turning point in real GDP by a few months is a normal feature of the business cycle.

The unemployment path looks the same regardless of whether we use the official measure, U–3, or add in discouraged workers (U–4) or other marginally attached workers (U–5).

Because all the unemployment rates move up and down together, we can conclude that the falling labor force participation rate is not being driven by a fall in the number of marginally attached workers.

Rather, as the news article says, it is long-term unemployed who are withdrawing from the labor force.

But as Fig. 3 shows, the percentage of the unemployed who are long-term unemployed (15 weeks or longer) continued to rise through mid-2010.

The news article identifies one link between unemployment benefits and the unemployment rate—for those whose benefits run out, the incentive to remain unemployed weakens so these people are more likely to withdraw from the labor force.

There is a second link between unemployment benefits and the unemployment rate: When benefits are extended (to 99 weeks in some states), for those who qualify, the incentive to remain unemployed and take longer to find a suitable job strengthens.

The increase in the percentage of the unemployed who remain unemployed for 15 weeks or longer shown in Fig. 3 might be influenced by this effect.
CHAPTER 5 Monitoring Jobs and Inflation

Key Points

Employment and Unemployment (pp. 108–112)
- Unemployment is a serious personal, social, and economic problem because it results in lost output and income and a loss of human capital.
- The unemployment rate averaged 6.2 percent between 1980 and 2010. It increases in recessions and decreases in expansions.
- The labor force participation rate and the employment-to-population ratio have an upward trend and fluctuate with the business cycle.
- Two alternative measures of unemployment, narrower than the official measure, count the long-term unemployed and unemployed job losers.
- Three alternative measures of unemployment, broader than the official measure, count discouraged workers, other marginally attached workers, and part-time workers who want full-time jobs.

Working Problems 1 to 5 will give you a better understanding of employment and unemployment.

Unemployment and Full Employment (pp. 113–115)
- Some unemployment is unavoidable because people are constantly entering and leaving the labor force and losing or quitting jobs; also firms that create jobs are constantly being born, expanding, contracting, and dying.
- Unemployment can be frictional, structural, or cyclical.
- When all unemployment is frictional and structural, the unemployment rate equals the natural unemployment rate, the economy is at full employment, and real GDP equals potential GDP.
- Over the business cycle, real GDP fluctuates around potential GDP and the unemployment rate fluctuates around the natural unemployment rate.

Working Problems 6 to 11 will give you a better understanding of unemployment and full employment.

The Price Level, Inflation, and Deflation (pp. 116–121)
- Inflation and deflation that are unexpected redistribute income and wealth and divert resources from production.
- The Consumer Price Index (CPI) is a measure of the average of the prices paid by urban consumers for a fixed basket of consumer goods and services.
- The CPI is defined to equal 100 for a reference base period—currently 1982–1984.
- The inflation rate is the percentage change in the CPI from one period to the next.
- Changes in the CPI probably overstate the inflation rate because of the bias that arises from new goods, quality changes, commodity substitution, and outlet substitution.
- The bias in the CPI distorts private contracts and increases government outlays.
- Alternative price level measures such as the PCE deflator and GDP deflator avoid the bias of the CPI but do not make a large difference to the measured inflation rate.
- Real economic variables are calculated by dividing nominal variables by the price level.

Working Problems 12 to 20 will give you a better understanding of the price level, inflation, and deflation.

Key Terms

- Consumer Price Index (CPI), 117
- Core CPI inflation rate, 121
- Cyclical unemployment, 113
- Deflation, 116
- Discouraged worker, 111
- Employment-to-population ratio, 110
- Frictional unemployment, 113
- Full employment, 113
- Hyperinflation, 116
- Inflation, 116
- Labor force, 109
- Labor force participation rate, 111
- Marginally attached worker, 111
- Natural unemployment rate, 113
- Output gap, 114
- Price level, 116
- Structural unemployment, 113
- Unemployment rate, 110
- Working-age population, 109
What is a discouraged worker? Explain how an increase in discouraged workers influences the official unemployment rate and U–4.

Unemployment and Full Employment (Study Plan 5.2)

Use the following news clip to work Problems 6 to 8.

Nation’s Economic Pain Deepens

A spike in the unemployment rate—the biggest in more than two decades—raised new concerns that the economy is heading into a recession. The U.S. unemployment rate soared to 5.5% in May from 5% in April—much higher than forecasted. The surge marked the biggest one-month jump in unemployment since February 1986, and the 5.5% rate is the highest seen since October 2004.

Source: CNN, June 6, 2008

6. How does the unemployment rate in May compare to the unemployment rate during the earlier recessions?

7. Why might the unemployment rate tend to actually underestimate the unemployment problem, especially during a recession?

8. How does the unemployment rate in May compare to the estimated natural unemployment rate? What does this imply about the relationship between real GDP and potential GDP at this time?

Use the following information to work Problems 9 and 10.

Some Firms Struggle to Hire Despite High Unemployment

Matching people with available jobs is always difficult after a recession as the economy remakes itself. But Labor Department data suggest the disconnect is particularly acute this time. Since the recovery began in mid-2009, the number of job openings has risen more than twice as fast as actual hires. If the job market were working normally, openings would be getting filled as they appear. Some five million more would be employed and the unemployment rate would be 6.8%, instead of 9.5%.

Source: The Wall Street Journal, August 9, 2010

9. If the labor market is working properly, why would there be any unemployment at all?

10. Are the 5 million workers who cannot find jobs because of mismatching in the labor market...
counted as part of the economy’s structural unemployment or part of its cyclical unemployment?

11. Which of the following people are unemployed because of labor market mismatching?
   - Michael has unemployment benefits of $450 a week and he turned down a full-time job paying $7.75 an hour.
   - Tory used to earn $60,000 a year and he turned down a low-paid job to search for one that pays at least $50,000 a year.
   - David turned down a temporary full-time job paying $15 an hour because it was an hour’s drive away and the gas cost would be high.

The Price Level, Inflation, and Deflation

(Study Plan 5.3)

Use the following information to work Problems 12 and 13.

The people on Coral Island buy only juice and cloth. The CPI basket contains the quantities bought in 2009. The average household spent $60 on juice and $30 on cloth in 2009 when the price of juice was $2 a bottle and the price of cloth was $5 a yard. In the current year, 2010, juice is $4 a bottle and cloth is $6 a yard.

12. Calculate the CPI basket and the percentage of the household’s budget spent on juice in 2009.

13. Calculate the CPI and the inflation rate in 2010.

Use the following data to work Problems 14 to 16.

The BLS reported the following CPI data:

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>117.1</td>
<td>120.4</td>
<td>124.0</td>
</tr>
<tr>
<td>Euro area</td>
<td>113.6</td>
<td>117.1</td>
<td>119.6</td>
</tr>
<tr>
<td>Japan</td>
<td>98.1</td>
<td>98.1</td>
<td>98.8</td>
</tr>
</tbody>
</table>

14. Calculate the inflation rates for the years ended June 2007 and June 2008. How did the inflation rate change in 2008?

15. Why might these CPI numbers be biased?

16. How do alternative price indexes help to avoid the bias in the CPI numbers?

17. Inflation Can Act as a Safety Valve

Workers will more readily accept a real wage cut that arises from an increase in the price level than a cut in their nominal wage rate.

Source: FT.com, May 28, 2009

Explain why inflation influences a worker’s real wage rate. Why might this observation be true?

18. The IMF World Economic Outlook reported the following price level data (2000 = 100):

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>117.1</td>
<td>120.4</td>
<td>124.0</td>
</tr>
<tr>
<td>Euro area</td>
<td>113.6</td>
<td>117.1</td>
<td>119.6</td>
</tr>
<tr>
<td>Japan</td>
<td>98.1</td>
<td>98.1</td>
<td>98.8</td>
</tr>
</tbody>
</table>

a. In which region was the inflation rate highest in 2007 and in 2008?

b. Describe the path of the price level in Japan.

19. Inflation Getting “Uglier and Uglier”

The Labor Department reported that the CPI rose 4.2% through the 12 months ending in May and 0.6% in May. Energy costs rose 4.4% in May, and surged 17.4% over the 12 months ending in May; transportation costs increased 2% in May, and jumped 8.1% over the 12 months ending in May. The price of food increased 0.3% in May, and jumped 5.1% during the 12 months ending in May. The price of milk increased 10.2% over the 12 months. The price of clothing fell 0.2% in May, and decreased 0.4% over the 12 months. The core CPI rose 0.2% in May and 2.3% during the 12 months ending in May.

Source: CNN, June 13, 2008

a. Which components of the CPI basket experienced price increases (i) faster than the average and (ii) slower than the average?

b. Distinguish between the CPI and the core CPI. Why might the core CPI be a useful measurement and why might it be misleading?

20. Dress for Less

Since 1998, the price of the Louis Vuitton “Speedy” handbag has more than doubled, to $685, while the price of Joe Boxer’s “licky face” underwear has dropped by nearly half, to $8.99. As luxury fashion has become more expensive, mainstream apparel has become markedly less so. Clothing is one of the few categories in the CPI in which overall prices have declined—about 10 percent—since 1998.


a. What percentage of the CPI basket does apparel comprise?

b. If luxury clothing prices have increased dramatically since the late 1990s, why has the clothing category of the CPI actually declined by about 10 percent?
Employment and Unemployment

21. What is the unemployment rate supposed to measure and why is it an imperfect measure?

22. The Bureau of Labor Statistics reported the following data for 2005:
   - Labor force participation rate: 66 percent
   - Working-age population: 226 million
   - Employment-to-population ratio: 62.7

   Calculate the:
   a. Labor force.
   b. Employment.
   c. Unemployment rate.

23. In the New Orleans metropolitan area in August 2005, the labor force was 634,512 and 35,222 people were unemployed. In September 2005 following Hurricane Katrina, the labor force fell by 156,518 and the number employed fell by 206,024. Calculate the unemployment rate in August 2005 and in September 2005.

24. The BLS reported the following data: In July 2010, employment declined by 131,000 but the unemployment rate was unchanged at 9.5 percent. About 2.6 million persons were marginally attached to the labor force and among the marginally attached, 1.2 million workers were discouraged.
   a. Calculate the change in unemployment in July 2010.
   b. With 2.6 million marginally attached workers and 1.2 million of them discouraged workers, what are the characteristics of the other 1.4 million marginally attached workers?

25. A high unemployment rate tells us a large percentage of the labor force is unemployed, but it doesn’t tell us why the unemployment rate is high. What measure of unemployment tells us if (i) people are taking longer than usual to find a job, (ii) more people are economic part-time workers, or (iii) more unemployed people are job losers?

26. Some Firms Struggle to Hire Despite High Unemployment

   With about 15 million Americans looking for work, some employers are swamped with job applicants, but many employers can’t hire enough workers. What has changed in the jobs market? During the recession, millions of middle-skill, middle-wage jobs disappeared. Now with the recovery, these people can’t find the skilled jobs that they seek and have a hard time adjusting to lower-skilled work with less pay.

   Source: The Wall Street Journal, August 9, 2010

   How will extending the period over which the government is willing to pay unemployment benefits to 99 weeks influence the cost of unemployment?

27. Why might the unemployment rate underestimate the underutilization of labor resources?

Unemployment and Full Employment

Use the following data to work Problems 28 and 29.

The IMF World Economic Outlook reports the following unemployment rates:

<table>
<thead>
<tr>
<th>Region</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>4.6</td>
<td>5.4</td>
</tr>
<tr>
<td>Euro area</td>
<td>7.4</td>
<td>7.3</td>
</tr>
<tr>
<td>Japan</td>
<td>3.9</td>
<td>3.9</td>
</tr>
</tbody>
</table>

28. What do these numbers tell you about the phase of the business cycle in the United States, Euro area, and Japan in 2008?

29. What do these numbers tell us about the relative size of the natural unemployment rates in the United States, the Euro area, and Japan?

30. Do these numbers tell us anything about the relative size of the labor force participation rates and employment-to-population ratios in the three regions?

31. A Half-Year of Job Losses

   Employers trimmed jobs in June for the sixth straight month, with the total for the first six months at 438,000 jobs lost by the U.S. economy. The job losses in June were concentrated in manufacturing and construction, two sectors that have been badly battered in the recession.

   Source: CNN, July 3, 2008

   a. Based on the news clip, what might be the main source of increased unemployment?
   b. Based on the news clip, what might be the main type of increased unemployment?
32. Governor Plans to Boost Economy with Eco-friendly Jobs

Oregon’s 5.6 percent unemployment rate hovers close to the national average of 5.5 percent. A few years ago, Oregon had one of the highest unemployment rates in the nation. To avoid rising unemployment, Oregon Governor Kulongoski introduced a plan that provides public schools and universities with enough state funds to meet growing demand for skilled workers. Also, Kulongoski wants to use state and federal money for bridges, roads, and buildings to stimulate more construction jobs.

Source: The Oregonian, July 8, 2008

a. What is the main type of unemployment that Governor Kulongoski is using policies to avoid? Explain.

b. How might these policies impact Oregon’s natural unemployment rate? Explain.

The Price Level, Inflation, and Deflation

33. A typical family on Sandy Island consumes only juice and cloth. Last year, which was the base year, the family spent $40 on juice and $25 on cloth. In the base year, juice was $4 a bottle and cloth was $5 a length. This year, juice is $4 a bottle and cloth is $6 a length. Calculate

a. The CPI basket.

b. The CPI in the current year.

c. The inflation rate in the current year.

34. Amazon.com agreed to pay its workers $20 an hour in 1999 and $22 an hour in 2001. The price level for these years was 166 in 1999 and 180 in 2001. Calculate the real wage rate in each year. Did these workers really get a pay raise between 1999 and 2001?

35. News release

In June 2010, real personal consumption expenditure (PCE) was $9,283.4 billion and the PCE deflator was 110.8. In July 2010, real personal consumption expenditure was $9,301.3 billion and personal consumption expenditure was $10,325.5 billion.

Source: Bureau of Economic Analysis, August 30, 2010

Calculate personal consumption expenditure in June 2010 and the PCE deflator in July 2010. Was the percentage increase in real personal consumption expenditure greater or smaller than that in personal consumption expenditure?

36. After you have studied Reading Between the Lines on pp. 122–123 answer the following questions.

a. When did the unemployment rate peak after the 2008–2009 recession?

b. What might we conclude from the three unemployment measures in Fig. 2 (p. 123)?

c. Why might unemployment benefits influence the unemployment rate?

d. Do unemployment benefits influence cyclical unemployment or natural unemployment? Explain.

e. Is the rise in unemployment after mid-2009 most likely cyclical, structural, or frictional? Explain.

f. Suggest some actions that the U.S. government might take to create more jobs.

37. Out of a Job and Out of Luck at 54

Too young to retire, too old to get a new job. That’s how many older workers feel after getting the pink slip and spending time on the unemployment line. Many lack the skills to craft resumes and search online, experts say. Older workers took an average of 21.1 weeks to land a new job in 2007, about 5 weeks longer than younger people. “Older workers will be more adversely affected because of the time it takes to transition into another job,” said Deborah Russell, AARP’s director of workforce issues.

Source: CNN, May 21, 2008

a. What type of unemployment might older workers be more prone to experience?

b. Explain how the unemployment rate of older workers is influenced by the business cycle.

c. Why might older unemployed workers become marginally attached or discouraged workers during a recession?

Data Graphing

Use the Data Grapher in MyEconLab to work Problems 38 to 40.

38. In which country in 2009 was the unemployment rate highest and in which was it lowest: Canada, Japan, France, or the United States?

39. In which country in 2009 was the inflation rate highest and in which was it lowest: Australia, United Kingdom, France, or the United States?

40. Make a scatter diagram of U.S. inflation and unemployment. Describe the relationship.
The Big Picture

Macroconomics is a large and controversial subject that is interlaced with political ideological disputes. And it is a field in which charlatans as well as serious thinkers have much to say.

You have just learned in Chapters 4 and 5 how we monitor and measure the main macroeconomic variables. We use real GDP to calculate the rate of economic growth and business cycle fluctuations. And we use the CPI and other measures of the price level to calculate the inflation rate and to “deflate” nominal values to find real values.

In the chapters that lie ahead, you will learn the theories that economists have developed to explain economic growth, fluctuations, and inflation.

First, in Chapters 6 through 9, you will study the long-term trends. This material is central to the oldest question in macroeconomics that Adam Smith tried to answer: What are the causes of the wealth of nations? You will also study three other old questions that Adam Smith’s contemporary and friend David Hume first addressed: What causes inflation? What causes international deficits and surpluses? And why do exchange rates fluctuate?

In Chapters 10 through 12, you will study macroeconomic fluctuations.

Finally, in Chapters 13 and 14, you will study the policies that the federal government and Federal Reserve might adopt to make the economy perform well.

David Hume, a Scot who lived from 1711 to 1776, did not call himself an economist. “Philosophy and general learning” is how he described the subject of his life’s work. Hume was an extraordinary thinker and writer. Published in 1742, his Essays, Moral and Political, range across economics, political science, moral philosophy, history, literature, ethics, and religion and explore such topics as love, marriage, divorce, suicide, death, and the immortality of the soul.

His economic essays provide astonishing insights into the forces that cause inflation, business cycle fluctuations, balance of payments deficits, and interest rate fluctuations; and they explain the effects of taxes and government deficits and debts.

Data were scarce in Hume’s day, so he was not able to draw on detailed evidence to support his analysis. But he was empirical. He repeatedly appealed to experience and evidence as the ultimate judge of the validity of an argument. Hume’s fundamentally empirical approach dominates macroeconomics today.

“... in every kingdom into which money begins to flow in greater abundance than formerly, everything takes a new face: labor and industry gain life; the merchant becomes more enterprising, the manufacturer more diligent and skillful, and even the farmer follows his plow with greater alacrity and attention.”

DAVID HUME
Essays, Moral and Political
The combination of these shocks brought an unusually large decrease in real GDP and increase in unemployment. These shocks also severely disrupted international trade and financial markets and triggered the largest ever fiscal and monetary stimulus measures.

When did the recession begin and end and why is the recovery so painfully slow?

The National Bureau of Economic Research (with whom I am affiliated as a Research Associate) is the arbiter of when a recession begins and ends and the Bureau declared the recession began in December 2007 and ended in June 2009. So the U.S. economy is now in the second year of recovery from the worst recession in 75 years. But the recovery to date has been sluggish. Unemployment remains high and eco-
RICHARD H. CLARIDA is the C. Lowell Harriss Professor of Economics at Columbia University, where he has taught since 1988. He graduated with highest honors from the University of Illinois at Urbana in 1979 and received his masters and Ph.D. in Economics from Harvard University in 1983, writing his dissertation under the supervision of Benjamin Friedman.

Professor Clarida has taught at Yale University and held public service positions as Senior Staff Economist with the President’s Council of Economic Advisers in President Ronald Reagan’s Administration and most recently as Assistant Secretary of the Treasury for Economic Policy in the Administration of President George W. Bush. He has also been a visiting scholar at the International Monetary Fund and at many central banks around the world, including the Federal Reserve, the European Central Bank, the Bank of Canada, the Deutsche Bundesbank, the Bank of Italy, and the Bank of England.

Professor Clarida has published a large number of important articles in leading academic journals and books on monetary policy, exchange rates, interest rates, and international capital flows.

Michael Parkin talked with Richard Clarida about his research and some of the macroeconomic policy challenges facing the United States and the world today.

Economic growth, while positive, has been much slower than in a typical recovery. This is because the U.S. economy continues to suffer the consequences of the significant negative shocks that caused the recession. The bursting of the housing bubble, the financial crisis, and the credit crunch continue to hamper bank lending.

The collapse of the housing market and the financial crisis have forced U.S. households to reduce borrowing and increase savings, which has brought a further negative shock to aggregate demand that fiscal and monetary policy have been unable to fully offset.

Research by the International Monetary Fund has found that recoveries from recessions associated with financial crises are usually sluggish, with slower growth and higher unemployment than recoveries that are not associated with financial crises. In this case—I hope my forecast is wrong—it would seem that the United States runs the risk of going through a sustained period of slow growth.

As the recovery gains momentum, do you think we might have a period of stagflation like the 1970s?

Because of the recession, inflation in the United States was well below two percent, the level that the Fed and most central banks strive for. This is mostly due to the large output gap that opened up during the recession as well as surprisingly strong productivity growth. Despite these trends, measures of expected inflation remain well anchored at around 2 percent. Stagflation is not a near-term risk.

The Fed has an implicit target for inflation over a horizon of three years. It realizes that monetary policy operates with long lags, so it seeks to set a path for policy that it expects will bring inflation to two percent over several years.

If inflation expectations start to drift up, I am confident that the Fed will eventually do what it takes to keep inflation around the two percent level.

Is the current account deficit sustainable? Do you see it correcting?

The U.S. current account deficit has been shrinking as a share of GDP for almost two years. In a growing global economy, with the dollar as reserve currency, the United States can run a sustainable current account deficit of two to three percent of GDP forever. Over time, as budget deficits fall and a more competitive dollar boosts exports, the current account deficit should stabilize at the high end of this range.

In the past, the dollar has been relatively strong when compared to the euro, the pound and the yen, but now we are experiencing a weaker dollar with drastically unfavorable exchange rates. Is the dollar going to continue to go down? Does it matter?

The dollar has been trending down for some time and I expect this to continue. The United States is
The United States is now lagging, not leading global growth, and the share of dollars in global portfolios will continue to trend down. I don’t see a free fall or crash landing in the dollar, if only because the euro, at this time, is not a viable alternative.

Why isn’t the euro a viable alternative to the dollar? At this time there isn’t an integrated financial market in Europe. There is a collection of a dozen markets. Also, with the privileges of being a global reserve currency come obligations. Global growth drives growing global demand for currency of the reserve country and this implies that the reserve currency country on average, runs a balance of payments deficit as Britain did until World War I and as the United States has since the 1960s.

Many central banks around the world, including those at which you’ve been a visiting scholar, have an explicit inflation target. Should the Fed target inflation like these other central banks do?

The Fed has a dual mandate to keep prices stable and the economy at full employment. I do not foresee the Fed changing this mandate. But through its communication strategy, the Fed has moved pretty close to an inflation forecast target.

With the deep and sustained recession and the record low interest rates, has fiscal policy been reinstated as a stabilization tool?

Given the huge impact that falling house prices had on wealth and the balance sheets of financial institutions, fiscal policy is proving to be a necessary tool in the cycle to complement monetary policy. However, the ‘bang per buck’, or multiplier from fiscal policy, was less than many expected. This was because the impairment of credit markets and a desire to rebuild savings offset much of the impact of fiscal policy.

The world economy has been getting much attention in the press, as many Asian countries are growing in global market share in emerging and established industries. Are China and India going to keep nudging double digit growth rates for the foreseeable future?

I am bullish on global growth prospects for the next five years for China, India, and the many other “emerging” economies that are benefiting from a combination of favorable fundamentals and globalization.

Is China’s exchange rate policy a problem for the United States?

China is allowing its currency to appreciate versus the dollar and will continue to do so. This is in China’s interest as much as it is in the United States’ interest. China in recent years has seen a sharp rise in inflation and a surge in capital inflows in anticipation that its currency will strengthen. China has and will continue to allow its currency to strengthen in order to reduce inflation and short term capital inflows.

What is your advice to a student who is just starting to study economics? Is it a good subject in which to major? What other subjects work well with it?

It won’t surprise you to learn that I think economics is an excellent subject in which to major. In many colleges, including Columbia, it is among the most popular majors. My advice would be to take a broad range of electives and to avoid the temptation to specialize in one narrow area of economics. Also, do as much data, statistics, and presentation work as you can. You will learn the most when you have to explain yourself to others.
ECONOMIC GROWTH

Real GDP per person in the United States tripled between 1960 and 2010. If you live in a dorm that was built during the 1960s, it is likely to have just two power outlets: one for a desk lamp and one for a bedside lamp. Today, with the help of a power bar (or two), your room bulges with a personal computer, television and DVD player, microwave, refrigerator, coffeeemaker, and toaster—and the list goes on. Economic growth has brought about this improvement in living standards.

We see even greater economic growth in modern Asia. At the mouth of the Yangtze River in one of the world’s great cities, Shanghai, people are creating businesses, investing in new technologies, developing local and global markets, and transforming their lives. Incomes have tripled not in 50 years but in the 13 years since 1997. In the summer of 2010, China overtook Japan as the world’s second largest economy. Why are incomes in China growing so rapidly?

In this chapter, we study the forces that make real GDP grow. In Reading Between the Lines at the end of the chapter, we return to the economic growth of China and see how it compares with that of Japan and the United States.
**The Basics of Economic Growth**

Economic growth is a sustained expansion of production possibilities measured as the increase in real GDP over a given period. Rapid economic growth maintained over a number of years can transform a poor nation into a rich one. Such have been the stories of Hong Kong, South Korea, and some other Asian economies. Slow economic growth or the absence of growth can condemn a nation to devastating poverty. Such has been the fate of Sierra Leone, Somalia, Zambia, and much of the rest of Africa.

The goal of this chapter is to help you to understand why some economies expand rapidly and others stagnate. We'll begin by learning how to calculate the economic growth rate and by discovering the magic of sustained growth.

**Calculating Growth Rates**

We express the economic growth rate as the annual percentage change of real GDP. To calculate this growth rate, we use the formula:

\[
\text{Real GDP growth rate} = \frac{\text{Real GDP in current year} - \text{Real GDP in previous year}}{\text{Real GDP in previous year}} \times 100.
\]

For example, if real GDP in the current year is $11 trillion and if real GDP in the previous year was $10 trillion, then the economic growth rate is 10 percent.

The standard of living depends on real GDP per person (also called *per capita* real GDP), which is real GDP divided by the population. So the contribution of real GDP growth to the change in the standard of living depends on the growth rate of real GDP per person. We use the above formula to calculate this growth rate, replacing real GDP with real GDP per person.

Suppose, for example, that in the current year, when real GDP is $11 trillion, the population is 202 million. Then real GDP per person is $11 trillion divided by 202 million, which equals $54,455. And suppose that in the previous year, when real GDP was $10 trillion, the population was 200 million. Then real GDP per person in that year was $10 trillion divided by 200 million, which equals $50,000.

Use these two values of real GDP per person with the growth formula above to calculate the growth rate of real GDP per person. That is,

\[
\text{Real GDP per person growth rate} = \frac{\$54,455 - \$50,000}{\$50,000} \times 100 = 8.9 \text{ percent}.
\]

The growth rate of real GDP per person can also be calculated (approximately) by subtracting the population growth rate from the real GDP growth rate. In the example you've just worked through, the growth rate of real GDP is 10 percent. The population changes from 200 million to 202 million, so the population growth rate is 1 percent. The growth rate of real GDP per person is approximately equal to 10 percent minus 1 percent, which equals 9 percent.

Real GDP per person grows only if real GDP grows faster than the population grows. If the growth rate of the population exceeds the growth of real GDP, then real GDP per person falls.

**The Magic of Sustained Growth**

Sustained growth of real GDP per person can transform a poor society into a wealthy one. The reason is that economic growth is like compound interest.

**Compound Interest** Suppose that you put $100 in the bank and earn 5 percent a year interest on it. After one year, you have $105. If you leave that $105 in the bank for another year, you earn 5 percent interest on the original $100 and on the $5 interest that you earned last year. You are now earning interest on interest! The next year, things get even better. Then you earn 5 percent on the original $100 and on the interest earned in the first year and the second year. You are even earning interest on the interest that you earned on the interest of the first year.

Your money in the bank is growing at a rate of 5 percent a year. Before too many years have passed, your initial deposit of $100 will have grown to $200. But after how many years?

The answer is provided by a formula called the **Rule of 70**, which states that the number of years it takes for the level of any variable to double is approx-
Immediately 70 divided by the annual percentage growth rate of the variable. Using the Rule of 70, you can now calculate how many years it takes your $100 to become $200. It is 70 divided by 5, which is 14 years.

**Applying the Rule of 70**

The Rule of 70 applies to any variable, so it applies to real GDP per person. Figure 6.1 shows the doubling time for growth rates of 1 percent per year to 12 percent per year.

You can see that real GDP per person doubles in 70 years (70 divided by 1)—an average human life span—if the growth rate is 1 percent a year. It doubles in 35 years if the growth rate is 2 percent a year and in just 10 years if the growth rate is 7 percent a year.

We can use the Rule of 70 to answer other questions about economic growth. For example, in 2010, U.S. real GDP per person was approximately 4 times that of China. China’s recent growth rate of real GDP per person was 10 percent a year. If this growth rate were maintained, how long would it take China’s real GDP per person to reach that of the United States in 2010? The answer, provided by the Rule of 70, is 14 years. China’s real GDP per person doubles in 7 years (70 divided by 10). It doubles again to 4 times its current level in another 7 years. So after 14 years of growth at 10 percent a year, China’s real GDP per person is 4 times its current level and equals that of the United States in 2010. Of course, after 14 years, U.S. real GDP per person would have increased, so China would still not have caught up to the United States. But at the current growth rates, China’s real GDP per person will equal that of the United States by 2026.

**REVIEW QUIZ**

1. What is economic growth and how do we calculate its rate?
2. What is the relationship between the growth rate of real GDP and the growth rate of real GDP per person?
3. Use the Rule of 70 to calculate the growth rate that leads to a doubling of real GDP per person in 20 years.

You can work these questions in Study Plan 6.1 and get instant feedback.
**Economic Growth Trends**

You have just seen the power of economic growth to increase incomes. At a 1 percent growth rate, it takes a human life span to double the standard of living. But at a 7 percent growth rate, the standard of living doubles every decade. How fast is our economy growing? How fast are other economies growing? Are poor countries catching up to rich ones, or do the gaps between the rich and poor persist or even widen? Let’s answer these questions.

**Growth in the U.S. Economy**

Figure 6.2 shows real GDP per person in the United States for the hundred years from 1910 to 2010. The red line is actual real GDP and the black line (that starts in 1949) is potential GDP. The trend in potential GDP tells us about economic growth. Fluctuations around potential GDP tell us about the business cycle.

Two extraordinary events dominate the graph: the Great Depression of the 1930s, when growth stopped for a decade, and World War II of the 1940s, when growth briefly exploded.

For the century as a whole, the average growth rate was 2 percent a year. But the growth rate has not remained constant. From 1910 to the onset of the Great Depression in 1929, the average growth rate was a bit lower than the century average at 1.8 percent a year. Between 1930 and 1950, averaging out the Great Depression and World War II, the growth rate was 2.4 percent a year. After World War II, the growth rate started out at 2 percent a year. It then increased and growth averaged 3 percent a year during the 1960s. In 1973, and lasting for a decade, the growth rate slowed. Growth picked up somewhat during the 1980s and even more during the 1990s dot.com expansion. But the growth rate never returned to the pace achieved during the fast-growing 1960s.

A major goal of this chapter is to explain why our economy grows and why the growth rate changes. Another goal is to explain variations in the economic growth rate across countries. Let’s now look at some of these growth rates.

**FIGURE 6.2 A Hundred Years of Economic Growth in the United States**

During the 100 years from 1910 to 2010, real GDP per person in the United States grew by 2 percent a year, on average. The growth rate was greater after World War II than it was before the Great Depression. Growth was most rapid during the 1960s. It slowed during the 1970s and speeded up again during the 1980s and 1990s, but it never returned to its 1960s’ rate.

Real GDP Growth in the World Economy

Figure 6.3 shows real GDP per person in the United States and in other countries between 1960 and 2010. Part (a) looks at the seven richest countries—known as the G7 nations. Among these nations, the United States has the highest real GDP per person. In 2010, Canada had the second-highest real GDP per person, ahead of Japan and France, Germany, Italy, and the United Kingdom (collectively the Europe Big 4).

During the fifty years shown here, the gaps between the United States, Canada, and the Europe Big 4 have been almost constant. But starting from a long way below, Japan grew fastest. It caught up to Europe in 1970 and to Canada in 1990. But during the 1990s, Japan’s economy stagnated.

Many other countries are growing more slowly than, and falling farther behind, the United States. Figure 6.3(b) looks at some of these countries.

Real GDP per person in Central and South America was 28 percent of the U.S. level in 1960. It grew more quickly than the United States and reached 30 percent of the U.S. level by 1980, but then growth slowed and by 2010, real GDP per person in these countries was 23 percent of the U.S. level.

In Eastern Europe, real GDP per person has grown more slowly than anywhere except Africa, and fell from 32 percent of the U.S. level in 1980 to 19 percent in 2003 and then increased again to 22 percent in 2010.

Real GDP per person in Africa, the world’s poorest continent, fell from 10 percent of the U.S. level in 1960 to 5 percent in 2007 and then increased slightly to 6 percent in 2010.

CHAPTER 6 Economic Growth

Economics in Action

Fast Trains on the Same Track

Four Asian economies, Hong Kong, Korea, Singapore, and China, have experienced spectacular growth, which you can see in the figure. During the 1960s, real GDP per person in these economies ranged from 3 to 28 percent of that in the United States. But by 2010, real GDP per person in Singapore and Hong Kong had surpassed that of the United States.

The figure also shows that China is catching up rapidly but from a long way behind. China’s real GDP per person increased from 3 percent of the U.S. level in 1960 to 26 percent in 2010.

The Asian economies shown here are like fast trains running on the same track at similar speeds and with a roughly constant gap between them. Singapore and Hong Kong are hooked together as the lead train, which runs about 20 years in front of Korea and about 40 years in front of China.

Real GDP per person in Korea in 2010 was similar to that in Hong Kong in 1988, and real GDP in China in 2010 was similar to that of Hong Kong in 1976. Between 1976 and 2010, Hong Kong transformed itself from a poor developing economy into one of the richest economies in the world.

The rest of China is now doing what Hong Kong has done. China has a population 200 times that of Hong Kong and more than 4 times that of the United States. So if China continues its rapid growth, the world economy will change dramatically.

Even modest differences in economic growth rates sustained over a number of years bring enormous differences in the standard of living. And some of the differences that you’ve just seen are enormous. So the facts about economic growth in the United States and around the world raise some big questions.

What are the preconditions for economic growth? What sustains economic growth once it gets going? How can we identify the sources of economic growth and measure the contribution that each source makes? What can we do to increase the sustainable rate of economic growth?

We’re now going to address these questions and discover the causes of economic growth. We start by seeing how potential GDP is determined and what makes it grow. You will see that labor productivity growth is the key to rising living standards and go on to explore the sources of this growth.

As these fast-growing Asian economies catch up with the United States, we can expect their growth rates to slow. But it will be surprising if China’s growth rate slows much before it has closed the gap on the United States.


Review Quiz

1. What has been the average growth rate of U.S. real GDP per person over the past 100 years? In which periods was growth most rapid and in which periods was it slowest?
2. Describe the gaps between real GDP per person in the United States and in other countries. For which countries is the gap narrowing? For which is it widening? For which is it the same?
3. Compare real GDP per person and its growth rate in Hong Kong, Korea, Singapore, China, and the United States. In terms of real GDP per person, how far is China behind these others?
How Potential GDP Grows

Economic growth occurs when real GDP increases. But a one-shot rise in real GDP or a recovery from recession isn’t economic growth. Economic growth is a sustained, year-after-year increase in potential GDP.

So what determines potential GDP and what are the forces that make it grow?

What Determines Potential GDP?

Labor, capital, land, and entrepreneurship produce real GDP, and the productivity of the factors of production determines the quantity of real GDP that can be produced.

The quantity of land is fixed and on any given day, the quantities of entrepreneurial ability and capital are also fixed and their productivities are given. The quantity of labor employed is the only variable factor of production. Potential GDP is the level of real GDP when the quantity of labor employed is the full-employment quantity.

To determine potential GDP, we use a model with two components:
- An aggregate production function
- An aggregate labor market

Aggregate Production Function

When you studied the limits to production in Chapter 2 (see p. 30), you learned that the production possibilities frontier is the boundary between the combinations of goods and services that can be produced and those that cannot. We’re now going to think about the production possibilities frontier for two special “goods”: real GDP and the quantity of leisure time.

Think of real GDP as a number of big shopping carts. Each cart contains some of each kind of different goods and services produced, and one cartload of items costs $1 trillion. To say that real GDP is $13 trillion means that it is 13 very big shopping carts of goods and services.

The quantity of leisure time is the number of hours spent not working. Each leisure hour could be spent working. If we spent all our time taking leisure, we would do no work and produce nothing. Real GDP would be zero. The more leisure we forgo, the greater is the quantity of labor we supply and the greater is the quantity of real GDP produced.

But labor hours are not all equally productive. We use our most productive hours first and as more hours are worked less and less productive hours are used. So for each additional hour of leisure forgone (each additional hour of labor), real GDP increases but by successively smaller amounts.

The aggregate production function is the relationship that tells us how real GDP changes as the quantity of labor changes when all other influences on production remain the same. Figure 6.4 shows this relationship—the curve labeled PF. An increase in the quantity of labor (and a corresponding decrease in leisure hours) brings a movement along the production function and an increase in real GDP.

Aggregate Labor Market

In macroeconomics, we pretend that there is one large labor market that determines the quantity of labor employed and the quantity of real GDP produced. To see how this aggregate labor market works, we study the demand for labor, the supply of labor, and labor market equilibrium.

The Demand for Labor

The demand for labor is the relationship between the quantity of labor demanded and the real wage rate. The quantity of labor demanded is the number of labor hours hired by all the firms in the economy during a given period. This

At point A on the aggregate production function PF, 200 billion hours of labor produce $13 trillion of real GDP.
quantity depends on the price of labor, which is the real wage rate. The real wage rate is the money wage rate divided by the price level. The real wage rate is the quantity of goods and services that an hour of labor earns. It contrasts with the money wage rate, which is the number of dollars that an hour of labor earns.

The real wage rate influences the quantity of labor demanded because what matters to firms is not the number of dollars they pay (money wage rate) but how much output they must sell to earn those dollars.

The quantity of labor demanded increases as the real wage rate decreases—the demand for labor curve slopes downward. Why? The answer lies in the shape of the production function.

You’ve seen that along the production function, each additional hour of labor increases real GDP by successively smaller amounts. This tendency has a name: the law of diminishing returns. Because of diminishing returns, firms will hire more labor only if the real wage rate falls to match the fall in the extra output produced by that labor.

The Supply of Labor The supply of labor is the relationship between the quantity of labor supplied and the real wage rate. The quantity of labor supplied is the number of labor hours that all the households in the economy plan to work during a given period. This quantity depends on the real wage rate.

The real wage rate influences the quantity of labor supplied because what matters to households is not the number of dollars they earn (money wage rate) but what they can buy with those dollars.

The quantity of labor supplied increases as the real wage rate increases—the supply of labor curve slopes upward. At a higher real wage rate, more people choose to work and more people choose to work longer hours if they can earn more per hour.

Labor Market Equilibrium The price of labor is the real wage rate. The forces of supply and demand operate in labor markets just as they do in the markets for goods and services to eliminate a shortage or a surplus. But a shortage or a surplus of labor brings only a gradual change in the real wage rate. If there is a shortage of labor, the real wage rate rises to eliminate it; and if there is a surplus of labor, the real wage rate eventually falls to eliminate it. When there is neither a shortage nor a surplus, the labor market is in equilibrium—a full-employment equilibrium.

Labor market equilibrium occurs when the quantity of labor demanded equals the quantity of labor supplied. The equilibrium real wage rate is $35 an hour, and equilibrium employment is 200 billion hours per year.

At a wage rate above $35 an hour, there is a surplus of labor and the real wage rate falls to eliminate the surplus. At a wage rate below $35 an hour, there is a shortage of labor and the real wage rate rises to eliminate the shortage.

Figure 6.5 illustrates labor market equilibrium. The demand for labor curve is LD and the supply of labor curve is LS. This labor market is in equilibrium at a real wage rate of $35 an hour and 200 billion hours per year are employed.

If the real wage rate exceeds $35 an hour, the quantity of labor supplied exceeds the quantity demanded and there is a surplus of labor. When there is a surplus of labor, the real wage rate falls toward the equilibrium real wage rate where the surplus is eliminated.

If the real wage rate is less than $35 an hour, the quantity of labor demanded exceeds the quantity supplied and there is a shortage of labor. When there is a shortage of labor, the real wage rate rises toward the equilibrium real wage rate where the shortage is eliminated.

If the real wage rate is $35 an hour, the quantity of labor demanded equals the quantity supplied and...
there is neither a shortage nor a surplus of labor. In this situation, there is no pressure in either direction on the real wage rate. So the real wage rate remains constant and the market is in equilibrium. At this equilibrium real wage rate and level of employment, the economy is at full employment.

**Potential GDP** You’ve seen that the production function tells us the quantity of real GDP that a given amount of labor can produce—see Fig. 6.4. The quantity of real GDP produced increases as the quantity of labor increases. At the equilibrium quantity of labor, the economy is at full employment, and the quantity of real GDP at full employment is potential GDP. So the full-employment quantity of labor produces potential GDP.

Figure 6.6 illustrates the determination of potential GDP. Part (a) shows labor market equilibrium. At the equilibrium real wage rate, equilibrium employment is 200 billion hours. Part (b) shows the production function. With 200 billion hours of labor, the economy can produce a real GDP of $13 trillion. This amount is potential GDP.

**What Makes Potential GDP Grow?**

We can divide all the forces that make potential GDP grow into two categories:

- Growth of the supply of labor
- Growth of labor productivity

**Growth of the Supply of Labor** When the supply of labor grows, the supply of labor curve shifts rightward. The quantity of labor at a given real wage rate increases.

The quantity of labor is the number of workers employed multiplied by average hours per worker; and the number employed equals the employment-to-population ratio multiplied by the working-age population (see Chapter 5, p. 110). So the quantity of labor changes as a result of changes in

1. Average hours per worker
2. The employment-to-population ratio
3. The working-age population

Average hours per worker have decreased as the workweek has become shorter, and the employment-to-population ratio has increased as more women have entered the labor force. The combined effect of
these two factors has kept the average hours per working-age person (approximately) constant.

Growth in the supply of labor has come from growth in the working-age population. In the long run, the working-age population grows at the same rate as the total population.

**The Effects of Population Growth** Population growth brings growth in the supply of labor, but it does not change the demand for labor or the production function. The economy can produce more output by using more labor, but there is no change in the quantity of real GDP that a given quantity of labor can produce.

With an increase in the supply of labor and no change in the demand for labor, the real wage rate falls and the equilibrium quantity of labor increases. The increased quantity of labor produces more output and potential GDP increases.

**Illustrating the Effects of Population Growth** Figure 6.7 illustrates the effects of an increase in the population. In Fig. 6.7(a), the demand for labor curve is $LD$ and initially the supply of labor curve is $LS_0$. The equilibrium real wage rate is $35$ an hour and the quantity of labor is $200$ billion hours a year. In Fig. 6.7(b), the production function ($PF$) shows that with $200$ billion hours of labor employed, potential GDP is $13$ trillion at point $A$.

An increase in the population increases the supply of labor and the supply of labor curve shifts rightward to $LS_1$. At a real wage rate of $35$ an hour, there is now a surplus of labor. So the real wage rate falls. In this example, the real wage rate will fall until it reaches $25$ an hour. At $25$ an hour, the quantity of labor demanded equals the quantity of labor supplied. The equilibrium quantity of labor increases to $300$ billion a year.

Figure 6.7(b) shows the effect on real GDP. As the equilibrium quantity of labor increases from $200$ billion to $300$ billion hours, potential GDP increases along the production function from $13$ trillion to $16$ trillion at point $B$.

So an increase in the population increases the full-employment quantity of labor, increases potential GDP, and lowers the real wage rate. But the population increase decreases potential GDP per hour of labor. Initially, it was $65$ ($13$ trillion divided by $200$ billion). With the population increase, potential GDP per hour of labor is $53.33$ ($16$ trillion divided by $300$ billion). Diminishing returns are the source of the decrease in potential GDP per hour of labor.

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**FIGURE 6.7** The Effects of an Increase in Population

(a) The labor market

(b) Potential GDP

An increase in the population increases the supply of labor. In part (a), the supply of labor curve shifts rightward. The real wage rate falls and aggregate labor hours increase. In part (b), the increase in aggregate labor hours brings an increase in potential GDP. But diminishing returns bring a decrease in potential GDP per hour of labor.
How Potential GDP Grows

**Growth of Labor Productivity** Labor productivity is the quantity of real GDP produced by an hour of labor. It is calculated by dividing real GDP by aggregate labor hours. For example, if real GDP is $13 trillion and aggregate hours are 200 billion, labor productivity is $65 per hour.

When labor productivity grows, real GDP per person grows and brings a rising standard of living. Let’s see how an increase in labor productivity changes potential GDP.

**Effects of an Increase in Labor Productivity** If labor productivity increases, production possibilities expand. The quantity of real GDP that any given quantity of labor can produce increases. If labor is more productive, firms are willing to pay more for a given number of hours of labor so the demand for labor also increases.

With an increase in the demand for labor and no change in the supply of labor, the real wage rate rises and the quantity of labor supplied increases. The equilibrium quantity of labor also increases.

So an increase in labor productivity increases potential GDP for two reasons: Labor is more productive and more labor is employed.

**Illustrating the Effects of an Increase in Labor Productivity** Figure 6.8 illustrates the effects of an increase in labor productivity.

In part (a), the production function initially is $PF_0$. With 200 billion hours of labor employed, potential GDP is $13$ trillion at point $A$.

In part (b), the demand for labor curve is $LD_0$ and the supply of labor curve is $LS$. The real wage rate is $35$ an hour, and the equilibrium quantity of labor is 200 billion hours a year.

Now labor productivity increases. In Fig. 6.8(a), the increase in labor productivity shifts the production function upward to $PF_1$. At each quantity of labor, more real GDP can be produced. For example, at 200 billion hours, the economy can now produce $18$ trillion of real GDP at point $B$.

In Fig. 6.8(b), the increase in labor productivity increases the demand for labor and the demand for labor curve shifts rightward to $LD_1$. At the initial real wage rate of $35$ an hour, there is now a shortage of labor. The real wage rate rises. In this example, the real wage rate will rise until it reaches $45$ an hour. At $45$ an hour, the quantity of labor demanded equals the quantity of labor supplied and the equilibrium quantity of labor is 225 billion hours a year.

![Figure 6.8 The Effects of an Increase in Labor Productivity](image)

(b) The labor market

An increase in labor productivity shifts the production function upward from $PF_0$ to $PF_1$ in part (a) and shifts the demand for labor curve rightward from $LD_0$ to $LD_1$ in part (b). The real wage rate rises to $45$ an hour, and aggregate labor hours increase from 200 billion to 225 billion. Potential GDP increases from $13$ trillion to $19$ trillion.
Why Labor Productivity Grows

You've seen that labor productivity growth makes potential GDP grow; and you've seen that labor productivity growth is essential if real GDP per person and the standard of living are to grow. But why does labor productivity grow? What are the preconditions that make labor productivity growth possible and what are the forces that make it grow? Why does labor productivity grow faster at some times and in some places than others?

Preconditions for Labor Productivity Growth

The fundamental precondition for labor productivity growth is the incentive system created by firms, markets, property rights, and money. These four social institutions are the same as those described in Chapter 2 (see pp. 41–42) that enable people to gain by specializing and trading.

Labor productivity is the key to increasing output per hour of labor and rising living standards. But what brings an increase in labor productivity? The next section answers this question.

Economics in Action

Intellectual Property Rights Propel Growth

In 1760, when the states that 16 years later would become the United States of America were developing agricultural economies, England was on the cusp of an economic revolution, the Industrial Revolution.

For 70 dazzling years, technological advances in the use of steam power, the manufacture of cotton, wool, iron, and steel, and in transportation, accompanied by massive capital investment associated with these technologies, transformed the economy of England. Incomes rose and brought an explosion in an increasingly urbanized population.

By 1825, advances in steam technology had reached a level of sophistication that enabled Robert Stevenson to build the world's first steam-powered rail engine (the Rocket pictured here) and the birth of the world's first railroad.


England's patent system began with the Statute of Monopolies of 1624, which gave inventors a monopoly to use their idea for a term of 14 years. For about 100 years, the system was used to reward friends of the

REVIEW QUIZ

1. What is the aggregate production function?
2. What determines the demand for labor, the supply of labor, and labor market equilibrium?
3. What determines potential GDP?
4. What are the two broad sources of potential GDP growth?
5. What are the effects of an increase in the population on potential GDP, the quantity of labor, the real wage rate, and potential GDP per hour of labor?
6. What are the effects of an increase in labor productivity on potential GDP, the quantity of labor, the real wage rate, and potential GDP per hour of labor?

You can work these questions in Study Plan 6.3 and get instant feedback.
Why Labor Productivity Grows

It was the presence of secure property rights in Britain in the middle 1700s that got the Industrial Revolution going (see Economics in Action below). And it is their absence in some parts of Africa today that is keeping labor productivity stagnant.

With the preconditions for labor productivity growth in place, three things influence its pace:
- Physical capital growth
- Human capital growth
- Technological advances

Physical Capital Growth
As the amount of capital per worker increases, labor productivity also increases. Production processes that use hand tools can create beautiful objects, but production methods that use large amounts of capital per worker are much more productive. The accumulation of capital on farms, in textile factories, in iron foundries and steel mills, in coal mines, on building sites, in chemical plants, in auto plants, in banks and insurance companies, and in shopping malls has added incredibly to the labor productivity of our economy. The next time you see a movie that is set in the Old West or colonial times, look carefully at the small amount of capital around. Try to imagine how productive you would be in such circumstances compared with your productivity today.

Human Capital Growth
Human capital—the accumulated skill and knowledge of human beings—is the fundamental source of labor productivity growth. Human capital grows when a new discovery is made and it grows as more and more people learn how to use past discoveries. The development of one of the most basic human skills—writing—was the source of some of the earliest major gains in productivity. The ability to keep written records made it possible to reap ever-larger gains from specialization and trade. Imagine how hard it would be to do any kind of business if all the accounts, invoices, and agreements existed only in people's memories.

Later, the development of mathematics laid the foundation for the eventual expansion of knowledge about physical forces and chemical and biological processes. This base of scientific knowledge was the foundation for the technological advances of the Industrial Revolution and of today’s information revolution.

But a lot of human capital that is extremely productive is much more humble. It takes the form of millions of individuals learning and becoming remarkably more productive by repetitively doing simple production tasks. One much-studied example of this type of human capital growth occurred in World War II. With no change in physical capital, thousands of workers and managers in U.S. shipyards learned from experience and accumulated human capital that more than doubled their productivity in less than two years.

Technological Advances
The accumulation of physical capital and human capital have made a large contribution to labor productivity growth. But technological change—the discovery and the application of new technologies—has made an even greater contribution.
Labor is many times more productive today than it was a hundred years ago but not because we have more steam engines and more horse-drawn carriages per person. Rather, it is because we have transportation equipment that uses technologies that were unknown a hundred years ago and that are more productive than the old technologies were.

Technological advance arises from formal research and development programs and from informal trial and error, and it involves discovering new ways of getting more out of our resources.

To reap the benefits of technological change, capital must increase. Some of the most powerful and far-reaching fundamental technologies are embodied in human capital—for example, language, writing, and mathematics. But most technologies are embodied in physical capital. For example, to reap the benefits of the internal combustion engine, millions of horse-drawn carriages had to be replaced with automobiles; and to reap the benefits of digital music, millions of Discmans had to be replaced by iPods.

Figure 6.9 summarizes the sources of labor productivity growth and more broadly of real GDP growth. The figure also emphasizes that for real GDP per person to grow, real GDP must grow faster than the population.
Growth Theories, Evidence, and Policies

You’ve seen how population growth and labor productivity growth make potential GDP grow. You’ve also seen that the growth of physical capital and human capital and technological advances make labor productivity grow. How do all these factors interact? What is cause and what is effect? Growth theories address these questions.

Alternative theories of economic growth provide insights into the process of economic growth, but none provides a complete and definite answer to the basic questions: What causes economic growth and why do growth rates vary? Economics has some way to go before it can provide definite answers to these questions. We look at the current state of the empirical evidence. Finally, we’ll look at the policies that might achieve faster growth.

Let’s start by studying the three main theories of economic growth:

- Classical growth theory
- Neoclassical growth theory
- New growth theory

Classical Growth Theory

Classical growth theory is the view that the growth of real GDP per person is temporary and that when it rises above the subsistence level, a population explosion eventually brings it back to the subsistence level. Adam Smith, Thomas Robert Malthus, and David Ricardo—the leading economists of the late eighteenth century and early nineteenth century—proposed this theory, but the view is most closely associated with the name of Malthus and is sometimes called the Malthusian theory. Charles Darwin’s ideas about evolution by natural selection were inspired by the insights of Malthus.

Modern-Day Malthusians Many people today are Malthusians. They say that if today’s global population of 6.9 billion explodes to 11 billion by 2050 and perhaps 35 billion by 2300, we will run out of resources, real GDP per person will decline, and we will return to a primitive standard of living. We must, say Malthusians, contain population growth.

Modern-day Malthusians also point to global warming and climate change as reasons to believe that eventually, real GDP per person will decrease.

Neoclassical Growth Theory

Neoclassical growth theory is the proposition that real GDP per person grows because technological change induces saving and investment that make capital per hour of labor grow. Growth ends if technological change stops because of diminishing marginal returns to both labor and capital. Robert Solow of MIT suggested the most popular version of this growth theory in the 1950s.

Neoclassical growth theory’s big break with its classical predecessor is its view about population growth.

The Neoclassical Theory of Population Growth The population explosion of eighteenth century Europe that created the classical theory of population eventually ended. The birth rate fell, and while the population continued to increase, its rate of increase moderated.

The key economic influence that slowed the population growth rate is the opportunity cost of a woman’s time. As women’s wage rates increase and their job opportunities expand, the opportunity cost of having children increases. Faced with a higher opportunity cost, families choose to have fewer children and the birth rate falls.

Technological advances that bring higher incomes also bring advances in health care that extends lives. So as incomes increase, both the birth rate and the death rate decrease. These opposing forces offset each other and result in a slowly rising population.

This modern view of population growth and the historical trends that support it contradict the views of the classical economists. They also call into question the modern doomsday view that the planet will be swamped with more people than it can support.

Technological Change and Diminishing Returns In neoclassical growth theory, the pace of technological change influences the economic growth rate but economic growth does not influence the pace of technological change. It is assumed that technological change results from chance. When we’re lucky, we have rapid technological change, and when bad luck strikes, the pace of technological advance slows.

To understand neoclassical growth theory, imagine the world of the mid-1950s, when Robert Solow is explaining his idea. Income per person is around $12,000 a year in today’s money. The population is growing at about 1 percent a year. Saving and investment are about 20 percent of GDP, enough to keep the quantity of capital per hour of labor constant. Income per person is growing but not very fast.
Then technology begins to advance at a more rapid pace across a range of activities. The transistor revolutionizes an emerging electronics industry. New plastics revolutionize the manufacture of household appliances. The interstate highway system revolutionizes road transportation. Jet airliners start to replace piston-engine airplanes and speed air transportation.

These technological advances bring new profit opportunities. Businesses expand, and new businesses are created to exploit the newly available profitable technologies. Investment and saving increase. The economy enjoys new levels of prosperity and growth. But will the prosperity last? And will the growth last? Neoclassical growth theory says that the prosperity will last but the growth will not last unless technology keeps advancing.

According to neoclassical growth theory, the prosperity will persist because there is no classical population growth to induce the wage rate to fall. So the gains in income per person are permanent. But growth will eventually stop if technology stops advancing because of diminishing marginal returns to capital. The high profit rates that result from technological change bring increased saving and capital accumulation. But as more capital is accumulated, more and more projects are undertaken that have lower rates of return—diminishing marginal returns. As the return on capital falls, the incentive to keep investing weakens. With weaker incentives to save and invest, saving decreases and the rate of capital accumulation slows. Eventually, the pace of capital accumulation slows so that it is only keeping up with population growth. Capital per worker remains constant.

**A Problem with Neoclassical Growth Theory**

All economies have access to the same technologies, and capital is free to roam the globe, seeking the highest available real interest rate. Capital will flow until rates of return are equal, and rates of return will be equal when capital per hour of labor are equal. Real GDP growth rates and income levels per person around the world will converge. Figure 6.3 on p. 137 shows that while there is some sign of convergence among the rich countries in part (a), convergence is slow, and part (b) shows that it does not appear to be imminent for all countries. New growth theory overcomes this shortcoming of neoclassical growth theory. It also explains what determines the pace of technological change.

**New Growth Theory**

New growth theory holds that real GDP per person grows because of the choices people make in the pursuit of profit and that growth will persist indefinitely. Paul Romer of Stanford University developed this theory during the 1980s, based on ideas of Joseph Schumpeter during the 1930s and 1940s.

According to the new growth theory, the pace at which new discoveries are made—and at which technology advances—is not determined by chance. It depends on how many people are looking for a new technology and how intensively they are looking. The search for new technologies is driven by incentives.

Profit is the spur to technological change. The forces of competition squeeze profits, so to increase profit, people constantly seek either lower-cost methods of production or new and better products for which people are willing to pay a higher price. Inventors can maintain a profit for several years by taking out a patent or a copyright, but eventually, a new discovery is copied, and profits disappear. So more research and development is undertaken in the hope of creating a new burst of profitable investment and growth.

Two facts about discoveries and technological knowledge play a key role in the new growth theory: Discoveries are (at least eventually) a public capital good; and knowledge is capital that is not subject to diminishing marginal returns.

Economists call a good a public good when no one can be excluded from using it and when one person's use does not prevent others from using it. National defense is the classic example of a public good. The programming language used to write apps for the iPhone is another.

Because knowledge is a public good, as the benefits of a new discovery spread, free resources become available. Nothing is given up when they are used: They have a zero opportunity cost. When a student in Austin writes a new iPhone app, his use of the programming language doesn't prevent another student in Seattle from using it.

Knowledge is even more special because it is not subject to diminishing returns. But increasing the stock of knowledge makes both labor and machines more productive. Knowledge capital does not bring diminishing returns. Biotech knowledge illustrates this idea well. Biologists have spent a lot of time developing DNA sequencing technology. As more
has been discovered, the productivity of this knowledge capital has relentlessly increased. In 1990, it cost about $50 to sequence one DNA base pair. That cost had fallen to $1 by 2000 and to 1/10,000th of a penny by 2010.

The implication of this simple and appealing observation is astonishing. Unlike the other two theories, new growth theory has no growth-stopping mechanism. As physical capital accumulates, the return to capital—the real interest rate—falls. But the incentive to innovate and earn a higher profit becomes stronger. So innovation occurs, capital becomes more productive, the demand for capital increases, and the real interest rate rises again.

Labor productivity grows indefinitely as people discover new technologies that yield a higher real interest rate. The growth rate depends only on people’s incentives and ability to innovate.

**A Perpetual Motion Economy** New growth theory sees the economy as a perpetual motion machine, which Fig. 6.10 illustrates.

No matter how rich we become, our wants exceed our ability to satisfy them. We always want a higher standard of living. In the pursuit of a higher standard of living, human societies have developed incentive systems—markets, property rights, and money—that enable people to profit from innovation. Innovation leads to the development of new and better techniques of production and new and better products. To take advantage of new techniques and to produce new products, new firms start up and old firms go out of business—firms are born and die. As old firms die and new firms are born, some jobs are destroyed and others are created. The new jobs created are better than the old ones and they pay higher real wage rates. Also, with higher wage rates and more productive techniques, leisure increases. New and better jobs and new and better products lead to more consumption goods and services and, combined with increased leisure, bring a higher standard of living.

But our insatiable wants are still there, so the process continues: Wants and incentives create innovation, new and better products, and a yet higher standard of living.

**FIGURE 6.10 A Perpetual Motion Machine**

People want a higher standard of living and are spurred by profit incentives to make the innovations that lead to new and better techniques and new and better products.

These new and better techniques and products, in turn, lead to the birth of new firms and the death of some old firms, new and better jobs, and more leisure and more consumption goods and services.

The result is a higher standard of living, but people want a still higher standard of living, and the growth process continues.

New Growth Theory Versus Malthusian Theory

The contrast between the Malthusian theory and new growth theory couldn’t be more sharp. Malthusians see the end of prosperity as we know it today and new growth theorists see unending plenty. The contrast becomes clearest by thinking about the differing views about population growth.

To a Malthusian, population growth is part of the problem. To a new growth theorist, population growth is part of the solution. People are the ultimate economic resource. A larger population brings forth more wants, but it also brings a greater amount of scientific discovery and technological advance. So rather than being the source of falling real GDP per person, population growth generates faster labor productivity growth and rising real GDP per person. Resources are limited, but the human imagination and ability to increase productivity are unlimited.

Sorting Out the Theories

Which theory is correct? None of them tells us the whole story, but each teaches us something of value.

Classical growth theory reminds us that our physical resources are limited and that without advances in technology, we must eventually hit diminishing returns.

Neoclassical growth theory reaches the same conclusion but not because of a population explosion. Instead, it emphasizes diminishing returns to capital and reminds us that we cannot keep growth going just by accumulating physical capital. We must also advance technology and accumulate human capital. We must become more creative in our use of scarce resources.

New growth theory emphasizes the capacity of human resources to innovate at a pace that offsets diminishing returns. New growth theory fits the facts of today’s world more closely than do either of the other two theories. But that doesn’t make it correct.

The Empirical Evidence on the Causes of Economic Growth

Economics makes progress by the interplay between theory and empirical evidence. A theory makes predictions about what we will observe if the theory is correct. Empirical evidence, the data generated by history and the natural experiments that it performs, provides the data for testing the theory.

Economists have done an enormous amount of research confronting theories of growth with the empirical evidence. The way in which this research has been conducted has changed over the years.

In 1776, when Adam Smith wrote about “the nature and causes of the Wealth of Nations” in his celebrated book, empirical evidence took the form of carefully selected facts described in words and stories. Today, large databases, sophisticated statistical methods, and fast computers provide numerical measurements of the causes of economic growth.

Economists have looked at the growth rate data for more than 100 countries for the period since 1960 and explored the correlations between the growth rate and more than 60 possible influences on it. The conclusion of this data crunching is that most of these possible influences have variable and unpredictable effects, but a few of them have strong and clear effects. Table 6.1 summarizes these more robust influences. They are arranged in order of difficulty (or in the case of region, impossibility) of changing. Political and economic systems are hard to change, but market distortions, investment, and openness to international trade are features of a country’s economy that can be influenced by policy.

Let’s now look at growth policies.

Policies for Achieving Faster Growth

Growth theory supported by empirical evidence tells us that to achieve faster economic growth, we must increase the growth rate of physical capital, the pace of technological advance, or the growth rate of human capital and openness to international trade.

The main suggestions for achieving these objectives are

- Stimulate saving
- Stimulate research and development
- Improve the quality of education
- Provide international aid to developing nations
- Encourage international trade

Stimulate Saving

Saving finances investment so stimulating saving increases economic growth. The East Asian economies have the highest growth rates and the highest saving rates. Some African economies have the lowest growth rates and the lowest saving rates.

Tax incentives can increase saving. Individual Retirement Accounts (IRAs) are a tax incentive to save. Economists claim that a tax on consumption rather than income provides the best saving incentive.
Growth Theories, Evidence, and Policies

Stimulate Research and Development

Everyone can use the fruits of basic research and development efforts. For example, all biotechnology firms can use advances in gene-splicing technology. Because basic inventions can be copied, the inventor’s profit is limited and the market allocates too few resources to this activity. Governments can direct public funds toward financing basic research, but this solution is not foolproof. It requires a mechanism for allocating the public funds to their highest-valued use.

Improve the Quality of Education

The free market produces too little education because it brings benefits beyond those valued by the people who receive the education. By funding basic education and by ensuring high standards in basic skills such as language, mathematics, and science, governments can contribute to a nation’s growth potential. Education can also be stimulated and improved by using tax incentives to encourage improved private provision.

Provide International Aid to Developing Nations

It seems obvious that if rich countries give financial aid to developing countries, investment and growth will increase in the recipient countries. Unfortunately, the obvious does not routinely happen. A large amount of data-driven research on the effects of aid on growth has turned up a zero and even negative effect. Aid often gets diverted and spent on consumption.

Encourage International Trade

Trade, not aid, stimulates economic growth. It works by extracting the available gains from specialization and trade. The fastest-growing nations are those most open to trade. If the rich nations truly want to aid economic development, they will lower their trade barriers against developing nations, especially in farm products. The World Trade Organization’s efforts to achieve more open trade are being resisted by the richer nations.

**TABLE 6.1** The Influences on Economic Growth

<table>
<thead>
<tr>
<th>Influence</th>
<th>Good for Economic Growth</th>
<th>Bad for Economic Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>Far from equator</td>
<td>Sub-Saharan Africa</td>
</tr>
<tr>
<td>Politics</td>
<td>Rule of law</td>
<td>Revolutions</td>
</tr>
<tr>
<td></td>
<td>Civil liberties</td>
<td>Military coups</td>
</tr>
<tr>
<td>Economic system</td>
<td>Capitalist</td>
<td>Wars</td>
</tr>
<tr>
<td>Market distortions</td>
<td>Human capital</td>
<td>Exchange rate distortions</td>
</tr>
<tr>
<td></td>
<td>Physical capital</td>
<td>Price controls and black markets</td>
</tr>
<tr>
<td>Investment</td>
<td>Open to trade</td>
<td></td>
</tr>
</tbody>
</table>


**REVIEW QUIZ**

1. What is the key idea of classical growth theory that leads to the dismal outcome?
2. What, according to neoclassical growth theory, is the fundamental cause of economic growth?
3. What is the key proposition of new growth theory that makes economic growth persist?

You can work these questions in Study Plan 6.5 and get instant feedback.
China insisted Tuesday it was still a developing nation despite overtaking Japan as the world’s second largest economy, in the face of pressure to take on a greater role in global affairs. ...

Thirty years after opening its doors to the outside world, China has enjoyed spectacular economic growth and already claimed the titles of world’s top exporter, auto market, and steelmaker.

After outpacing its neighbor in the second quarter, China is on course this year to officially confirm its position as world number two—a title Japan held for 40 years—underscoring its emergence as a global economic and political force.

While some analysts are predicting that China could take on the top spot from the United States within a few decades, commentators insisted it remained a developing nation with tens of millions living in poverty.

Commerce ministry spokesman Yao Jian said China still lagged far behind its rivals in per capita terms and has a long way to go to becoming a world-class power.

“The quality of China’s economic growth still needs to be improved, no matter whether it is in terms of people’s quality of life or in terms of science, technology, and environmental protection,” the spokesman said.

“We still have an enormous gap to make up.”

He said China’s per capita GDP was 3,800 dollars—putting it around 105th in the world—and that 150 million of its 1.3 billion people live below the poverty line, according to UN standards.

“China’s economy will continue to develop because China has a large population and its economy lagged behind,” he said. ...

ESSENCE OF THE STORY

- China is a large developing nation that ranks at 105 in the world on per capita income with 150 million of its 1.3 billion people living below the UN poverty line.
- After opening to global trade and investment 30 years ago, China has experienced rapid economic growth.
- In mid-2010, China displaced Japan as the world’s number 2 economy. Japan held this spot for 40 years.
- Some analysts predict that China will take the top spot from the United States within a few decades.
- A commerce ministry spokesman says people’s quality of life, and science, technology, and environmental protection need to be improved.
The news that China overtook Japan in mid-2010 to become the world’s second largest economy is based on GDP data.

When the GDP of China measured in yuan and the GDP of Japan measured in yen are converted to U.S. dollars at the current exchange rate, China’s GDP became slightly larger than Japan’s in the second quarter of 2010.

Figure 1 shows the data on GDP in China, Japan, and the United States. You can see that Japan has stagnated since 1995 while China has streaked upward.

You learned in Chapter 4 that PPP prices provide a more useful international comparison of GDP. You also learned that real GDP measures economic growth and nominal GDP (in Fig. 1) measures a combination of economic growth and inflation (or deflation).

Comparing China and Japan using real GDP in PPP prices (in Fig. 2), China became the number 2 economy as long ago as 1995, and in 2010 it became not the number 2 economy but the number 1, overtaking the United States.

In 2010, China had 4 times as many people as the United States and they earned, on average, 1/4 the income of Americans. So total income and GDP in China roughly equaled that in the United States.

China remains a poor country in three respects: Income per person is low; income inequality is large so many people live in poverty; and most of the country’s advanced technology is imported from the United States and Europe.

How poor China appears depends on the numbers used. At the current exchange rate and in China’s prices, income per person was $3,800 in 2010, but in PPP prices, it was $11,000. Figure 3 shows how far China is behind Japan and the United States when measured by income per person valued in PPP prices.

The growth of physical capital and human capital and technological change are proceeding at a rapid pace in China and bringing rapid growth in real GDP per person.

But China lags a long way behind the United States in science, technology, and environmental protection.

As China’s economy continues to expand, it will devote more resources to narrowing the gap in these areas as well as narrowing the income gap.
CHAPTER 6 Economic Growth

Key Points

The Basics of Economic Growth (pp. 134–135)
- Economic growth is the sustained expansion of production possibilities and is measured as the annual percentage rate of change of real GDP.
- The Rule of 70 tells us the number of years in which real GDP doubles—70 divided by the annual percentage growth rate.

Working Problems 1 to 5 will give you a better understanding of the basics of economic growth.

Economic Growth Trends (pp. 136–138)
- Real GDP per person in the United States grows at an average rate of 2 percent a year. Growth was most rapid during the 1960s and the 1990s.
- The gap in real GDP per person between the United States and Central and South America has persisted. The gaps between the United States and Hong Kong, Korea, and China have narrowed. The gaps between the United States and Africa and Central Europe have widened.

Working Problem 6 will give you a better understanding of economic growth trends.

How Potential GDP Grows (pp. 139–144)
- The aggregate production function and equilibrium in the aggregate labor market determine potential GDP.
- Potential GDP grows if the labor supply grows or if labor productivity grows.

- Only labor productivity growth makes real GDP per person and the standard of living grow.

Working Problems 7 to 14 will give you a better understanding of how potential GDP grows.

Why Labor Productivity Grows (pp. 144–146)
- Labor productivity growth requires an incentive system created by firms, markets, property rights, and money.
- The sources of labor productivity growth are growth of physical capital and human capital and advances in technology.

Working Problems 15 and 16 will give you a better understanding of why labor productivity grows.

Growth Theories, Evidence, and Policies (pp. 147–151)
- In classical theory, real GDP per person keeps returning to the subsistence level.
- In neoclassical growth theory, diminishing returns to capital limit economic growth.
- In new growth theory, economic growth persists indefinitely at a rate determined by decisions that lead to innovation and technological change.
- Policies for achieving faster growth include stimulating saving and research and development, encouraging international trade, and improving the quality of education.

Working Problems 17 and 18 will give you a better understanding of growth theories, evidence, and policies.

Key Terms

Aggregate production function, 139  Labor productivity, 143  Real GDP per person, 134
Classical growth theory, 147  Neoclassical growth theory, 147  Real wage rate, 140
Economic growth rate, 134  New growth theory, 148
How long, at the current growth rate, will it take for China to double its real GDP per person?

Economic Growth Trends (Study Plan 6.2)

6. China was the largest economy for centuries because everyone had the same type of economy—subsistence—and so the country with the most people would be economically biggest. Then the Industrial Revolution sent the West on a more prosperous path. Now the world is returning to a common economy, this time technology- and information-based, so once again population triumphs.

   a. Why was China the world’s largest economy until 1890?
   b. Why did the United States surpass China in 1890 to become the world’s largest economy?

How Potential GDP Grows (Study Plan 6.3)

Use the following information to work Problems 7 and 8.

Suppose that the United States cracks down on illegal immigrants and returns millions of workers to their home countries.

7. Explain what will happen to U.S. potential GDP, employment, and the real wage rate.

8. Explain what will happen in the countries to which the immigrants return to potential GDP, employment, and the real wage rate.

Use the following news clip to work Problems 9 to 11.

U.S. Workers World’s Most Productive

Americans work longer hours than those in other rich nations. Americans also produce more per person but only part of the U.S. productivity growth can be explained by the longer hours they work. Americans also create more wealth per hour of work. U.S. employees worked an average of 1,804 hours in 2006, compared to 1,564.4 for the French, but far less than the 2,200 hours that Asians worked. But in Asian countries the average labor productivity is lower.


9. What is the difference between productivity in this news clip and real GDP per person?

10. Identify and correct a confusion between levels and growth rates of productivity in the news clip.
11. If workers in developing Asian economies work more hours than Americans, why are they not the world’s most productive?

Use the following tables to work Problems 12 to 14. The tables describe an economy’s labor market and its production function in 2010.

<table>
<thead>
<tr>
<th>Real wage rate (dollars per hour)</th>
<th>Labor hours supplied</th>
<th>Labor hours demanded</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>70</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>60</td>
<td>35</td>
<td>15</td>
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<td>50</td>
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<td>20</td>
<td>15</td>
<td>35</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Labor (hours)</th>
<th>Real GDP (2005 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>425</td>
</tr>
<tr>
<td>10</td>
<td>800</td>
</tr>
<tr>
<td>15</td>
<td>1,125</td>
</tr>
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<td>20</td>
<td>1,400</td>
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<td>1,625</td>
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<td>1,800</td>
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<td>35</td>
<td>1,925</td>
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<tr>
<td>40</td>
<td>2,000</td>
</tr>
</tbody>
</table>

12. What are the equilibrium real wage rate, the quantity of labor employed in 2010, labor productivity, and potential GDP in 2010?

13. In 2011, the population increases and labor hours supplied increase by 10 at each real wage rate. What are the equilibrium real wage rate, labor productivity, and potential GDP in 2011?

14. In 2011, the population increases and labor hours supplied increase by 10 at each real wage rate. Does the standard of living in this economy increase in 2011? Explain why or why not.

**Why Labor Productivity Grows** (Study Plan 6.4)

15. **Labor Productivity on the Rise**

The Bureau of Labor Statistics reported the following data for the year ended June 2009: In the nonfarm sector, output fell 5.5 percent as labor productivity increased 1.9 percent—the largest increase since 2003—but in the manufacturing sector, output fell 9.8 percent as labor productivity increased by 4.9 percent—the largest increase since the first quarter of 2005.

Source: bls.gov/news.release, August 11, 2009

In both sectors, output fell while labor productivity increased. Did the quantity of labor (aggregate hours) increase or decrease? In which sector was the change in the quantity of labor larger?

16. For three years, there was no technological change in Longland but capital per hour of labor increased from $10 to $20 to $30 and real GDP per hour of labor increased from $3.80 to $5.70 to $7.13. Then, in the fourth year, capital per hour of labor remained constant but real GDP per hour of labor increased to $10. Does Longland experience diminishing returns? Explain why or why not.

**Growth Theories, Evidence, and Policies** (Study Plan 6.5)

17. Explain the processes that will bring the growth of real GDP per person to a stop according to
   a. Classical growth theory.
   b. Neoclassical growth theory.
   c. New growth theory.

18. In the economy of Cape Despair, the subsistence real wage rate is $15 an hour. Whenever real GDP per hour rises above $15, the population grows, and whenever real GDP per hour of labor falls below this level, the population falls. The table shows Cape Despair’s production function:

<table>
<thead>
<tr>
<th>Labor (billions of hours per year)</th>
<th>Real GDP (billions of 2000 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>8</td>
</tr>
<tr>
<td>1.0</td>
<td>15</td>
</tr>
<tr>
<td>1.5</td>
<td>21</td>
</tr>
<tr>
<td>2.0</td>
<td>26</td>
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<td>2.5</td>
<td>30</td>
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<td>3.0</td>
<td>33</td>
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<tr>
<td>3.5</td>
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</table>

Initially, the population of Cape Despair is constant and real GDP per hour of labor is at the subsistence level of $15. Then a technological advance shifts the production function upward by 50 percent at each level of labor.
   a. What are the initial levels of real GDP and labor productivity?
   b. What happens to labor productivity immediately following the technological advance?
   c. What happens to the population growth rate following the technological advance?
   d. What are the eventual levels of real GDP and real GDP per hour of labor?
The Basics of Economic Growth

19. If in 2010 China’s real GDP is growing at 9 percent a year, its population is growing at 1 percent a year, and these growth rates continue, in what year will China’s real GDP per person be twice what it is in 2010?

20. Mexico’s real GDP was 8,600 trillion pesos in 2009 and 8,688 trillion pesos in 2010. Mexico’s population was 107 million in 2009 and 108 million in 2010. Calculate
   a. The economic growth rate.
   b. The growth rate of real GDP per person.
   c. The approximate number of years it takes for real GDP per person in Mexico to double if the 2010 economic growth rate and population growth rate are maintained.

21. Venezuela’s real GDP was 57,049 trillion bolivares in 2009 and 56,764 trillion bolivares in 2010. Venezuela’s population was 28.6 million in 2009 and 29.2 million in 2010. Calculate
   a. The economic growth rate.
   b. The growth rate of real GDP per person.
   c. The approximate number of years it takes for real GDP per person in Venezuela to double if economic growth returns to its average since 2009 of 3.6 percent a year and is maintained.

Economic Growth Trends

22. The New World Order
   While gross domestic product growth is cooling a bit in emerging market economies, the results are still tremendous compared with the United States and much of Western Europe. The emerging market economies posted a 6.7% jump in real GDP in 2008, down from 7.5% in 2007. The advanced economies grew an estimated 1.6% in 2008. The difference in growth rates represents the largest spread between emerging market economies and advanced economies in the 37-year history of the survey.

   Source: Fortune, July 14, 2008
   Do growth rates over the past few decades indicate that gaps in real GDP per person around the world are shrinking, growing, or staying the same? Explain.

How Potential GDP Grows

23. If a large increase in investment increases labor productivity, explain what happens to
   a. Potential GDP.
   b. Employment.
   c. The real wage rate.

24. If a severe drought decreases labor productivity, explain what happens to
   a. Potential GDP.
   b. Employment.
   c. The real wage rate.

Use the following tables to work Problems 25 to 27.

The first table describes an economy’s labor market in 2010 and the second table describes its production function in 2010.

<table>
<thead>
<tr>
<th>Real wage rate (dollars per hour)</th>
<th>Labor hours supplied</th>
<th>Labor hours demanded</th>
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<tbody>
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<td>80</td>
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<td>2,800</td>
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<td>45</td>
<td>2,925</td>
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<td>50</td>
<td>3,000</td>
</tr>
</tbody>
</table>

25. What are the equilibrium real wage rate and the quantity of labor employed in 2010?
26. What are labor productivity and potential GDP in 2010?
27. Suppose that labor productivity increases in 2010. What effect does the increased labor productivity have on the demand for labor, the supply of labor, potential GDP, and real GDP per person?
Why Labor Productivity Grows

28. India’s Economy Hits the Wall

Just six months ago, India was looking good. Annual growth was 9%, consumer demand was huge, and foreign investment was growing. But now most economic forecasts expect growth to slow to 7%—a big drop for a country that needs to accelerate growth. India needs urgently to upgrade its infrastructure and education and health-care facilities. Agriculture is unproductive and needs better technology. The legal system needs to be strengthened with more judges and courtrooms.

Source: *BusinessWeek*, July 1, 2008

Explain five potential sources for faster economic growth in India suggested in this news clip.

Growth Theories, Evidence, and Policies

29. The Productivity Watch

According to former Federal Reserve chairman Alan Greenspan, IT investments in the 1990s boosted productivity, which boosted corporate profits, which led to more IT investments, and so on, leading to a nirvana of high growth.

Source: *Fortune*, September 4, 2006

Which of the growth theories that you’ve studied in this chapter best corresponds to the explanation given by Mr. Greenspan?

30. Is faster economic growth always a good thing?

Argue the case for faster growth and the case for slower growth. Then reach a conclusion on whether growth should be increased or slowed.

31. Makani Power: A Mighty Wind

Makani Power aims to generate energy from what are known as high-altitude wind-extraction technologies. And that’s about all its 34-year-old Aussie founder, Saul Griffith, wants to say about it. But Makani can’t hide entirely, not when its marquee investor is Google.org, the tech company’s philanthropic arm. Makani’s plan is to capture that high-altitude wind with a very old tool: kites. Harnessing higher-altitude wind, at least in theory, has greater potential than the existing wind industry because at a thousand feet above the ground, the wind is stronger and more consistent.

Source: *Fortune*, April 28, 2008

Explain which growth theory best describes the news clip.

Economics in the News

32. After you have studied *Reading Between the Lines* on pp. 152–153 answer the following questions.

a. On what criterion is China the second largest economy in the world?

b. What is the distinction between the size of an economy and the standard of living of its people?

c. Where does China rank on a standard of living comparison? How is that rank changing and why?

d. What is the distinction between market prices and PPP prices?

e. Using PPP prices, where does China’s economy rank in size and standard of living?

f. For what might the size of an economy matter?

33. Make Way for India—The Next China

China grows at around 9 percent a year, but its one-child policy will start to reduce the size of China’s working-age population within the next 10 years. India, by contrast, will have an increasing working-age population for another generation at least.

Source: *The Independent*, March 1, 2006

a. Given the expected population changes, do you think China or India will have the greater economic growth rate? Why?

b. Would China’s growth rate remain at 9 percent a year without the restriction on its population growth rate?

c. India’s population growth rate is 1.6 percent a year, and in 2005 its economic growth rate was 8 percent a year. China’s population growth rate is 0.6 percent a year, and in 2005 its economic growth rate was 9 percent a year. In what year will real GDP per person double in each country?

Data Graphing

34. Use the Data Grapher to create a graph of the growth rate of real GDP per person in the United States, Canada, Germany, and the United Kingdom.

a. Which country had the fastest growth of real GDP per person since 1980 and which had the slowest?

b. In which country has real GDP per person fluctuated most?
After studying this chapter, you will be able to:

- Describe and define the flows of funds through financial markets and the financial institutions
- Explain how investment and saving along with borrowing and lending decisions are made and how these decisions interact in the loanable funds market
- Explain how a government deficit (or surplus) influences the real interest rate, saving, and investment in the loanable funds market
- Explain how international borrowing or lending influences the real interest rate, saving, and investment in the global loanable funds market

During September 2008, Wall Street put on a spectacular show. To prevent the collapse of Fannie Mae and Freddie Mac, the two largest lenders to home buyers, the U.S. government took over their risky debts. When Lehman Brothers, a venerable Wall Street investment bank, was on the verge of bankruptcy, secure phone lines and limousines worked overtime as the Federal Reserve Bank of New York, the U.S. Treasury, and senior officials of Bank of America and Barclays Bank (a British bank) tried to find ways to save the bank. The effort failed. On the same weekend, Bank of America bought Merrill Lynch, another big Wall Street investment bank. And a few days later, the U.S. government bought insurance giant AIG and tried to get Congress to provide $700 billion to buy just about every risky debt that anyone wanted to unload.

Behind such drama, Wall Street plays a crucial unseen role funneling funds from savers and lenders to investors and borrowers. This chapter explains how financial markets work and their place in the economy. In Reading Between the Lines at the end of the chapter, we’ll look at the effects of government budget deficits and apply what you’ve learned to better understand what is happening in U.S. and global financial markets today.
CHAPTER 7 Finance, Saving, and Investment

Financial Institutions and Financial Markets
The financial institutions and markets that we study in this chapter play a crucial role in the economy. They provide the channels through which saving flows to finance the investment in new capital that makes the economy grow.

In studying the economics of financial institutions and markets, we distinguish between:
- Finance and money
- Physical capital and financial capital

Finance and Money
In economics, we use the term finance to describe the activity of providing the funds that finance expenditures on capital. The study of finance looks at how households and firms obtain and use financial resources and how they cope with the risks that arise in this activity.

Money is what we use to pay for goods and services and factors of production and to make financial transactions. The study of money looks at how households and firms use it, how much of it they hold, how banks create and manage it, and how its quantity influences the economy.

In the economic lives of individuals and businesses, finance and money are closely interrelated. And some of the main financial institutions, such as banks, provide both financial services and monetary services. Nevertheless, by distinguishing between finance and money and studying them separately, we will better understand our financial and monetary markets and institutions.

For the rest of this chapter, we study finance. Money is the topic of the next chapter.

Physical Capital and Financial Capital
Economists distinguish between physical capital and financial capital. Physical capital is the tools, instruments, machines, buildings, and other items that have been produced in the past and that are used today to produce goods and services. Inventories of raw materials, semifinished goods, and components are part of physical capital. When economists use the term capital, they mean physical capital. The funds that firms use to buy physical capital are called financial capital.

Along the aggregate production function in Chapter 6 (see p. 139), the quantity of capital is fixed. An increase in the quantity of capital increases production possibilities and shifts the aggregate production function upward. You’re going to see, in this chapter, how investment, saving, borrowing, and lending decisions influence the quantity of capital and make it grow, and as a consequence, make real GDP grow.

We begin by describing the links between capital and investment and between wealth and saving.

Capital and Investment
The quantity of capital changes because of investment and depreciation. Investment increases the quantity of capital and depreciation decreases it (see Chapter 4, p. 86). The total amount spent on new capital is called gross investment. The change in the value of capital is called net investment. Net investment equals gross investment minus depreciation.

Figure 7.1 illustrates these terms. On January 1, 2010, Ace Bottling Inc. had machines worth $30,000—Ace’s initial capital. During 2010, the market value of Ace’s machines fell by 67 percent—$20,000. After this depreciation, Ace’s machines were valued at $10,000. During 2010, Ace spent $30,000 on new machines. This amount is Ace’s gross investment. By December 31, 2010, Ace Bottling had capital valued at $40,000, so its capital had increased by $10,000. This amount is Ace’s net investment. Ace’s net investment equals its gross investment of $30,000 minus depreciation of its initial capital of $20,000.

Wealth and Saving
Wealth is the value of all the things that people own. What people own is related to what they earn, but it is not the same thing. People earn an income, which is the amount they receive during a given time period from supplying the services of the resources they own. Saving is the amount of income that is not paid in taxes or spent on consumption goods and services. Saving increases wealth. Wealth also increases when the market value of assets rises—called capital gains—and decreases when the market value of assets falls—called capital losses.

For example, at the end of the school year you have $250 in the bank and a coin collection worth $300, so your wealth is $550. During the summer,
Financial Institutions and Financial Markets

You earn $5,000 (net of taxes) and spend $1,000 on consumption goods and services so your saving is $4,000. Your bank account increases to $4,250 and your wealth becomes $4,550. The $4,000 increase in wealth equals saving. If coins rise in value and your coin collection is now worth $500, you have a capital gain of $200, which is also added to your wealth.

National wealth and national saving work like this personal example. The wealth of a nation at the end of a year equals its wealth at the start of the year plus its saving during the year, which equals income minus consumption expenditure.

To make real GDP grow, saving and wealth must be transformed into investment and capital. This transformation takes place in the markets for financial capital and through the activities of financial institutions. We’re now going to describe these markets and institutions.

Financial Capital Markets

Saving is the source of the funds that are used to finance investment, and these funds are supplied and demanded in three types of financial markets:

- Loan markets
- Bond markets
- Stock markets

Loan Markets Businesses often want short-term finance to buy inventories or to extend credit to their customers. Sometimes they get this finance in the form of a loan from a bank. Households often want finance to purchase big ticket items, such as automobiles or household furnishings and appliances. They get this finance as bank loans, often in the form of outstanding credit card balances.

Households also get finance to buy new homes. (Expenditure on new homes is counted as part of investment.) These funds are usually obtained as a loan that is secured by a mortgage—a legal contract that gives ownership of a home to the lender in the event that the borrower fails to meet the agreed loan payments (repayments and interest). Mortgage loans were at the center of the U.S. credit crisis of 2007–2008.

All of these types of financing take place in loan markets.

Bond Markets When Wal-Mart expands its business and opens new stores, it gets the finance it needs by selling bonds. Governments—federal, state, and municipal—also raise finance by issuing bonds.

A bond is a promise to make specified payments on specified dates. For example, you can buy a Wal-Mart bond that promises to pay $5.00 every year until 2024 and then to make a final payment of $100 in 2025.

The buyer of a bond from Wal-Mart makes a loan to the company and is entitled to the payments promised by the bond. When a person buys a newly issued bond, he or she may hold the bond until the borrower has repaid the amount borrowed or sell it to someone else. Bonds issued by firms and governments are traded in the bond market.

The term of a bond might be long (decades) or short (just a month or two). Firms often issue very short-term bonds as a way of getting paid for their sales before the buyer is able to pay. For example, when GM sells $100 million of railway locomotives

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**FIGURE 7.1** Capital and Investment

On January 1, 2010, Ace Bottling had capital worth $30,000. During the year, the value of Ace’s capital fell by $20,000—depreciation—and it spent $30,000 on new capital—gross investment. Ace’s net investment was $10,000 ($30,000 gross investment minus $20,000 depreciation) so that at the end of 2010, Ace had capital worth $40,000.

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to Union Pacific, GM wants to be paid when the items are shipped. But Union Pacific doesn’t want to pay until the locomotives are earning an income. In this situation, Union Pacific might promise to pay GM $101 million three months in the future. A bank would be willing to buy this promise for (say) $100 million. GM gets $100 million immediately and the bank gets $101 million in three months when Union Pacific honors its promise. The U.S. Treasury issues promises of this type, called Treasury bills.

Another type of bond is a mortgage-backed security, which entitles its holder to the income from a package of mortgages. Mortgage lenders create mortgage-backed securities. They make mortgage loans to homebuyers and then create securities that they sell to obtain more funds to make more mortgage loans. The holder of a mortgage-backed security is entitled to receive payments that derive from the payments received by the mortgage lender from the homebuyer–borrower.

Mortgage-backed securities were at the center of the storm in the financial markets in 2007–2008.

**Stock Markets** When Boeing wants finance to expand its airplane building business, it issues stock. A stock is a certificate of ownership and claim to the firm’s profits. Boeing has issued about 900 million shares of its stock. So if you owned 900 Boeing shares, you would own one millionth of Boeing and be entitled to receive one millionth of its profits.

Unlike a stockholder, a bondholder does not own part of the firm that issued the bond.

A stock market is a financial market in which shares of stocks of corporations are traded. The New York Stock Exchange, the London Stock Exchange (in England), the Tokyo Stock Exchange (in Japan), and the Frankfurt Stock Exchange (in Germany) are all examples of stock markets.

**Financial Institutions**

Financial markets are highly competitive because of the role played by financial institutions in those markets. A financial institution is a firm that operates on both sides of the markets for financial capital. The financial institution is a borrower in one market and a lender in another.

Financial institutions also stand ready to trade so that households with funds to lend and firms or households seeking funds can always find someone on the other side of the market with whom to trade.

The key financial institutions are

- Commercial banks
- Government-sponsored mortgage lenders
- Pension funds
- Insurance companies

**Commercial Banks** Commercial banks are financial institutions that accept deposits, provide payment services, and make loans to firms and households. The bank that you use for your own banking services and that issues your credit card is a commercial bank. These institutions play a central role in the monetary system and we study them in detail in Chapter 8.

**Government-Sponsored Mortgage Lenders** Two large financial institutions, the Federal National Mortgage Association, or Fannie Mae, and the Federal Home Loan Mortgage Corporation, or Freddie Mac, are enterprises that buy mortgages from banks, package them into mortgage-backed securities, and sell them. In September 2008, Fannie and Freddie owned or guaranteed $6 trillion worth of mortgages (half of the U.S. $12 trillion of mortgages) and were taken over by the federal government.

**Economics in Action**

**The Financial Crisis and the Fix**

Bear Stearns: absorbed by JPMorgan Chase with help from the Federal Reserve. Lehman Brothers: gone. Fannie Mae and Freddie Mac: taken into government oversight. Merrill Lynch: absorbed by Bank of America. AIG: given an $85 billion lifeline by the Federal Reserve and sold off in parcels to financial institutions around the world. Wachovia: taken over by Wells Fargo. Washington Mutual: taken over by JPMorgan Chase. Morgan Stanley: 20 percent bought by Mitsubishi, a large Japanese bank. These are some of the events in the financial crisis of 2008. What was going on and how can a replay be avoided?

Between 2002 and 2005, mortgage lending exploded and home prices rocketed. Mortgage lenders bundled their loans into mortgage-backed securities and sold them to eager buyers around the world.

When interest rates began to rise in 2006 and asset prices fell, financial institutions took big losses. Some losses were too big to bear and big-name institutions failed.
**Pension Funds**  Pension funds are financial institutions that use the pension contributions of firms and workers to buy bonds and stocks. The mortgage-backed securities of Fannie Mae and Freddie Mac are among the assets of pension funds. Some pension funds are very large and play an active role in the firms whose stock they hold.

**Insurance Companies**  Insurance companies enable households and firms to cope with risks such as accident, theft, fire, illness, and a host of other misfortunes. They receive premiums from their customers and pay claims. Insurance companies use the funds they have received but not paid out as claims to buy bonds and stocks on which they earn interest income.

In normal times, insurance companies have a steady flow of funds coming in from premiums and interest on the financial assets they hold and a steady, but smaller, flow of funds paying claims. Their profit is the gap between the two flows. But in unusual times, when large and widespread losses are being incurred, insurance companies can run into difficulty in meeting their obligations. Such a situation arose in 2008 for one of the biggest insurers, AIG, and the firm was taken into public ownership.

**Insolvency and Illiquidity**

A financial institution’s net worth is the market value of what it has lent minus the market value of what it has borrowed. If net worth is positive, the institution is solvent. But if net worth is negative, the institution is insolvent and must go out of business. The owners of an insolvent financial institution—usually its stockholders—bear the loss.

A financial institution both borrows and lends, so it is exposed to the risk that its net worth might become negative. To limit that risk, financial institutions are regulated and a minimum amount of their lending must be backed by their net worth.

Sometimes, a financial institution is solvent but illiquid. A firm is illiquid if it has made long-term loans with borrowed funds and is faced with a sudden demand to repay more of what it has borrowed than its available cash. In normal times, a financial institution that is illiquid can borrow from another institution. But if all the financial institutions are short of cash, the market for loans among financial institutions dries up.

Insolvency and illiquidity were at the core of the financial meltdown of 2007–2008.

In the hope of avoiding a replay, Congress has enacted the *Restoring American Financial Stability Act of 2010*. The main points of the Act are

- A Consumer Financial Protection Agency to enforce consumer-oriented regulation, ensure that the fine print on financial services contracts is clear and accurate, and maintain a toll-free hotline for consumers to report alleged deception.
- A Financial Services Oversight Council to anticipate financial market weakness.
- Authority for the Federal Deposit Insurance Corporation to seize, liquidate, and reconstruct troubled financial firms.
- Tight restrictions to stop banks gambling for their own profits and limit their risky investments.
- Mortgage reforms that require lenders to review the income and credit histories of applicants and ensure they can afford payments.
- Require firms that create mortgage-backed securities to keep at least 5 percent of them.

The 2010 Act does nothing to solve the problem that Fannie and Freddie remain under government oversight. Many people believe that the measures are too timid and leave the financial system fragile.
**Interest Rates and Asset Prices**

Stocks, bonds, short-term securities, and loans are collectively called *financial assets*. The interest rate on a financial asset is the interest received expressed as a percentage of the price of the asset.

Because the interest rate is a percentage of the price of an asset, if the asset price rises, other things remaining the same, the interest rate falls. Conversely, if the asset price falls, other things remaining the same, the interest rate rises.

To see this inverse relationship between an asset price and the interest rate, let’s look at an example. We’ll consider a bond that promises to pay its holder $5 a year forever. What is the rate of return—the interest rate—on this bond? The answer depends on the price of the bond. If you could buy this bond for $50, the interest rate would be 10 percent per year:

\[
\text{Interest rate} = \frac{\$5}{\$50} \times 100 = 10\%.
\]

But if the price of this bond increased to $200, its rate of return or interest rate would be only 2.5 percent per year. That is,

\[
\text{Interest rate} = \frac{\$5}{\$200} \times 100 = 2.5\%.
\]

This relationship means that the price of an asset and the interest rate on that asset are determined simultaneously—one implies the other.

This relationship also means that if the interest rate on the asset rises, the price of the asset falls, debts become harder to pay, and the net worth of the financial institution falls. Insolvency can arise from a previously unexpected large rise in the interest rate.

In the next part of this chapter, we learn how interest rates and asset prices are determined in the financial markets.

**The Loanable Funds Market**

In macroeconomics, we group all the financial markets that we described in the previous section into a single loanable funds market. The *loanable funds market* is the aggregate of all the individual financial markets.

The circular flow model of Chapter 4 (see p. 85) can be extended to include flows in the loanable funds market that finance investment.

**Funds that Finance Investment**

Figure 7.2 shows the flows of funds that finance investment. They come from three sources:

1. Household saving
2. Government budget surplus
3. Borrowing from the rest of the world

Households’ income, \(Y\), is spent on consumption goods and services, \(C\), saved, \(S\), or paid in net taxes, \(T\). *Net taxes* are the taxes paid to governments minus the cash transfers received from governments (such as Social Security and unemployment benefits). So income is equal to the sum of consumption expenditure, saving, and net taxes:

\[
Y = C + S + T.
\]

You saw in Chapter 4 (p. 86) that \(Y\) also equals the sum of the items of aggregate expenditure: consumption expenditure, \(C\), investment, \(I\), government expenditure, \(G\), and exports, \(X\), minus imports, \(M\). That is:

\[
Y = C + I + G + X - M.
\]

By using these two equations, you can see that

\[
I + G + X = M + S + T.
\]

Subtract \(G\) and \(X\) from both sides of the last equation to obtain

\[
I = S + (T - G) + (M - X).
\]

This equation tells us that investment, \(I\), is financed by household saving, \(S\), the government budget surplus, \((T - G)\), and borrowing from the rest of the world, \((M - X)\).

A government budget surplus \((T > G)\) contributes funds to finance investment, but a government budget deficit \((T < G)\) competes with investment for funds.

**REVIEW QUIZ**

1. Distinguish between physical capital and financial capital and give two examples of each.
2. What is the distinction between gross investment and net investment?
3. What are the three main types of markets for financial capital?
4. Explain the connection between the price of a financial asset and its interest rate.

You can work these questions in Study Plan 7.1 and get instant feedback.
If we export less than we import, we borrow $(M - X)$ from the rest of the world to finance some of our investment. If we export more than we import, we lend $(X - M)$ to the rest of the world and part of U.S. saving finances investment in other countries.

The sum of private saving, $S$, and government saving, $(T - G)$, is called national saving. National saving and foreign borrowing finance investment.

In 2010, U.S. investment was $1.8 trillion. Governments (federal, state, and local combined) had a deficit of $1.5 trillion. This total of $3.3 trillion was financed by private saving of $2.8 trillion and borrowing from the rest of the world (negative net exports) of $0.5 trillion.

You're going to see how investment and saving and the flows of loanable funds—all measured in constant 2005 dollars—are determined. The price in the loanable funds market that achieves equilibrium is an interest rate, which we also measure in real terms as the real interest rate. In the loanable funds market, there is just one interest rate, which is an average of the interest rates on all the different types of financial securities that we described earlier. Let's see what we mean by the real interest rate.

**The Real Interest Rate**

The nominal interest rate is the number of dollars that a borrower pays and a lender receives in interest in a year expressed as a percentage of the number of dollars borrowed and lent. For example, if the annual interest paid on a $500 loan is $25, the nominal interest rate is 5 percent per year: $25 ÷ $500 × 100 or 5 percent.

The real interest rate is the nominal interest rate adjusted to remove the effects of inflation on the buying power of money. The real interest rate is approximately equal to the nominal interest rate minus the inflation rate.

You can see why if you suppose that you have put $500 in a savings account that earns 5 percent a year. At the end of a year, you have $525 in your savings account. Suppose that the inflation rate is 2 percent per year—during the year, all prices increased by 2 percent. Now, at the end of the year, it costs $510 to buy what $500 would have bought one year ago. Your money in the bank has really only increased by $15, from $510 to $525. That $15 is equivalent to a real interest rate of 3 percent a year on your original
The exact real interest rate formula, which allows for the change in the purchasing power of both the interest and the loan is:

$\text{Real interest rate} = \frac{(\text{Nominal interest rate} - \text{Inflation rate})}{(1 + \text{Inflation rate/100})}.$

If the nominal interest rate is 5 percent a year and the inflation rate is 2 percent a year, the real interest rate is $(5 - 2) \div (1 + 0.02) = 2.94$ percent a year.
Expected profit rises during a business cycle expansion and falls during a recession; rises when technological change creates profitable new products; rises as a growing population brings increased demand for goods and services; and fluctuates with contagious swings of optimism and pessimism, called “animal spirits” by Keynes and “irrational exuberance” by Alan Greenspan.

When expected profit changes, the demand for loanable funds curve shifts.

The Supply of Loanable Funds

The quantity of loanable funds supplied is the total funds available from private saving, the government budget surplus, and international borrowing during a given period. Our focus here is on saving. We’ll bring the other two items into the picture later.

How do you decide how much of your income to save and supply in the loanable funds market? Your decision is influenced by many factors, but chief among them are

1. The real interest rate
2. Disposable income
3. Expected future income
4. Wealth
5. Default risk

We begin by focusing on the real interest rate.

Other things remaining the same, the higher the real interest rate, the greater is the quantity of loanable funds supplied; and the lower the real interest rate, the smaller is the quantity of loanable funds supplied.

The Supply of Loanable Funds Curve  The supply of loanable funds is the relationship between the quantity of loanable funds supplied and the real interest rate when all other influences on lending plans remain the same. The curve SLF in Fig. 7.4 is a supply of loanable funds curve.

Think about a student’s decision to save some of what she earns from her summer job. With a real interest rate of 2 percent a year, she decides that it is not worth saving much—better to spend the income and take a student loan if funds run out during the semester. But if the real interest rate jumped to 10 percent a year, the payoff from saving would be high enough to encourage her to cut back on spending and increase the amount she saves.

Changes in the Supply of Loanable Funds  A change in disposable income, expected future income, wealth, or default risk changes the supply of loanable funds.

Disposable Income  A household’s disposable income is the income earned minus net taxes. When disposable income increases, other things remaining the same, consumption expenditure increases but by less than the increase in income. Some of the increase in income is saved. So the greater a household’s disposable income, other things remaining the same, the greater is its saving.

Expected Future Income  The higher a household’s expected future income, other things remaining the same, the smaller is its saving today.

Wealth  The higher a household’s wealth, other things remaining the same, the smaller is its saving. If a person’s wealth increases because of a capital gain, the person sees less need to save. For example, from 2002 through 2006, when house prices were rising rapidly, wealth increased despite the fact that personal saving dropped close to zero.
**Default Risk** Default risk is the risk that a loan will not be repaid. The greater that risk, the higher is the interest rate needed to induce a person to lend and the smaller is the supply of loanable funds.

**Shifts of the Supply of Loanable Funds Curve** When any of the four influences on the supply of loanable funds changes, the supply of loanable funds changes and the supply curve shifts. An increase in disposable income, a decrease in expected future income, a decrease in wealth, or a fall in default risk increases saving and increases the supply of loanable funds.

**Equilibrium in the Loanable Funds Market**
You’ve seen that other things remaining the same, the higher the real interest rate, the greater is the quantity of loanable funds supplied and the smaller is the quantity of loanable funds demanded. There is one real interest rate at which the quantities of loanable funds demanded and supplied are equal, and that interest rate is the equilibrium real interest rate.

Figure 7.5 shows how the demand for and supply of loanable funds determine the real interest rate. The **DLF** curve is the demand curve and the **SLF** curve is the supply curve. If the real interest rate exceeds 6 percent a year, the quantity of loanable funds supplied exceeds the quantity demanded—a surplus of funds. Borrowers find it easy to get funds, but lenders are unable to lend all the funds they have available. The real interest rate falls and continues to fall until the quantity of funds supplied equals the quantity of funds demanded.

If the real interest rate is less than 6 percent a year, the quantity of loanable funds supplied is less than the quantity demanded—a shortage of funds. Borrowers can’t get the funds they want, but lenders are able to lend all the funds they have. So the real interest rate rises and continues to rise until the quantity of funds supplied equals the quantity demanded.

Regardless of whether there is a surplus or a shortage of loanable funds, the real interest rate changes and is pulled toward an equilibrium level. In Fig. 7.5, the equilibrium real interest rate is 6 percent a year. At this interest rate, there is neither a surplus nor a shortage of loanable funds. Borrowers can get the funds they want, and lenders can lend all the funds they have available. The investment plans of borrowers and the saving plans of lenders are consistent with each other.

**Changes in Demand and Supply**
Financial markets are highly volatile in the short run but remarkably stable in the long run. Volatility in the market comes from fluctuations in either the demand for loanable funds or the supply of loanable funds. These fluctuations bring fluctuations in the real interest rate and in the equilibrium quantity of funds lent and borrowed. They also bring fluctuations in asset prices.

Here we’ll illustrate the effects of increases in demand and supply in the loanable funds market.

**An Increase in Demand** If the profits that firms expect to earn increase, they increase their planned investment and increase their demand for loanable funds to finance that investment. With an increase in the demand for loanable funds, but no change in the supply of loanable funds, there is a shortage of funds. As borrowers compete for funds, the interest rate rises and lenders increase the quantity of funds supplied.

Figure 7.6(a) illustrates these changes. An increase in the demand for loanable funds shifts the demand curve rightward from **DLF** to **DLF**. With no
An increase in the demand for loanable funds raises the real interest rate and increases saving.

An increase in supply shifts the supply curve rightward from $SLF_0$ to $SLF_1$. With no change in demand, there is a surplus of funds at a real interest rate of 6 percent a year. The real interest rate falls until it is 5 percent a year. Equilibrium is restored and the equilibrium quantity of funds has increased.

Long-Run Growth of Demand and Supply

Over time, both demand and supply in the loanable funds market fluctuate and the real interest rate rises and falls. Both the supply of loanable funds and the demand for loanable funds tend to increase over time. On the average, they increase at a similar pace, so although demand and supply trend upward, the real interest rate has no trend. It fluctuates around a constant average level.

REVIEW QUIZ

1. What is the loanable funds market?
2. Why is the real interest rate the opportunity cost of loanable funds?
3. How do firms make investment decisions?
4. What determines the demand for loanable funds and what makes it change?
5. How do households make saving decisions?
6. What determines the supply of loanable funds and what makes it change?
7. How do changes in the demand for and supply of loanable funds change the real interest rate and quantity of loanable funds?

You can work these questions in Study Plan 7.2 and get instant feedback.
Economics in Actions

Loanable Funds Fuel Home Price Bubble

The financial crisis that gripped the U.S. and global economies in 2007 and cascaded through the financial markets in 2008 had its origins much earlier in events taking place in the loanable funds market.

Between 2001 and 2005, a massive injection of loanable funds occurred. Some funds came from the rest of the world, but that source of supply has been stable. The Federal Reserve provided funds to keep interest rates low and that was a major source of the increase in the supply of funds. (The next chapter explains how the Fed does this.)

Figure 1 illustrates the loanable funds market starting in 2001. In that year, the demand for loanable funds was $DLF_{01}$ and the supply of loanable funds was $SLF_{01}$. The equilibrium real interest rate was 4 percent a year and the equilibrium quantity of loanable funds was $29$ trillion (in 2005 dollars).

During the ensuing four years, a massive increase in the supply of loanable funds shifted the supply curve rightward to $SLF_{05}$. A smaller increase in demand shifted the demand for loanable funds curve to $DLF_{05}$. The real interest rate fell to 1 percent a year and the quantity of loanable funds increased to $36$ trillion—a 24 percent increase in just four years.

With this large increase in available funds, much of it in the form of mortgage loans to home buyers, the demand for homes increased by more than the increase in the supply of homes. Home prices rose and the expectation of further increases fueled the demand for loanable funds.

By 2006, the expectation of continued rapidly rising home prices brought a very large increase in the demand for loanable funds. At the same time, the Federal Reserve began to tighten credit. (Again, you’ll learn how this is done in the next chapter). The result of the Fed’s tighter credit policy was a slowdown in the pace of increase in the supply of loanable funds.

Figure 2 illustrates these events. In 2006, the demand for loanable funds increased from $DLF_{05}$ to $DLF_{06}$ and the supply of loanable funds increased by a smaller amount from $SLF_{05}$ to $SLF_{06}$. The real interest rate increased to 3 percent a year.

The rise in the real interest rate (and a much higher rise in the nominal interest rate) put many homeowners in financial difficulty. Mortgage payments increased and some borrowers stopped repaying their loans.

By August 2007, the damage from mortgage default and foreclosure was so large that the credit market began to dry up. A large decrease in both demand and supply kept interest rates roughly constant but decreased the quantity of new business.

The total quantity of loanable funds didn’t decrease, but the rate of increase slowed to a snail’s pace and financial institutions most exposed to the bad mortgage debts and the securities that they backed (described on p. 162) began to fail.

These events illustrate the crucial role played by the loanable funds market in our economy.
Government enters the loanable funds market when it has a budget surplus or budget deficit. A government budget surplus increases the supply of loanable funds and contributes to financing investment; a government budget deficit increases the demand for loanable funds and competes with businesses for funds. Let’s study the effects of government on the loanable funds market.

**A Government Budget Surplus**

A government budget surplus increases the supply of loanable funds. The real interest rate falls, which decreases household saving and decreases the quantity of private funds supplied. The lower real interest rate increases the quantity of loanable funds demanded, and increases investment.

A government budget surplus of $1 trillion is added to private saving and the private supply of loanable funds ($PSLF$) to determine the supply of loanable funds, $SLF$. The real interest rate falls to 5 percent a year, private saving decreases, but investment increases to $2.5 trillion.

**A Government Budget Deficit**

A government budget deficit increases the demand for loanable funds. The real interest rate rises, which increases household saving and increases the quantity of private funds supplied. But the higher real interest rate decreases investment and the quantity of loanable funds demanded by firms to finance investment.

With no government deficit, the real interest rate is 6 percent a year, the quantity of loanable funds is $2 trillion a year, and investment is $2 trillion a year. But with the government surplus of $1 trillion a year, the equilibrium real interest rate falls to 5 percent a year and the equilibrium quantity of loanable funds increases to $2.5 trillion a year.

The fall in the interest rate decreases private saving to $1.5 trillion, but investment increases to $2.5 trillion, which is financed by private saving plus the government budget surplus (government saving).

Figure 7.7 shows these effects of a government budget surplus. The private supply of loanable funds curve is $PSLF$. The supply of loanable funds curve, $SLF$, shows the sum of private supply and the government budget surplus. Here, the government budget surplus is $1 trillion, so at each real interest rate the $SLF$ curve lies $1 trillion to the right of the $PSLF$ curve. That is, the horizontal distance between the $PSLF$ curve and the $SLF$ curve equals the government budget surplus.

With no government surplus, the real interest rate is 6 percent a year, the quantity of loanable funds is $2 trillion a year, and investment is $2 trillion a year. But with the government surplus of $1 trillion a year, the equilibrium real interest rate falls to 5 percent a year and the equilibrium quantity of loanable funds increases to $2.5 trillion a year.

The rise in the real interest rate decreases private saving to $1.5 trillion, but investment increases to $2.5 trillion, which is financed by private saving plus the government budget surplus (government saving).
CHAPTER 7 Finance, Saving, and Investment

A government budget deficit adds to the private demand for loanable funds curve (PDF) to determine the demand for loanable funds curve, DLF. The real interest rate rises, saving increases, but investment decreases—a crowding-out effect.

**The Crowding-Out Effect** The tendency for a government budget deficit to raise the real interest rate and decrease investment is called the crowding-out effect. The budget deficit crowds out investment by competing with businesses for scarce financial capital.

The crowding-out effect does not decrease investment by the full amount of the government budget deficit because the higher real interest rate induces an increase in private saving that partly contributes toward financing the deficit.

**The Ricardo-Barro Effect** First suggested by the English economist David Ricardo in the eighteenth century and refined by Robert J. Barro of Harvard University, the Ricardo-Barro effect holds that both of the effects we’ve just shown are wrong and the government budget, whether in surplus or deficit, has no effect on either the real interest rate or investment.

Barro says that taxpayers are rational. They can see that a budget deficit today means that future taxes will be higher and future disposable incomes will be smaller. With smaller expected future disposable incomes, saving increases today. Private saving and the private supply of loanable funds increase to match the quantity of loanable funds demanded by the government. So the budget deficit has no effect on either the real interest rate or investment. Figure 7.9 shows this outcome.

Most economists regard the Ricardo-Barro view as extreme. But there might be some change in private saving that goes in the direction suggested by the Ricardo-Barro effect that lessens the crowding-out effect.

**REVIEW QUIZ**

1. How does a government budget surplus or deficit influence the loanable funds market?
2. What is the crowding-out effect and how does it work?
3. What is the Ricardo-Barro effect and how does it modify the crowding-out effect?

You can work these questions in Study Plan 7.3 and get instant feedback.
The Global Loanable Funds Market

The loanable funds market is global, not national. Lenders on the supply side of the market want to earn the highest possible real interest rate and they will seek it by looking everywhere in the world. Borrowers on the demand side of the market want to pay the lowest possible real interest rate and they will seek it by looking everywhere in the world. Financial capital is mobile: It moves to the best advantage of lenders and borrowers.

International Capital Mobility

If a U.S. supplier of loanable funds can earn a higher interest rate in Tokyo than in New York, funds supplied in Japan will increase and funds supplied in the United States will decrease—funds will flow from the United States to Japan.

If a U.S. demander of loanable funds can pay a lower interest rate in Paris than in New York, the demand for funds in France will increase and the demand for funds in the United States will decrease—funds will flow from France to the United States.

Because lenders are free to seek the highest real interest rate and borrowers are free to seek the lowest real interest rate, the loanable funds market is a single, integrated, global market. Funds flow into the country in which the interest rate is highest and out of the country in which the interest rate is lowest.

When funds leave the country with the lowest interest rate, a shortage of funds raises the real interest rate. When funds move into the country with the highest interest rate, a surplus of funds lowers the real interest rate. The free international mobility of financial capital pulls real interest rates around the world toward equality.

Only when the real interest rates in New York, Tokyo, and Paris are equal does the incentive to move funds from one country to another stop.

Equality of real interest rates does not mean that if you calculate the average real interest rate in New York, Tokyo, and Paris, you’ll get the same number. To compare real interest rates, we must compare financial assets of equal risk.

Lending is risky. A loan might not be repaid. Or the price of a stock or bond might fall. Interest rates include a risk premium—the riskier the loan, other things remaining the same, the higher is the interest rate. The interest rate on a risky loan minus that on a safe loan is called the risk premium.

International capital mobility brings real interest rates in all parts of the world to equality except for differences that reflect differences in risk—differences in the risk premium.

International Borrowing and Lending

A country’s loanable funds market connects with the global market through net exports. If a country’s net exports are negative \((X < M)\), the rest of the world supplies funds to that country and the quantity of loanable funds in that country is greater than national saving. If a country’s net exports are positive \((X > M)\), the country is a net supplier of funds to the rest of the world and the quantity of loanable funds in that country is less than national saving.

Demand and Supply in the Global and National Markets

The demand for and supply of funds in the global loanable funds market determines the world equilibrium real interest rate. This interest rate makes the quantity of loanable funds demanded equal the quantity supplied in the world economy. But it does not make the quantity of funds demanded and supplied equal in each national economy. The demand for and supply of funds in a national economy determine whether the country is a lender to or a borrower from the rest of the world.

The Global Loanable Funds Market

Figure 7.10(a) illustrates the global market. The demand for loanable funds, \(DLF_w\) is the sum of the demands in all countries. Similarly, the supply of loanable funds, \(SLF_w\) is the sum of the supplies in all countries. The world equilibrium real interest rate makes the quantity of funds supplied in the world as a whole equal to the quantity demanded. In this example, the equilibrium real interest rate is 5 percent a year and the quantity of funds is $10 trillion.

An International Borrower

Figure 7.10(b) shows the loanable funds market in a country that borrows from the rest of the world. The country’s demand for loanable funds, \(DLF\), is part of the world demand in Fig. 7.10(a). The country’s supply of loanable funds, \(SLF_D\), is part of the world supply.
CHAPTER 7 Finance, Saving, and Investment

If this country were isolated from the global market, the real interest rate would be 6 percent a year (where the $DLF_D$ and $SLF_D$ curves intersect). But if the country is integrated into the global economy, with an interest rate of 6 percent a year, funds would flood into it. With a real interest rate of 5 percent a year in the rest of the world, suppliers of loanable funds would seek the higher return in this country. In effect, the country faces the supply of loanable funds curve $SLF_D$, which is horizontal at the world equilibrium real interest rate.

The country's demand for loanable funds and the world interest rate determine the equilibrium quantity of loanable funds—$2.5 billion in Fig. 7.10(b).

If this country were isolated from the global market, the real interest rate would be 6 percent a year (where the $DLF$ and $SLF$ curves intersect). But if the country is integrated into the global economy, with an interest rate of 5 percent a year, funds would flood into it. With a real interest rate of 5 percent a year in the rest of the world, suppliers of loanable funds would seek the higher return in other countries. Again, the country faces the supply of loanable funds curve $SLF$, which is horizontal at the world equilibrium real interest rate.

The country’s demand for loanable funds and the world interest rate determine the equilibrium quantity of loanable funds—$1.5 billion in Fig. 7.10(c).

**Changes in Demand and Supply** A change in the demand or supply in the global loanable funds market changes the real interest rate in the way shown in Fig. 7.6 (see p. 169). The effect of a change in demand or supply in a national market depends on the size of the country. A change in demand or supply in a small country has no significant effect on global demand or supply, so it leaves the world real interest rate unchanged and changes only the country’s net exports and international borrowing or lending. A change in demand or supply in a large country has a significant effect on global demand or supply, so it changes the world real interest rate as well as the country’s net exports and international borrowing or lending. Every country feels some of the effect of a large country’s change in demand or supply.

**FIGURE 7.10** Borrowing and Lending in the Global Loanable Funds Market

(a) The global market
(b) An international borrower
(c) An international lender

In the global loanable funds market in part (a), the demand for loanable funds, $DLF_W$, and the supply of funds, $SLF_W$, determine the world real interest rate. Each country can get funds at the world real interest rate and faces the (horizontal) supply curve $SLF$ in parts (b) and (c).

At the world real interest rate, borrowers in part (b) want more funds than the quantity supplied by domestic lenders [$SLF_D$]. The shortage is made up by international borrowing.

Domestic suppliers of funds in part (c) want to lend more than domestic borrowers demand. The excess quantity supplied goes to foreign borrowers.

If this country were isolated from the global market, the real interest rate would be 6 percent a year (where the $DLF$ and $SLF$ curves intersect). But if the country is integrated into the global economy, with an interest rate of 5 percent a year, funds would quickly flow out of it. With a real interest rate of 5 percent a year in the rest of the world, domestic suppliers of loanable funds would seek the higher return in other countries. Again, the country faces the supply of loanable funds curve $SLF$, which is horizontal at the world equilibrium real interest rate.

The country’s demand for loanable funds and the world interest rate determine the equilibrium quantity of loanable funds—$1.5 billion in Fig. 7.10(c).
Economics in Action

Greenspan’s Interest Rate Puzzle

The real interest rate paid by big corporations in the United States fell from 5.5 percent a year in 2001 to 2.5 percent a year in 2005. Alan Greenspan, then the Chairman of the Federal Reserve, said he was puzzled that the real interest rate was falling at a time when the U.S. government budget deficit was increasing.

Why did the real interest rate fall?

The answer lies in the global loanable funds market. Rapid economic growth in Asia and Europe brought a large increase in global saving, which in turn increased the global supply of loanable funds. The supply of loanable funds increased because Asian and European saving increased strongly.

The U.S. government budget deficit increased the U.S. and global demand for loanable funds. But this increase was very small compared to the increase in the global supply of loanable funds.

The result of a large increase in supply and a small increase in demand was a fall in the world equilibrium real interest rate and an increase in the equilibrium quantity of loanable funds.

The figure illustrates these events. The supply of loanable funds increased from $SLF_{01}$ in 2001 to $SLF_{05}$ in 2005. (In the figure, we ignore the change in the global demand for loanable funds because it was small relative to the increase in supply.)

With the increase in supply, the real interest rate fell from 5.5 percent to 2.5 percent a year and the quantity of loanable funds increased.

In the United States, borrowing from the rest of the world increased to finance the increased government budget deficit.

The interest rate puzzle illustrates the important fact that the loanable funds market is a global market, not a national market.

**REVIEW QUIZ**

1. Why do loanable funds flow among countries?
2. What determines the demand for and supply of loanable funds in an individual economy?
3. What happens if a country has a shortage of loanable funds at the world real interest rate?
4. What happens if a country has a surplus of loanable funds at the world real interest rate?
5. How is a government budget deficit financed in an open economy?

You can work these questions in Study Plan 7.4 and get instant feedback.

To complete your study of financial markets, take a look at Reading Between the Lines on pp. 176–177 and see how you can use the model of the loanable funds market to understand the events in the financial market crisis of 2008.
“Borrowing to Live” Weighs on Families, Firms, Nation
http://www.dallasmorningnews.com
June 13, 2010

... In the last decade, American household, business, and government debts doubled to $39.2 trillion. We did not double the size of the economy. And that’s the problem. ...

The average Dallas consumer owed $26,599 in March [2010] on credit cards and loans covering cars, tuition, and other personal needs. (The amount doesn’t include mortgages.) Dallas County delinquency rates for student, auto, and credit card loans are above the national average.

Now the U.S. government is on a borrowing spree. For every dollar it spends, it is borrowing 40 cents. ...

Some politicians and policy wonks say we have 10 years. Gold bugs and debt Jeremiahs say the day [of reckoning] is at hand.

In April, Federal Reserve Chairman Ben Bernanke told a Dallas audience that we should plan now to cut spending, raise taxes, or both. That seems to be the middle ground—it’s time we have a plan. ...

It would be easier if we owed the money to ourselves. More than $4 trillion of our federal debt of $8.572 trillion (not counting loans the government owes itself) was borrowed from foreigners.

China is our top creditor. It holds roughly $1.2 trillion in U.S. government debt. ...

Reprinted with permission of the Dallas Morning News.

ESSENCE OF THE STORY

- U.S. household, business, and government debts doubled to $39.2 trillion in the last decade.
- The average Dallas consumer owed $26,599 in March 2010, not counting mortgages.
- For every dollar the U.S. government spends, it borrows 40 cents.
- Some people think the government’s deficit will bring financial collapse.
- Most people, including Fed chairman Ben Bernanke, think that taxes should rise and government spending be cut.
- More than $4 trillion of the federal debt of $8.6 trillion is owed to foreigners, $1.2 trillion to China alone.
This news article says that the growth of both U.S. government debt and U.S. international debt are unsustainable and must be stopped.

The article speculates about impending doom at an unknown future date, perhaps in 10 years.

Government debt grows when the government runs a budget deficit. The news article correctly points out that the U.S. government is running a whopping deficit.

In 2009, of every dollar the government spent, it borrowed 40 cents.

The U.S. government is not alone. Governments in Europe, Japan, China, and many other countries are running large budget deficits.

These deficits might bring a “day of reckoning” as the article states, but they bring a more immediate problem: crowding out investment and slowing the pace of economic growth.

In 2009, the increase in government borrowing in the loanable funds market sent the real interest rate on long-term corporate bonds to 6 percent per year, up from 2 percent per year in 2008.

Figure 1, which is like Fig. 7.10(a) on p. 174, illustrates what happened in the global loanable funds market, and Fig. 2, which is like Fig. 7.10(b), illustrates the U.S. loanable funds market.

In both figures, the supply of loanable funds curve is SLF and the private (non-government) demand for loanable funds curve is PDLF. These supply and demand curves are (assumed to be) the same in 2008 and 2009.

In 2008, the demand for loanable funds curve was DLF08 in both figures. The real interest rate, determined in the global market, was 2 percent per year.

Fiscal stimulus packages increased government budget deficits and increased the demand for loanable funds. The demand curves (both figures) shifted to DLF09. The real interest rate increased in the global market to 6 percent per year.

In the global market in Fig. 1, the higher real interest rate crowded out (lowered) investment by 25 percent.

In the U.S. market in Fig. 2, the higher real interest rate crowded out (lowered) investment by almost 25 percent.

The higher real interest rate had a second effect in the U.S. market: It increased saving and the quantity of loanable funds supplied.

The increase in the quantity of loanable funds supplied from U.S. sources decreased the amount borrowed from the rest of the world.

So, although the long-term problems correctly identified in the news article are a concern, crowding out brings an immediate problem.

But the drop in borrowing from the rest of the world is a move in the direction hoped for in the article.
Equilibrium in the loanable funds market determines the real interest rate and quantity of funds.

Working Study Plan Problems 6 to 9 will give you a better understanding of the loanable funds market.

Government in the Loanable Funds Market

(pp. 171–172)

A government budget surplus increases the supply of loanable funds, lowers the real interest rate, and increases investment and the equilibrium quantity of loanable funds.

A government budget deficit increases the demand for loanable funds, raises the real interest rate, and increases the equilibrium quantity of loanable funds, but decreases investment in a crowding-out effect.

The Ricardo-Barro effect is the response of rational taxpayers to a budget deficit: private saving increases to finance the budget deficit. The real interest rate remains constant and the crowding-out effect is avoided.

Working Study Plan Problems 10 to 15 will give you a better understanding of government in the loanable funds market.

The Global Loanable Funds Market

(pp. 173–175)

The loanable funds market is a global market.

The equilibrium real interest rate is determined in the global loanable funds market and national demand and supply determine the quantity of international borrowing or lending.

Working Study Plan Problems 16 to 18 will give you a better understanding of the global loanable funds market.

Key Points

Financial Institutions and Financial Markets

(pp. 160–164)

- Capital (physical capital) is a real productive resource; financial capital is the funds used to buy capital.
- Gross investment increases the quantity of capital and depreciation decreases it. Saving increases wealth.
- The markets for financial capital are the markets for loans, bonds, and stocks.
- Financial institutions ensure that borrowers and lenders can always find someone with whom to trade.

Working Study Plan Problems 1 to 5 will give you a better understanding of financial institutions and markets.

The Loanable Funds Market

(pp. 164–170)

- Investment in capital is financed by household saving, a government budget surplus, and funds from the rest of the world.
- The quantity of loanable funds demanded depends negatively on the real interest rate and the demand for loanable funds changes when profit expectations change.
- The quantity of loanable funds supplied depends positively on the real interest rate and the supply of loanable funds changes when disposable income, expected future income, wealth, and default risk change.

Working Study Plan Problems 6 to 9 will give you a better understanding of the loanable funds market.

Key Terms

- Bond, 161
- Bond market, 161
- Crowding-out effect, 172
- Demand for loanable funds, 166
- Financial capital, 160
- Financial institution, 162
- Gross investment, 160
- Loanable funds market, 164
- Mortgage, 161
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- Net taxes, 164
- Net worth, 163
- Nominal interest rate, 165
- Real interest rate, 165
- Saving, 160
- Stock, 162
- Stock market, 162
- Supply of loanable funds, 167
- Wealth, 160
a. Is the purchase of corporate equities part of household consumption or saving? Explain your answer.

b. Equities reap a capital gain in the same way that houses reap a capital gain. Does this mean that the purchase of equities is investment? If not, explain why it is not.

5. **G-20 Leaders Look to Shake off Lingering Economic Troubles**

The G-20 aims to take stock of the economic recovery. One achievement of the G-20 in Pittsburgh could be a deal to require that financial institutions hold more capital.

Source: *USA Today*, September 24, 2009

What are the financial institutions that the G-20 might require to hold more capital? What exactly is the “capital” referred to in the news clip? How might the requirement to hold more capital make financial institutions safer?

### The Loanable Funds Market (Study Plan 7.2)

Use the following information to work Problems 6 and 7.

First Call, Inc., is a cellular phone company. It plans to build an assembly plant that costs $10 million if the real interest rate is 6 percent a year. If the real interest rate is 5 percent a year, First Call will build a larger plant that costs $12 million. And if the real interest rate is 7 percent a year, First Call will build a smaller plant that costs $8 million.

6. Draw a graph of First Call’s demand for loanable funds curve.

7. First Call expects its profit from the sale of cellular phones to double next year. If other things remain the same, explain how this increase in expected profit influences First Call’s demand for loanable funds.

8. Draw a graph to illustrate how an increase in the supply of loanable funds and a decrease in the demand for loanable funds can lower the real interest rate and leave the equilibrium quantity of loanable funds unchanged.

9. Use the information in Problem 4.
a. U.S. household income has grown considerably since 1984. Has U.S. saving been on a downward trend because Americans feel wealthier?
b. Explain why households preferred to buy corporate equities rather than bonds.

**Government in the Loanable Funds Market**

*(Study Plan 7.3)*

Use the following table to work Problems 10 to 12. The table shows an economy’s demand for loanable funds and the supply of loanable funds schedules, when the government’s budget is balanced.

<table>
<thead>
<tr>
<th>Real interest rate (percent per year)</th>
<th>Loanable funds demanded (trillions of 2005 dollars)</th>
<th>Loanable funds supplied (trillions of 2005 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>8.5</td>
<td>5.5</td>
</tr>
<tr>
<td>5</td>
<td>8.0</td>
<td>6.0</td>
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<td>6</td>
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<td>6.0</td>
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</tr>
<tr>
<td>10</td>
<td>5.5</td>
<td>8.5</td>
</tr>
</tbody>
</table>

10. Suppose that the government has a budget surplus of $1 trillion. What are the real interest rate, the quantity of investment, and the quantity of private saving? Is there any crowding out in this situation?

11. Suppose that the government has a budget deficit of $1 trillion. What are the real interest rate, the quantity of investment, and the quantity of private saving? Is there any crowding out in this situation?

12. Suppose that the government has a budget deficit of $1 trillion and the Ricardo-Barro effect occurs. What are the real interest rate and the quantity of investment?

Use the table in Problem 10 to work Problems 13 to 15.

Suppose that the quantity of loanable funds demanded increases by $1 trillion at each real interest rate and the quantity of loanable funds supplied increases by $2 trillion at each interest rate.

13. If the government budget is balanced, what are the real interest rate, the quantity of loanable funds, investment, and private saving? Does any crowding out occur?

14. If the government budget becomes a deficit of $1 trillion, what are the real interest rate, the quantity of loanable funds, investment, and private saving? Does any crowding out occur?

15. If the government wants to stimulate investment and increase it to $9 trillion, what must it do?

**The Global Loanable Funds Market** *(Study Plan 7.4)*

Use the following information to work Problems 16 and 17.

**Global Saving Glut and U.S. Current Account**, remarks by Ben Bernanke (when a governor of the Federal Reserve) on March 10, 2005:

The U.S. economy appears to be performing well: Output growth has returned to healthy levels, the labor market is firming, and inflation appears to be under control. But, one aspect of U.S. economic performance still evokes concern: the nation’s large and growing current account deficit (negative net exports). Most forecasters expect the nation’s current account imbalance to decline slowly at best, implying a continued need for foreign credit and a concomitant decline in the U.S. net foreign asset position.

16. Why is the United States, with the world’s largest economy, borrowing heavily on international capital markets—rather than lending, as would seem more natural?

17. a. What implications do the U.S. current account deficit (negative net exports) and our reliance on foreign credit have for economic performance in the United States?

b. What policies, if any, should be used to address this situation?

18. **IMF Says It Battled Crisis Well**

The International Monetary Fund (IMF) reported that it acted effectively in combating the global recession. Since September 2008, the IMF made $163 billion available to developing countries. While the IMF urged developed countries and China to run deficits to stimulate their economies, the IMF required developing countries with large deficits to cut spending and not increase spending.


a. Explain how increased government budget deficits change the loanable funds market.

b. Would the global recession have been less severe had the IMF made larger loans to developing countries?
Financial Institutions and Financial Markets

19. On January 1, 2009, Terry’s Towing Service owned 4 tow trucks valued at $300,000. During 2009, Terry’s bought 2 new trucks for a total of $180,000. At the end of 2009, the market value of all of the firm’s trucks was $400,000. What was Terry’s gross investment? Calculate Terry’s depreciation and net investment.

Use the following information to work Problems 20 and 21.

The Bureau of Economic Analysis reported that the U.S. capital stock was $40.4 trillion at the end of 2007, $41.1 trillion at the end of 2008, and $41.4 trillion at the end of 2009. Depreciation in 2008 was $1.3 trillion, and gross investment during 2009 was $1.5 trillion (all in 2005 dollars).


22. Annie runs a fitness center. On December 31, 2009, she bought an existing business with exercise equipment and a building worth $300,000. During 2010, business improved and she bought some new equipment for $50,000. At the end of 2010, her equipment and buildings were worth $325,000. Calculate Annie’s gross investment, depreciation, and net investment during 2010.

23. Karrie is a golf pro, and after she paid taxes, her income from golf and interest from financial assets was $1,500,000 in 2010. At the beginning of 2010, she owned $900,000 worth of financial assets. At the end of 2010, Karrie’s financial assets were worth $1,900,000.

   a. How much did Karrie save during 2010?
   b. How much did she spend on consumption goods and services?

The Loanable Funds Market

Use the following information to work Problems 24 and 25.

In 2010, the Lee family had disposable income of $80,000, wealth of $140,000, and an expected future income of $80,000 a year. At a real interest rate of 4 percent a year, the Lee family saves $15,000 a year; at a real interest rate of 6 percent a year, they save $20,000 a year; and at a real interest rate of 8 percent, they save $25,000 a year.

24. Draw a graph of the Lee family’s supply of loanable funds curve.

25. In 2011, suppose that the stock market crashes and the default risk increases. Explain how this increase in default risk influences the Lee family’s supply of loanable funds curve.

26. Draw a graph to illustrate the effect of an increase in the demand for loanable funds and an even larger increase in the supply of loanable funds on the real interest rate and the equilibrium quantity of loanable funds.

27. Greenspan’s Conundrum Spells Confusion for Us All

In January 2005, the interest rate on bonds was 4% a year and it was expected to rise to 5% a year by the end of 2005. As the rate rose to 4.3% during February, most commentators focused, not on why the interest rate rose, but on why it was so low before. Explanations of this “conundrum” included that unusual buying and expectations for an economic slowdown were keeping the interest rate low.

Source: Financial Times, February 26, 2005

   a. Explain how “unusual buying” might lead to a low real interest rate.
   b. Explain how investors’ “expectations for an economic slowdown” might lead to a lower real interest rate.

Government in the Loanable Funds Market

Use the following information to work Problems 28 and 29.

India’s Economy Hits the Wall

At the start of 2008, India had an annual growth of 9%, huge consumer demand, and increasing foreign investment. But by July 2008, India had 11.4% inflation, large government deficits, and rising interest rates. Economic growth is expected to fall to 7% by
the end of 2008. A Goldman Sachs report suggests that India needs to lower the government’s deficit, raise educational achievement, control inflation, and liberalize its financial markets.

Source: Business Week, July 1, 2008

28. If the Indian government reduces its deficit and returns to a balanced budget, how will the demand for or supply of loanable funds in India change?

29. With economic growth forecasted to slow, future incomes are expected to fall. If other things remain the same, how will the demand or supply of loanable funds in India change?

30. Federal Deficit Surges to $1.38 trillion through August
House Republican Leader John Boehner of Ohio asks: When will the White House tackle these jaw-dropping deficits that pile more and more debt on future generations while it massively increases federal spending?

Source: USA Today, September 11, 2009

Explain the effect of the federal deficit and the mounting debt on U.S. economic growth.

The Global Loanable Funds Market

31. The Global Savings Glut and Its Consequences
Several developing countries are running large current account surpluses (representing an excess of savings over investment) and rapid growth has led to high saving rates as people save a large fraction of additional income. In India, the saving rate has risen from 23% a decade ago to 33% today. China’s saving rate is 55%. The glut of saving in Asia is being put into U.S. bonds. When a poor country buys U.S. bonds, it is in effect lending to the United States.

Source: The Cato Institute, June 8, 2007

a. Graphically illustrate and explain the impact of the “glut of savings” on the real interest rate and the quantity of loanable funds.

b. How do the high saving rates in Asia impact investment in the United States?

Use the following information to work Problems 32 to 35.

Most economists agree that the problems we are witnessing today developed over a long period of time. For more than a decade, a massive amount of money flowed into the United States from investors abroad, because our country is an attractive and secure place to do business. This large influx of money to U.S. financial institutions—along with low interest rates—made it easier for Americans to get credit. These developments allowed more families to borrow money for cars and homes and college tuition—some for the first time. They allowed more entrepreneurs to get loans to start new businesses and create jobs.

President George W. Bush, Address to the Nation, September 24, 2008

32. Explain why, for more than a decade, a massive amount of money flowed into the United States. Compare and contrast your explanation with that of the President.

33. Provide a graphical analysis of the reasons why the interest rate was low.

34. Funds have been flowing into the United States since the early 1980s. Why might they have created problems in 2008 but not earlier?

35. Could the United States stop funds from flowing in from other countries? How?

Economics in the News

36. After you have studied Reading Between the Lines on pp. 176–177 answer the following questions.

a. What are the long-term problems to which the news article draws attention?

b. What was the major event in the global and U.S. loanable funds markets in 2009?

c. How did the event identified in part (b) influence the world real interest rate and the global supply of and demand for loanable funds?

d. How did the event identified in part (b) influence the U.S. supply of and demand for loanable funds and the amount that the United States borrowed from the rest of the world?

e. If governments in other countries were to lower their budget deficits but the U.S. government did not lower its deficit, what would happen to the world real interest rate, the supply of and demand for loanable funds in the United States, and the amount that the United States borrows from the rest of the world?

f. If the U.S. government lowered its budget deficit but the governments in other countries did not lower their deficits, what would happen to the world real interest rate, the supply of and demand for loanable funds in the United States, and the amount that the United States borrows from the rest of the world?
After studying this chapter, you will be able to:

- Define money and describe its functions
- Explain the economic functions of banks and other depository institutions
- Describe the structure and functions of the Federal Reserve System (the Fed)
- Explain how the banking system creates money
- Explain what determines the demand for money, the supply of money, and the nominal interest rate
- Explain how the quantity of money influences the price level and the inflation rate in the long run

Money, like fire and the wheel, has been around for a long time, and it has taken many forms. Money was wampum (beads made from shells) for North American Indians, whale’s teeth for Fijians, and tobacco for early American colonists. Cakes of salt served as money in Ethiopia and Tibet. Today, when we want to buy something, we use coins or dollar bills, write a check, or swipe a debit card or a credit card. Soon, we’ll be using a “smart card” or even a cell phone to make payments. Are all these things money?

The quantity of money in our economy is regulated by the Federal Reserve—the Fed. How does the Fed influence the quantity of money? And what happens if the Fed creates too much money or too little money?

In this chapter, we study the functions of money, the banks that create it, the Federal Reserve and its influence on the quantity of money, and the long-run consequences of changes in the quantity of money. In Reading Between the Lines at the end of the chapter, we look at the extraordinary actions taken by the Fed during the recent financial crisis.
What Is Money?

What do wampum, tobacco, and nickels and dimes have in common? They are all examples of money, which is defined as any commodity or token that is generally acceptable as a means of payment. A means of payment is a method of settling a debt. When a payment has been made, there is no remaining obligation between the parties to a transaction. So what wampum, tobacco, and nickels and dimes have in common is that they have served (or still do serve) as the means of payment. Money serves three other functions:

- **Medium of exchange**
- **Unit of account**
- **Store of value**

**Medium of Exchange**

A medium of exchange is any object that is generally accepted in exchange for goods and services. Without a medium of exchange, goods and services must be exchanged directly for other goods and services—an exchange called barter. Barter requires a double coincidence of wants, a situation that rarely occurs. For example, if you want a hamburger, you might offer a CD in exchange for it. But you must find someone who is selling hamburgers and wants your CD.

A medium of exchange overcomes the need for a double coincidence of wants. Money acts as a medium of exchange because people with something to sell will always accept money in exchange for it. But money isn’t the only medium of exchange. You can buy with a credit card, but a credit card isn’t money. It doesn’t make a final payment, and the debt it creates must eventually be settled by using money.

**Unit of Account**

A unit of account is an agreed measure for stating the prices of goods and services. To get the most out of your budget, you have to figure out whether seeing one more movie is worth its opportunity cost. But that cost is not dollars and cents. It is the number of ice-cream cones, sodas, or cups of coffee that you must give up. It’s easy to do such calculations when all these goods have prices in terms of dollars and cents (see Table 8.1). If the price of a movie is $8 and the price of a cappuccino is $4, you know right away that seeing one movie costs you 2 cappuccinos.

<table>
<thead>
<tr>
<th>Good</th>
<th>Price in money units</th>
<th>Price in units of another good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movie</td>
<td>$8.00 each</td>
<td>2 cappuccinos</td>
</tr>
<tr>
<td>Cappuccino</td>
<td>$4.00 each</td>
<td>2 ice-cream cones</td>
</tr>
<tr>
<td>Ice cream</td>
<td>$2 per cone</td>
<td>2 packs of jelly beans</td>
</tr>
<tr>
<td>Jelly beans</td>
<td>$1 per pack</td>
<td>2 sticks of gum</td>
</tr>
<tr>
<td>Gum</td>
<td>$0.50 per stick</td>
<td></td>
</tr>
</tbody>
</table>

Money as a unit of account: The price of a movie is $8 and the price of a stick of gum is 50¢, so the opportunity cost of a movie is 16 sticks of gum ($8.00 ÷ 50¢ = 16). No unit of account: You go to a movie theater and learn that the cost of seeing a movie is 2 cappuccinos. You go to a grocery store and learn that a pack of jelly beans costs 2 sticks of gum. But how many sticks of gum does seeing a movie cost you? To answer that question, you go to the coffee shop and find that a cappuccino costs 2 ice-cream cones. Now you head for the ice-cream shop, where an ice-cream cone costs 2 packs of jelly beans. Now you get out your pocket calculator: 1 movie costs 2 cappuccinos, or 4 ice-cream cones, or 8 packs of jelly beans, or 16 sticks of gum!

If jelly beans are $1 a pack, one movie costs 8 packs of jelly beans. You need only one calculation to figure out the opportunity cost of any pair of goods and services.

Imagine how troublesome it would be if your local movie theater posted its price as 2 cappuccinos, the coffee shop posted the price of a cappuccino as 2 ice-cream cones, the ice-cream shop posted the price of an ice-cream cone as 2 packs of jelly beans, and the grocery store priced a pack of jelly beans as 2 sticks of gum! Now how much running around and calculating will you have to do to find out how much that movie is going to cost you in terms of the cappuccinos, ice cream cones, jelly beans, or gum that you must give up to see it? You get the answer for cappuccinos right away from the sign posted on the movie theater. But for all the other goods, you’re going to
have to visit many different stores to establish the price of each good in terms of another and then calculate the prices in units that are relevant for your own decision. The hassle of doing all this research might be enough to make a person swear off movies! You can see how much simpler it is if all the prices are expressed in dollars and cents.

**Store of Value**

Money is a *store of value* in the sense that it can be held and exchanged later for goods and services. If money were not a store of value, it could not serve as a means of payment.

Money is not alone in acting as a store of value. A house, a car, and a work of art are other examples.

The more stable the value of a commodity or token, the better it can act as a store of value and the more useful it is as money. No store of value has a completely stable value. The value of a house, a car, or a work of art fluctuates over time. The value of the commodities and tokens that are used as money also fluctuate over time.

Inflation lowers the value of money and the values of other commodities and tokens that are used as money. To make money as useful as possible as a store of value, a low inflation rate is needed.

**Money in the United States Today**

In the United States today, money consists of

- Currency
- Deposits at banks and other depository institutions

**Currency**  The notes and coins held by individuals and businesses are known as *currency*. Notes are money because the government declares them so with the words “This note is legal tender for all debts, public and private.” You can see these words on every dollar bill. Notes and coins inside banks are not counted as currency because they are not held by individuals and businesses.

**Deposits**  Deposits of individuals and businesses at banks and other depository institutions, such as savings and loan associations, are also counted as money. Deposits are money because the owners of the deposits can use them to make payments.

**Official Measures of Money**  Two official measures of money in the United States today are known as M1 and M2. M1 consists of currency and traveler’s checks plus checking deposits owned by individuals and businesses. M1 does not include currency held by banks, and it does not include currency and checking deposits owned by the U.S. government. M2 consists of M1 plus time deposits, savings deposits, and money market mutual funds and other deposits.

### Economics in Action

**Official Measures of U.S. Money**

The figure shows the relative magnitudes of the items that make up M1 and M2. Notice that M2 is almost five times as large as M1 and that currency is a small part of our money.

- **M2**: 8,611
- **M1**: 1,723
- **Currency and traveler’s checks**: 888
- **Checking deposits**: 835
- **Savings deposits**: 5,075
- **Time deposits**: 1,059
- **Money market mutual funds and other deposits**: 754

**Source of data:** The Federal Reserve Board. The data are for June 2010.
Are M1 and M2 Really Money? Money is the means of payment. So the test of whether an asset is money is whether it serves as a means of payment. Currency passes the test. But what about deposits? Checking deposits are money because they can be transferred from one person to another by writing a check or using a debit card. Such a transfer of ownership is equivalent to handing over currency. Because M1 consists of currency plus checking deposits and each of these is a means of payment, $M1$ is money.

But what about M2? Some of the savings deposits in M2 are just as much a means of payment as the checking deposits in M1. You can use an ATM to get funds from your savings account to pay for your purchase at the grocery store or the gas station. But some savings deposits are not means of payment. These deposits are known as liquid assets. Liquidity is the property of being easily convertible into a means of payment without loss in value. Because the deposits in M2 that are not means of payment are quickly and easily converted into a means of payment—into currency or checking deposits—they are counted as money.

Deposits Are Money but Checks Are Not In defining money, we include, along with currency, deposits at banks and other depository institutions. But we do not count the checks that people write as money. Why are deposits money and checks not?

To see why deposits are money but checks are not, think about what happens when Colleen buys some roller-blades for $100 from Rocky’s Rollers. When Colleen goes to Rocky’s shop, she has $500 in her deposit account at the Laser Bank. Rocky has $1,000 in his deposit account—at the same bank, as it happens. The total deposits of these two people are $1,500. Colleen writes a check for $100. Rocky takes the check to the bank right away and deposits it. Rocky’s bank balance rises from $1,000 to $1,100, and Colleen’s balance falls from $500 to $400. The total deposits of Colleen and Rocky are still the same as before: $1,500. Rocky now has $100 more than before, and Colleen has $100 less.

This transaction has transferred money from Colleen to Rocky, but the check itself was never money. There wasn’t an extra $100 of money while the check was in circulation. The check instructs the bank to transfer money from Colleen to Rocky.

If Colleen and Rocky use different banks, there is an extra step. Rocky’s bank credits $100 to Rocky’s account and then takes the check to a check-clearing center. The check is then sent to Colleen’s bank, which pays Rocky’s bank $100 and then debits Colleen’s account $100. This process can take a few days, but the principles are the same as when two people use the same bank.

Credit Cards Are Not Money You’ve just seen that checks are not money. What about credit cards? Isn’t having a credit card in your wallet and presenting the card to pay for your roller-blades the same thing as using money? Why aren’t credit cards somehow valued and counted as part of the quantity of money?

When you pay by check, you are frequently asked to prove your identity by showing your driver’s license. It would never occur to you to think of your driver’s license as money. It’s just an ID card. A credit card is also an ID card, but one that lets you take out a loan at the instant you buy something. When you sign a credit card sales slip, you are saying, “I agree to pay for these goods when the credit card company bills me.” Once you get your statement from the credit card company, you must make at least the minimum payment due. To make that payment, you need money—you need to have currency or a checking deposit to pay the credit card company. So although you use a credit card when you buy something, the credit card is not the means of payment and it is not money.

**REVIEW QUIZ**

1. What makes something money? What functions does money perform? Why do you think packs of chewing gum don’t serve as money?
2. What are the problems that arise when a commodity is used as money?
3. What are the main components of money in the United States today?
4. What are the official measures of money? Are all the measures really money?
5. Why are checks and credit cards not money?

You can work these questions in Study Plan 8.1 and get instant feedback.

We’ve seen that the main component of money in the United States is deposits at banks and other depository institutions. Let’s take a closer look at these institutions.
Depository Institutions

A **depository institution** is a financial firm that takes deposits from households and firms. These deposits are components of M1 and M2. You will learn what these institutions are, what they do, the economic benefits they bring, how they are regulated, and how they have innovated to create new financial products.

**Types of Depository Institutions**
The deposits of three types of financial firms make up the nation’s money. They are

- Commercial banks
- Thrift institutions
- Money market mutual funds

**Commercial Banks** A **commercial bank** is a firm that is licensed to receive deposits and make loans. In 2010, about 7,000 commercial banks operated in the United States but mergers make this number fall each year as small banks disappear and big banks expand.

A few very large commercial banks offer a wide range of banking services and have extensive international operations. The largest of these banks are Bank of America, Wells Fargo, JPMorgan Chase, and Citigroup. Most commercial banks are small and serve their regional and local communities.

The deposits of commercial banks represent 40 percent of M1 and 65 percent of M2.

**Thrift Institutions** Savings and loan associations, savings banks, and credit unions are **thrift institutions**.

**Savings and Loan Association** A **savings and loan association** (S&L) is a depository institution that receives deposits and makes personal, commercial, and home-purchase loans.

**Savings Bank** A **savings bank** is a depository institution that accepts savings deposits and makes mostly home-purchase loans.

**Credit Union** A **credit union** is a depository institution owned by a social or economic group, such as a firm’s employees, that accepts savings deposits and makes mostly personal loans.

The deposits of the thrift institutions represent 9 percent of M1 and 16 percent of M2.

**Money Market Mutual Funds** A **money market mutual fund** is a fund operated by a financial institution that sells shares in the fund and holds assets such as U.S. Treasury bills and short-term commercial bills.

Money market mutual fund shares act like bank deposits. Shareholders can write checks on their money market mutual fund accounts, but there are restrictions on most of these accounts. For example, the minimum deposit accepted might be $2,500, and the smallest check a depositor is permitted to write might be $500.

Money market mutual funds do not feature in M1 and represent 9 percent of M2.

**What Depository Institutions Do**
Depository institutions provide services such as check clearing, account management, credit cards, and Internet banking, all of which provide an income from service fees.

But depository institutions earn most of their income by using the funds they receive from depositors to make loans and to buy securities that earn a higher interest rate than that paid to depositors. In this activity, a depository institution must perform a balancing act weighing return against risk. To see this balancing act, we’ll focus on the commercial banks.

A commercial bank puts the funds it receives from depositors and other funds that it borrows into four types of assets:

1. A bank’s **reserves** are notes and coins in the bank’s vault or in a deposit account at the Federal Reserve. (We’ll study the Federal Reserve later in this chapter.) These funds are used to meet depositors’ currency withdrawals and to make payments to other banks. In normal times, a bank keeps about a half of one percent of deposits as reserves. (You’ll see in Table 8.2 on the next page that 2010 is not a normal time.)

2. **Liquid assets** are overnight loans to other banks, U.S. government Treasury bills, and commercial bills. These assets are the banks’ first line of defense if they need reserves. Liquid assets can be sold and instantly converted into reserves with virtually no risk of loss. Because they have a low risk, they earn a low interest rate.

The interest rate on overnight loans to other banks, called the **federal funds rate**, is targeted by the Fed. We explain how and why on pp. 350–351.
3. **Securities** are U.S. government bonds and other bonds such as mortgage-backed securities. These assets can be sold and converted into reserves but at prices that fluctuate, so they are riskier than liquid assets and have a higher interest rate.

4. **Loans** are funds committed for an agreed-upon period of time to corporations to finance investment and to households to finance the purchase of homes, cars, and other durable goods. The outstanding balances on credit card accounts are also bank loans. Loans are a bank’s riskiest and highest-earning assets: They can’t be converted into reserves until they are due to be repaid, and some borrowers default and never repay.

Table 8.2 provides a snapshot of the sources and uses of funds of all the commercial banks in June 2010 that serves as a summary of the above account.

### Economic Benefits Provided by Depository Institutions

You’ve seen that a depository institution earns part of its profit because it pays a lower interest rate on deposits than what it earns on loans. What benefits do these institutions provide that make depositors willing to put up with a low interest rate and borrowers willing to pay a higher one?

**Create Liquidity**  
Depository institutions create liquidity by borrowing short and lending long—taking deposits and standing ready to repay them on short notice or on demand and making loan commitments that run for terms of many years.

**Pool Risk**  
A loan might not be repaid—a default. If you lend to one person who defaults, you lose the entire amount loaned. If you lend to 1,000 people (through a bank) and one person defaults, you lose almost nothing. Depository institutions pool risk.

**Lower the Cost of Borrowing**  
Imagine there are no depository institutions and a firm is looking for $1 million to buy a new factory. It hunts around for several dozen people from whom to borrow the funds. Depository institutions lower the cost of this search. The firm gets its $1 million from a single institution that gets deposits from a large number of people but spreads the cost of this activity over many borrowers.

**Lower the Cost of Monitoring Borrowers**  
By monitoring borrowers, a lender can encourage good decisions that prevent defaults. But this activity is costly. Imagine how costly it would be if each household that lent money to a firm incurred the costs of monitoring that firm directly. Depository institutions can perform this task at a much lower cost.

### How Depository Institutions Are Regulated

Depository institutions are engaged in a risky business, and a failure, especially of a large bank, would have damaging effects on the entire financial system and economy. To make the risk of failure small, depository institutions are required to hold levels of reserves and owners’ capital that equal or surpass ratios laid down by regulation. If a depository institution fails, its deposits are guaranteed up to $250,000 per depositor per bank by the Federal Deposit Insurance Corporation or FDIC. The FDIC can take over management of a bank that appears to be heading toward failure.

### Table 8.2  
**Commercial Banks: Sources and Uses of Funds**

<table>
<thead>
<tr>
<th></th>
<th>Funds (billions of dollars)</th>
<th>Percentage of deposits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total funds</strong></td>
<td>11,096</td>
<td>144.3</td>
</tr>
<tr>
<td><strong>Sources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deposits</td>
<td>7,694</td>
<td>100.0</td>
</tr>
<tr>
<td>Borrowing</td>
<td>1,997</td>
<td>26.0</td>
</tr>
<tr>
<td>Own capital and other sources</td>
<td>1,405</td>
<td>18.3</td>
</tr>
<tr>
<td><strong>Uses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserves</td>
<td>1,097</td>
<td>14.3</td>
</tr>
<tr>
<td>Liquid assets</td>
<td>98</td>
<td>1.3</td>
</tr>
<tr>
<td>Securities and other assets</td>
<td>3,040</td>
<td>39.5</td>
</tr>
<tr>
<td>Loans</td>
<td>6,861</td>
<td>89.2</td>
</tr>
</tbody>
</table>

Commercial banks get most of their funds from depositors and use most of them to make loans. In normal times banks hold about 0.5 percent of deposits as reserves. But in 2010, at a time of great financial uncertainty, they held an unusually large 14.3 percent as reserves.

*Source of data: The Federal Reserve Board. The data are for June, 2010.*
Depository Institutions

Financial Innovation

In the pursuit of larger profit, depository institutions are constantly seeking ways to improve their products in a process called financial innovation.

During the late 1970s, a high inflation rate sent the interest rate on home-purchase loans to 15 percent a year. Traditional fixed interest rate mortgages became unprofitable and variable interest rate mortgages were introduced.

During the 2000s, when interest rates were low and depository institutions were flush with funds, sub-prime mortgages were developed. To avoid the risk of carrying these mortgages, mortgage-backed securities were developed. The original lending institution sold these securities, lowered their own exposure to risk, and obtained funds to make more loans.

The development of low-cost computing and communication brought financial innovations such as credit cards and daily interest deposit accounts.

Financial innovation has brought changes in the composition of money. Checking deposits at thrift institutions have become an increasing percentage of M1 while checking deposits at commercial banks have become a decreasing percentage. Savings deposits have decreased as a percentage of M2, while time deposits and money market mutual funds have expanded. Surprisingly, the use of currency has not fallen much.

Economics in Action

Commercial Banks Flush with Reserves

When Lehman Brothers (a New York investment bank) failed in October 2008, panic spread through financial markets. Banks that are normally happy to lend to each other overnight for an interest rate barely above the rate they can earn on safe Treasury bills lost confidence and the interest rate in this market shot up to 3 percentage points above the Treasury bill rate. Banks wanted to be safe and to hold cash. The Fed created and the banks willingly held reserves at the unheard of level of $1 trillion or 14 percent of deposits.

Throughout 2009 and 2010, bank reserves remained at this extraordinary level. And despite having plenty of funds to lend, the level of bank loans barely changed over 2009 and 2010.

The figure compares the commercial banks’ sources and uses of funds (sources are liabilities and uses are assets) in 2008 with those in 2010.
The Federal Reserve System

The Federal Reserve System (usually called the Fed) is the central bank of the United States. A central bank is a bank’s bank and a public authority that regulates a nation’s depository institutions and conducts monetary policy, which means that it adjusts the quantity of money in circulation and influences interest rates.

We begin by describing the structure of the Fed.

The Structure of the Fed

Three key elements of the Fed’s structure are:

- The Board of Governors
- The regional Federal Reserve banks
- The Federal Open Market Committee

The Board of Governors

A seven-member board appointed by the President of the United States and confirmed by the Senate governs the Fed. Members have 14-year (staggered) terms and one seat on the board becomes vacant every two years. The President appoints one board member as chairman for a 4-year renewable term—currently Ben Bernanke, a former economics professor at Princeton University.

The Federal Reserve Banks

The nation is divided into 12 Federal Reserve districts (shown in Fig. 8.1). Each district has a Federal Reserve Bank that provides check-clearing services to commercial banks and issues bank notes.

The Federal Reserve Bank of New York (known as the New York Fed), occupies a special place in the Federal Reserve System because it implements the Fed’s policy decisions in the financial markets.

The Federal Open Market Committee

The Federal Open Market Committee (FOMC) is the main policy-making organ of the Federal Reserve System. The FOMC consists of the following voting members:

- The chairman and the other six members of the Board of Governors
- The president of the Federal Reserve Bank of New York
- The presidents of the other regional Federal Reserve banks (of whom, on a yearly rotating basis, only four vote)

The FOMC meets approximately every six weeks to review the state of the economy and to decide the actions to be carried out by the New York Fed.

FIGURE 8.1 The Federal Reserve System

The nation is divided into 12 Federal Reserve districts, each having a Federal Reserve bank. (Some of the larger districts also have branch banks.) The Board of Governors of the Federal Reserve System is located in Washington, D.C.

Source: Federal Reserve Bulletin.
The Fed’s Balance Sheet

The Fed influences the economy through the size and composition of its balance sheet—the assets that the Fed owns and the liabilities that it owes.

The Fed’s Assets

The Fed has two main assets:

1. U.S. government securities
2. Loans to depository institutions

The Fed holds U.S. securities—Treasury bills and Treasury bonds—that it buys in the bond market. When the Fed buys or sells bonds, it participates in the loanable funds market (see pp. 164–170).

The Fed makes loans to depository institutions. When these institutions in aggregate are short of reserves, they can borrow from the Fed. In normal times this item is small, but during 2007 and 2008, it grew as the Fed provided increasing amounts of relief from the financial crisis. By October 2008, loans to depository institutions exceeded government securities in the Fed’s balance sheet.

The Fed’s Liabilities

The Fed has two liabilities:

1. Federal Reserve notes
2. Depository institution deposits

Federal Reserve notes are the dollar bills that we use in our daily transactions. Some of these notes are held by individuals and businesses; others are in the tills and vaults of banks and other depository institutions.

Depository institution deposits at the Fed are part of the reserves of these institutions (see p. 187).

The Monetary Base

The Fed’s liabilities together with coins issued by the Treasury (coins are not liabilities of the Fed) make up the monetary base. That is, the monetary base is the sum of currency (Federal Reserve notes and coins) and depository institution deposits at the Fed.

The Fed’s assets are the sources of the monetary base. They are also called the backing for the monetary base. The Fed’s liabilities are the uses of the monetary base as currency and bank reserves. Table 8.3 provides a snapshot of the sources and uses of the monetary base in June 2010.

When the Fed changes the monetary base, the quantity of money and interest rate change. You’re going to see how these changes come about later in this chapter. First, we’ll look at the Fed’s tools that enable it to influence money and interest rates.

### TABLE 8.3 The Sources and Uses of the Monetary Base

<table>
<thead>
<tr>
<th>Sources (billions of dollars)</th>
<th>Uses (billions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. government securities</td>
<td>777</td>
</tr>
<tr>
<td>Loans to depository institutions</td>
<td>70</td>
</tr>
<tr>
<td>Other items (net)</td>
<td>1,152</td>
</tr>
<tr>
<td>Monetary base</td>
<td>1,999</td>
</tr>
</tbody>
</table>

Source of data: Federal Reserve Board. The data are for June, 2010.

The Fed’s Policy Tools

The Fed influences the quantity of money and interest rates by adjusting the quantity of reserves available to the banks and the reserves the banks must hold. To do this, the Fed manipulates three tools:

- Open market operations
- Last resort loans
- Required reserve ratio

Open Market Operations

An open market operation is the purchase or sale of securities by the Fed in the loanable funds market. When the Fed buys securities, it pays for them with newly created bank reserves. When the Fed sells securities, the Fed is paid with reserves held by banks. So open market operations directly influence the reserves of banks. By changing the quantity of bank reserves, the Fed changes the quantity of monetary base, which influences the quantity of money.

An Open Market Purchase

To see how an open market operation changes bank reserves, suppose the Fed buys $100 million of government securities from the Bank of America. When the Fed makes this transaction, two things happen:

1. The Bank of America has $100 million less securities, and the Fed has $100 million more securities.
2. The Fed pays for the securities by placing $100 million in the Bank of America’s deposit account at the Fed.

Figure 8.2 shows the effects of these actions on the balance sheets of the Fed and the Bank of America. Ownership of the securities passes from the Bank of
America to the Fed, so the Bank of America’s assets decrease by $100 million and the Fed’s assets increase by $100 million, as shown by the blue arrow running from the Bank of America to the Fed. The Fed pays for the securities by placing $100 million in the Bank of America’s reserve account at the Fed, as shown by the green arrow running from the Fed to the Bank of America. The Fed’s assets and liabilities increase by $100 million. The Bank of America’s total assets remain unchanged: It sold securities to increase its reserves.

**An Open Market Sale** If the Fed sells $100 million of government securities to the Bank of America in the open market:

1. The Bank of America has $100 million more securities, and the Fed has $100 million less securities.
2. The Bank of America pays for the securities by using $100 million of its reserve deposit at the Fed.

You can follow the effects of these actions on the balance sheets of the Fed and the Bank of America by reversing the arrows and the plus and minus signs in Fig. 8.2. Ownership of the securities passes from the Fed to the Bank of America, so the Fed’s assets decrease by $100 million and the Bank of America’s assets increase by $100 million.
The Bank of America uses $100 million of its reserves to pay for the securities.

Both the Fed's assets and liabilities decrease by $100 million. The Bank of America's total assets are unchanged: It has used reserves to buy securities.

The New York Fed conducts these open-market transactions on directions from the FOMC.

**Last Resort Loans** The Fed is the **lender of last resort**, which means that if a bank is short of reserves, it can borrow from the Fed. But the Fed sets the interest rate on last resort loans and this interest rate is called the **discount rate**.

During the period since August 2007 when the first effects of the financial crisis started to be felt, the Fed has been especially active as lender of last resort and, with the U.S. Treasury, has created a number of new lending facilities and initiatives to prevent banks from failing.

**Required Reserve Ratio** The **required reserve ratio** is the minimum percentage of deposits that depository institutions are required to hold as reserves. In 2010, required reserves were 3 percent of checking deposits between $10.7 million and $55.2 million and 10 percent of checking deposits in excess of $55.2 million. If the Fed requires the banks to hold more reserves, they must cut their lending.

**How Banks Create Money**

Banks create money. But this doesn’t mean that they have smoke-filled back rooms in which counterfeiters are busily working. Remember, money is both currency and bank deposits. What banks create is deposits, and they do so by making loans.

**Creating Deposits by Making Loans**

The easiest way to see that banks create deposits is to think about what happens when Andy, who has a Visa card issued by Citibank, uses his card to buy a tank of gas from Chevron. When Andy signs the card sales slip, he takes a loan from Citibank and obligates himself to repay the loan at a later date. At the end of the business day, a Chevron clerk takes a pile of signed credit card sales slips, including Andy’s, to Chevron’s bank. For now, let’s assume that Chevron also banks at Citibank. The bank immediately credits Chevron’s account with the value of the slips (minus the bank’s commission).

You can see that these transactions have created a bank deposit and a loan. Andy has increased the size of his loan (his credit card balance), and Chevron has increased the size of its bank deposit. Because bank deposits are money, Citibank has created money.

If, as we’ve just assumed, Andy and Chevron use the same bank, no further transactions take place. But the outcome is essentially the same when two banks are involved. If Chevron’s bank is Bank of America, then Citibank uses its reserves to pay Bank of America. Citibank has an increase in loans and a decrease in reserves; Bank of America has an increase in reserves and an increase in deposits. The banking system as a whole has an increase in loans and deposits but no change in reserves.

If Andy had swiped his card at an automatic payment pump, all these transactions would have occurred at the time he filled his tank, and the quantity of money would have increased by the amount of his purchase (minus the bank’s commission for conducting the transactions).

Three factors limit the quantity of loans and deposits that the banking system can create through transactions like Andy’s. They are:

- The monetary base
- Desired reserves
- Desired currency holding
The Monetary Base. You’ve seen that the monetary base is the sum of Federal Reserve notes, coins, and banks’ deposits at the Fed. The size of the monetary base limits the total quantity of money that the banking system can create. The reason is that banks have a desired level of reserves, households and firms have a desired holding of currency, and both of these desired holdings of the monetary base depend on the quantity of deposits.

Desired Reserves. A bank’s desired reserves are the reserves that it plans to hold. They contrast with a bank’s required reserves, which is the minimum quantity of reserves that a bank must hold.

The quantity of desired reserves depends on the level of deposits and is determined by the desired reserve ratio—the ratio of reserves to deposits that the banks plan to hold. The desired reserve ratio exceeds the required reserve ratio by an amount that the banks determine to be prudent on the basis of their daily business requirements and in the light of the current outlook in financial markets.

Desired Currency Holding. The proportions of money held as currency and bank deposits—the ratio of currency to deposits—depend on how households and firms choose to make payments: Whether they plan to use currency or debit cards and checks.

Choices about how to make payments change slowly so the ratio of desired currency to deposits also changes slowly, and at any given time this ratio is fixed. If bank deposits increase, desired currency holding also increases. For this reason, when banks make loans that increase deposits, some currency leaves the banks—the banking system leaks reserves. We call the leakage of bank reserves into currency the currency drain, and we call the ratio of currency to deposits the currency drain ratio.

We’ve sketched the way that a loan creates a deposit and described the three factors that limit the amount of loans and deposits that can be created. We’re now going to examine the money creation process more closely and discover a money multiplier.

The Money Creation Process.

The money creation process begins with an increase in the monetary base, which occurs if the Fed conducts an open market operation in which it buys securities from banks and other institutions. The Fed pays for the securities it buys with newly created bank reserves.

When the Fed buys securities from a bank, the bank’s reserves increase but its deposits don’t change. So the bank has excess reserves. A bank’s excess reserves are its actual reserves minus its desired reserves.

When a bank has excess reserves, it makes loans and creates deposits. When the entire banking system has excess reserves, total loans and deposits increase and the quantity of money increases.

One bank can make a loan and get rid of excess reserves. But the banking system as a whole can’t get rid of excess reserves so easily. When the banks make loans and create deposits, the extra deposits lower excess reserves for two reasons. First, the increase in deposits increases desired reserves. Second, a currency drain decreases total reserves. But excess reserves don’t completely disappear. So the banks lend some more and the process repeats.

As the process of making loans and increasing deposits repeats, desired reserves increase, total reserves decrease through the currency drain, and eventually enough new deposits have been created to use all the new monetary base.

Figure 8.3 summarizes one round in the process we’ve just described. The sequence has the following eight steps:

1. Banks have excess reserves.
2. Banks lend excess reserves.
3. The quantity of money increases.
4. New money is used to make payments.
5. Some of the new money remains on deposit.
6. Some of the new money is a currency drain.
7. Desired reserves increase because deposits have increased.
8. Excess reserves decrease.

If the Fed sells securities in an open market operation, then banks have negative excess reserves—they are short of reserves. When the banks are short of reserves, loans and deposits decrease and the process we’ve described above works in a downward direction until desired reserves plus desired currency holding has decreased by an amount equal to the decrease in monetary base.

A money multiplier determines the change in the quantity of money that results from a change in the monetary base.
The Money Multiplier

The money multiplier is the ratio of the change in the quantity of money to the change in monetary base. For example, if a $1 million increase in the monetary base increases the quantity of money by $2.5 million, then the money multiplier is 2.5.

The smaller the banks’ desired reserve ratio and the smaller the currency drain ratio, the larger is the money multiplier. (See the Mathematical Note on pp. 204–205 for details on the money multiplier).

Economics in Action

The Variable Money Multipliers

We can measure the money multiplier, other things remaining the same, as the ratio of the quantity of money (M1 or M2) to the monetary base. In normal times, these ratios (and the money multipliers) change slowly.

In the early 1990s, the M1 multiplier—the ratio of M1 to the monetary base—was about 3 and the M2 multiplier—the ratio of M2 to the monetary base—was about 12. Through the 1990s and 2000s, the currency drain ratio gradually increased and the money multipliers decreased. By 2007 the M1 multiplier was 2 and the M2 multiplier was 9.

Then, in 2008 and 2009 when the Fed increased the monetary base by an unprecedented $1 trillion, almost all of the newly created reserves were willingly held by the banks. In an environment of enormous uncertainty, desired reserves increased by an amount similar to the increase in actual reserves. The quantity of money barely changed.
The Money Market

There is no limit to the amount of money we would like to receive in payment for our labor or as interest on our savings. But there is a limit to how big an inventory of money we would like to hold and neither spend nor use to buy assets that generate an income. The quantity of money demanded is the inventory of money that people plan to hold on any given day. It is the quantity of money in our wallets and in our deposit accounts at banks. The quantity of money held must equal the quantity supplied, and the forces that bring about this equality in the money market have powerful effects on the economy, as you will see in the rest of this chapter.

But first, we need to explain what determines the amount of money that people plan to hold.

The Influences on Money Holding

The quantity of money that people plan to hold depends on four main factors:

- The price level
- The nominal interest rate
- Real GDP
- Financial innovation

The Price Level

The quantity of money measured in dollars is nominal money. The quantity of nominal money demanded is proportional to the price level, other things remaining the same. If the price level rises by 10 percent, people hold 10 percent more nominal money than before, other things remaining the same. If you hold $20 to buy your weekly movies and soda, you will increase your money holding to $22 if the prices of movies and soda—and your wage rate—increase by 10 percent.

The quantity of money measured in constant dollars (for example, in 2005 dollars) is real money. Real money is equal to nominal money divided by the price level and is the quantity of money measured in terms of what it will buy. In the above example, when the price level rises by 10 percent and you increase your money holding by 10 percent, your real money holding is constant. Your $22 at the new price level buys the same quantity of goods and is the same quantity of real money as your $20 at the original price level. The quantity of real money demanded is independent of the price level.

The Nominal Interest Rate

A fundamental principle of economics is that as the opportunity cost of something increases, people try to find substitutes for it. Money is no exception. The higher the opportunity cost of holding money, other things remaining the same, the smaller is the quantity of real money demanded. The nominal interest rate on other assets minus the nominal interest rate on money is the opportunity cost of holding money.

The interest rate that you earn on currency and checking deposits is zero. So the opportunity cost of holding these items is the nominal interest rate on other assets such as a savings bond or Treasury bill. By holding money instead, you forgo the interest that you otherwise would have received.

Money loses value because of inflation, so why isn’t the inflation rate part of the cost of holding money? It is. Other things remaining the same, the higher the expected inflation rate, the higher is the nominal interest rate.

Real GDP

The quantity of money that households and firms plan to hold depends on the amount they are spending. The quantity of money demanded in the economy as a whole depends on aggregate expenditure—real GDP.

Again, suppose that you hold an average of $20 to finance your weekly purchases of movies and soda. Now imagine that the prices of these goods and of all other goods remain constant but that your income increases. As a consequence, you now buy more goods and services and you also keep a larger amount of money on hand to finance your higher volume of expenditure.

Financial Innovation

Technological change and the arrival of new financial products influence the quantity of money held. Financial innovations include

1. Daily interest checking deposits
2. Automatic transfers between checking and saving deposits
3. Automatic teller machines
4. Credit cards and debit cards
5. Internet banking and bill paying

These innovations have occurred because of the development of computing power that has lowered the cost of calculations and record keeping.

We summarize the effects of the influences on money holding by using a demand for money curve.
The Demand for Money

The demand for money is the relationship between the quantity of real money demanded and the nominal interest rate when all other influences on the amount of money that people wish to hold remain the same.

Figure 8.4 shows a demand for money curve, $MD$. When the interest rate rises, other things remaining the same, the opportunity cost of holding money rises and the quantity of real money demanded decreases—there is a movement up along the demand for money curve. Similarly, when the interest rate falls, the opportunity cost of holding money falls, and the quantity of real money demanded increases—there is a movement down along the demand for money curve.

When any influence on money holding other than the interest rate changes, there is a change in the demand for money and the demand for money curve shifts. Let’s study these shifts.

Shifts in the Demand for Money Curve

A change in real GDP or financial innovation changes the demand for money and shifts the demand for money curve.

Figure 8.5 illustrates the change in the demand for money. A decrease in real GDP decreases the demand for money and shifts the demand for money curve leftward from $MD_0$ to $MD_1$. An increase in real GDP has the opposite effect. It increases the demand for money and shifts the demand for money curve rightward from $MD_0$ to $MD_2$.

The influence of financial innovation on the demand for money curve is more complicated. It decreases the demand for currency and might increase the demand for some types of deposits and decrease the demand for others. But generally, financial innovation decreases the demand for money.

Changes in real GDP and financial innovation have brought large shifts in the demand for money in the United States.
Money Market Equilibrium
You now know what determines the demand for money, and you’ve seen how the banking system creates money. Let’s now see how the money market reaches an equilibrium.

Money market equilibrium occurs when the quantity of money demanded equals the quantity of money supplied. The adjustments that occur to bring money market equilibrium are fundamentally different in the short run and the long run.

Short-Run Equilibrium The quantity of money supplied is determined by the actions of the banks and the Fed. As the Fed adjusts the quantity of money, the interest rate changes.

In Fig. 8.6, the Fed uses open market operations to make the quantity of real money supplied $3.0 trillion and the supply of money curve $MS$. With demand for money curve $MD$, the equilibrium interest rate is 5 percent a year.

If the interest rate were 4 percent a year, people would want to hold more money than is available. They would sell bonds, bid down their price, and the interest rate would rise. If the interest rate were 6 percent a year, people would want to hold less money than is available. They would buy bonds, bid up their price, and the interest rate would fall.

The Short-Run Effect of a Change in the Supply of Money Starting from a short-run equilibrium, if the Fed increases the quantity of money, people find themselves holding more money than the quantity demanded. With a surplus of money holding, people enter the loanable funds market and buy bonds. The increase in demand for bonds raises the price of a bond and lowers the interest rate (refresh your memory by looking at Chapter 7, p. 164).

If the Fed decreases the quantity of money, people find themselves holding less money than the quantity demanded. They now enter the loanable funds market to sell bonds. The decrease in the demand for bonds lowers their price and raises the interest rate.

Figure 8.7 illustrates the effects of the changes in the quantity of money that we’ve just described. When the supply of money curve shifts rightward from $MS_0$ to $MS_1$, the interest rate falls to 4 percent a year; when the supply of money curve shifts leftward to $MS_2$, the interest rate rises to 6 percent a year.

Long-Run Equilibrium You’ve just seen how the nominal interest rate is determined in the money market at the level that makes the quantity of money demanded equal the quantity supplied by the Fed. You learned in Chapter 7 (on p. 168) that the real interest rate is determined in the loanable funds market at the level that makes the quantity of loanable funds demanded equal the quantity of loanable funds supplied. You also learned in Chapter 7 (on p. 165) that the real interest rate equals the nominal interest rate minus the inflation rate.

When the inflation rate equals the expected (or forecasted) inflation rate and when real GDP equals potential GDP, the money market, the loanable funds market, the goods market, and the labor market are in long-run equilibrium—the economy is in long-run equilibrium.

If in long-run equilibrium, the Fed increases the quantity of money, eventually a new long-run equilibrium is reached in which nothing real has changed. Real GDP, employment, the real quantity of money, and the real interest rate all return to their original levels. But something does change: the price level. The price level rises by the same percentage as the rise in the quantity of money supplied.
in the quantity of money. Why does this outcome occur in the long run?

The reason is that real GDP and employment are determined by the demand for labor, the supply of labor, and the production function—the real forces described in Chapter 6 (pp. 139–141); and the real interest rate is determined by the demand for and supply of (real) loanable funds—the real forces described in Chapter 7 (pp. 166–168). The only variable that is free to respond to a change in the supply of money in the long run is the price level. The price level adjusts to make the quantity of real money supplied equal to the quantity demanded.

So when the Fed changes the nominal quantity of money, in the long run the price level changes by a percentage equal to the percentage change in the quantity of nominal money. In the long run, the change in the price level is proportional to the change in the quantity of money.

The Transition from the Short Run to the Long Run

How does the economy move from the first short-run response to an increase in the quantity of money to the long-run response?

The adjustment process is lengthy and complex. Here, we’ll only provide a sketch of the process. A more thorough account must wait until you’ve studied Chapter 9.

We start out in long-run equilibrium and the Fed increases the quantity of money by 10 percent. Here are the steps in what happens next.

First, the nominal interest rate falls (just like you saw on p. 198 and in Fig. 8.6). The real interest rate falls too, as people try to get rid of their excess money holdings and buy bonds.

With a lower real interest rate, people want to borrow and spend more. Firms want to borrow to invest and households want to borrow to invest in bigger homes or to buy more consumer goods.

The increase in the demand for goods cannot be met by an increase in supply because the economy is already at full employment. So there is a general shortage of all kinds of goods and services.

The shortage of goods and services forces the price level to rise.

As the price level rises, the real quantity of money decreases. The decrease in the quantity of real money raises the nominal interest rate and the real interest rate. As the interest rate rises, spending plans are cut back, and eventually the original full-employment equilibrium is restored. At the new long-run equilibrium, the price level has risen by 10 percent and nothing real has changed.
The Quantity Theory of Money

In the long run, the price level adjusts to make the quantity of real money demanded equal the quantity supplied. A special theory of the price level and inflation—the quantity theory of money—explains this long-run adjustment of the price level.

The quantity theory of money is the proposition that in the long run, an increase in the quantity of money brings an equal percentage increase in the price level. To explain the quantity theory of money, we first need to define the velocity of circulation.

The velocity of circulation is the average number of times a dollar of money is used annually to buy the goods and services that make up GDP. But GDP equals the price level \((P)\) multiplied by real GDP \((Y)\). That is,

\[
GDP = PY.
\]

Call the quantity of money \(M\). The velocity of circulation, \(V\), is determined by the equation

\[
V = PY/M.
\]

For example, if GDP is $1,000 billion \((PY = $1,000\) billion) and the quantity of money is $250 billion, then the velocity of circulation is 4.

From the definition of the velocity of circulation, the equation of exchange tells us how \(M\), \(V\), \(P\), and \(Y\) are connected. This equation is

\[
MV = PY.
\]

Given the definition of the velocity of circulation, the equation of exchange is always true—it is true by definition. It becomes the quantity theory of money if the quantity of money does not influence the velocity of circulation or real GDP. In this case, the equation of exchange tells us that in the long run, the price level is determined by the quantity of money. That is,

\[
P = M(V/Y),
\]

where \((V/Y)\) is independent of \(M\). So a change in \(M\) brings a proportional change in \(P\).

We can also express the equation of exchange in growth rates, \(^{1}\) in which form it states that

\[
\text{Money growth rate} + \text{Rate of velocity change} = \text{Inflation rate} + \text{Real GDP growth rate}.
\]

\(^{1}\)To obtain this equation, begin with

\[MV = PY.\]

Then changes in these variables are related by the equation

\[\Delta MV + M\Delta V = \Delta PY + P\Delta Y.\]

Divide this equation by the equation of exchange to obtain

\[\Delta M/M + \Delta V/V = \Delta P/P + \Delta Y/Y.\]

The term \(\Delta M/M\) is the money growth rate, \(\Delta V/V\) is the rate of velocity change, \(\Delta P/P\) is the inflation rate, and \(\Delta Y/Y\) is the real GDP growth rate.

Economics in Action

Does the Quantity Theory Work?

On average, as predicted by the quantity theory of money, the inflation rate fluctuates in line with fluctuations in the money growth rate minus the real GDP growth rate. Figure 1 shows the relationship between money growth (M2 definition) and inflation in the United States. You can see a clear relationship between the two variables.

\[\text{Inflation rate} = \frac{\text{Money growth rate}}{\text{Rate of velocity change}} - \frac{\text{Real GDP growth rate}}{\text{Real GDP growth rate}}\]

In the long run, the rate of velocity change is not influenced by the money growth rate. More strongly, in the long run, the rate of velocity change is approxi-
International data also support the quantity theory. Figure 2 shows a scatter diagram of the inflation rate and the money growth rate in 134 countries and Fig. 3 shows the inflation rate and money growth rate in countries with inflation rates below 20 percent a year. You can see a general tendency for money growth and inflation to be correlated, but the quantity theory (the red line) does not predict inflation precisely.

The correlation between money growth and inflation isn’t perfect, and the correlation does not tell us that money growth causes inflation. Money growth might cause inflation; inflation might cause money growth; or some third variable might cause both inflation and money growth. Other evidence does confirm, though, that causation runs from money growth to inflation.

In the long run, fluctuations in the money growth rate minus the real GDP growth rate bring equal fluctuations in the inflation rate.

Also, in the long run, with the economy at full employment, real GDP equals potential GDP, so the real GDP growth rate equals the potential GDP growth rate. This growth rate might be influenced by inflation, but the influence is most likely small and the quantity theory assumes that it is zero. So the real GDP growth rate is given and doesn’t change when the money growth rate changes—inflation is correlated with money growth.

Figure 2 134 Countries: 1990–2005
Figure 3 Lower-Inflation Countries: 1990–2005

Sources of data: International Financial Statistics Yearbook, 2008 and International Monetary Fund, World Economic Outlook, October, 2008.

The Quantity Theory of Money 201

REVIEW QUIZ

1. What is the quantity theory of money?
2. How is the velocity of circulation calculated?
3. What is the equation of exchange?
4. Does the quantity theory correctly predict the effects of money growth on inflation?

You can work these questions in Study Plan 8.6 and get instant feedback.

• You now know what money is, how the banks create it, and how the quantity of money influences the nominal interest rate in the short run and the price level in the long run. Reading Between the Lines on pp. 202–203 looks at the Fed’s incredible actions in the recent financial crisis.
Can More Money Keep the Recovery Going?

It Falls to the Fed to Fuel Recovery
The Financial Times
August 30, 2010

The U.S. recovery is stalling. ... The recovery is in danger of petering out altogether. Recent numbers have been dismal. Second-quarter growth was marked down to 1.6 percent on Friday. Earlier, signs of a new crunch in the housing market gave the stock market another pummelling. Already low expectations were disappointed nonetheless: Sales of existing single-family homes in July fell by nearly 30 percent, to their lowest for 15 years. Sales of new homes were at their lowest since the series began to be reported in 1963. ...

At the end of last week, speaking at the Jackson Hole conference, Ben Bernanke, Fed chief, acknowledged the faltering recovery, and reminded his audience that the central bank has untapped capacity for stimulus. The benchmark interest rate is effectively zero, but that leaves quantitative easing (QE) and other unconventional measures. So far as QE goes, the Fed has already pumped trillions of dollars into the economy by buying debt. If it chose, it could pump in trillions more. ...

As the monetary economist Scott Sumner has pointed out, Milton Friedman—name me a less reconstructed monetarist—talked of “the fallacy of identifying tight money with high interest rates and easy money with low interest rates.” When long-term nominal interest rates are very low, and inflation expectations are therefore also very low, money is tight in the sense that matters. When money is loose, inflation expectations rise, and so do long-term interest rates. ... Under current circumstances, better to print money and be damned. ...

ESSENCE OF THE STORY

- The 2010 second-quarter real GDP growth rate was a low 1.6 percent a year and home sales were at their lowest since measurement started in 1963.
- Fed Chairman Ben Bernanke agrees the recovery is weak but says the Fed has weapons to fight recession.
- Interest rates are close to zero but the Fed has pumped trillions of dollars into the economy by buying debt (quantitative easing) and the Fed can pump in trillions more.
- Economist Scott Sumner, citing Milton Friedman, says the interest rate that influences spending decisions is the real interest rate and that isn’t low when inflation is expected to be low.
- With the U.S. recovery stalling and possibly ending, the Fed should pump in more money.
Between October 2007 and October 2008, to counter a global financial crisis, the Fed cut the federal funds interest rate to almost zero.

Between October 2008 and October 2009, the Fed increased the monetary base by an unprecedented $900 billion.

Between October 2009 and March 2010, the Fed added a further $300 billion to the monetary base—a total increase of $1.2 trillion over 18 months.

Figure 1 shows these extraordinary increases in the monetary base.

As you’ve seen in this chapter, most of the increase in monetary base was willingly held by the banks. They increased their desired reserves.

These monetary actions by the Fed lowered the interest rates that firms and households pay on very short-term loans, as you can see in Fig. 2.

But the interest rate on long-term loans that finance business investment barely changed.

You can see in Fig. 2 that the long-term corporate bond rate (the rate paid by the safest big firms) hovered around 5.5 percent.

For the Fed’s injection of monetary base to lower the long-term corporate bond rate, the banks would have to get into the loanable funds market and start to lend their large volume of reserves.

As the news article notes, it is the real interest rate, not the nominal interest rate, that influences expenditure. And because for a few months, deflation was expected (a falling price level), the real interest rate spiked upward.

Figure 3 shows the real interest rate on long-term corporate borrowing.

Despite massive injections of monetary base (quantitative easing) and powerful effects on the short-term interest rate, it is hard to see the effects of the Fed’s actions on the long-term real interest rate.

Increasing the monetary base further, as advocated in the news article, might lower the long-term real interest rate, but it might alternatively merely add to bank reserves and leave the long-term interest rate unchanged.
MATHEMATICAL NOTE

The Money Multiplier

This note explains the basic math of the money multiplier and shows how the value of the multiplier depends on the banks’ desired reserve ratio and the currency drain ratio.

To make the process of money creation concrete, we work through an example for a banking system in which each bank has a desired reserve ratio of 10 percent of deposits and the currency drain ratio is 50 percent of deposits. (Although these ratios are larger than the ones in the U.S. economy, they make the process end more quickly and enable you to see more clearly the principles at work.)

The figure keeps track of the numbers. Before the process begins, all the banks have no excess reserves. Then the monetary base increases by $100,000 and one bank has excess reserves of this amount.

The bank lends the $100,000 of excess reserves. When this loan is made, new money increases by $100,000.

Some of the new money will be held as currency and some as deposits. With a currency drain ratio of 50 percent of deposits, one third of the new money will be held as currency and two thirds will be held as deposits. That is, $33,333 drains out of the banks as currency and $66,667 remains in the banks as deposits. The increase in the quantity of money of $100,000 equals the increase in deposits plus the increase in currency holdings.

The increased bank deposits of $66,667 generate an increase in desired reserves of 10 percent of that amount, which is $6,667. Actual reserves have increased by the same amount as the increase in deposits: $66,667. So the banks now have excess reserves of $60,000.

The process we’ve just described repeats but begins with excess reserves of $60,000. The figure shows the next two rounds. At the end of the process, the quantity of money has increased by a multiple of the increase in the monetary base. In this case, the increase is $250,000, which is 2.5 times the increase in the monetary base.

The sequence in the figure shows the first stages of the process that finally reaches the total shown in the final row of the “money” column.

To calculate what happens at the later stages in the process and the final increase in the quantity of money, we look at what happens at the later stages in the process. Each bank lends its excess reserves of $60,000. When this loan is made, new money increases by $60,000.

Some of the new money will be held as currency and some as deposits. With a currency drain ratio of 50 percent of deposits, deposits increase by $40,000 and currency increases by $20,000. The quantity of money has now increased by $160,000.

The money creation process continues until the quantity of money has increased to $250,000 and the banks have no excess reserves.

Figure 1 The money creation process
money, look closely at the numbers in the figure. The initial increase in reserves is $100,000 (call it \(A\)). At each stage, the loan is 60 percent (0.6) of the previous loan and the quantity of money increases by 0.6 of the previous increase. Call that proportion \(L\) (\(L = 0.6\)). We can write down the complete sequence for the increase in the quantity of money as

\[ A + AL + AL^2 + AL^3 + AL^4 + AL^5 + \ldots. \]

Remember, \(L\) is a fraction, so at each stage in this sequence, the amount of new loans and new money gets smaller. The total value of loans made and money created at the end of the process is the sum of the sequence, which is

\[ \frac{A}{1 - L}. \]

If we use the numbers from the example, the total increase in the quantity of money is

\[
\begin{align*}
\$100,000 + 60,000 + 36,000 + \ldots &= $100,000 (1 + 0.6 + 0.36 + \ldots) \\
&= $100,000 (1 + 0.6 + 0.6^2 + \ldots) \\
&= $100,000 \times \frac{1}{1 - 0.6} \\
&= $100,000 \times \frac{1}{0.4} \\
&= $100,000 \times 2.5 \\
&= $250,000.
\end{align*}
\]

The magnitude of the money multiplier depends on the desired reserve ratio and the currency drain ratio. Let’s explore this relationship.

The money multiplier is the ratio of money to the monetary base. Call the money multiplier \(mm\), the quantity of money \(M\), and the monetary base \(MB\).

\[
mm = \frac{M}{MB}.
\]

Next recall that money, \(M\), is the sum of deposits and currency. Call deposits \(D\) and currency \(C\). Then

\[ M = D + C. \]

Finally, recall that the monetary base, \(MB\), is the sum of banks’ reserves and currency. Call banks’ reserves \(R\). Then

\[ MB = R + C. \]

Use the equations for \(M\) and \(MB\) in the \(mm\) equation to give:

\[
mm = \frac{M}{MB} = \frac{(D + C)}{(R + C)}. \]

Now divide all the variables on the right side of the equation by \(D\) to give:

\[
mm = \frac{M}{MB} = \frac{(1 + CD)}{(R/D + CD)}. \]

In this equation, \(CD\) is the currency drain ratio and \(R/D\) is the banks’ reserve ratio. If we use the values in the example on the previous page, \(CD\) is 0.5 and \(R/D\) is 0.1, and

\[
mm = \frac{(1 + 0.5)}{(0.1 + 0.5)} = \frac{1.5}{0.6} = 2.5. \]

The U.S. Money Multiplier

The money multiplier in the United States can be found by using the formula above along with the values of \(CD\) and \(R/D\) in the U.S. economy.

Because we have two definitions of money, \(M1\) and \(M2\), we have two money multipliers. Call the \(M1\) deposits \(D1\) and call the \(M2\) deposits \(D2\).

The numbers for \(M1\) in 2010 are \(CD1 = 1.06\) and \(R/D1 = 1.32\). So

\[
M1 \text{ multiplier} = \frac{(1 + 1.06)}{(1.32 + 1.06)} = 0.87.
\]

For \(M2\) in 2010, \(CD2 = 0.11\) and \(R/D2 = 0.14\), so

\[
M2 \text{ multiplier} = \frac{(1 + 0.11)}{(0.14 + 0.11)} = 4.44.
\]
How Banks Create Money  
- Banks create money by making loans.
- The total quantity of money that can be created depends on the monetary base, the desired reserve ratio, and the currency drain ratio.

Working Problems 10 to 14 will give you a better understanding of how banks create money.

The Money Market  
- The quantity of money demanded is the amount of money that people plan to hold.
- The quantity of real money equals the quantity of nominal money divided by the price level.
- The quantity of real money demanded depends on the nominal interest rate, real GDP, and financial innovation.
- The nominal interest rate makes the quantity of money demanded equal the quantity supplied.
- When the Fed increases the supply of money, the nominal interest rate falls (the short-run effect).
- In the long run, when the Fed increases the supply of money, the price level rises and the nominal interest rate returns to its initial level.

Working Problems 15 and 16 will give you a better understanding of the money market.

The Quantity Theory of Money  
- The quantity theory of money is the proposition that money growth and inflation move up and down together in the long run.

Working Problem 17 will give you a better understanding of the quantity theory of money.

Key Points

What Is Money?  
- Money is the means of payment. It functions as a medium of exchange, a unit of account, and a store of value.
- Today, money consists of currency and deposits.

Working Problems 1 to 4 will give you a better understanding of what money is.

Depository Institutions  
- Commercial banks, S&Ls, savings banks, credit unions, and money market mutual funds are depository institutions whose deposits are money.
- Depository institutions provide four main economic services: They create liquidity, minimize the cost of obtaining funds, minimize the cost of monitoring borrowers, and pool risks.

Working Problems 5 and 6 will give you a better understanding of depository institutions.

The Federal Reserve System  
- The Federal Reserve System is the central bank of the United States.
- The Fed influences the quantity of money by setting the required reserve ratio, making last resort loans, and by conducting open market operations.
- When the Fed buys securities in an open market operation, the monetary base increases; when the Fed sells securities, the monetary base decreases.

Working Problems 7 to 9 will give you a better understanding of the Federal Reserve System.

Key Terms

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<td>Reserves</td>
<td>187</td>
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<tr>
<td>Velocity of circulation</td>
<td>200</td>
</tr>
</tbody>
</table>
What Is Money? (Study Plan 8.1)

1. In the United States today, money includes which of the following items?
   a. Federal Reserve bank notes in Citibank's cash machines
   b. Your Visa card
   c. Coins inside a vending machine
   d. U.S. dollar bills in your wallet
   e. The check you have just written to pay for your rent
   f. The loan you took out last August to pay for your school fees

2. In June 2009, currency held by individuals and businesses was $853 billion; traveler's checks were $5 billion; checkable deposits owned by individuals and businesses were $792 billion; savings deposits were $4,472 billion; time deposits were $1281 billion; and money market funds and other deposits were $968 billion. Calculate M1 and M2 in June 2009.

3. In June 2008, M1 was $1,394 billion; M2 was $7,681 billion; checkable deposits owned by individuals and businesses were $619 billion; time deposits were $1,209 billion; and money market funds and other deposits were $1,057 billion. Calculate currency and traveler's checks held by individuals and businesses and calculate savings deposits.

4. One More Thing Cell Phones Could Do: Replace Wallets
   Soon you'll be able to pull out your cell phone and wave it over a scanner to make a payment. The convenience of whipping out your phone as a payment mechanism is driving the transition.
   Source: USA Today, November 21, 2007
   If people can use their cell phones to make payments, will currency disappear? How will the components of M1 change?

Depository Institutions (Study Plan 8.2)

Use the following news clip to work Problems 5 and 6.

Regulators Give Bleak Forecast for Banks
Regulators said that they were bracing for an uptick in the number of bank failures. The Fed declined to comment on the health of specific companies but said that Wall Street firms have learned a great deal from Bear Stearns and have reduced leverage and built up their liquidity. Today, investment banks are stronger than they were a month-and-a-half ago.

Source: CNN, June 5, 2008

5. Explain a bank’s “balancing act” and how the over-pursuit of profit or underestimation of risk can lead to a bank failure.

6. During a time of uncertainty, why might it be necessary for a bank to build up its liquidity?

The Federal Reserve System (Study Plan 8.3)

7. Suppose that at the end of December 2009, the monetary base in the United States was $700 billion, Federal Reserve notes were $650 billion, and banks’ reserves at the Fed were $20 billion. Calculate the quantity of coins.

8. Risky Assets: Counting to a Trillion
   Prior to the financial crisis, the Fed held less than $1 trillion in assets and most were in safe U.S. government securities. By mid-December 2008, the Fed's balance sheet had increased to over $2.3 trillion. The massive expansion began when the Fed rolled out its lending program: sending banks cash in exchange for risky assets.
   Source: CNNMoney, September 29, 2009
   What are the Fed’s policy tools and which policy tool did the Fed use to increase its assets to $2.3 trillion in 2008?

9. The FOMC sells $20 million of securities to Wells Fargo. Enter the transactions that take place to show the changes in the following balance sheets.

Federal Reserve Bank of New York

<table>
<thead>
<tr>
<th>Assets (millions)</th>
<th>Liabilities (millions)</th>
</tr>
</thead>
</table>
| Wells Fargo
| Assets (millions) | Liabilities (millions) |

STUDY PLAN PROBLEMS AND APPLICATIONS

You can work Problems 1 to 19 in MyEconLab Chapter 8 Study Plan and get instant feedback.
How Banks Create Money (Study Plan 8.4)

10. The commercial banks in Zap have

| Reserves   | $250 million |
| Loans     | $1,000 million |
| Deposits  | $2,000 million |
| Total assets | $2,500 million |

If the banks hold no excess reserves, calculate their desired reserve ratio.

Use the following information to work Problems 11 and 12.

In the economy of Nocoin, banks have deposits of $300 billion. Their reserves are $15 billion, two thirds of which is in deposits with the central bank. Households and firms hold $30 billion in bank notes. There are no coins!

11. Calculate the monetary base and the quantity of money.

12. Calculate the banks’ desired reserve ratio and the currency drain ratio (as percentages).

Use the following news clip to work Problems 13 and 14.

Banks Drop on Higher Reserve Requirement

China’s central bank will raise its reserve ratio requirement by a percentage point to a record 17.5 percent, stepping up a battle to contain lending growth. Banks’ ratio of excess reserves to deposits was 2 percent. Every half-point increase in the required reserve ratio cuts banks’ profits by 1.5 percent.

Source: People’s Daily Online, June 11, 2008

13. Explain how increasing the required reserve ratio impacts banks’ money creation process.

14. Why might a higher required reserve ratio decrease bank profits?

The Money Market (Study Plan 8.5)

15. The spreadsheet provides information about the demand for money in Minland. Column A is the nominal interest rate, \( r \). Columns B and C show the quantity of money demanded at two values of real GDP: \( Y_0 \) is $10 billion and \( Y_1 \) is $20 billion. The quantity of money supplied is $3 billion.

Initially, real GDP is $20 billion. What happens in Minland if the interest rate (i) exceeds 4 percent a year and (ii) is less than 4 percent a year?

16. The figure shows the demand for money curve.

If the Fed decreases the quantity of real money supplied from $4 trillion to $3.9 trillion, explain how the price of a bond will change.

The Quantity Theory of Money (Study Plan 8.6)

17. Quantecon is a country in which the quantity theory of money operates. In year 1, the economy is at full employment and real GDP is $400 million, the price level is 200, and the velocity of circulation is 20. In year 2, the quantity of money increases by 20 percent.

Calculate the quantity of money, the price level, real GDP, and the velocity of circulation in year 2.

Mathematical Note (Study Plan 8.MN)

18. In Problem 11, the banks have no excess reserves. Suppose that the Bank of Nocoin, the central bank, increases bank reserves by $0.5 billion.

a. What happens to the quantity of money?

b. Explain why the change in the quantity of money is not equal to the change in the monetary base.

c. Calculate the money multiplier.

19. In Problem 11, the banks have no excess reserves. Suppose that the Bank of Nocoin, the central bank, decreases bank reserves by $0.5 billion.

a. Calculate the money multiplier.

b. What happens to the quantity of money, deposits, and currency?
What Is Money?

20. Sara withdraws $1,000 from her savings account at the Lucky S&L, keeps $50 in cash, and deposits the balance in her checking account at the Bank of Illinois. What is the immediate change in M1 and M2?

21. Rapid inflation in Brazil in the early 1990s caused the cruzeiro to lose its ability to function as money. Which of the following commodities would most likely have taken the place of the cruzeiro in the Brazilian economy? Explain why.
   a. Tractor parts
   b. Packs of cigarettes
   c. Loaves of bread
   d. Impressionist paintings
   e. Baseball trading cards

22. From Paper-Clip to House, in 14 Trades
   A 26-year-old Montreal man appears to have succeeded in his quest to barter a single, red paper-clip all the way up to a house. It took almost a year and 14 trades. …

   Source: CBC News, 7 July 2006
   Is barter a means of payment? Is it just as efficient as money when trading on e-Bay? Explain.

Depository Institutions

Use the following news clip to work Problems 23 and 24.

What Bad Banking Means to You

Bad news about the banking industry makes you wonder about the safety of your cash in the bank. Regulators expect 100–200 bank failures over the next 12–24 months. Expected loan losses, the deteriorating housing market, and the credit squeeze are blamed for the drop in bank profits. The number of institutions classed as “problem” institutions was at 76 at the end of 2007, but, to put that number in perspective, at the end of the banking crisis in 1992, 1,063 banks were on that “trouble” list. One thing that will save your money if your bank goes under is FDIC insurance. The FDIC insures deposits in banks and thrift institutions and it maintains that not one depositor has lost a single cent of insured funds as a result of a bank failure since it was created in 1934.

   Source: CNN, February 28, 2008

23. Explain how attempts by banks to maximize profits can sometimes lead to bank failures.

24. How does FDIC insurance help minimize bank failures and bring more stability to the banking system?

The Federal Reserve System

25. Explain the distinction between a central bank and a commercial bank.

26. If the Fed makes an open market sale of $1 million of securities to a bank, what initial changes occur in the economy?

27. Set out the transactions that the Fed undertakes to increase the quantity of money.

28. Describe the Fed’s assets and liabilities. What is the monetary base and how does it relate to the Fed’s balance sheet?

29. Banks Using Fewer Emergency Loans
   In a sign of some improvement in the financial crisis, during the week ending July 9 investment banks didn’t borrow from the Federal Reserve’s emergency lending program and commercial banks also scaled back. In March the Fed scrambled to avert the crisis by giving investment banks a place to go for emergency overnight loans. In exchange for short-term loans of Treasury securities, companies can put up as collateral more risky investments.

   Source: Time, July 11, 2008

What is the rationale behind allowing the Federal Reserve to make loans to banks?

How Banks Create Money

30. Banks in New Transylvania have a desired reserve ratio of 10 percent and no excess reserves. The currency drain ratio is 50 percent. Then the central bank increases the monetary base by $1,200 billion.
   a. How much do the banks lend in the first round of the money creation process?
   b. How much of the initial amount lent flows back to the banking system as new deposits?
   c. How much of the initial amount lent does not return to the banks but is held as currency?
   d. Why does a second round of lending occur?
31. Explain the change in the nominal interest rate in the short run if
   a. Real GDP increases.
   b. The money supply increases.
   c. The price level rises.

32. In Minland in Problem 15, the interest rate is 4 percent a year. Suppose that real GDP decreases to $10 billion and the quantity of money supplied remains unchanged. Do people buy bonds or sell bonds? Explain how the interest rate changes.

The Quantity Theory of Money
33. The table provides some data for the United States in the first decade following the Civil War.

<table>
<thead>
<tr>
<th></th>
<th>1869</th>
<th>1879</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of money</td>
<td>$1.3 billion</td>
<td>$1.7 billion</td>
</tr>
<tr>
<td>Real GDP (1929 dollars)</td>
<td>$7.4 billion</td>
<td>Z</td>
</tr>
<tr>
<td>Price level (1929 = 100)</td>
<td>X</td>
<td>54</td>
</tr>
<tr>
<td>Velocity of circulation</td>
<td>4.50</td>
<td>4.61</td>
</tr>
</tbody>
</table>

Source of data: Milton Friedman and Anna J. Schwartz, A Monetary History of the United States 1867–1960

   a. Calculate the value of X in 1869.
   b. Calculate the value of Z in 1879.
   c. Are the data consistent with the quantity theory of money? Explain your answer.

Mathematical Note
34. In the United Kingdom, the currency drain ratio is 0.38 of deposits and the reserve ratio is 0.002. In Australia, the quantity of money is $150 billion, the currency drain ratio is 33 percent of deposits, and the reserve ratio is 8 percent.
   a. Calculate the U.K. money multiplier.
   b. Calculate the monetary base in Australia.

Economics in the News
35. After you have studied Reading Between the Lines on pp. 202–203 answer the following questions.
   a. What changes in the monetary base have occurred since October 2008?
   b. How does the Fed bring about an increase in the monetary base?
   c. How did the increase in the monetary base change the quantities of M1 and M2? Why?
   d. How did the change in monetary base influence short-term nominal interest rates? Why?
   e. How did the change in monetary base influence long-term nominal interest rates? Why?
   f. How did the change in monetary base influence long-term real interest rates? Why?

36. Fed at Odds with ECB over Value of Policy Tool

Financial innovation and the spread of U.S. currency throughout the world has broken down relationships between money, inflation, and growth, making monetary gauges a less useful tool for policy makers, the U.S. Federal Reserve chairman, Ben Bernanke, said. Many other central banks use monetary aggregates as a guide to policy decision, but Bernanke believes reliance on monetary aggregates would be unwise because empirical relationship between U.S. money growth, inflation, and output growth is unstable. Bernanke said that the Fed had “philosophical” and economic differences with the European Central Bank and the Bank of England regarding the role of money and that debate between institutions was healthy. “Ultimately, the risk of bad policy arising from a devoted following of money growth led the Fed to downgrade the importance of money measures.”

Source: International Herald Tribune, November 10, 2006

   a. Explain how the debate surrounding the quantity theory of money could make “monetary gauges a less useful tool for policy makers.”
   b. What do Bernanke’s statements reveal about his stance on the accuracy of the quantity theory of money?
The dollar ($), the euro (€), and the yen (¥) are three of the world’s monies and most international payments are made using one of them. But the world has more than 100 different monies.

In October 2000, one U.S. dollar bought 1.17 euros, but from 2000 through 2008, the dollar sank against the euro and by July 2008 one U.S. dollar bought only 63 euro cents. Why did the dollar fall against the euro? Can or should the United States do anything to stabilize the value of the dollar?

Every year since 1988, foreign entrepreneurs have roamed the United States with giant virtual shopping carts and loaded them up with Gerber, Firestone, Columbia Pictures, Ben & Jerry’s, and Anheuser-Busch, all of which are now controlled by Japanese or European companies. Why have foreigners been buying U.S. businesses?

In this chapter, you’re going to discover the answers to these questions. In Reading Between the Lines at the end of the chapter, we’ll look at a risky investment strategy that exploits interest rate differences and the foreign exchange market.
The Foreign Exchange Market

When Wal-Mart imports DVD players from Japan, it pays for them using Japanese yen. And when Japan Airlines buys an airplane from Boeing, it pays using U.S. dollars. Whenever people buy things from another country, they use the currency of that country to make the transaction. It doesn't make any difference what the item is that is being traded internationally. It might be a DVD player, an airplane, insurance or banking services, real estate, the stocks and bonds of a government or corporation, or even an entire business.

Foreign money is just like U.S. money. It consists of notes and coins issued by a central bank and mint and deposits in banks and other depository institutions. When we described U.S. money in Chapter 8, we distinguished between currency (notes and coins) and deposits. But when we talk about foreign money, we refer to it as foreign currency. Foreign currency is the money of other countries regardless of whether that money is in the form of notes, coins, or bank deposits.

We buy these foreign currencies and foreigners buy U.S. dollars in the foreign exchange market.

Trading Currencies

The currency of one country is exchanged for the currency of another in the foreign exchange market. The foreign exchange market is not a place like a downtown flea market or a fruit and vegetable market. The foreign exchange market is made up of thousands of people—importers and exporters, banks, international investors and speculators, international travelers, and specialist traders called foreign exchange brokers.

The foreign exchange market opens on Monday morning in Sydney, Australia, and Hong Kong, which is still Sunday evening in New York. As the day advances, markets open in Singapore, Tokyo, Bahrain, Frankfurt, London, New York, Chicago, and San Francisco. As the West Coast markets close, Sydney is only an hour away from opening for the next day of business. The sun barely sets in the foreign exchange market. Dealers around the world are in continual contact by telephone and computer, and on a typical day in 2010, around $3 trillion (of all currencies) were traded in the foreign exchange market—or more than $600 trillion in a year.

Exchange Rates

An exchange rate is the price at which one currency exchanges for another currency in the foreign exchange market. For example, on September 1, 2010, $1 would buy 84 Japanese yen or 79 euro cents. So the exchange rate was 84 yen per dollar or, equivalently, 79 euro cents per dollar.

The exchange rate fluctuates. Sometimes it rises and sometimes it falls. A rise in the exchange rate is called an appreciation of the dollar, and a fall in the exchange rate is called a depreciation of the dollar. For example, when the exchange rate rises from 84 yen to 100 yen per dollar, the dollar appreciates, and when the exchange rate falls from 100 yen to 84 yen per dollar, the dollar depreciates.

Economics in Action on the next page shows the fluctuations in the U.S. dollar against three currencies since 2000.

Questions About the U.S. Dollar Exchange Rate

The performance of the U.S. dollar in the foreign exchange market raises a number of questions that we address in this chapter.

First, how is the exchange rate determined? Why did the U.S. dollar appreciate from 2000 to 2002 and then begin to depreciate?

Second, how do the Fed and other central banks operate in the foreign exchange market? In particular, how was the exchange rate between the U.S. dollar and the Chinese yuan fixed and why did it remain constant for many years?

Third, how do exchange rate fluctuations influence our international trade and international payments? In particular, could we eliminate, or at least decrease, our international deficit by changing the exchange rate? Would an appreciation of the yuan change the balance of trade and payments between the United States and China?

We begin by learning how trading in the foreign exchange market determines the exchange rate.

An Exchange Rate Is a Price

An exchange rate is a price—the price of one currency in terms of another. And like all prices, an exchange rate is determined in a market—the foreign exchange market.

The U.S. dollar trades in the foreign exchange market and is supplied and demanded by tens of
The Foreign Exchange Market

Economics in Action
The U.S. Dollar: More Down than Up

The figure shows the U.S. dollar exchange rate against the three currencies that feature prominently in U.S. imports—the Chinese yuan, the European euro, and the Japanese yen—between 2000 and 2010.

Against the Chinese yuan, the dollar was constant before 2005 and then started to depreciate. Against the European euro and the Japanese yen, the dollar appreciated before 2002 and then mainly depreciated but staged a brief appreciation against the yen in 2005–2007.

Notice the high-frequency fluctuations (rapid brief up and down movements) of the dollar against the euro and the yen compared to the smooth changes against the yuan. Think about why that might be, and we’ll check your answer later in this chapter.

The Demand for One Money Is the Supply of Another Money

When people who are holding the money of some other country want to exchange it for U.S. dollars, they demand U.S. dollars and supply that other country’s money. And when people who are holding U.S. dollars want to exchange them for the money of some other country, they supply U.S. dollars and demand that other country’s money.

So the factors that influence the demand for U.S. dollars also influence the supply of European Union euros, or Japanese yen, or Chinese yuan. And the factors that influence the demand for that other country’s money also influence the supply of U.S. dollars.

We’ll first look at the influences on the demand for U.S. dollars in the foreign exchange market.

Demand in the Foreign Exchange Market

People buy U.S. dollars in the foreign exchange market so that they can buy U.S.-produced goods and services—U.S. exports. They also buy U.S. dollars so that they can buy U.S. assets such as bonds, stocks, businesses, and real estate or so that they can keep part of their money holding in a U.S. dollar bank account.

The quantity of U.S. dollars demanded in the foreign exchange market is the amount that traders plan to buy during a given time period at a given exchange rate. This quantity depends on many factors, but the main ones are

1. The exchange rate
2. World demand for U.S. exports
3. Interest rates in the United States and other countries
4. The expected future exchange rate

We look first at the relationship between the quantity of U.S. dollars demanded in the foreign exchange market and the exchange rate when the other three influences remain the same.

The Law of Demand for Foreign Exchange

The law of demand applies to U.S. dollars just as it does to anything else that people value. Other things remaining the same, the higher the exchange rate, the smaller is the quantity of U.S. dollars demanded in the foreign exchange market. For example, if the

thousands of traders every hour of every business day. Because it has many traders and no restrictions on who may trade, the foreign exchange market is a competitive market.

In a competitive market, demand and supply determine the price. So to understand the forces that determine the exchange rate, we need to study the factors that influence demand and supply in the foreign exchange market. But there is a feature of the foreign exchange market that makes it special.
price of the U.S. dollar rises from 100 yen to 120 yen but nothing else changes, the quantity of U.S. dollars that people plan to buy in the foreign exchange market decreases. The exchange rate influences the quantity of U.S. dollars demanded for two reasons:

- Exports effect
- Expected profit effect

**Exports Effect** The larger the value of U.S. exports, the larger is the quantity of U.S. dollars demanded in the foreign exchange market. But the value of U.S. exports depends on the prices of U.S.-produced goods and services expressed in the currency of the foreign buyer. And these prices depend on the exchange rate. The lower the exchange rate, other things remaining the same, the lower are the prices of U.S.-produced goods and services to foreigners and the greater is the volume of U.S. exports. So if the exchange rate falls (and other influences remain the same), the quantity of U.S. dollars demanded in the foreign exchange market increases.

To see the exports effect at work, think about orders for Boeing’s new 787 airplane. If the price of a 787 is $100 million and the exchange rate is 90 euro cents per U.S. dollar, the price of this airplane to KLM, a European airline, is €90 million. KLM decides that this price is too high, so it doesn’t buy a new 787. If the exchange rate falls to 80 euro cents per U.S. dollar and other things remain the same, the price of a 787 falls to €80 million. KLM now decides to buy a 787 and buys U.S. dollars in the foreign exchange market.

**Expected Profit Effect** The larger the expected profit from holding U.S. dollars, the greater is the quantity of U.S. dollars demanded in the foreign exchange market. But expected profit depends on the exchange rate. For a given expected future exchange rate, the lower the exchange rate today, the larger is the expected profit from buying U.S. dollars today and holding them, so the greater is the quantity of U.S. dollars demanded in the foreign exchange market today. Let’s look at an example.

Suppose that Mizuho Bank, a Japanese bank, expects the exchange rate to be 120 yen per U.S. dollar at the end of the year. If today’s exchange rate is also 120 yen per U.S. dollar, Mizuho Bank expects no profit from buying U.S. dollars and holding them until the end of the year. But if today’s exchange rate is 100 yen per U.S. dollar and Mizuho Bank buys U.S. dollars, it expects to sell those dollars at the end of the year for 120 yen per dollar and make a profit of 20 yen per U.S. dollar.

The lower the exchange rate today, other things remaining the same, the greater is the expected profit from holding U.S. dollars and the greater is the quantity of U.S. dollars demanded in the foreign exchange market today.

**Demand Curve for U.S. Dollars**

Figure 9.1 shows the demand curve for U.S. dollars in the foreign exchange market. A change in the exchange rate, other things remaining the same, brings a change in the quantity of U.S. dollars demanded and a movement along the demand curve. The arrows show such movements.

We will look at the factors that change demand in the next section of this chapter. Before doing that, let’s see what determines the supply of U.S. dollars.
Supply in the Foreign Exchange Market

People sell U.S. dollars and buy other currencies so that they can buy foreign-produced goods and services—U.S. imports. People also sell U.S. dollars and buy foreign currencies so that they can buy foreign assets such as bonds, stocks, businesses, and real estate or so that they can hold part of their money in bank deposits denominated in a foreign currency.

The quantity of U.S. dollars supplied in the foreign exchange market is the amount that traders plan to sell during a given time period at a given exchange rate. This quantity depends on many factors, but the main ones are

1. The exchange rate
2. U.S. demand for imports
3. Interest rates in the United States and other countries
4. The expected future exchange rate

Let’s look at the law of supply in the foreign exchange market—the relationship between the quantity of U.S. dollars supplied in the foreign exchange market and the exchange rate when the other three influences remain the same.

The Law of Supply of Foreign Exchange

Other things remaining the same, the higher the exchange rate, the greater is the quantity of U.S. dollars supplied in the foreign exchange market. For example, if the exchange rate rises from 100 yen to 120 yen per U.S. dollar and other things remain the same, the quantity of U.S. dollars that people plan to sell in the foreign exchange market increases.

The exchange rate influences the quantity of dollars supplied for two reasons:

- Imports effect
- Expected profit effect

Imports Effect

The larger the value of U.S. imports, the larger is the quantity of U.S. dollars supplied in the foreign exchange market. But the value of U.S. imports depends on the prices of foreign-produced goods and services expressed in U.S. dollars. These prices depend on the exchange rate. The higher the exchange rate, other things remaining the same, the lower are the prices of foreign-produced goods and services to Americans and the greater is the volume of U.S. imports. So if the exchange rate rises (and other influences remain the same), the quantity of U.S. dollars supplied in the foreign exchange market increases.

Expected Profit Effect

This effect works just like that on the demand for the U.S. dollar but in the opposite direction. The higher the exchange rate today, other things remaining the same, the larger is the expected profit from selling U.S. dollars today and holding foreign currencies, so the greater is the quantity of U.S. dollars supplied.

Supply Curve for U.S. Dollars

Figure 9.2 shows the supply curve of U.S. dollars in the foreign exchange market. A change in the exchange rate, other things remaining the same, brings a change in the quantity of U.S. dollars supplied and a movement along the supply curve. The arrows show such movements.

![Figure 9.2: The Supply of U.S. Dollars](image-url)
Market Equilibrium

Equilibrium in the foreign exchange market depends on how the Federal Reserve and other central banks operate. Here, we will study equilibrium when central banks keep out of this market. In a later section (on pp. 222–224), we examine the effects of alternative actions that the Fed or another central bank might take in the foreign exchange market.

Figure 9.3 shows the demand curve for U.S. dollars, \( D \), from Fig. 9.1 and the supply curve of U.S. dollars, \( S \), from Fig. 9.2, and the equilibrium exchange rate.

The exchange rate acts as a regulator of the quantities demanded and supplied. If the exchange rate is too high, there is a surplus—the quantity supplied exceeds the quantity demanded. For example, in Fig. 9.3, if the exchange rate is 150 yen per U.S. dollar, there is a surplus of U.S. dollars. If the exchange rate is too low, there is a shortage—the quantity supplied is less than the quantity demanded. For example, if the exchange rate is 50 yen per U.S. dollar, there is a shortage of U.S. dollars.

At the equilibrium exchange rate, there is neither a shortage nor a surplus—the quantity supplied equals the quantity demanded. In Fig. 9.3, the equilibrium exchange rate is 100 yen per U.S. dollar. At this exchange rate, the quantity demanded and the quantity supplied are each $1.5 trillion a day.

The foreign exchange market is constantly pulled to its equilibrium by the forces of supply and demand. Foreign exchange traders are constantly looking for the best price they can get. If they are selling, they want the highest price available. If they are buying, they want the lowest price available. Information flows from trader to trader through the worldwide computer network, and the price adjusts minute by minute to keep buying plans and selling plans in balance. That is, the price adjusts minute by minute to keep the exchange rate at its equilibrium.

Figure 9.3 shows how the exchange rate between the U.S. dollar and the Japanese yen is determined. The exchange rates between the U.S. dollar and all other currencies are determined in a similar way. So are the exchange rates among the other currencies. But the exchange rates are tied together so that no profit can be made by buying one currency, selling it for a second one, and then buying back the first one. If such a profit were available, traders would spot it, demand and supply would change, and the exchange rates would snap into alignment.

**FIGURE 9.3 Equilibrium Exchange Rate**

The demand curve for U.S. dollars is \( D \), and the supply curve of U.S. dollars is \( S \). If the exchange rate is 150 yen per U.S. dollar, there is a surplus of U.S. dollars and the exchange rate falls. If the exchange rate is 50 yen per U.S. dollar, there is a shortage of U.S. dollars and the exchange rate rises. If the exchange rate is 100 yen per U.S. dollar, there is neither a shortage nor a surplus of U.S. dollars and the exchange rate remains constant. The foreign exchange market is in equilibrium.

**REVIEW QUIZ**

1. What are the influences on the demand for U.S. dollars in the foreign exchange market?
2. Provide an example of the exports effect on the demand for U.S. dollars.
3. What are the influences on the supply of U.S. dollars in the foreign exchange market?
4. Provide an example of the imports effect on the supply of U.S. dollars.
5. How is the equilibrium exchange rate determined?
6. What happens if there is a shortage or a surplus of U.S. dollars in the foreign exchange market?

You can work these questions in Study Plan 9.1 and get instant feedback.
Exchange Rate Fluctuations

You’ve seen (in *Economics in Action* on p. 213) that the U.S. dollar fluctuates a lot against the yen and the euro. Changes in the demand for U.S. dollars or the supply of U.S. dollars bring these exchange rate fluctuations. We’ll now look at the factors that make demand and supply change, starting with the demand side of the market.

**Changes in the Demand for U.S. Dollars**

The demand for U.S. dollars in the foreign exchange market changes when there is a change in
- World demand for U.S. exports
- U.S. interest rate relative to the foreign interest rate
- The expected future exchange rate

**World Demand for U.S. Exports** An increase in world demand for U.S. exports increases the demand for U.S. dollars. To see this effect, think about Boeing’s airplane sales. An increase in demand for air travel in Australia sends that country’s airlines on a global shopping spree. They decide that the 787 is the ideal product, so they order 50 airplanes from Boeing. The demand for U.S. dollars now increases.

**U.S. Interest Rate Relative to the Foreign Interest Rate** People and businesses buy financial assets to make a return. The higher the interest rate that people can make on U.S. assets compared with foreign assets, the more U.S. assets they buy.

What matters is not the *level* of the U.S. interest rate, but the U.S. interest rate minus the foreign interest rate—a gap that is called the *U.S. interest rate differential*. If the U.S. interest rate rises and the foreign interest rate remains constant, the U.S. interest rate differential increases. The larger the U.S. interest rate differential, the greater is the demand for U.S. assets and the greater is the demand for U.S. dollars in the foreign exchange market.

**The Expected Future Exchange Rate** For a given current exchange rate, other things remaining the same, a rise in the expected future exchange rate increases the profit that people expect to make by holding U.S. dollars and the demand for U.S. dollars increases today.

Figure 9.4 summarizes the influences on the demand for U.S. dollars. An increase in the demand for U.S. exports, a rise in the U.S. interest rate differential, or a rise in the expected future exchange rate increases the demand for U.S. dollars today and shifts the demand curve rightward from $D_0$ to $D_1$. A decrease in the demand for U.S. exports, a fall in the U.S. interest rate differential, or a fall in the expected future exchange rate decreases the demand for U.S. dollars today and shifts the demand curve leftward from $D_0$ to $D_2$.
Changes in the Supply of U.S. Dollars

The supply of U.S. dollars in the foreign exchange market changes when there is a change in

- U.S. demand for imports
- U.S. interest rate relative to the foreign interest rate
- The expected future exchange rate

U.S. Demand for Imports

An increase in the U.S. demand for imports increases the supply of U.S. dollars in the foreign exchange market. To see why, think about Wal-Mart’s purchase of DVD players. An increase in the demand for DVD players sends Wal-Mart out on a global shopping spree. Wal-Mart decides that Panasonic DVD players produced in Japan are the best buy, so Wal-Mart increases its purchases of these players. The supply of U.S. dollars now increases as Wal-Mart goes to the foreign exchange market for Japanese yen to pay Panasonic.

U.S. Interest Rate Relative to the Foreign Interest Rate

The effect of the U.S. interest rate differential on the supply of U.S. dollars is the opposite of its effect on the demand for U.S. dollars. The larger the U.S. interest rate differential, the smaller is the supply of U.S. dollars in the foreign exchange market.

With a higher U.S. interest rate differential, people decide to keep more of their funds in U.S. dollar assets and less in foreign currency assets. They buy a smaller quantity of foreign currency and sell a smaller quantity of dollars in the foreign exchange market.

So, a rise in the U.S. interest rate, other things remaining the same, decreases the supply of U.S. dollars in the foreign exchange market.

The Expected Future Exchange Rate

For a given current exchange rate, other things remaining the same, a fall in the expected future exchange rate decreases the profit that can be made by holding U.S. dollars and decreases the quantity of U.S. dollars that people want to hold. To reduce their holdings of U.S. dollar assets, people must sell U.S. dollars. When they do so, the supply of U.S. dollars in the foreign exchange market increases.

Figure 9.5 summarizes the influences on the supply of U.S. dollars. If the supply of U.S. dollars decreases, the supply curve shifts leftward from $S_0$ to $S_1$. And if the supply of U.S. dollars increases, the supply curve shifts rightward from $S_0$ to $S_2$.

Changes in the Exchange Rate

If the demand for U.S. dollars increases and the supply does not change, the exchange rate rises. If the demand for U.S. dollars decreases and the supply does not change, the exchange rate falls. Similarly, if the supply of U.S. dollars decreases and the demand does not change, the exchange rate rises. If the supply of U.S. dollars increases and the demand does not change, the exchange rate falls.

These predictions are exactly the same as those for any other market. Two episodes in the life of the U.S. dollar (next page) illustrate these predictions.
Economics in Action

The Dollar on a Roller Coaster

The foreign exchange market is a striking example of a competitive market. The expectations of thousands of traders around the world influence this market minute-by-minute throughout the 24-hour global trading day.


An Appreciating U.S. Dollar: 2005–2007 Between January 2005 and July 2007, the U.S. dollar appreciated against the yen. It rose from 103 yen to 123 yen per U.S. dollar. Part (a) of the figure provides an explanation for this appreciation.

In 2005, the demand and supply curves were those labeled $D_{05}$ and $S_{05}$. The exchange rate was 103 yen per U.S. dollar. Part (a) of the figure provides an explanation for this appreciation.

In 2005, the demand and supply curves were those labeled $D_{05}$ and $S_{05}$. The exchange rate was 103 yen per U.S. dollar. During 2005 and 2006, the Federal Reserve raised the interest rate, but the interest rate in Japan barely changed. With an increase in the U.S. interest rate differential, funds flowed into the United States. Also, currency traders, anticipating this increased flow of funds into the United States, expected the dollar to appreciate against the yen. The demand for U.S. dollars increased, and the supply of U.S. dollars decreased.

In the figure, the demand curve shifted rightward from $D_{05}$ to $D_{07}$ and the supply curve shifted leftward from $S_{05}$ to $S_{07}$. The exchange rate rose to 123 yen per U.S. dollar. In the figure, the equilibrium quantity remained unchanged—an assumption.

A Depreciating U.S. Dollar: 2007–2008 Between July 2007 and September 2008, the U.S. dollar depreciated against the yen. It fell from 123 yen to 107 yen per U.S. dollar. Part (b) of the figure provides a possible explanation for this depreciation. The demand and supply curves labeled $D_{07}$ and $S_{07}$ are the same as in part (a).

During the last quarter of 2007 and the first three quarters of 2008, the U.S. economy entered a severe credit crisis and the Federal Reserve cut the interest rate in the United States. But the Bank of Japan kept the interest rate unchanged in Japan. With a narrowing of the U.S. interest rate differential, funds flowed out of the United States. Also, currency traders expected the U.S. dollar to depreciate against the yen. The demand for U.S. dollars decreased and the supply of U.S. dollars increased.

In part (b) of the figure, the demand curve shifted leftward from $D_{07}$ to $D_{08}$, the supply curve shifted rightward from $S_{07}$ to $S_{08}$, and the exchange rate fell to 107 yen per U.S. dollar.
Interest Rate Parity

Suppose a bank deposit earns 1 percent a year in Tokyo and 3 percent a year in New York. Why wouldn’t people move their funds to New York, and even borrow in Japan to do so? The answer is that some would, in an activity called the “carry trade” (see Reading Between the Lines on pp. 230–231). The New York deposit is in dollars and the Tokyo deposit is in yen. So a change in the exchange rate brings risk to borrowing in one currency and lending in another. If investors expect the yen to appreciate by 2 percent a year and they buy and hold yen for a year they will earn 1 percent interest and expect a 2 percent return from the higher yen. The total expected return is 3 percent, the same as on U.S. dollars in New York.

This situation is called interest rate parity, which means equal rates of return. Adjusted for risk, interest rate parity always prevails. Funds move to get the highest expected return available. If for a few seconds a higher return is available in New York than in Tokyo, the demand for U.S. dollars increases and the exchange rate rises until the expected rates of return are equal.

Purchasing Power Parity

Suppose a memory stick costs 5,000 yen in Tokyo and $50 in New York. If the exchange rate is 100 yen per dollar, the two monies have the same value. You can buy a memory stick in either Tokyo or New York for the same price. You can express that price as either 5,000 yen or $50, but the price is the same in the two currencies.

The situation we’ve just described is called purchasing power parity, which means equal value of money. If purchasing power parity does not prevail, powerful arbitrage forces go to work. To see these forces, suppose that the price of a memory stick in New York rises to $60, but in Tokyo it remains at 5,000 yen. Further, suppose the exchange rate remains at 100 yen per dollar. In this case, a memory stick in Tokyo still costs 5,000 yen or $50, but in New York, it costs $60 or 6,000 yen. Money buys more in Japan than in the United States. Money is not of equal value in the two countries.

If all (or most) prices have increased in the United States and not increased in Japan, then people will generally expect that the value of the U.S. dollar in the foreign exchange market must fall. In this situation, the exchange rate is expected to fall. The demand for U.S. dollars decreases, and the supply of U.S. dollars increases. The exchange rate falls, as expected. If the exchange rate falls to 83.33 yen per dollar and there are no further price changes, purchasing power parity is restored. A memory stick that costs $60 in New York also costs the equivalent of $60 (60 × 83.33 = 5,000) in Tokyo.

If prices rise in Japan and other countries but remain constant in the United States, then people will expect the U.S. dollar to appreciate. The demand for U.S. dollars increases, and the supply of U.S. dollars decreases. The exchange rate rises, as expected.

So far we’ve been looking at the forces that determine the nominal exchange rate—the amount of one money that another money buys. We’re now going to study the real exchange rate.

Fundamentals, Expectations, and Arbitrage

Changes in the expected exchange rate change the actual exchange rate. But what makes the expected exchange rate change? The answer is new information about the fundamental influences on the exchange rate—the world demand for U.S. exports, U.S. demand for imports, and the U.S. interest rate relative to the foreign interest rate. Expectations about these variables change the exchange rate through their influence on the expected exchange rate, and the effect is instant.

To see why, suppose news breaks that the Fed will raise the interest rate next week. Traders now expect the demand for dollars to increase and the dollar to appreciate: They expect to profit by buying dollars today and selling them next week for a higher price than they paid. The rise in the expected future value of the dollar increases the demand for dollars today, decreases the supply of dollars today, and raises the exchange rate. The exchange rate changes as soon as the news about a fundamental influence is received.

Profiting by trading in the foreign exchange market often involves arbitrage. The practice of buying in one market and selling for a higher price in another related market. Arbitrage ensures that the exchange rate is the same in New York, London, and all other trading centers. It isn’t possible to buy at a low price in London and sell for a higher price in New York. If it were possible, demand would increase in London and decrease in New York to make the prices equal.

Arbitrage also removes profit from borrowing in one currency and lending in another and buying goods in one currency and selling them in another. These arbitrage activities bring about

- Interest rate parity
- Purchasing power parity
The Real Exchange Rate

The **real exchange rate** is the relative price of U.S.-produced goods and services to foreign-produced goods and services. It is a measure of the quantity of the real GDP of other countries that a unit of U.S. real GDP buys.

The real Japanese yen exchange rate, \( RER \), is

\[
RER = \frac{(E \times P)}{P^*},
\]

where \( E \) is the exchange rate (yen per U.S. dollar), \( P \) is the U.S. price level, and \( P^* \) is the Japanese price level.

To understand the real exchange rate, suppose that each country produces only one good and that the exchange rate \( E \) is 100 yen per dollar. The United States produces only computer chips priced at $150 each, so \( P \) equals $150 and \( E \times P \) equals 15,000 yen. Japan produces only iPods priced at 5,000 yen each, so \( P^* \) equals 5,000 yen. Then the real Japanese yen exchange rate is

\[
RER = \frac{(100 \times 150)}{5,000} = 3 \text{ iPods per chip.}
\]

**The Short Run** In the short run, if the nominal exchange rate changes, the real exchange rate also changes. The reason is that prices and the price levels in the United States and Japan don’t change every time the exchange rate changes. Sticking with the chips and iPods example, if the dollar appreciates to 200 yen per dollar and prices don’t change, the real exchange rate rises to 6 iPods per chip. The price of an iPod in the United States falls to $25 (5,000 yen ÷ 200 yen per dollar = $25).

Changes in the real exchange rate bring short-run changes in the quantity of imports demanded and the quantity of exports supplied.

**The Long Run** But in the long run, the situation is radically different: In the long run, the nominal exchange rate and the price level are determined together and the real exchange rate does **not** change when the nominal exchange rate changes.

In the long run, demand and supply in the markets for goods and services determine prices. In the chips and iPod example, the world markets for chips and iPods determine their **relative** price. In our example the relative price is 3 iPods per chip. The same forces determine all relative prices and so determine nations’ relative price levels.

In the long run, if the dollar appreciates prices **do** change. To see why, recall the quantity theory of money that you met in Chapter 8 (pp. 200–201).

In the long run, the quantity of money determines the price level. But the quantity theory of money applies to all countries, so the quantity of money in Japan determines the price level in Japan, and the quantity of money in the United States determines the price level in the United States.

For a given real exchange rate, a change in the quantity of money brings a change in the price level and a change in the exchange rate.

Suppose that the quantity of money doubles in Japan. The dollar appreciates (the yen depreciates) from 100 yen per dollar to 200 yen per dollar and all prices double, so the price of an iPod rises from 5,000 yen to 10,000 yen.

At the new price in Japan and the new exchange rate, an iPod still costs $50 (10,000 yen ÷ 200 yen per dollar = $50). The real exchange rate remains at 3 iPods per chip.

If Japan and the United States produced identical goods (if GDP in both countries consisted only of computer chips), the real exchange rate in the long run would equal 1.

In reality, although there is overlap in what each country produces, U.S. real GDP is a different bundle of goods and services from Japanese real GDP. So the relative price of Japanese and U.S. real GDP—the real exchange rate—is not 1, and it changes over time. The forces of demand and supply in the markets for the millions of goods and services that make up real GDP determine the relative price of Japanese and U.S. real GDP, and changes in these forces change the real exchange rate.

**REVIEW QUIZ**

1. Why does the demand for U.S. dollars change?
2. Why does the supply of U.S. dollars change?
3. What makes the U.S. dollar exchange rate fluctuate?
4. What is interest rate parity and what happens when this condition doesn’t hold?
5. What is purchasing power parity and what happens when this condition doesn’t hold?
6. What determines the real exchange rate and the nominal exchange rate in the short run?
7. What determines the real exchange rate and the nominal exchange rate in the long run?

You can work these questions in Study Plan 9.2 and get instant feedback.
Exchange Rate Policy

Because the exchange rate is the price of a country’s money in terms of another country’s money, governments and central banks must have a policy toward the exchange rate. Three possible exchange rate policies are

- Flexible exchange rate
- Fixed exchange rate
- Crawling peg

Flexible Exchange Rate

A flexible exchange rate is an exchange rate that is determined by demand and supply in the foreign exchange market with no direct intervention by the central bank.

Most countries, including the United States, operate a flexible exchange rate, and the foreign exchange market that we have studied so far in this chapter is an example of a flexible exchange rate regime.

But even a flexible exchange rate is influenced by central bank actions. If the Fed raises the U.S. interest rate and other countries keep their interest rates unchanged, the demand for U.S. dollars increases, the supply of U.S. dollars decreases, and the exchange rate rises. (Similarly, if the Fed lowers the U.S. interest rate, the demand for U.S. dollars decreases, the supply increases, and the exchange rate falls.)

In a flexible exchange rate regime, when the central bank changes the interest rate, its purpose is not usually to influence the exchange rate, but to achieve some other monetary policy objective. (We return to this topic at length in Chapter 14.)

Fixed Exchange Rate

A fixed exchange rate is an exchange rate that is determined by a decision of the government or the central bank and is achieved by central bank intervention in the foreign exchange market to block the unregulated forces of demand and supply.

The world economy operated a fixed exchange rate regime from the end of World War II to the early 1970s. China had a fixed exchange rate until recently. Hong Kong has had a fixed exchange rate for many years and continues with that policy today.

Active intervention in the foreign exchange market is required to achieve a fixed exchange rate.

If the Fed wanted to fix the U.S. dollar exchange rate against the Japanese yen, the Fed would have to sell U.S. dollars to prevent the exchange rate from rising above the target value and buy U.S. dollars to prevent the exchange rate from falling below the target value.

There is no limit to the quantity of U.S. dollars that the Fed can sell. The Fed creates U.S. dollars and can create any quantity it chooses. But there is a limit to the quantity of U.S. dollars the Fed can buy. That limit is set by U.S. official foreign currency reserves because to buy U.S. dollars the Fed must sell foreign currency. Intervention to buy U.S. dollars stops when U.S. official foreign currency reserves run out.

Let’s look at the foreign exchange interventions that the Fed can make.

Suppose the Fed wants the exchange rate to be steady at 100 yen per U.S. dollar. If the exchange rate rises above 100 yen, the Fed sells dollars. If the exchange rate falls below 100 yen, the Fed buys dollars. By these actions, the Fed keeps the exchange rate close to its target rate of 100 yen per U.S. dollar.

Figure 9.6 shows the Fed’s intervention in the foreign exchange market. The supply of dollars is $S$ and initially the demand for dollars is $D_0$. The equilibrium exchange rate is 100 yen per dollar. This exchange rate is also the Fed’s target exchange rate, shown by the horizontal red line.

When the demand for U.S. dollars increases and the demand curve shifts rightward to $D_1$, the Fed sells $100$ billion. This action prevents the exchange rate from rising. When the demand for U.S. dollars decreases and the demand curve shifts leftward to $D_2$, the Fed buys $100$ billion. This action prevents the exchange rate from falling.

If the demand for U.S. dollars fluctuates between $D_1$ and $D_2$ and on average is $D_0$, the Fed can repeatedly intervene in the way we’ve just seen. Sometimes the Fed buys and sometimes it sells, but on average, it neither buys nor sells.

But suppose the demand for U.S. dollars increases permanently from $D_0$ to $D_1$. To maintain the exchange rate at 100 yen per U.S. dollar, the Fed must sell dollars and buy foreign currency, so U.S. official foreign currency reserves would be increasing. At some point, the Fed would abandon the exchange rate of 100 yen per U.S. dollar and stop piling up foreign currency reserves.

Now suppose the demand for U.S. dollars decreases permanently from $D_0$ to $D_2$. In this situation, the Fed...
cannot maintain the exchange rate at 100 yen per U.S. dollar indefinitely. To hold the exchange rate at 100 yen, the Fed must buy U.S. dollars. When the Fed buys U.S. dollars in the foreign exchange market, it uses U.S. official foreign currency reserves. So the Fed’s action decreases its foreign currency reserves. Eventually, the Fed would run out of foreign currency and would then have to abandon the target exchange rate of 100 yen per U.S. dollar.

Crawling Peg

A crawling peg is an exchange rate that follows a path determined by a decision of the government or the central bank and is achieved in a similar way to a fixed exchange rate by central bank intervention in the foreign exchange market. A crawling peg works like a fixed exchange rate except that the target value changes. The target might change at fixed intervals (daily, weekly, monthly) or at random intervals.

The Fed has never operated a crawling peg, but some prominent countries do use this system. When China abandoned its fixed exchange rate, it replaced it with a crawling peg. Developing countries might use a crawling peg as a method of trying to control inflation—of keeping the inflation rate close to target.

The ideal crawling peg sets a target for the exchange rate equal to the equilibrium exchange rate.

Economics in Action

The People’s Bank of China in the Foreign Exchange Market

You saw in the figure on p. 213 that the exchange rate between the U.S. dollar and the Chinese yuan was constant for several years. The reason for this near constant exchange rate is that China’s central bank, the People’s Bank of China, intervened to operate a fixed exchange rate policy. From 1997 until 2005, the yuan was pegged at 8.28 yuan per U.S. dollar. Since 2005, the yuan has appreciated slightly but it has not been permitted to fluctuate freely. Since 2005, the yuan has been on a crawling peg.

Why Does China Manage Its Exchange Rate?

The popular story is that China manages its exchange rate to keep its export prices low and to make it easier to compete in world markets. You’ve seen that this story is correct only in the short run. With prices in China unchanged, a lower yuan–U.S. dollar exchange rate brings lower U.S. dollar prices for China’s exports. But the yuan–U.S. dollar exchange rate was fixed for almost 10 years and has been managed for five more years. This long period of a fixed exchange rate has long-run, not short-run, effects. In the long run, the exchange rate has no effect on competitiveness. The reason is that prices adjust to reflect the exchange rate and the real exchange rate is unaffected by the nominal exchange rate.

So why does China fix its exchange rate? The most convincing answer is that China sees a fixed exchange rate as a way of controlling its inflation rate. By making the yuan crawl against the U.S. dollar, China’s inflation rate is anchored to the U.S. inflation rate and will depart from U.S. inflation by an amount determined by the speed of the crawl.

FIGURE 9.6

Foreign Exchange Market Intervention

Initially, the demand for U.S. dollars is $D_0$, the supply of U.S. dollars is $S$, and the exchange rate is 100 yen per U.S. dollar. The Fed can intervene in the foreign exchange market to keep the exchange rate close to its target rate (100 yen in this example). If the demand for U.S. dollars increases and the demand curve shifts from $D_0$ to $D_1$, the Fed sells dollars. If the demand for U.S. dollars decreases and the demand curve shifts from $D_0$ to $D_2$, the Fed buys dollars. Persistent intervention on one side of the market cannot be sustained.
CHAPTER 9 The Exchange Rate and the Balance of Payments

The bottom line is that in the long run, exchange rate policy is monetary policy, not foreign trade policy. To change its exports and imports, a country must change its comparative advantage (Chapter 2).

**How Does China Manage Its Exchange Rate?** The People’s Bank pegs the yuan at 7 yuan per U.S. dollar by intervening in the foreign exchange market and buying U.S. dollars. But to do so, it must pile up U.S. dollars.

Part (a) of the figure shows the scale of China’s increase in official foreign currency reserves, some of which are euros and yen but most of which are U.S. dollars. You can see that China’s reserves increased by more than $400 billion in 2007, 2008, and 2009.

The demand and supply curves in part (b) of the figure illustrate what is happening in the market for U.S. dollars priced in terms of the yuan and explains why China’s reserves have increased. The demand curve $D$ and supply curve $S$ intersect at 5 yuan per U.S. dollar. If the People’s Bank of China takes no actions in the market, this exchange rate is the equilibrium rate (an assumed value).

The consequence of the fixed (and crawling peg) yuan exchange rate is that China has piled up U.S. dollar reserves on a huge scale. By mid-2006, China’s official foreign currency reserves approached $1 trillion and by the end of 2009, they exceeded $2 trillion!

If the People’s Bank stopped buying U.S. dollars, the U.S. dollar would depreciate and the yuan would appreciate—the yuan–U.S. dollar exchange rate would fall—and China would stop piling up U.S. dollar reserves.

In the example in the figure, the dollar would depreciate to 5 yuan per dollar.

**REVIEW QUIZ**

1. What is a flexible exchange rate and how does it work?
2. What is a fixed exchange rate and how is its value fixed?
3. What is a crawling peg and how does it work?
4. How has China operated in the foreign exchange market, why, and with what effect?

You can work these questions in Study Plan 9.3 and get instant feedback.
Financing International Trade

You now know how the exchange rate is determined, but what is the effect of the exchange rate? How does currency depreciation or currency appreciation influence our international trade and payments? We’re going to lay the foundation for addressing these questions by looking at the scale of international trading, borrowing, and lending and at the way in which we keep our records of international transactions. These records are called the balance of payments accounts.

Balance of Payments Accounts

A country’s balance of payments accounts records its international trading, borrowing, and lending in three accounts:

1. Current account
2. Capital and financial account
3. Official settlements account

The current account records receipts from exports of goods and services sold abroad, payments for imports of goods and services from abroad, net interest income paid abroad, and net transfers abroad (such as foreign aid payments). The current account balance equals the sum of exports minus imports, net interest income, and net transfers.

The capital and financial account records foreign investment in the United States minus U.S. investment abroad. (This account also has a statistical discrepancy that arises from errors and omissions in measuring international capital transactions.)

The official settlements account records the change in U.S. official reserves, which are the government’s holdings of foreign currency. If U.S. official reserves increase, the official settlements account balance is negative. The reason is that holding foreign money is like investing abroad. U.S. investment abroad is a minus item in the capital and financial account and in the official settlements account.

The sum of the balances on the three accounts always equals zero. That is, to pay for our current account deficit, we must either borrow more from abroad than we lend abroad or use our official reserves to cover the shortfall.

Table 9.1 shows the U.S. balance of payments accounts in 2010. Items in the current account and the capital and financial account that provide foreign currency to the United States have a plus sign; items that cost the United States foreign currency have a minus sign. The table shows that in 2010, U.S. imports exceeded U.S. exports and the current account had a deficit of $436 billion. How do we pay for imports that exceed the value of our exports? That is, how do we pay for our current account deficit?

We pay by borrowing from the rest of the world. The capital account tells us by how much. We borrowed $1,408 billion (foreign investment in the United States) but made loans of $1,200 billion (U.S. investment abroad). Our net foreign borrowing was $1,408 billion minus $1,200 billion, which equals $208 billion. There is almost always a statistical discrepancy between our capital account and current account transactions, and in 2010, the discrepancy was $231 billion. Combining the discrepancy with the measured net foreign borrowing gives a capital and financial account balance of $439 billion.

<table>
<thead>
<tr>
<th>TABLE 9.1 U.S. Balance of Payments Accounts in 2010</th>
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<tbody>
<tr>
<td>Current account</td>
</tr>
<tr>
<td>Billions of dollars</td>
</tr>
<tr>
<td>Exports of goods and services</td>
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<tr>
<td>Imports of goods and services</td>
</tr>
<tr>
<td>Net interest income</td>
</tr>
<tr>
<td>Net transfers</td>
</tr>
<tr>
<td>Current account balance</td>
</tr>
<tr>
<td>Capital and financial account</td>
</tr>
<tr>
<td>Foreign investment in the United States</td>
</tr>
<tr>
<td>U.S. investment abroad</td>
</tr>
<tr>
<td>Statistical discrepancy</td>
</tr>
<tr>
<td>Capital and financial account balance</td>
</tr>
<tr>
<td>Official settlements account</td>
</tr>
<tr>
<td>Official settlements account balance</td>
</tr>
</tbody>
</table>

Source of data: Bureau of Economic Analysis (based on first quarter).
The capital and financial account balance plus the current account balance equals the change in U.S. official reserves. In 2010, the capital and financial account balance of $439 billion plus the current account balance of –$436 billion equaled $3 billion. Official reserves increased in 2010 by $3 billion. Holding more foreign reserves is like lending to the rest of the world, so this amount appears in the official settlements account in Table 9.1 as –$3 billion. The sum of the balances on the three balance of payments accounts equals zero.

To see more clearly what the nation’s balance of payments accounts mean, think about your own balance of payments accounts. They are similar to the nation’s accounts.

An Individual’s Balance of Payments Accounts An individual’s current account records the income from supplying the services of production and the expenditure on goods and services. Consider Jackie, for example. She worked in 2010 and earned an income of $25,000. Jackie has $10,000 worth of investments that earned her an interest income of $1,000. Jackie’s current account shows an income of $26,000. Jackie spent $18,000 buying consumption goods and services. She also bought a new house, which cost her $60,000. So Jackie’s total expenditure was $78,000. Jackie’s expenditure minus her income is $52,000 ($78,000 minus $26,000). This amount is Jackie’s current account deficit.

Economics in Action
Three Decades of Deficits

The numbers that you reviewed in Table 9.1 give a snapshot of the balance of payments accounts in 2010. The figure below puts that snapshot into perspective by showing the balance of payments between 1980 and 2010.

Because the economy grows and the price level rises, changes in the dollar value of the balance of payments do not convey much information. To remove the influences of economic growth and inflation, the figure shows the balance of payments expressed as a percentage of nominal GDP.

As you can see, a large current account deficit emerged during the 1980s but declined from 1987 to 1991. The current account deficit then increased through 2000, decreased slightly in 2001, and then increased through 2006 after which it decreased again but increased slightly in 2010. The capital and financial account balance is almost a mirror image of the current account balance. The official settlements balance is very small in comparison with the balances on the other two accounts.
To pay for expenditure of $52,000 in excess of her income, Jackie must either use the money that she has in the bank or take out a loan. Suppose that Jackie took out a loan of $50,000 to help buy her house and that this loan was the only borrowing that she did. Borrowing is an inflow in the capital account, so Jackie’s capital account surplus was $50,000. With a current account deficit of $52,000 and a capital account surplus of $50,000, Jackie was still $2,000 short. She got that $2,000 from her own bank account. Her cash holdings decreased by $2,000.

Jackie’s income from her work is like a country’s income from its exports. Her income from her investments is like a country’s interest income from foreigners. Her purchases of goods and services, including her purchase of a house, are like a country’s imports. Jackie’s loan—borrowing from someone else—is like a country’s borrowing from the rest of the world. The change in Jackie’s bank account is like the change in the country’s official reserves.

**Borrowers and Lenders**

A country that is borrowing more from the rest of the world than it is lending to the rest of the world is called a net borrower. Similarly, a net lender is a country that is lending more to the rest of the world than it is borrowing from the rest of the world.

The United States is a net borrower, but it has not always been in this situation. Throughout the 1960s and most of the 1970s, the United States was a net lender to the rest of the world—the United States had a current account surplus and a capital account deficit. But from the early 1980s, with the exception of only a single year, 1991, the United States has been a net borrower from the rest of the world. And during the years since 1992, the scale of U.S. borrowing has mushroomed.

Most countries are net borrowers like the United States. But a few countries, including China, Japan, and oil-rich Saudi Arabia, are net lenders. In 2010, when the United States borrowed more than $400 billion from the rest of the world, most of it came from China.

**Debtors and Creditors**

A net borrower might be decreasing its net assets held in the rest of the world, or it might be going deeper into debt. A nation’s total stock of foreign investment determines whether it is a debtor or a creditor. A debtor nation is a country that during its entire history has borrowed more from the rest of the world than it has lent to it. It has a stock of outstanding debt to the rest of the world that exceeds the stock of its own claims on the rest of the world. A creditor nation is a country that during its entire history has invested more in the rest of the world than other countries have invested in it.

The United States was a debtor nation through the nineteenth century as we borrowed from Europe to finance our westward expansion, railroads, and industrialization. We paid off our debt and became a creditor nation for most of the twentieth century. But following a string of current account deficits, we became a debtor nation again in 1986.

Since 1986, the total stock of U.S. borrowing from the rest of the world has exceeded U.S. lending to the rest of the world. The largest debtor nations are the capital-hungry developing countries (such as the United States was during the nineteenth century). The international debt of these countries grew from less than a third to more than a half of their gross domestic product during the 1980s and created what was called the “Third World debt crisis.”

Should we be concerned that the United States is a net borrower and a debtor? The answer to this question depends mainly on what the net borrower is doing with the borrowed money. If borrowing is financing investment that in turn is generating economic growth and higher income, borrowing is not a problem. It earns a return that more than pays the interest. But if borrowed money is used to finance consumption, to pay the interest and repay the loan, consumption will eventually have to be reduced. In this case, the greater the borrowing and the longer it goes on, the greater is the reduction in consumption that will eventually be necessary.

**Is U.S. Borrowing for Consumption?**

In 2010, we borrowed $439 billion from abroad. In that year, private investment in buildings, plant, and equipment was $1,840 billion and government investment in defense equipment and social projects was $500 billion. All this investment added to the nation’s capital, and increased productivity. Government also spends on education and health care services, which increase human capital. Our international borrowing is financing private and public investment, not consumption.
Current Account Balance

What determines a country’s current account balance and net foreign borrowing? You’ve seen that net exports \((NX)\) is the main item in the current account. We can define the current account balance \((CAB)\) as

\[
CAB = NX + \text{Net interest income} + \text{Net transfers}
\]

We can study the current account balance by looking at what determines net exports because the other two items are small and do not fluctuate much.

Net Exports

Net exports are determined by the government budget and private saving and investment. To see how net exports are determined, we need to recall some of the things that we learned in Chapter 7 about the flows of funds that finance investment. Table 9.2 refreshes your memory and summarizes some calculations.

Part (a) lists the national income variables that are needed, with their symbols. Part (b) defines three balances: net exports, the government sector balance, and the private sector balance.

Net exports is exports of goods and services minus imports of goods and services.

The government sector balance is equal to net taxes minus government expenditures on goods and services. If that number is positive, a government sector surplus is lent to other sectors; if that number is negative, a government deficit must be financed by borrowing from other sectors. The government sector deficit is the sum of the deficits of the federal, state, and local governments.

The private sector balance is saving minus investment. If saving exceeds investment, a private sector surplus is lent to other sectors. If investment exceeds saving, a private sector deficit is financed by borrowing from other sectors.

Part (b) also shows the values of these balances for the United States in 2010. As you can see, net exports were $–536 billion, a deficit of $536 billion. The government sector’s revenue from net taxes was $1,698 billion and its expenditure was $2,993 billion, so the government sector balance was $–1,295 billion—a deficit of $1,295 billion. The private sector saved $2,598 billion and invested $1,839 billion, so its balance was $759 billion—a surplus of $759 billion.

Part (c) shows the relationship among the three balances. From the National Income and Product Accounts, we know that real GDP, \(Y\), is the sum of consumption expenditure \((C)\), investment, government expenditure, and net exports. Real GDP also equals the sum of consumption expenditure, saving, and net taxes. Rearranging these equations tells us that net exports is the sum of the government sector balance and the private sector balance. In the United States in 2010, the government sector balance was $–1,295 billion and the private sector balance was $759 billion. The difference is $536 billion, which is the value of net exports.
Financing International Trade

229 –$1,295 billion and the private sector balance was $759 billion. The government sector balance plus the private sector balance equaled net exports of –$536 billion.

Where Is the Exchange Rate?

We haven’t mentioned the exchange rate while discussing the balance of payments. Doesn’t it play a role? The answer is that in the short run it does but in the long run it doesn’t.

In the short run, a fall in the dollar lowers the real exchange rate, which makes U.S. imports more costly and U.S. exports more competitive. A higher price of imported consumption goods and services might induce a decrease in consumption expenditure and an increase in saving. A higher price of imported capital goods might induce a decrease in investment. Other things remaining the same, an increase in saving or a decrease in investment decreases the private sector deficit and decreases the current account deficit.

But in the long run, a change in the nominal exchange rate leaves the real exchange rate unchanged and plays no role in influencing the current account balance.

Economics in Action

The Three Sector Balances

You’ve seen that net exports equal the sum of the government sector balance and the private sector balance. How do these three sector balances fluctuate over time?

The figure answers this question. It shows the government sector balance (the red line), net exports (the blue line), and the private sector balance (the green line).

The private sector balance and the government sector balance move in opposite directions. When the government sector deficit increased during the late 1980s and early 1990s, the private sector surplus increased. And when the government sector deficit decreased and became a surplus during the 1990s and early 2000s, the private sector’s surplus decreased and became a deficit. And when the government deficit increased yet again from 2007 to 2009, the private sector deficit shrunk and became a surplus.

Sometimes, when the government sector deficit increases, as it did during the first half of the 1980s, net exports become more negative. But after the early 1990s, net exports did not follow the government sector balance closely. Rather, net exports respond to the sum of the government sector and private sector balances. When both the private sector and the government sector have a deficit, net exports are negative and the combined private and government deficit is financed by borrowing from the rest of the world. But the dominant trend in net exports is negative.

REVIEW QUIZ

1. What are the transactions that the balance of payments accounts record?
2. Is the United States a net borrower or a net lender? Is it a debtor or a creditor nation?
3. How are net exports and the government sector balance linked?

You can work these questions in Study Plan 9.4 and get instant feedback.

Reading Between the Lines on pp. 230–231 looks at risky trading that exploits the U.S. interest rate differential in the foreign exchange market.
Only a few weeks ago, the dollar was powering toward its highest levels in four years, the beneficiary of widespread gloom about Europe’s debt crisis and rising optimism about the U.S. recovery.

Since then, investors have soured on the world’s largest economy. The dollar has tumbled 9 percent on a trade-weighted basis in two months, and yesterday fell to ¥85.29, within a whisker of a 15-year low. ...

A wave of weak economic data, including disappointing jobs figures, and expectations of further monetary easing by the U.S. Federal Reserve to head off the risk of a double-dip recession have been the main drivers of the dollar’s fall. ...

As they pull money out of the greenback, investors are betting the recovery in other parts of the world will outpace that of the United States. Asian countries, expected to enjoy stronger growth than the debt-burdened west, have enjoyed strong inflows of funds. ...

The conditions are building, too, for a return of the dollar “carry trade”, in which investors take advantage of low U.S. borrowing costs to invest in higher-yielding assets elsewhere. ...

One dollar “carry trade” has involved buying Indonesian bonds. Foreign ownership of Indonesian bonds has risen to a record, while bond yields—which move inversely to prices—have fallen to record lows. Tim Lee at Pi Economics, a consultancy, says the dollar carry trade may now be worth more than $750 billion. ...

In the longer term, the success of the dollar “carry trade” will depend on the U.S. economy remaining weak—but not too weak. ...

Concern about Europe’s debt crisis and optimism about U.S. real GDP growth brought an appreciation of the U.S. dollar. Disappointing jobs figures and expectations of further monetary easing by the Fed changed the outlook, ended the rise in the dollar, and lowered its value by 9 percent on average and close to a 15-year low against the Japanese yen (¥).

Investors are pulling funds out of the U.S. dollar and moving them to the Asian currencies. The dollar “carry trade” is expanding and one estimate puts it at more than $750 billion. The longer term success of the dollar “carry trade” will depend on the U.S. economy remaining weak so that interest rates remain low.

The news article says the dollar will keep depreciating and U.S. interest rates will remain low, so the “carry trade” will be profitable.

The carry trade is borrowing at a low interest rate in one currency, converting the funds to another currency to earn a higher interest rate, then converting the funds back to the original currency.

Carry trade is profitable provided the interest rate difference doesn’t get wiped out by a fall in the value of the currency with the higher interest rate.

If the carry trade was persistently profitable, it would mean that interest rate parity did not hold.

Interest rate parity (explained on p. 220) is a situation in which, adjusted for risk, expected rates of return are equal in all currencies.

The “carry trade” was profitable in 2009 and 2010.

Figure 1 shows that the Indonesian rupiah has appreciated against the U.S. dollar (the dollar has depreciated).

Figure 2 shows the interest rates in Indonesia and the United States. Large investors can borrow at the U.S. commercial bill rate (almost zero) and small investors can borrow at an interest rate of about 2 percentage points above the prime lending rate.

Large investors can buy and sell rupiah for a small percentage transaction fee. Small investors pay a large percentage transaction fee.

Figure 3 shows the profit (and loss) from borrowing $100 and using the carry trade to earn the Indonesian interest rate.

Because the Indonesian interest rate exceeds the U.S. interest rate and the rupiah has appreciated, the carry trade has been profitable.

But the percentage rate of return has fallen, and it turned negative for small investors.

Does the profitable carry trade mean that interest rate parity doesn’t hold?

It does not. Investing in Indonesian rupiah is risky. The rupiah might depreciate and wipe out the interest rate difference.

The economic rear-view mirror is much clearer than the windshield.

Expected returns are equal, but actual past returns are unequal. As people have increased investments in Indonesia, the “carry trade” profit has shrunk.

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**Figure 1** The falling dollar and rising Indonesian rupiah

<table>
<thead>
<tr>
<th>Month/year</th>
<th>Exchange rate (rupiah per dollar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 09</td>
<td>12,000</td>
</tr>
<tr>
<td>Jun 09</td>
<td>11,000</td>
</tr>
<tr>
<td>Sept 09</td>
<td>10,000</td>
</tr>
<tr>
<td>Dec 09</td>
<td>9,000</td>
</tr>
<tr>
<td>Mar 10</td>
<td>11,000</td>
</tr>
<tr>
<td>Jun 10</td>
<td>10,000</td>
</tr>
<tr>
<td>Sept 10</td>
<td>9,000</td>
</tr>
</tbody>
</table>

**Figure 2** U.S. and Indonesian interest rates

<table>
<thead>
<tr>
<th>Month/year</th>
<th>Indonesia bank deposit rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 09</td>
<td>12%</td>
</tr>
<tr>
<td>Jun 09</td>
<td>10%</td>
</tr>
<tr>
<td>Sept 09</td>
<td>8%</td>
</tr>
<tr>
<td>Dec 09</td>
<td>6%</td>
</tr>
<tr>
<td>Mar 10</td>
<td>4%</td>
</tr>
<tr>
<td>Jun 10</td>
<td>2%</td>
</tr>
<tr>
<td>Sept 10</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month/year</th>
<th>U.S. prime lending rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 09</td>
<td>6%</td>
</tr>
<tr>
<td>Jun 09</td>
<td>4%</td>
</tr>
<tr>
<td>Sept 09</td>
<td>2%</td>
</tr>
<tr>
<td>Dec 09</td>
<td>0%</td>
</tr>
<tr>
<td>Mar 10</td>
<td>2%</td>
</tr>
<tr>
<td>Jun 10</td>
<td>0%</td>
</tr>
<tr>
<td>Sept 10</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month/year</th>
<th>U.S. commercial bill rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 09</td>
<td>2%</td>
</tr>
<tr>
<td>Jun 09</td>
<td>0%</td>
</tr>
<tr>
<td>Sept 09</td>
<td>2%</td>
</tr>
<tr>
<td>Dec 09</td>
<td>4%</td>
</tr>
<tr>
<td>Mar 10</td>
<td>6%</td>
</tr>
<tr>
<td>Jun 10</td>
<td>8%</td>
</tr>
<tr>
<td>Sept 10</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Figure 3** Profit from U.S.-Indonesian “carry trade”

<table>
<thead>
<tr>
<th>Month/year</th>
<th>Return from “carry trade” (percent per quarter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jun 09</td>
<td>10%</td>
</tr>
<tr>
<td>Sept 09</td>
<td>8%</td>
</tr>
<tr>
<td>Dec 09</td>
<td>6%</td>
</tr>
<tr>
<td>Mar 10</td>
<td>4%</td>
</tr>
<tr>
<td>Jun 10</td>
<td>2%</td>
</tr>
</tbody>
</table>

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The dollar has fallen against the Indonesian rupiah...
CHAPTER 9 The Exchange Rate and the Balance of Payments

Key Points

The Foreign Exchange Market (pp. 212–216)
- Foreign currency is obtained in exchange for domestic currency in the foreign exchange market.
- Demand and supply in the foreign exchange market determine the exchange rate.
- The higher the exchange rate, the smaller is the quantity of U.S. dollars demanded and the greater is the quantity of U.S. dollars supplied.
- The equilibrium exchange rate makes the quantity of U.S. dollars demanded equal the quantity of U.S. dollars supplied.

Working Problems 1 to 6 will give you a better understanding of the foreign exchange market.

Exchange Rate Fluctuations (pp. 217–221)
- Changes in the world demand for U.S. exports, the U.S. interest rate differential, or the expected future exchange rate change the demand for U.S. dollars.
- Changes in U.S. demand for imports, the U.S. interest rate differential, or the expected future exchange rate change the supply of U.S. dollars.
- Exchange rate expectations are influenced by purchasing power parity and interest rate parity.

- In the long run, the nominal exchange rate is a monetary phenomenon and the real exchange rate is independent of the nominal exchange rate.

Working Problems 7 to 15 will give you a better understanding of exchange rate fluctuations.

Exchange Rate Policy (pp. 222–224)
- An exchange rate can be flexible, fixed, or a crawling peg.
- To achieve a fixed or a crawling exchange rate, a central bank must intervene in the foreign exchange market and either buy or sell foreign currency.

Working Problems 16 and 17 will give you a better understanding of exchange rate policy.

Financing International Trade (pp. 225–229)
- International trade, borrowing, and lending are financed by using foreign currency.
- A country’s international transactions are recorded in its current account, capital account, and official settlements account.
- The current account balance is similar to net exports and is determined by the government sector balance plus the private sector balance.

Working Problems 18 and 19 will give you a better understanding of financing international trade.

Key Terms

Balance of payments accounts, 225
Capital and financial account, 225
Crawling peg, 223
Creditor nation, 227
Current account, 225
Debtor nation, 227
Exchange rate, 212
Fixed exchange rate, 222
Flexible exchange rate, 222
Foreign currency, 212
Foreign exchange market, 212
Government sector balance, 228
Interest rate parity, 220
Net borrower, 227
Net exports, 228
Net lender, 227
Official settlements account, 225
Private sector balance, 228
Purchasing power parity, 220
Real exchange rate, 221
U.S. interest rate differential, 217
U.S. official reserves, 225
The Foreign Exchange Market (Study Plan 9.1)
Use the following data to work Problems 1 to 3.
The U.S. dollar exchange rate increased from $0.89 Canadian in June 2009 to $0.96 Canadian in June 2010, and it decreased from 83.8 euro cents in January 2009 to 76.9 euro cents in January 2010.

1. Did the U.S. dollar appreciate or depreciate against the Canadian dollar? Did the U.S. dollar appreciate or depreciate against the euro?
2. What was the value of the Canadian dollar in terms of U.S. dollars in June 2009 and June 2010? Did the Canadian dollar appreciate or depreciate against the U.S. dollar over the year June 2009 to June 2010?
3. What was the value of one euro (100 euro cents) in terms of U.S. dollars in January 2009 and January 2010? Did the euro appreciate or depreciate against the U.S. dollar in 2009?

Use the following data to work Problems 4 to 6.
In January 2010, the exchange rate was 91 yen per U.S. dollar. By September 2010, the exchange rate had fallen to 84 yen per U.S. dollar.

4. Explain the exports effect of this change in the exchange rate.
5. Explain the imports effect of this change in the exchange rate.
6. Explain the expected profit effect of this change in the exchange rate.

Exchange Rate Fluctuations (Study Plan 9.2)
7. On August 3, 2010, the U.S. dollar was trading at 86 yen per U.S. dollar on the foreign exchange market. On September 13, 2010, the U.S. dollar was trading at 83 yen per U.S. dollar.
   a. What events in the foreign exchange market might have brought this fall in the value of the U.S. dollar?
   b. Did the events change the demand for U.S. dollars, the supply of U.S. dollars, or both demand and supply in the foreign exchange market?
8. Colombia is the world’s biggest producer of roses. The global demand for roses increases and at the same time, the central bank in Colombia increases the interest rate. In the foreign exchange market for Colombian pesos, what happens to
   a. The demand for pesos?
   b. The supply of pesos?
   c. The quantity of pesos demanded?
   d. The quantity of pesos supplied?
   e. The exchange rate of the peso against the U.S. dollar?
9. If a euro deposit in a bank in Paris, France, earns interest of 4 percent a year and a yen deposit in Tokyo, Japan, earns 0.5 percent a year, everything else remaining the same and adjusted for risk, what is the exchange rate expectation of the Japanese yen?
10. The U.K. pound is trading at 1.54 U.S. dollars per U.K. pound. There is purchasing power parity at this exchange rate. The interest rate in the United States is 2 percent a year and the interest rate in the United Kingdom is 4 percent a year.
    a. Calculate the U.S. interest rate differential.
    b. What is the U.K. pound expected to be worth in terms of U.S. dollars one year from now?
    c. Which country more likely has the lower inflation rate? How can you tell?
11. You can purchase a laptop in Mexico City for 12,960 Mexican pesos. If the exchange rate is 10.8 Mexican pesos per U.S. dollar and if purchasing power parity prevails, at what price can you buy an identical computer in Dallas, Texas?
12. When the Chips Are Down
   The Economist magazine uses the price of a Big Mac to determine whether a currency is undervalued or overvalued. In July 2010, the price of a Big Mac was $3.73 in New York, 13.2 yuan in Beijing, and 6.50 Swiss francs in Geneva. The exchanges rates were 6.78 yuan per U.S. dollar and 1.05 Swiss francs per U.S. dollar.
   Source: The Economist, July 22, 2010
   a. Was the yuan undervalued or overvalued relative to purchasing power parity?
   b. Was the Swiss franc undervalued or overvalued relative to purchasing power parity?
   c. Do you think the price of a Big Mac in different countries provides a valid test of purchasing power parity?
13. The price level in the Eurozone is 112.4, the price level in the United States is 109.1, and the nominal exchange rate was 80 euro cents per U.S. dollar. What is the real exchange rate expressed as Eurozone real GDP per unit of U.S. real GDP?

14. The U.S. price level is 106.3, the Japanese price level is 95.4, and the real exchange rate is 103.6 Japanese real GDP per unit of U.S. real GDP. What is the nominal exchange rate?

15. **Dollar Hits 15-Year Low vs Yen**
   Today in Tokyo a dollar bought only 84.71 yen, the lowest since 1995. The dollar’s weakness against the yen is making Japanese exports more expensive. Investors stepped up selling of U.S. dollars after the Federal Reserve announced yesterday only small steps aimed at shoring up the flagging U.S. economy. “Investors were unnerved by the Fed’s statement. It just confirmed that the U.S. economic recovery is slowing,” said a dealer at a Japanese bank in Tokyo.

   Source: *USA Today*, August 11, 2010

   On a graph of the foreign exchange market show the effects of:
   a. Japanese exports becoming more expensive.
   b. Investors stepping up the sale of dollars.

**Exchange Rate Policy** *(Study Plan 9.3)*

16. With the strengthening of the yen against the U.S. dollar in 2010, Japan’s central bank did not take any action. A leading Japanese politician has called on the central bank to take actions to weaken the yen, saying it will help exporters in the short run and have no long-run effects.
   a. What is Japan’s current exchange rate policy?
   b. What does the politician want the exchange rate policy to be in the short run? Why would such a policy have no effect on the exchange rate in the long run?

17. **Double-Talking the Dollar**
   In the 1970s and 1980s, the United States was constantly buying and selling foreign currencies to change the value of the dollar, but since 1995 it has made only a few transactions and since 2000 none at all. The foreign exchange market is so huge, trying to manipulate the dollar is largely futile. A currency’s value reflects an economy’s fundamentals: How well a country allocates resources, how productive its workers are, how it contains inflation, etc., but for years on end, currencies can move in directions that seem to have little to do with fundamentals. They overshoot their correct values, in part because nobody is ever sure exactly what those correct values are.

   a. How has U.S. exchange rate policy evolved since the early 1970s?
   b. Explain why “trying to manipulate the dollar is largely futile,” especially in the long run.
   c. Explain why a currency can experience short-run fluctuations “that seem to have little to do with fundamentals.” Illustrate with a graph.

**Financing International Trade** *(Study Plan 9.4)*


<table>
<thead>
<tr>
<th>Item</th>
<th>Billions of U.S. dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports of goods and services</td>
<td>2,561</td>
</tr>
<tr>
<td>Foreign investment</td>
<td></td>
</tr>
<tr>
<td>in the United States</td>
<td>955</td>
</tr>
<tr>
<td>Exports of goods and services</td>
<td>1,853</td>
</tr>
<tr>
<td>U.S. investment abroad</td>
<td>300</td>
</tr>
<tr>
<td>Net interest income</td>
<td>121</td>
</tr>
<tr>
<td>Net transfers</td>
<td>-123</td>
</tr>
<tr>
<td>Statistical discrepancy</td>
<td>66</td>
</tr>
</tbody>
</table>

   a. Calculate the current account balance.
   b. Calculate the capital and financial account balance.
   c. Did U.S. official reserves increase or decrease?
   d. Was the United States a net borrower or a net lender in 2008? Explain your answer.

19. **The United States, Debtor Nation**
   The United States is a debtor nation, and for most of the past 30 years it has been piling up large trade deficits. The current account has now reached a deficit of 6 percent of GDP, and must be financed by capital inflows. Foreigners must purchase large amounts of U.S. assets, or the current account deficit cannot be financed.

   Source: *Asia Times*, September 28, 2006
   a. Explain why a current account deficit “must be financed by capital inflows.”
   b. Under what circumstances should the debtor nation status of the United States be a concern?
20. Suppose that yesterday, the U.S. dollar was trading on the foreign exchange market at 0.75 euros per U.S. dollar and today the U.S. dollar is trading at 0.78 euros per U.S. dollar. Which of the two currencies (the U.S. dollar or the euro) has appreciated and which has depreciated today?

21. Suppose that the exchange rate fell from 84 yen per U.S. dollar to 71 yen per U.S. dollar. What is the effect of this change on the quantity of U.S. dollars that people plan to buy in the foreign exchange market?

22. Suppose that the exchange rate rose from 71 yen per U.S. dollar to 100 yen per U.S. dollar. What is the effect of this change on the quantity of U.S. dollars that people plan to sell in the foreign exchange market?

23. Today's exchange rate between the yuan and the U.S. dollar is 6.78 yuan per dollar and the central bank of China is buying U.S. dollars in the foreign exchange market. If the central bank of China did not purchase U.S. dollars would there be excess demand or excess supply of U.S. dollars in the foreign exchange market? Would the exchange rate remain at 6.78 yuan per U.S. dollar? If not, which currency would appreciate?

24. Yesterday, the current exchange rate was $1.05 Canadian per U.S. dollar and traders expected the exchange rate to remain unchanged for the next month. Today, with new information, traders now expect the exchange rate next month to fall to $1 Canadian per U.S. dollar. Explain how the revised expected future exchange rate influences the demand for U.S. dollars, or the supply of U.S. dollars, or both in the foreign exchange market.

25. On January 1, 2010, the exchange rate was 91 yen per U.S. dollar. Over the year, the supply of U.S. dollars increased and by January, 2011, the exchange rate fell to 84 yen per U.S. dollar. What happened to the quantity of U.S. dollars that people planned to buy in the foreign exchange market?

26. On August 1, 2010, the exchange rate was 84 yen per U.S. dollar. Over the year, the demand for U.S. dollars increased and by August 1, 2011, the exchange rate was 100 yen per U.S. dollar. What happened to the quantity of U.S. dollars that people planned to sell in the foreign exchange market?

Use the following news clip to work Problems 27 and 28.

Top U.S. Real Estate Markets for Investment

Rahul Reddy has been investing in Australian real estate for the last two years. Now, with the Australian dollar growing in strength and the American housing market strained, he’s got his eye on real estate in Florida and California. Encouraged by a weak dollar and a belief in the resiliency of the U.S. economy, investors are seeking investment properties and development opportunities in the United States. “The United States is good for speculative higher-risk investments from our perspective because the strong Australian dollar will enable us to gain hold of real estate at prices we will probably not see for a long time,” says Reddy. “The United States is an economic powerhouse that I think will recover, and if the exchange rate goes back to what it was a few years ago, we will benefit.”

Source: Forbes, July 10, 2008

27. Explain why foreigners are “seeking investment properties and development opportunities in the United States.”

28. Explain what would happen if the speculation made by Reddy became widespread. Would expectations become self-fulfilling?

Use the following information to work Problems 29 and 30.

Brazil’s Overvalued Real

The Brazilian real has appreciated 33 percent against the U.S. dollar and has pushed up the price of a Big Mac in Sao Paulo to $4.60, higher than the New York price of $3.99. Despite Brazil’s interest rate being at 8.75 percent a year compared to the U.S. interest rate at near zero, foreign funds flowing into Brazil surged in October.

Source: Bloomberg News, October 27, 2009
29. Does purchasing power parity hold? If not, does PPP predict that the Brazilian real will appreciate or depreciate against the U.S. dollar? Explain.

30. Does interest rate parity hold? If not, why not? Will the Brazilian real appreciate further or depreciate against the U.S. dollar if the Fed raises the interest rate while the Brazilian interest rate remains at 8.75 percent a year?

**Exchange Rate Policy**

Use the following news clip to work Problems 31 to 34.

**U.S. Declines to Cite China as Currency Manipulator**

The Bush administration has declined to cite China for manipulating its currency to gain unfair trade advantages against the United States. America’s growing trade deficit with China, which last year hit an all-time high of $256.3 billion, is the largest deficit ever recorded with a single country. Chinese currency, the yuan, has risen in value by 18.4 percent against the U.S. dollar since the Chinese government loosened its currency system in July 2005. However, American manufacturers contend the yuan is still undervalued by as much as 40 percent, making Chinese products more competitive in this country and U.S. goods more expensive in China. China buys U.S. dollar-denominated securities to maintain the value of the yuan in terms of the U.S. dollar.

Source: MSN, May 15, 2008

31. What was the exchange rate policy adopted by China until July 2005? Explain how it worked. Draw a graph to illustrate your answer.

32. What was the exchange rate policy adopted by China after July 2005? Explain how it works.

33. Explain how fixed and crawling peg exchange rates can be used to manipulate trade balances in the short run, but not the long run.

34. Explain the long-run effect of China’s current exchange rate policy.

**Aussie Dollar Hit by Interest Rate Talk**

The Australian dollar fell against the U.S. dollar to its lowest value in the past two weeks. The CPI inflation rate was reported to be generally as expected but not high enough to justify previous expectations for an aggressive interest rate rise by Australia’s central bank next week.

Source: Reuters, October 28, 2009

35. What is Australia’s exchange rate policy? Explain why expectations about the Australian interest rate lowered the value of the Australian dollar against the U.S. dollar.

36. To avoid the fall in the value of the Australian dollar against the U.S. dollar, what action could the central bank of Australia have taken? Would such an action signal a change in Australia’s exchange rate policy?

**Financing International Trade**

Use the following table to work Problems 36 to 38.

<table>
<thead>
<tr>
<th>Item</th>
<th>Billions of U.K. pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption expenditure</td>
<td>721</td>
</tr>
<tr>
<td>Exports of goods and services</td>
<td>277</td>
</tr>
<tr>
<td>Government expenditures</td>
<td>230</td>
</tr>
<tr>
<td>Net taxes</td>
<td>217</td>
</tr>
<tr>
<td>Investment</td>
<td>181</td>
</tr>
<tr>
<td>Saving</td>
<td>162</td>
</tr>
</tbody>
</table>

36. Calculate the private sector balance.

37. Calculate the government sector balance.

38. Calculate net exports and show the relationship between the government sector balance and net exports.

**Economics in the News**

39. After you have studied Reading Between the Lines on pp. 230–231 answer the following questions.

a. What is the “carry trade” and between what types of countries and currencies is it likely to take place?

b. What are the risks in the “carry trade”?

c. Is it possible to earn a profit in the “carry trade” in the long run? Explain why or why not.

d. Explain how participating in the “carry trade” reduces the profit available to other traders.

e. Define interest rate parity and explain its connection with the “carry trade.”

f. Define purchasing power parity and explain how this concept might be used in the “carry trade.”
Economics is about how we cope with scarcity. We cope as individuals by making choices that balance marginal benefits and marginal costs so that we use our scarce resources efficiently. We cope as societies by creating incentive systems and social institutions that encourage specialization and exchange.

These choices and the incentive systems that guide them determine what we specialize in; how much work we do; how hard we work at school to learn the mental skills that form our human capital and that determine the kinds of jobs we get and the incomes we earn; how much we save for future big-ticket expenditures; how much businesses and governments spend on new capital—on auto assembly lines, computers and fiber cables for improved Internet services, shopping malls, highways, bridges, and tunnels; how intensively existing capital and natural resources are used and how quickly they wear out or are used up; and the problems that scientists, engineers, and other inventors work on to develop new technologies.

All the choices we’ve just described combine to determine the standard of living and the rate at which it improves—the economic growth rate.

Money that makes specialization and exchange in markets possible is a huge contributor to economic growth. But too much money brings a rising cost of living with no improvement in the standard of living.

Joseph Schumpeter, the son of a textile factory owner, was born in Austria in 1883. He moved from Austria to Germany during the tumultuous 1920s when those two countries experienced hyperinflation. In 1932, in the depths of the Great Depression, he came to the United States and became a professor of economics at Harvard University.

This creative economic thinker wrote about economic growth and development, business cycles, political systems, and economic biography. He was a person of strong opinions who expressed them forcefully and delighted in verbal battles.

Schumpeter saw the development and diffusion of new technologies by profit-seeking entrepreneurs as the source of economic progress. But he saw economic progress as a process of creative destruction—the creation of new profit opportunities and the destruction of currently profitable businesses. For Schumpeter, economic growth and the business cycle were a single phenomenon.
What attracted you to economics?

It was a random event. I wanted to be rich, so I asked my mom, “In my family, who is the richest guy?” She said, “Your uncle John.” And I asked, “What did he study?” And she said, “Economics.” So I went into economics!

In Spain, there are no liberal arts colleges where you can study lots of things. At age 18, you must decide what career you will follow. If you choose economics, you go to economics school and take economics five years in a row. So you have to make a decision in a crazy way, like I did.

How did economic growth become your major field of research?

I studied economics. I liked it. I studied mathematical economics. I liked it too, and I went to graduate school. In my second year at Harvard, Jeffrey Sachs hired me to go to Bolivia. I saw poor people for the first time in my life. I was shocked. I decided I should try to answer the question “Why are these people so poor and why are we so rich, and what can we do to turn their state into our state?” We live in a bubble world in the United States and Europe, and we don’t realize how poor people really are. When you see poverty at first hand, it is very hard to think about something else. So I decided to study economic growth. Coincidentally, when I returned from Bolivia, I was assigned to be Robert Barro’s teaching assistant. He was teaching economic growth, so I studied with him and eventually wrote books and articles with him.

In your first research on economic growth, you tested the neoclassical growth model using data for a number of countries and for the states of the United States. What did you discover?

Neoclassical theory was criticized on two grounds. First, its source of growth, technological change, is exogenous—not explained. Second, its assumption of diminishing marginal returns to capital seems to imply that income per person should converge to the same level in every country. If you are poor, your marginal product should be high. Every cookie that you save should generate huge growth. If you are rich, your marginal product should be low. Every cookie you save should generate very little growth. Therefore poor countries should grow faster than rich countries, and convergence of income levels should occur. Convergence doesn’t occur, so, said its critics, neoclassical theory must be wrong.

It turned out that it was this criticism that was wrong. Growth depends on the productivity of your cookies and on how many cookies you save. If you don’t save any cookies, you don’t grow, even if your marginal product is large.

Conditional convergence is the idea that income per person will converge only if countries have similar savings rates, similar technologies, and similar everything. That’s what I tested. To hold every relevant factor equal, I tested the hypothesis using regions: states within the United States or countries that are similar. And once you’re careful to hold other things equal, you see a perfect negative relationship between growth rates and income levels.
These are general principles. Because we know these principles we should ask: How come Africa is still poor? The answer is, it is very hard to translate “Markets are good” and “Property rights work” into practical actions. We know that Zimbabwe has to guarantee property rights. With the government it has, that’s not going to work. The U.S. constitution works in the United States. If you try to copy the constitution and impose the system in Zimbabwe, it’s not going to work.

You’ve done a lot of work on distribution of income, and you say we’ve made a lot of progress. What is the evidence to support this conclusion?

There are two issues: poverty and inequality. When in 2001 I said poverty is going down, everyone said I was crazy. The United Nations Development Report, which uses World Bank data, was saying the exact opposite. I said the World Bank methodology was flawed. After a big public argument that you can see in *The Economist*, the World Bank revised their poverty numbers and they now agree with me that poverty rates are falling.

Now why is poverty falling? In 1970, 80 percent of the world’s poor were in Asia—in China, India, Bangladesh, and Indonesia. China’s “Great Leap Forward” was a great leap backward. People were starving to death. Now, the growth of these countries has been spectacular and the global poverty rate has fallen. Yes, if you look at Africa, Africa is going backwards. But Africa has 700 million people. China has 1.3 billion. India has 1.1 billion. Indonesia has 300 million. Asia has 4 billion of the world’s 6 billion people. These big guys are growing. It’s impossible that global poverty is not going down.

But what we care about is poverty in different regions of the world. Asia has been doing very well, but Africa has not. Unfortunately, Africa is still going in the wrong direction.

You’ve made a big personal commitment to Africa. What is the Africa problem? Why does this continent lag behind Asia? Why, as you’ve just put it, is Africa going in the wrong direction?

Number one, Africa is a very violent continent. There are twenty-two wars in Africa as we speak. Two, nobody will invest in Africa. Three, we in the rich world—the United States, Europe, and Japan—won’t
let them trade. Because we have agricultural subsidies, trade barriers, and tariffs for their products, they can’t sell to us.

Africans should globalize themselves. They should open, and we should let them open. They should introduce markets. But to get markets, you need legal systems, police, transparency, less red tape. You need a lot of the things we have now. They have corrupt economies, very bureaucratic, with no property rights, the judiciary is corrupt. All of that has to change.

They need female education. One of the biggest rates of return that we have is educating girls. To educate girls, they’ll need to build schools, they need to pay teachers, they need to buy uniforms, they need to provide the incentives for girls to go to school, which usually is like a string. You pull it, you don’t push it. Pushing education doesn’t work. What you need is: Let the girls know that the rate of return on education is very high by providing jobs after they leave school. So you need to change the incentives of the girls to go to school and educate themselves. That’s going to increase the national product, but it will also increase health, and it will also reduce fertility.

Returning to the problems of poverty and inequality, how can inequality be increasing within countries but decreasing globally—across countries?

Because most inequality comes from the fact that some people live in rich countries and some people live in poor countries. The big difference across people is not that there are rich Americans and poor Americans. Americans are very close to each other relative to the difference between Americans and people from Senegal. What is closing today is the gap across countries—and for the first time in history. Before the Industrial Revolution, everybody was equal. Equal and poor. Equally poor. People were living at subsistence levels, which means you eat, you’re clothed, you have a house, you die. No movies, no travel, no music, no toothbrush. Just subsist. And if the weather is not good, one third of the population dies. That was the history of the world between 10,000 B.C. and today.

Yes, there was a king, there was Caesar, but the majority of the population were peasants.

All of a sudden, the Industrial Revolution means that one small country, England, takes off and there is 2 percent growth every year. The living standard of the workers of England goes up and up and up. Then the United States, then France, then the rest of Europe, then Canada all begin to grow.

In terms of today’s population, one billion people become rich and five billion remain poor. Now for the first time in history, the majority of these five billion people are growing more rapidly than the rich guys. They’re catching up quickly. The incomes of the majority of poor citizens of the world are growing faster than those of Americans.

What advice do you have for someone who is just beginning to study economics?

Question! Question everything! Take some courses in history and math. And read my latest favorite book, Bill Easterly’s *White Man’s Burden.* *It shows why we have not been doing the right thing in the aid business. I’m a little bit less dramatic than he is. He says that nothing has worked. I think some things have worked, and we have to take advantage of what has worked to build on it. But I agree with the general principle that being nice, being good, doesn’t necessarily mean doing good. Lots of people with good intentions do harm. Economic science teaches us that incentives are the key.*