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Macroeconomics-Theory Through Application

香港公開大學
THE OPEN UNIVERSITY OF HONG KONG

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Contents

Preface

We have written a fundamentally different text for principles of economics, based on two premises:

1. Students are motivated to study economics if they see that it relates to their own lives.
2. Students learn best from an inductive approach, in which they are first confronted with a question and then led through the process of how to answer that question.

The intended audience of the textbook is first-year undergraduates taking courses on the principles of macroeconomics and microeconomics. Many may never take another economics course. We aim to increase their economic literacy both by developing their aptitude for economic thinking and by presenting key insights about economics that every educated individual should know.

Applications ahead of Theory

We present all the theory that is standard in books on the principles of economics. But by beginning with applications, we also show students *why* this theory is needed.

We take the kind of material that other authors put in "applications boxes" and place it at the heart of our book. Each chapter is built around a particular business or policy application, such as (for microeconomics) minimum wages, stock exchanges, and auctions, and (for macroeconomics) social security, globalization, and the wealth and poverty of nations.

Why take this approach? Traditional courses focus too much on abstract theory relative to the interests and capabilities of the average undergraduate. Students are rarely engaged, and the formal theory is never integrated into the way students think about economic issues. We provide students with a vehicle to understand the structure of economics, *and*we train them how to use this structure.

A New Organization

Traditional books are organized around theoretical constructs that mean nothing to students. Our book is organized around the *use* of economics.

Our applications-first approach leads to a fundamental reorganization of the textbook. Students will not see chapters with titles like “Cost Functions” or “Short-Run Fluctuations.” We introduce tools and ideas as, and when, they are needed. Each chapter is designed with two goals. First, the application upon which the chapter is built provides a “hook” that gets students’ attention. Second, the application is a suitable vehicle for teaching the principles of economics.

Learning through Repetition

Important tools appear over and over again, allowing students to learn from repetition and to see how one framework can be useful in many different contexts.

Each piece of economic theory is first introduced and explained in the context of a specific application. Most are reused in other chapters, so students see them in action on multiple occasions. As students progress through the book, they accumulate a set of techniques and ideas. These are collected separately in a “toolkit” that provides students with an easy reference and also gives them a condensed summary of economic principles for exam preparation.

A Truly International Book

International economics is not an afterthought in our book; it is integrated throughout.

Many other texts pay lip service to international content. We have taught in numerous countries in Europe, North America, and Asia, and we use that expertise to write a book that deals with economics in a globalized world.

Rigor without Fear

We hold ourselves to high standards of rigor yet use mathematical argument only when it is truly necessary.

We believe students are capable of grasping rigorous argument, and indeed are often confused by loose argumentation. But rigor need not mean high mathematical difficulty. Many students—even very bright ones—switch off when they see a lot of mathematics. Our book is more rigorous yet less overtly mathematical than most others in the market. We also include a math/stat toolkit to help students understand the key mathematical tools they do need.

A Textbook for the 21st Century

We introduce students to accessible versions of dynamic decision-making, choice under uncertainty, and market power from the beginning.

Students are aware that they live in an uncertain world, and their choices are made in a forward-looking manner. Yet traditional texts emphasize static choices in a world of certainty. Students are also aware that firms typically set prices and that most firms sell products that are differentiated from those of their competitors. Traditional texts base most of their analysis on competitive markets. Students end up thinking that economic theory is unrealistic and unrelated to the real world.

We do not shy away from dynamics and uncertainty, but instead introduce students to the tools of discounted present value and decision-making under uncertainty. We also place relatively more emphasis on imperfect competition and price-setting behavior, and then explain why the competitive model is relevant even when markets are not truly competitive. We give more prominence than other texts to topics such as basic game theory, statistics, auctions, and asset prices. Far from being too difficult for principles students, such ideas are in fact more intuitive, relevant, and easier to understand than many traditional topics.

At the same time, we downplay some material that is traditionally included in principles textbooks but that can seem confusing or irrelevant to students. We discuss imperfect competition in terms of market power and strategic behavior, and say little about the confusing taxonomy of market structure. We present a simplified treatment of costs that— instead of giving excruciating detail about different cost definitions—explains which costs matter for which decisions, and why.

A Non-Ideological Book

We emphasize the economics that most economists agree upon, minimizing debates and schools of thought.

There is probably less ideological debate today among economists than there has been for almost four decades. Textbooks have not caught up. We do not avoid all controversy, but we avoid taking sides. We choose and present our material so that instructors will have all the tools and resources they need to discuss controversial issues in the manner they choose. Where appropriate, we explain why economists sometimes disagree on questions of policy.

Most key economic ideas—both microeconomic and macroeconomic—can be understood using basic tools of markets, accounting identities, and budget sets. These are simpler for students to understand, are less controversial within the profession, and do not require allegiance to a particular school of thought.

A Single Voice

The book is a truly collaborative venture.

Very often, coauthored textbooks have one author for microeconomics and another for macroeconomics. Both of us have researched and taught both microeconomic and macroeconomic topics, and we have worked together on all aspects of the book. This means that students who study both microeconomics and macroeconomics from our book will benefit from a completely integrated and consistent approach to economics.

Chapter 1 What Is Economics?

Fast-Food Economics

You are just beginning your study of economics, but let us fast-forward to the end of your first economics course. How will your study of economics affect the way you see the world?

The final exam is over. You are sitting at a restaurant table, waiting for your friends to arrive. The place is busy and loud as usual. Looking around, you see small groups of people sitting and talking animatedly. Most of the customers are young; this is not somewhere your parents visit very often. At the counter, people line up to buy food. You watch a woman choose some items from the menu and hand some notes and coins to the young man behind the counter. He is about the same age as you, and you think that he is probably from China. After a few moments, he hands her some items, and she takes them to a table next to yours.

Where are you? Based on this description, you could be almost anywhere in the world. This particular fast-food restaurant is a Kentucky Fried Chicken, or KFC, but it could easily have been a McDonald's, a Burger King, or any number of other fast-food chains. Restaurants like this can be found in Auckland, Buenos Aires, Cairo, Denver, Edinburgh, Frankfurt, Guangzhou, and nearly every other city in the world. Here, however, the menu is written in French, and the customer paid in euros (€). Welcome to Paris.

While you are waiting, you look around you and realize that you are not looking at the world in the same way that you previously did. The final exam you just completed was for an economics course, and—for good or for ill—it has changed the way you understand the world. Economics, you now understand, is all around you, all the time.

1.1 Microeconomics in a Fast-Food Restaurant

LEARNING OBJECTIVE

1. What kinds of problems do we study in microeconomics?

You watch another customer go to the counter and place an order. She purchases some fried chicken, an order of fries, and a Coca-Cola. The cost is €10. She hands over a bill and gets the food in exchange. It's a simple transaction; you have witnessed exchanges like it thousands of times before. Now, though, you think about the fact that this exchange has made both the customer and the store better off than they were previously. The customer has voluntarily given up money to get food. Presumably, she would do this only if having the food makes her happier than having the €10. KFC, meanwhile, voluntarily gave up the food to get the €10. Presumably, the managers of the store would sell the food only if they benefit from the deal as well. They are willing to give up something of value (their food) in exchange for something else of value (the customer's money).

Think for a moment about all the transactions that *could* have taken place but did not. For the same €10, the customer could have bought two orders of fried chicken. But she didn't. So even though you have never met the person, you know something about her. You know that—at this moment at least—she prefers having a Coca-Cola, fries, and one order of fried chicken to having two orders of fried chicken. You also know that she prefers having that food to any number of other things she could have bought with those euros, such as a movie theater ticket, some chocolate bars, or a book.

From your study of economics, you know that her decision reflects two different factors. The first is her tastes. Each customer likes different items on the menu. Some love the spicy fried chicken; others dislike it. There is no accounting for differences in tastes. The second is what she can afford. She has a budget in mind that limits how much she is willing to spend on fast food on a given day. Her decision about what to buy comes from the interaction between her tastes and her budget. Economists have built a rich and complicated theory of decision making from this basic idea.

You look back at the counter and to the kitchen area behind it. The kitchen, you now know, is an example of a *production process* that takes inputs and produces output. Some of the inputs are perhaps obvious, such as basic ingredients like raw chicken and cooking oil. Before you took the economics course, you might have thought only about those ingredients. Now you know that there are many more inputs to the production process, including the following:

- The building housing the restaurant
- The tables and chairs inside the room
- The people working behind the cash register and in the kitchen
- The people working at KFC headquarters managing the outlets in Paris
- The stoves, ovens, and other equipment in the kitchen used to cook the food
- The energy used to run the stoves, the ovens, the lighting, and the heat
- The recipes used to convert the ingredients into a finished product

The outputs of KFC are all the items listed on the menu. And, you realize, the restaurant provides not only the food but also an additional service, which is a place where you can eat the food. Transforming these inputs (for example, tables, chickens, people, recipes) into outputs is not easy. Let us examine one output—for example, an order of fried chicken. The production process starts with the purchase of some uncooked chicken. A cook then adds some spices to the chicken and places it in a vat of very hot oil in the huge pots in the kitchen. Once the chicken is cooked, it is placed in a box for you and served to you at the counter. That production process uses, to a greater or lesser degree, almost all the inputs of KFC. The person responsible for overseeing this transformation is the manager. Of course, she doesn't have to analyze how to do this herself; the head office provides a detailed organizational plan to help her.

KFC management decides not only what to produce and how to produce it but also how much to charge for each item. Before you took your economics course, you probably gave very little thought to where those prices on the menu came from. You look at the price again: €5 for an order of fried chicken. Just as you were able to learn some things about the customer from observing her decision, you realize that you can also learn something about KFC. You know that KFC wouldn't sell an order of fried chicken at that price unless it was able to make a profit by doing so. For example, if a piece of raw chicken cost €6, then KFC would obviously make a loss. So the price charged must be greater than the cost of producing the fried chicken.

KFC can't set the price too low, or it would lose money. It also can't set the price too high. What would happen if KFC tried to charge, say, €100 for an order of chicken? Common sense tells you that no one would buy it at that price. Now you understand that the challenge of pricing is to find a balance: KFC needs to set the price high enough to earn a good profit on each order sold but not so high that it drives away too many customers. In general, there is a trade-off: as the price increases, each piece sold brings in more revenue, but fewer pieces are sold. Managers need to understand this trade-off between price and quantity, which economists call *demand*. It depends on many things, most of which are beyond the manager's control. These include the income of potential customers, the prices charged in alternative restaurants nearby, the number of people who think that going to KFC is a cool thing to do, and so on.

The simple transaction between the customer and the restaurant was therefore the outcome of many economic choices. You can see other examples of economics as you look around you— for example, you might know that the workers earn relatively low wages; indeed, they may very well be earning minimum wage. Across the street, however, you see a very different kind of establishment: a fancy restaurant. The chef there is also preparing food for customers, but he undoubtedly earns a much higher wage than KFC cooks.

Before studying economics, you would have found it hard to explain why two cooks should earn such different amounts. Now you notice that most of the workers at KFC are young— possibly students trying to earn a few euros a month to help support them through college. They do not have years of experience, and they have not spent years studying the art of cooking. The chef across the street, however, has chosen to invest years of his life training and acquiring specialized skills and, as a result, earns a much higher wage. The well-heeled customers leaving that restaurant are likewise much richer than those around you at KFC. You could probably eat for a week at KFC for the price of one meal at that restaurant. Again, you used to be puzzled about why there are such disparities of income and wealth in society—why some people can afford to pay €200 for one meal while others can barely afford the prices at KFC. Your study of economics has revealed that there are many causes: some people are rich because, like the skilled chef, they have abilities, education, and experience that allow them to command high wages. Others are rich because of luck, such as those born of wealthy parents.

Everything we have discussed in this section—the production process, pricing decisions, purchase decisions, and the employment and career choices of firms and workers—are examples of what we study in the part of economics called **microeconomics**. Microeconomics is about the behavior of individuals and firms. It is also about how these individuals and firms interact with each other through markets, as they do when KFC hires a worker or when a customer buys a piece of fried chicken. When you sit in a fast-food restaurant and look around you, you can see microeconomic decisions everywhere.

KEY TAKEAWAY

- In microeconomics, we study the decisions of individual entities, such as households and firms. We also study how households and firms interact with each other.

CHECKING YOUR UNDERSTANDING

1. List three microeconomic decisions you have made today.

1.2 Macroeconomics in a Fast-Food Restaurant

LEARNING OBJECTIVE

1. What kinds of problems do we study in macroeconomics?

The economic decisions you witness inside Kentucky Fried Chicken (KFC) are only a few examples of the vast number of economic transactions that take place daily across the globe. People buy and sell goods and services. Firms hire and lay off workers. Governments collect taxes and spend the revenues that they receive. Banks accept deposits and make loans. When we think about the overall impact of all these choices, we move into the realm of macroeconomics. **Macroeconomics** is the study of the economy as a whole.

While sitting in KFC, you can also see macroeconomic forces at work. Inside the restaurant, some young men are sitting around talking and looking at the newspaper. It is early afternoon on a weekday, yet these individuals are not working. Like many other workers in France and around the world, they recently lost their jobs. Across the street, there are other signs that the economy is not healthy: some storefronts are boarded up because many businesses have recently been forced to close down.

You know from your economics class that the unemployed workers and closed-down businesses are the visible signs of the global downturn, or *recession*, that began around the middle of 2008. In a recession, several things typically happen. One is that the total production of goods and services in a country decreases. In many countries, the total value of all the goods and services produced was lower in 2008 than it was in 2007. A second typical feature of a recession is that some people lose their jobs, and those who don't have jobs find it more difficult to find new employment. And a third feature of most recessions is that those who do still have jobs are unlikely to see big increases in their wages or salaries. These recessionary features are interconnected. Because people have lower income and perhaps because they are nervous about the future, they tend to spend less. And because firms are finding it harder to sell their products, they are less likely to invest in building new factories. And when fewer factories are being built, there are fewer jobs available both for those who build factories and for those who work in them.

Down the street from KFC, a large construction project is visible. An old road and a nearby bridge are in the process of being replaced. The French government finances projects such as these as a way to provide more jobs and help the economy recover from the recession. The government has to finance this spending somehow. One way that governments obtain income is by taxing people. KFC customers who have jobs pay taxes on their income. KFC pays taxes on its profits. And customers pay taxes when they buy their food.

Unfortunately for the government, higher taxes mean that people and firms have less income to spend. But to help the economy out of a recession, the government would prefer people to spend more. Indeed, another response to a recession is to *reduce* taxes. In the face of the recession, the Obama administration in the United States passed a stimulus bill that both increased government spending *and* reduced taxes. Before you studied macroeconomics, this would have seemed quite mysterious. If the government is taking in less tax income, how is it able to increase spending at the same time? The answer, you now know, is that the government borrows the money. For example, to pay for the $787 billion stimulus bill, the US government issued new debt. People and institutions (such as banks), both inside and outside the United States, buy this debt—that is, they lend to the government.

There is another institution—called the monetary authority—that purchases government debt. It has specific names in different countries: in the United States, it is called the Federal Reserve Bank; in Europe, it is called the European Central Bank; in Australia, it is called the Reserve Bank of Australia; and so on. When the US government issues more debt, the Federal Reserve Bank purchases some of it. The Federal Reserve Bank has the legal authority to create new money (in effect, to print new currency) and then to use that to buy government debt. When it does so, the currency starts circulating in the economy. Similarly, decisions by the European Central Bank lead to the circulation of the euro notes and coins you saw being used to purchase fried chicken.

The decisions of the monetary authority have a big impact on the economy as well. When the European Central Bank decides to put more euros into circulation, this has the effect of reducing interest rates, which means it becomes cheaper for individuals to get a student loan or a mortgage, and it is cheaper for firms to buy new machinery and build new factories. Typically, another consequence is that the euro will become less valuable relative to other currencies, such as the US dollar. If you are planning a trip to the United States now that your class is finished, you had better hope that the European Central Bank doesn't increase the number of euros in circulation. If it does, it will be more expensive for you to buy US dollars.

Today, the world's economies are highly interconnected. People travel from country to country. Goods are shipped around the world. If you were to look at the labels on the clothing worn by the customers in KFC, you would probably find that some of the clothes were manufactured in China, perhaps some in Malaysia, some in France, some in the United States, some in Guatemala, and so on. Information also moves around the world. The customer sitting in the corner using a laptop might be in the process of transferring money from a Canadian bank account to a Hong Kong account; the person at a neighboring table using a mobile phone might be downloading an app from a web server in Illinois. This globalization brings many benefits, but it means that recessions can be global as well.

Your study of economics has taught you one more thing: the idea that you can take a trip to the United States would have seemed remarkable half a century ago. Despite the recent recession, the world is a much richer place than it was 25, or 50, or 100 years ago. Almost everyone in KFC has a mobile phone, and some people are using laptops. Had you visited a similar fast-food restaurant 25 years ago, you would not have seen people carrying computers and phones. A century ago, there was, of course, no such thing as KFC; automobiles were still a novelty; and if you cut your finger on the sharp metal edge of a table, you ran a real risk of dying from blood poisoning. Understanding why world economies have grown so spectacularly—and why not all countries have shared equally in this growth—is one of the big challenges of macroeconomics.

KEY TAKEAWAY

- In macroeconomics, we study the economy as a whole to understand why economies grow and why they sometimes experience recessions. We also study the effects of different kinds of government policy on the overall economy.

CHECKING YOUR UNDERSTANDING

1. If the government and the monetary authority think that the economy is growing too fast, what could they do to slow down the economy?

1.3 What Is Economics, Really?

LEARNING OBJECTIVE

1. What methods do economists use to study the world?

Economists take their inspiration from exactly the kinds of observations that we have discussed. Economists look at the world around them—from the transactions in fast-food restaurants to the policies of central banks—and try to understand how the economic world works. This means that economics is driven in large part by data. In microeconomics, we look at data on the choices made by firms and households. In macroeconomics, we have access to a lot of data gathered by governments and international agencies. Economists seek to describe and understand these data.

But economics is more than just description. Economists also build models to explain these data and make predictions about the future. The idea of a model is to capture the most important aspects of the behavior of firms (like KFC) and individuals (like you). Models are abstractions; they are not rich enough to capture all dimensions of what people do. Yet a good model, for all its simplicity, is still capable of explaining economic data.

And what do we do with this understanding? Much of economics is about policy evaluation. Suppose your national government has a proposal to undertake a certain policy—for example, to cut taxes, build a road, or increase the minimum wage. Economics gives us the tools to assess the likely effects of such actions and thus to help policymakers design good public policies.

This is not really what you thought economics was going to be about when you walked into your first class. Back then, you didn't know much about what economics was. You had a vague thought that maybe your economics class would teach you how to make money. Now you know that this is not really the point of economics. You don't have any more ideas about how to get rich than you did when you started the class. But your class has taught you something about how to make better decisions and has given you a better understanding of the world that you live in. You have started to think like an economist.

KEY TAKEAWAY

- Economists gather data about the world and then build models to explain those data and make predictions.

CHECKING YOUR UNDERSTANDING

1. Suppose you were building a model of pricing at KFC. Which of the following factors would you want to make sure to include in your model? Which factors do you think would be irrelevant?
    1. the age of the manager making the pricing decisions
    2. the price of chicken
    3. the number of customers who come to the store on a typical day
    4. the price of apples
    5. the kinds of restaurants nearby

1.4 End-of-Chapter Material

In Conclusion

Economics is all around us. We all make dozens of economic decisions every day—some big, some small. Your decisions—and those of others—shape the world we live in. In this book, we will help you develop an understanding of economics by looking at examples of economics in the everyday world. Our belief is that the best way to study economics is to understand how economists think about such examples.

With this in mind, we have organized our book rather differently from most economics textbooks. It is built not around the theoretical concepts of economics but around different applications—economic illustrations as you encounter them in your own life or see them in the world around you. As you read this book, we will show you how economists analyze these illustrations, introducing you to the tools of economics as we proceed. After you have read the whole book, you will have been introduced to all the fundamental tools of economics, and you will also have seen them in action. Most of the tools are used in several different applications, thus allowing you to practice using them and gain a deeper understanding of how they work.

You can see this organization at work in our table of contents. In fact, there are two versions of the table of contents so that both students and instructors can easily see how the book is organized. The student table of contents focuses on the applications and the questions that we address in each chapter. The instructor table of contents lists the theoretical concepts introduced in each chapter so that instructors can easily see how economic theory is developed and used in the book.

We have also gathered all the tools of economics into a toolkit. You will see many links to this toolkit as you read the book. You can refer to the toolkit as needed when you want to be reminded of how a tool works, and you can also use it as a study aid when preparing for exams and quizzes.

ECERCISES

1. A map is a model constructed by geographers and cartographers. Like an economic model, it is a simplified representation of reality. Suppose you have a map of your hometown in front of you. Think of one question about your town that you could answer using the map. Think of another question about your town for which the map would be useless.
2. Which of the following questions do you think would be studied by a macroeconomist and which by a microeconomist? (Note: we don't expect you to be able to answer all these questions yet.)
    1. What should the European Central Bank do about increasing prices in Europe?
    2. What happens to the price of ice cream in the summer?
    3. Should you take out a student loan to pay for college?
    4. What happens when the US government cuts taxes and pays for these tax cuts by borrowing money?
    5. What would happen to the prices of computers if Apple and Microsoft merged into a single firm?

Economics Detective

1. Look at a newspaper on the Internet. Find a news story about macroeconomics. How do you know that it is about macroeconomics? Find a news story about microeconomics. How do you know that it is about microeconomics?

Chapter 2 Macroeconomics in Action

Four Examples of Macroeconomics

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. How might you encounter macroeconomics?
2. What are the main indicators of the macroeconomy?
3. What are the primary macroeconomic policy tools of the government?

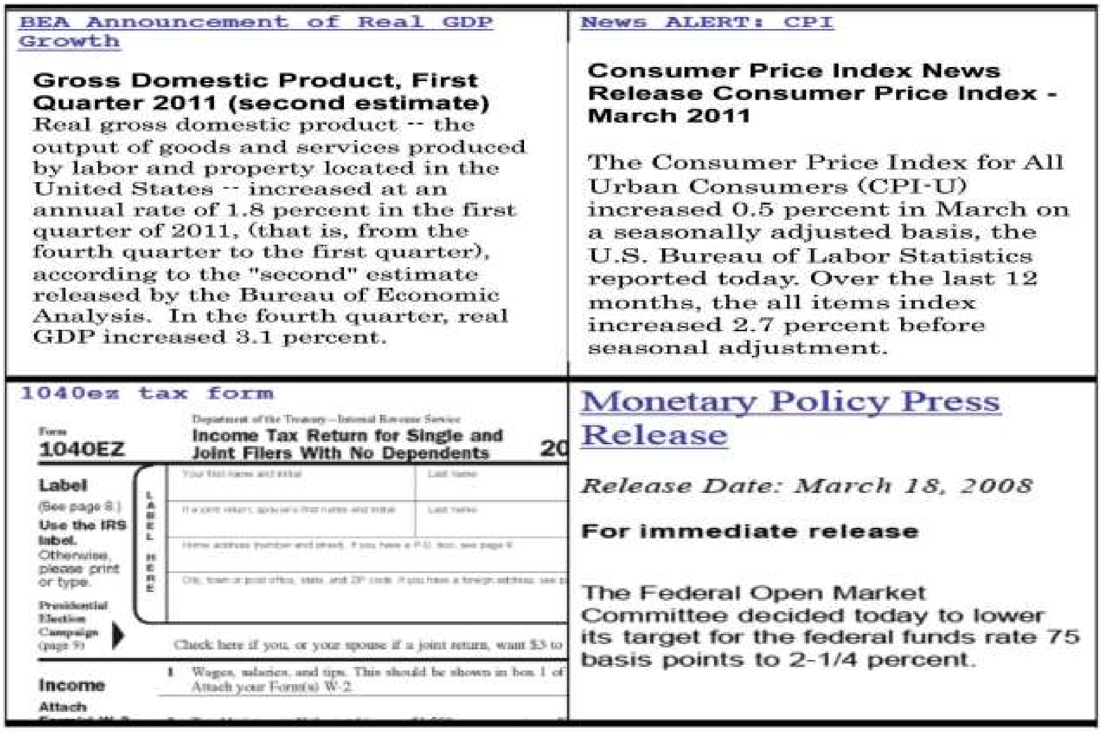

Fig. 2.1: Diverse illustrations of macroeconomics

The four screens in Figure 2.1 Diverse illustrations of macroeconomics are diverse illustrations of macroeconomics as you might encounter it:

- An evening news show presents a story about whether the economy is in a recession.
- You wonder why prices seem to be higher now than they were a few years ago.
- You sit down to fill out your tax return.
- You make payments on a car loan or a student loan.

By the time you have finished this book, you will see these examples very differently from the way you do right now. You may not know it, but your everyday life is filled with macroeconomics in action.

Economic Activity in the United States

The top left screen in Figure 2.1 Diverse illustrations of macroeconomics is tuned to the Bureau of Economic Analysis (BEA;http://www.bea.gov), which is a part of the US government. A newspaper article or blog that reports such news from the BEA is telling us about the state of the macroeconomy. The report from the BEA tells you how the economy has been doing over the previous three months. More specifically, it describes what has happened to something called **real gross domestic product (real GDP)**.

As you will soon learn, real GDP is a measure of the overall level of economic activity within an economy. We won't worry for the moment about exactly what GDP means or how it is measured. Looking at the BEA announcement (http://www.bea.gov/newsreleases/national/gdp/2011/gdp1q11_2nd.htm), you can see that in the first quarter of 2011, real GDP increased by 1.8 percent, whereas in the fourth quarter of 2010, it increased by 3.1 percent. Because real GDP increased in both quarters, we know that the economy is growing. However, it grew much more slowly in the first quarter of 2011 than in the final quarter of 2010.

You might wonder why you would bother to listen to this report. Perhaps it looks rather dry and boring. Yet the performance of the economy has a direct impact on how easy it is to find a job if you are looking for one, how likely you are to lose your job if you are already employed, how much you will earn, and what you can buy with the income you receive from working. Overall economic activity is directly linked to the well-being of everyone in the economy, including yourself. Should you be worried when you see that real GDP is growing much more slowly than before? After you have read this book, we hope you will know the answer.

Because real GDP is such a general measure of economic activity, it can also be used to compare how economies throughout the world are performing. If you have traveled to other countries, you may have observed big differences in people's standards of living. If you go to Canada, France, or Japan, you will generally see relatively prosperous people who can afford decent food, clothing, and shelter. If you go to Laos, Guatemala, or Malawi, you will see people living in severe poverty. To understand these differences, we need to understand what determines real GDP in an economy.

Inflation in the United States

The top right screen in Figure 2.1 Diverse illustrations of macroeconomics reports on another economic variable that comes up all the time in the news: the **rate of inflation**. You have probably never visited the Bureau of Labor Statistics (BLS; http://www.bls.gov) website from which we took this quotation. But you have certainly heard a news story, perhaps on television or your car radio, telling you about the inflation rate.

After the BLS releases a report such as this one (http://www.bls.gov/news.release/cpi.nr0.htm), news programs will note that the inflation rate reported in March 2011 was 2.7 percent. This means that, on average, prices in the economy are 2.7 percent greater than they were a year ago. If you bought a jacket for $100 last year, you should expect the same jacket to cost about $102.70 right now. Not every single good and service increases by exactly this amount, of course. But, on average, prices are now 2.7 percent higher. A news report like this tells us that the things we buy have become more expensive. This matters to all of us. If your income has not increased over the last year, this inflation report tells you that you are worse off now than you were last year because you can no longer buy as much with your income.

Most of the time, you will hear news reports about inflation only for the country in which you are living. Occasionally, you might also hear a news report about inflation somewhere else. In early 2008, you might well have heard a news report that the inflation rate in Zimbabwe was over 100,000 percent. You would probably find it difficult to imagine living in a country where prices increase so quickly, and you might reasonably wonder how two different countries in the world could have such different rates of inflation. When you have finished this book, you will know the answer to this question.

Fiscal Policy in Action

The bottom left screen in Figure 2.1 Diverse illustrations of macroeconomics is something you may have seen before. It is a US tax form. Residents of the United States must file this form or one like it every year by April 15. If you live in another country, you almost certainly have to file a similar form. As individuals, we typically see this form as a personal inconvenience, and we don't think much about what it means for the economy as a whole. But this is much more than a form. It is a manifestation of decisions made by the government about how much tax you and everyone else should pay.

Decisions about how much to tax and how much to spend are known as **fiscal policy**. The fiscal policy adopted by a government affects your life in more ways than you can easily imagine. It not only tells you how much gets taken out of your paycheck, but it also affects real GDP and much more. It affects how likely you are to be unemployed in the future and how much money you will receive from the government if you do lose your job. It affects the interest rate you must pay on your car loan or student loan. It affects the tax rates you will pay 20 years from now and your likelihood of receiving social security payments when you retire.

Monetary Policy in Action

The bottom right screen in Figure 2.1 Diverse illustrations of macroeconomics draws the attention of individuals and businesses all around the world. Every six weeks a group called the Federal Open Market Committee (FOMC) meets in Washington, DC, to make decisions on the course of US **monetary policy**. Their decisions affect the interest rates we pay on loans, including car loans, student loans, and mortgages. Their decisions also influence the level of economic activity and the inflation rate. The FOMC could, if it chose, create very high inflation by allowing rapid growth in the amount of money in the economy. It could, if it chose, create high rates of unemployment. It is a powerful organization. There are other similar organizations elsewhere in the world: every country conducts monetary policy in some form, and most have some equivalent of the FOMC.

International Channels

Figure 2.1 Diverse illustrations of macroeconomics shows the kind of economic news you might see in the United States. If you are living or traveling in a different country, you would see similar announcements about real GDP, inflation, and economic policy.

Using the Internet, it is also easy to check news sources in other countries. If you start reading about economics on the Internet, you will come to appreciate the global nature of economics. You can read stories in the United States about monetary policy in China or fiscal policy in Portugal. And you can read news stories in other countries about economic policy in the United States. In the modern globalized world, economic connections across countries are impossible to ignore.

Figure 2.2 Price of Euro in British Pounds, March 2008 presents two stories that show globalization at work. Both share a common theme: the effects of a March 20, 2008, decision by the FOMC to cut the target federal funds rate. The graph at the top of Figure 2.2 Price of Euro in British Pounds, March 2008 shows the market price of the euro—the currency used in most of Europe—in terms of the British pound. When you travel, you typically exchange one currency for another. For example, an American tourist traveling to France would buy euros with dollars to have money to spend in France. If that same tourist then wanted to travel from France to London, she might take some of her euros and buy British pounds. The graph tells the price she would have paid in February and March of 2008.

You can see that, over a little more than a week, the euro became much more valuable relative to the pound. Most notably, there was a big increase in the price of the euro between March 9 and March 19, and then prices settled down a bit. This was a wild week for the international economy. In the United States, the Federal Reserve announced major financial support for Wall Street firms on March 16 and then reduced interest rates on March 19. Around the same time, the European Central Bank (ECB) and the Bank of England in London were also taking actions to try to calm the financial markets. At least for a period of time, they seemed to succeed in stopping the rapid rise of the euro against the British pound. It is striking that much of the financial action was taking place in the United States, yet the markets in which Europeans trade currencies were also affected.

The story at the bottom of Figure 2.2 Price of Euro in British Pounds, March 2008 discusses the response of Asian stock markets to the action of the US Federal Reserve. Markets all over the world increased in value after the action of the FOMC. The actions of the Fed matter well beyond the borders of the United States. Bankers and businesspeople all over the globe are “Fed watchers.”

Fig. 2.2: Price of Euro in British Pounds, March 2008

(Source: http://www.oanda.com.) .

Asian Stocks Rise after Fed Cut

TOKYO (AP)—Asian stock markets rose Wednesday as investors welcomed a hefty U.S. interest rate cut…

Japan's benchmark Nikkei 225 index climbed 2.5 percent to close at 12,260.44 after rising more than 3 percent earlier. Hong Kong's Hang Seng index, which rose as much as 3 percent earlier, closed up 2.3 percent at 21,866.94.

Australia's main index jumped 4 percent, and markets in South Korea, China and India also rose. [1]

KEY TAKEAWAYS

- You encounter macroeconomics everyday through the news about the state of the macroeconomy, the price you pay for goods and services, the tax you pay on income, and the effects of macroeconomic policy on interest rates. Macroeconomic events and policies in other countries affect you as well.
- Real GDP, the rate of inflation, and the rate of unemployment are three primary indicators of the state of the macroeconomy.
- The government influences the macroeconomy through its level of spending, taxes, and control of the money supply.

Checking your Understanding

1. What do we mean by "real" when we talk about GDP?
2. How might the state of the macroeconomy in another country, such as China, or in agroup of countries, such as the European Union, affect the macroeconomy of the UnitedStates?

1. "Asian Stocks Rise after Fed Cut," MSNBC.com, March 19, 2008, accessed June 27, 2011,http://www.msnbc.msn.com/id/23703748/ns/business-eye_on_the_economy.

2.1 Behind the Screens

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. How has real GDP changed over the past 40 years?
2. What is inflation and how does it affect the macroeconomy?
3. How can we see fiscal and monetary policy in action?

Let's look at Figure 2.1 Diverse illustrations of macroeconomics again in a bit more detail.

2.1.1 The State of the Economy

The top two panels in Figure 2.1 Diverse illustrations of macroeconomics provide information on some key indicators of the state of the economy. The announcement from the Bureau of Economic Analysis (BEA) concerns one of the most closely watched indicators of the macroeconomy: real gross domestic product (real GDP). This is a measure of the goods and services produced by an economy in a year. We discuss real GDP in every macroeconomic application in this book.

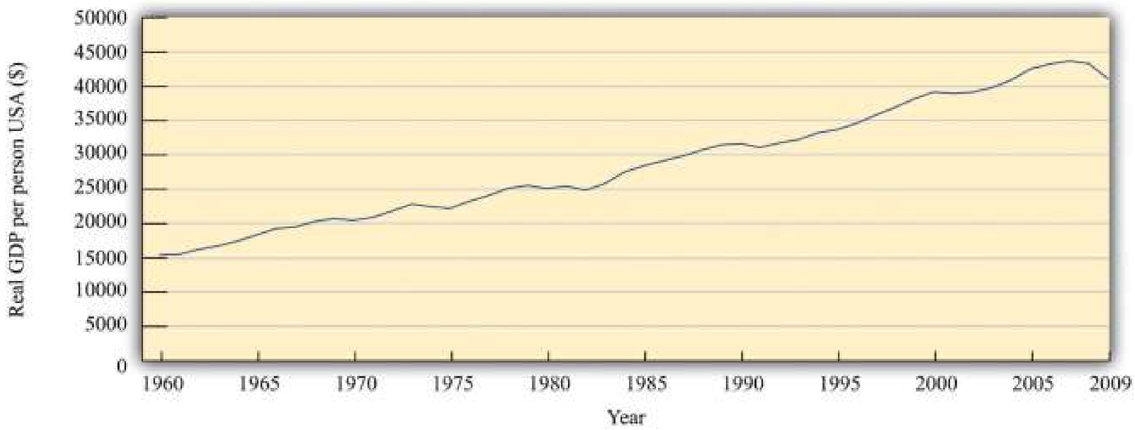

Fig. 2.3: Real GDP per Person in the United States, 1960–2009

. Source: Alan Heston, Robert Summers, and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011..

Figure 2.3 Real GDP per Person in the United States, 1960–2009 shows real GDP per person (often called real GDP per capita) from 1960 to 2009. Pictures like this one show up all the time in newspapers, in magazines, on television, or on the Internet.

One of the things you will learn in your study of macroeconomics is how to interpret such economic data. We devote an entire chapter to understanding exactly how real GDP is measured. For now, we draw your attention to some details to help you appreciate what the graph means.

The horizontal axis indicates the year. Real GDP per person is shown on the vertical axis. To read this graph, you would look at a particular year on the horizontal axis, such as 2000, and then use the curve to see that the real GDP per person in 1965 was about $39,000.

If you look at this picture, the single most notable thing is that real GDP per person has been increasing. It was about 2.6 times larger in 2009 than in 1960. This tells us that, on average, the typical individual in the United States was 2.6 times richer in 2000 compared to 1960. The increase in GDP is not caused by the fact that there are more people in the economy because the figure shows GDP *per person*. The increase in GDP is not because prices are going up: the word *real* in this discussion means that it has been *corrected for inflation*. [2]

Another thing you can see from the picture is that the growth of the economy has not been smooth. Sometimes the economy grows fast; sometimes it grows more slowly. Sometimes there are even periods in which the economy shrinks rather than grows. From this figure, you can see that real GDP per person decreased in the mid-1970s, the mid-1980s, and most notably in 2008 and 2009. During these times, people were becoming poorer on average, not richer.

We keep using the phrase *on average*. This reminds us that, even though the economy as a whole has been getting richer, the picture doesn't tell us anything about how those gains have been shared across the economy. In fact, some people became a lot richer over this period, while many others saw only small gains, and some became poorer.

We see this uneven distribution very clearly when the economy shrinks. When that happens, one of the things we also observe is that more people in the economy are unemployed—that is, they are looking for a job but unable to find one. The burden of an economic downturn is borne disproportionately by those who lose their jobs.

Although this figure displays the history of the US economy over these 50 years, similar figures can be constructed for other countries around the world. They do not all look identical, but the pattern of uneven growth that we observe for the United States is one that we also see for most other countries. However, it is not true everywhere. We will also see examples of countries that have become poorer rather than richer in recent decades.

Real GDP is the most frequently watched indicator of economic performance. A second key indicator is the one in the top right screen ofFigure 2.1 Diverse illustrations of macroeconomics : the inflation rate. The Bureau of Labor Statistics (BLS) collects information on prices on an ongoing basis; each month it releases information on how fast prices are changing. The rate at which prices are changing is the inflation rate. Other countries similarly have government agencies entrusted with gathering

2. In the bottom right of the picture, you can see the phrase Data in 1996 dollars. This means that the numbers in the table are based on how much a dollar would have bought in 1996. Donot worry if you do not understand exactly what this phrase means right now. Chapter 3 "The State of the Economy" will provide much more detail.

information about the inflation rate and other economic indicators. It may seem that the job of the BLS is pretty easy: get information on prices and report it. Their task is, in fact, rather complex. In part, it is difficult because there are so many goods and services in the economy. So when we say that prices are increasing, we must decide which goods and services we are talking about. In addition, new goods appear, and obsolete goods disappear; the BLS must take this into account. And the quality of goods changes as well. If the price of a computer increases, is this an example of inflation or does it reflect an increase in the quality of the computer?

What are the implications of an inflation announcement? All else being the same, higher prices mean that we are unable to afford goods and services we were able to buy when prices were lower. But "all else" is not the same. Generally when prices increase, wages also increase. This means that the overall effects of inflation on our ability to buy goods and services are not self-evident.

Another implication of inflation is the policy response it elicits. The monetary authorities in the United States and many other countries are focused on ensuring that inflation does not get out of control. A report of inflation might therefore lead to a response by a monetary authority. Inflation affects us directly through the prices we pay and the wages we receive and indirectly through the policy response it induces.

Though not included in our screens, another significant variable also indicates the state of the macroeconomy: the rate of unemployment. The BLS (http://www.bls.gov/news.release/empsit.toc.htm) reports the **unemployment rate** on a monthly basis. It measures the fraction of people in the labor force who do not have a job. When real GDP is relatively high, then the unemployment rate tends to be lower than average, but when real GDP decreases, more people find themselves out of a job.

2.1.2 The Making of Fiscal and Monetary Policy

The top screens in Figure 2.1 Diverse illustrations of macroeconomics provide information that flows to the policymakers in an economy. These policymakers carefully watch the state of the economy and then, if appropriate, take actions. The bottom screens in Figure 2.1 Diverse illustrations of macroeconomics show policy in action.

2.1.3 Fiscal Policy

For individuals and firms paying taxes in the United States, April 15 is an important day because tax forms are due for the previous calendar year. Each year US citizens fill out their tax forms and either make tax payments or receive reimbursements from the government.

The tax day differs across countries, but the experience is much the same everywhere: individuals and firms must pay taxes to the government. This is one of the key ways in which citizens interact with their governments.

A more complete version of the 1040EZ form for 2010 is shown in Figure 2.4 Form 1040EZ .

Department of the Treasury—Internal Revenue Service
Form 1040EZ — Income Tax Return for Single and Joint Filers With No Dependents (99) — 2010 — OMB No. 1545-0074

Name, Address, and SSN — See separate instructions. PRINT CLEARLY
Your first name and initial | Last name | Your social security number
If a joint return, spouse's first name and initial | Last name | Spouse's social security number
Home address (number and street). If you have a P.O. box, see instructions. | Apt. no. | ▲ Make sure the SSN(s) above are correct. ▲
City, town or post office, state, and ZIP code. If you have a foreign address, see instructions. | Checking a box below will not change your tax or refund.

Presidential Election Campaign (see page 9) — Check here if you, or your spouse if a joint return, want $3 to go to this fund ► ☐ You ☐ Spouse

Income — Attach Form(s) W-2 here. Enclose, but do not attach, any payment.
1 Wages, salaries, and tips. This should be shown in box 1 of your Form(s) W-2. Attach your Form(s) W-2. — 1
2 Taxable interest. If the total is over $1,500, you cannot use Form 1040EZ. — 2
3 Unemployment compensation and Alaska Permanent Fund dividends (see page 11). — 3
4 Add lines 1, 2, and 3. This is your **adjusted gross income.** — 4
5 If someone can claim you (or your spouse if a joint return) as a dependent, check the applicable box(es) below and enter the amount from the worksheet on back. ☐ You ☐ Spouse. If no one can claim you (or your spouse if a joint return), enter $9,350 if **single;** $18,700 if **married filing jointly.** See back for explanation. — 5
(You may be entitled to a larger deduction if you file Form 1040A or 1040. See *Before You Begin* on page 4.)
6 Subtract line 5 from line 4. If line 5 is larger than line 4, enter -0-. This is your **taxable income.** ► 6

Payments, Credits, and Tax
7 Federal income tax withheld from Form(s) W-2 and 1099. — 7
8 Making work pay credit (see worksheet on back). — 8
9a **Earned income credit (EIC)** (see page 13). — 9a
b Nontaxable combat pay election. — 9b
10 Add lines 7, 8, and 9a. These are your **total payments and credits.** ► 10
11 **Tax.** Use the amount on **line 6 above** to find your tax in the tax table on pages 27 through 35 of the instructions. Then, enter the tax from the table on this line. — 11

Refund — Have it directly deposited! See page 18 and fill in 12b, 12c, and 12d or Form 8888.
12a If line 10 is larger than line 11, subtract line 11 from line 10. This is your **refund.** If Form 8888 is attached, check here ► ☐ — 12a
► b Routing number ► c Type: ☐ Checking ☐ Savings
► d Account number

Amount You Owe
13 If line 11 is larger than line 10, subtract line 10 from line 11. This is the **amount you owe.** For details on how to pay, see page 19. ► 13

Third Party Designee — Do you want to allow another person to discuss this return with the IRS (see page 20)? ☐ **Yes.** Complete the following. ☐ **No**
Designee's name ► Phone no. ► Personal identification number (PIN) ►

Sign Here — Under penalties of perjury, I declare that I have examined this return, and to the best of my knowledge and belief, it is true, correct, and accurately lists all amounts and sources of income I received during the tax year. Declaration of preparer (other than the taxpayer) is based on all information of which the preparer has any knowledge.
Joint return? See page 6. Keep a copy for your records.
Your signature | Date | Your occupation | Daytime phone number
Spouse's signature. If a joint return, **both** must sign. | Date | Spouse's occupation

Paid Preparer Use Only
Print/Type preparer's name | Preparer's signature | Date | Check ☐ if self-employed | PTIN
Firm's name ► | Firm's EIN ►
Firm's address ► | Phone no.

For Disclosure, Privacy Act, and Paperwork Reduction Act Notice, see page 36. Cat. No. 11329W Form **1040EZ** (2010)

Fig. 2.4: Form 1040EZ

From the perspective of an individual filling out this form, the task is to get the data correct and determine exactly what figures go where on the form. This is no small challenge. From the perspective of economists working for the government, the tax form is an instrument of fiscal policy. Embedded in the tax form are various tax rates that must be paid on the different types of income you earn.

Where do these tax revenues go? The government collects taxes to finance its purchases of goods and services in the economy—such as roads, schools, and national defense—and also to make transfers to households, such as unemployment insurance.

The tax forms we fill out change each year, sometimes quite significantly. The tax rates households and firms confront are changed by governmental decisions. The government alters tax rates to affect the level of economic activity in the economy. It uses these tools when, in its judgment, the level of economic activity (as measured by real GDP, the unemployment rate, and other variables we will learn about) is insufficient. This is a delicate assessment that requires an understanding of the meaning and measurement of satisfactory economic performance and a deep understanding of how the economy works.

For example, consider the winter of 2008. Policymakers working in the White House and on Capitol Hill kept careful track of the state of the economy, looking as we just did at announcements from the BEA and the BLS on output and inflation. Eventually, they concluded that economic activity was not at a high enough level. They took actions to increase output by reducing taxes through the American Recovery and Reinvestment Act of 2009 (http://www.irs.gov/newsroom/article/0,,id=204335,00.html). The idea is as follows: when people pay less in taxes, they have more income available to spend, so they will purchase more goods and services. The link between the legislation and you as an individual is through tax forms like the one shown in Figure 2.4 Form 1040EZ .

2.1.4 Monetary Policy

The bottom right screen in Figure 2.1 Diverse illustrations of macroeconomics shows a decision of the Federal Open Market Committee (FOMC) to reduce a key interest rate by three-fourths of a percentage point to 2.25 percent. As we shall see in our study of monetary policy, a reduction in interest rates is a tool to increase economic activity. Lower interest rates make it cheaper for households and firms to borrow, so they spend more on goods and services. The FOMC action was taken on account of weak economic conditions in the United States, but its consequences were felt worldwide.

Other monetary authorities likewise look at the state of their economies and adjust their monetary policy. The following is part of a statement from the European Central Bank (ECB), the monetary policy authority for the European Union. It was part of a press conference held in April 2005 in which Jean-Claude Trichet, president of the ECB, and Lucas Papademos, vice president of the ECB, provided a statement about economic outlook for Europe and the stance of monetary policy.

All in all, we have not changed our assessment of risks to price stability over the medium term. So far, we have seen no significant evidence of underlying domestic inflationary pressures building up in the euro area. Accordingly, we have left the key ECB interest rates unchanged. Both nominal and real rates are at exceptionally low levels, lending ongoing support to economic activity. However, upside risks to price stability over the medium term remain and continued vigilance is therefore of the essence.

I shall now explain our assessment in more detail, turning first to the **economic analysis**. Recent data and survey indicators on economic activity have been mixed. In general they point to ongoing economic growth at a moderate pace over the short term, with no clear signs as yet of a strengthening in underlying dynamics.

Looking further ahead, the conditions remain in place for moderate economic growth to continue. Global growth remains solid, providing a favourable environment for euro area exports. On the domestic side, investment is expected to continue to be supported by very favourable financing conditions, improved profits and greater business efficiency. Consumption growth should develop in line with real disposable income growth. However, at the same time, persistently high oil prices in particular pose downside risks to growth. [...] [3]

Statements such as this are reported in the business press and widely read. Businesspeople all over the world closely follow the actions of central banks. That is, the people interested in this statement by the ECB were not only European citizens but also individuals in the United States and other countries. Likewise, when the Fed takes action, the news shows up on televisions and computer screens across the world.

The ECB quotation mentions several key economic variables: inflation, real interest rates, nominal interest rates, economic activity, investment, exports, consumption growth, and real disposable income growth. These variables are also important indicators of the state of the economy, as we can tell from the fact that they play such a prominent role in the ECB assessment.

The economists at the ECB need to know the current state of the economy when deciding on what policies to pursue. But there are compelling reasons for others to care about these variables as well. Suppose, for example, that you are an investor contemplating an investment in Spain. Your interest is in making profit from producing a good in Spain and selling it in that country and others. The profitability of the investment in Spain depends on the overall state of the Spanish economy and its neighbors in the European Union who are the target group for your sales.

For you as an investor, the ECB statement contains vital information about the state of the European economy. It also contains information on the likely conduct of monetary and fiscal policy in Europe. These factors matter for you simply because they impact the profitability of your investment. Thus you want to understand the statements from the ECB, starting with the definitions of key macroeconomic variables.

By now, you may well have a number of questions. What exactly are these monetary authorities in Europe and the United States? Where do they come from and what are their powers? How exactly do their actions have so much influence on our lives? Answering these questions is one of our tasks in this book. We devote two full chapters to the determination and the influence of monetary policy in the economy.

3. "Introductory Statement with Q&A," European Central Bank, April 7, 2005, accessed June 27, 2011, http://www.ecb.int/press/pressconf/2005/html/is050407.en.html.

KEY TAKEAWAY

- Real GDP has grown on average over the past 50 years, but the growth is not always constant: sometimes the economy grows quickly and sometimes real GDP grows slowly (or not at all).
- The inflation rate measures the percent change in prices. If prices are increasing, then a unit of currency, such as a dollar, buys fewer goods and services. During a period of inflation, the monetary authority may take action to reduce the inflation rate.
- Each year, the income taxes we pay to the government reflect its choice of fiscal policy. The policy meetings of the FOMC in the United States, the ECB of the European Monetary Union, and other central banks around the world are examples of monetary policy.

Checking Your Understanding

1. Which of the macroeconomic variables discussed would a fiscal authority pay attentionto?
2. Do the ECB and the FOMC always make the same policy decision?
3. Is a change in the tax code an example of fiscal or monetary policy?

2.2 Between News and Policy: The Framework of Macroeconomics

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. What is the methodology of macroeconomics?
2. What is the role of models in the making of macroeconomic policy?

We have seen the news and policy in action. But there is a vital piece missing: given the economic news, how do policymakers know what to do? The answer to this question is at the heart of this book. The basic methodology of macroeconomics is displayed in Figure 2.5 Macroeconomics Methodology . Macroeconomics involves the interplay of theory, data, and policy. We have already seen two of these components in Figure 2.1 Diverse illustrations of macroeconomics . Two screens highlighted data we have on the macroeconomy, and two screens highlighted policy actions.

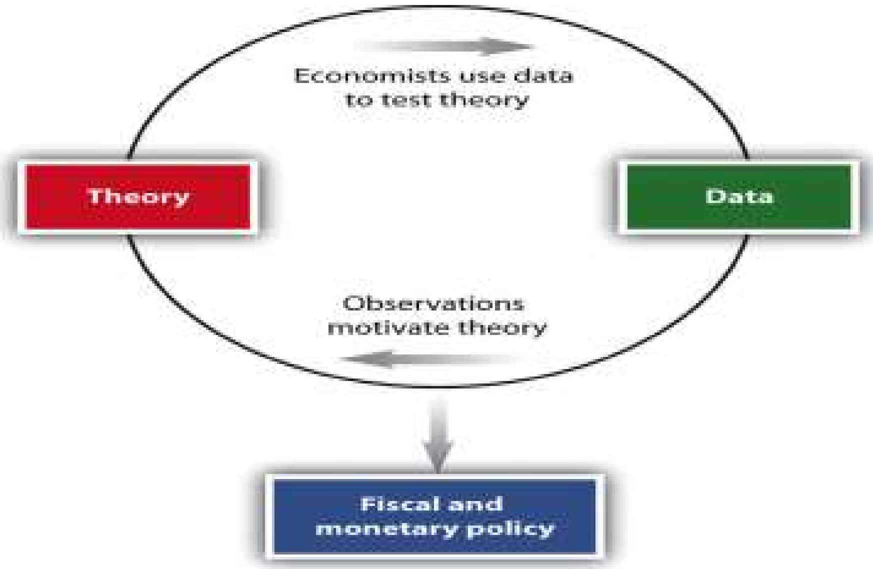

Fig. 2.5: Macroeconomics Methodology

The answer to the question "how do policymakers know what to do?" is on the top left Of Figure 2.5 Macroeconomics Methodology : theory. Macroeconomists typically begin by observing the world and then try to develop a theoretical framework to explain what they have seen. (An old joke says that the definition of an economist is "someone who sees something happen in practice and wonders whether on earth it is possible in theory.") Usually, a theory developed by economists has a mathematical foundation—expressed by either equations or diagrams. There is even a bit of art here: the theoretical framework must be simple enough to work with yet realistic enough to be useful.

We hinted at these theories in our earlier discussion when we explained that both monetary policy and fiscal policy affect the economy by changing the willingness of households and firms to purchase goods and services. In our applications chapters, we develop these ideas and explain the frameworks that policymakers use when deciding on their policies.

Our frameworks—or models, as they are often called—are tested by their ability to match existing data and provide accurate predictions about new data. Models are constantly refined so that they can do a better job of matching facts. After many rounds of interaction between theory and data, a useful framework emerges. This then becomes the basis for policymaking. How do policymakers know about the theories devised by economists? Politicians are typically not expert economists. In most countries, a large number of trained economists are employed as advisors to the government. These individuals have studied economic theory and are also familiar with economic statistics, allowing them to provide the link between the economic frameworks and the actual implementation of policy.

The big challenge for economists is to understand the links from policy to the aggregate economy. When you first learned to drive, you were presumably introduced to all the instruments in the car: the steering wheel, the accelerator, the brake, the mirrors, and so forth. At the same time, you were learning the rules of the road. For many, the instruments of the car are easy enough to grasp, and the rules of the road are reasonably intuitive. The difficulty (and this is why driving schools make money) is in making the connection between the controls in the car and the outcome you wish to achieve while driving. The same is true of economic modeling: policy tools are not very difficult to understand, yet it can take decades of experience to truly understand how to use these tools effectively. Economists and businesspeople hope, for example, that the current chairman of the Federal Reserve, Ben Bernanke, has this understanding, as discussed in the following news article excerpt.

2.2.1 Economic View: Bernanke's Models, and Their Limits

In terms of intellect, Ben S. Bernanke may be to the Federal Reserve what John G. Roberts Jr. is to the Supreme Court. And like Chief Justice Roberts, Mr. Bernanke, the nominee to replace Alan Greenspan at the Fed, has left a paper trail worth studying. What can it tell us about the sort of Fed chairman he would be?

In general, Mr. Bernanke's work has been solidly in the mainstream—a mainstream he has helped define since he began publishing papers in major economic journals since 1981. He has written repeatedly about ways of using mathematical models of a dauntingly complex economy to set monetary policy. When he has strayed from that subject, his conclusions have sometimes raised eyebrows.

[...]

These topics, however, are not at the core of what Mr. Bernanke would be concerned with at the Fed. There, his opinions about domestic monetary policy would be more important. One tenet of Mr. Bernanke's philosophy could not be clearer: that the central bank should use a model, not just hunches, to decide about interest rates and the money supply.

This is how he put it in 1997 in a paper with Michael Woodford, now a professor of political economy at Columbia: "We conclude that, although private-sector forecasts may contain information useful to the central bank, ultimately the monetary authorities must rely on an explicit structural model of the economy to guide their policy decisions."

[...] [4]

KEY TAKEAWAY

- The methodology of macroeconomics involves the interplay between data and models.
- Abstract models provide policymakers with a framework to understand what is happening in the macroeconomy and also a way to predict the effects of policy actions.

4. Daniel Altman, "Economic View: Bernanke's Models, and Their Limits," New York Times, October 30, 2005, accessed June 27, 2011,http://www.nytimes.com/2005/10/30/business/yourmoney/30econview.html.

Checking Your Understanding

1. Why are economic models always being refined?
2. If a theory is inconsistent with some but not all observations, could it still be useful for policymaking purposes?

2.3 End-of-Chapter Material

In Conclusion

Our book is built around economic topics, such as the income tax code, the social security system, the determination of monetary policy in Europe, and the contrasting economic health of different countries.

Throughout this book, we will emphasize the measurement and interpretation of economic data. Understanding how to read charts and tables of economic data is a critical skill for anyone who wants to be a sophisticated consumer of economic and political news. We also explain both policy tools and their links to economic outcomes. Understanding these links requires a model of the economy. We introduce models as needed, in the context of their applications. Mastering macroeconomics involves both understanding the tools that macroeconomists use and knowing how and when those tools should be applied. In this book, you will learn about these tools by example: you will see them in use as we study different questions in economics. At the same time, you will learn about many topics that should interest you as engaged and aware citizens of the world. We hope that, after reading this book, you will both better understand what it is that economists do and be better informed about the world in which we all live.

As you proceed through the chapters, you will often see reference to our *toolkit*. This is a collection of some of the most important tools that we use over and over in different chapters. Each tool is fully introduced somewhere in the book, but you can also use the toolkit as a reference when working through different chapters. In addition, it can serve as a study aid when you are preparing for quizzes and examinations.

We try to avoid getting too hung up on the mathematical expression of our theories (although the math will usually be lurking in the background where you can't quite see it). In particular, our applications chapters contain very little mathematics. This means that you can read and understand the applications without needing to work through a lot of mathematics. Compared to our applications chapters, our toolkit contains slightly more formal versions of the frameworks that we develop. You will refer to the tools over and over again as we progress through the book, for the same tool is often used to shed light on all sorts of different questions.

2.3.1 Key Links

- Bureau of Economic Analysis: http://www.bea.gov
- Bureau of Labor Statistics: http://www.bls.gov
- Board of Governors of the Federal Reserve System:http://www.federalreserve.gov
- European Central Bank: http://www.ecb.int/home/html/index.en.html

EXERCISES

1. Provide updated information for at least one of the four screens in .
2. Use the Internet to find an article (for example, magazine, newspaper, publication of an economics research group) that contains a graph of real GDP for a country other than the United States. What purpose does the picture serve in the article? Why do you think it was included?
3. Find a statement about monetary policy from the monetary authority in the United States, Canada, or Australia. What are some of the indicators of the state of the economy that are used in the policy statement?
4. The article on Bernanke's model contained the following quote: "We conclude that, although private-sector forecasts may contain information useful to the central bank, ultimately the monetary authorities must rely on an explicit structural model of the economy to guide their policy decisions." What do you think is meant by this statement?

Chapter 3 The State of the Economy

The IMF Comes to Town

In early 2002, a team from the International Monetary Fund (IMF) flew to Buenos Aires, Argentina. Argentina had been prospering during most of the 1990s, but more recently it had begun to run into economic problems. The IMF is an organization that attempts to help countries having financial difficulties.

An IMF team consists of professionally trained economists. These teams visit many countries, such as Argentina, on a regular basis. In this chapter, we imagine that the IMF added you to this mission and asked *you* to report back on the state of the Argentine economy. As we proceed, we think about how you might have approached this task.

You arrive at Aeropuerto Internacional Ministro Pistarini de Ezeiza Airport, which is a clean and modern airport on the outskirts of Buenos Aires. You ride into the city in a new car along modern highways lined with fancy billboards. When you get to the city center, you notice that there are luxurious shopping malls. You see high-end stores selling luxury brands, such as Louis Vuitton, Versace, Hermes, and Christian Dior. The city seems prosperous, reminiscent of Paris or New York. Just looking around, you see immediately that you are not in one of the really poor countries of the world.

Fig. 3.1: Picture of Buenos Aires, Argentina

(Source: Image taken by authors.) .

As you explore the city, though, you begin to look more closely and notice that things are not quite what they seemed at first glance. The luxury stores do not have many customers in them. Some buildings show signs of a lack of maintenance; it has been a while since they were repainted. Some stores are boarded up or bear signs saying that they are going out of business. There seem to be a lot of people who are not working or who are making a living selling goods on the street.

Reflecting on these conflicting clues to Argentina's prosperity, you quickly realize that it is difficult to assess the health of an economy by casual observation. In addition, you have seen almost nothing of the country. Argentina covers over one million square miles; it is almost one-third of the size of the United States and has a population of nearly 40 million. The more you think about this, the harder the problem seems. Forty million people are buying things, selling things, making things, and consuming things every day. It seems an impossible task to make sense of all this activity and say anything useful about the economy as a whole. That challenge is the subject of this chapter.

How can we evaluate the overall performance of something as complicated as an economy?

Road Map

If you think about this question for a bit, you will realize that it has more than one dimension.

- First, we need *measurement*. We must summarize the economy in a manageable way, which is impossible unless we find some way of measuring what is going on in the economy. One of the primary tasks of economics is accounting. That leads to other questions: what should we count, and how should we count it?
- Data are not enough. Measurement will not take us very far unless we can combine it with some understanding of how the economy works. We need to know how to interpret the things we count. We need to know what our numbers mean. For this, we need *frameworks* that help us make sense of the economy.

These two ideas guide our discussion in this chapter.

Think for a moment in very general terms about what happens in an economy. An economy possesses some resources. These include the time and abilities of the people who live in the economy, as well as natural resources, such as land or mineral deposits. An economy also possesses various means of changing, or transforming, one set of things into other things (see the following figure). For example, we have a process for making tea. We produce tea by taking cold water, energy, and dried leaves and transforming those inputs into a hot beverage that people like to drink. The simple act of making a cup of tea is an example of production.

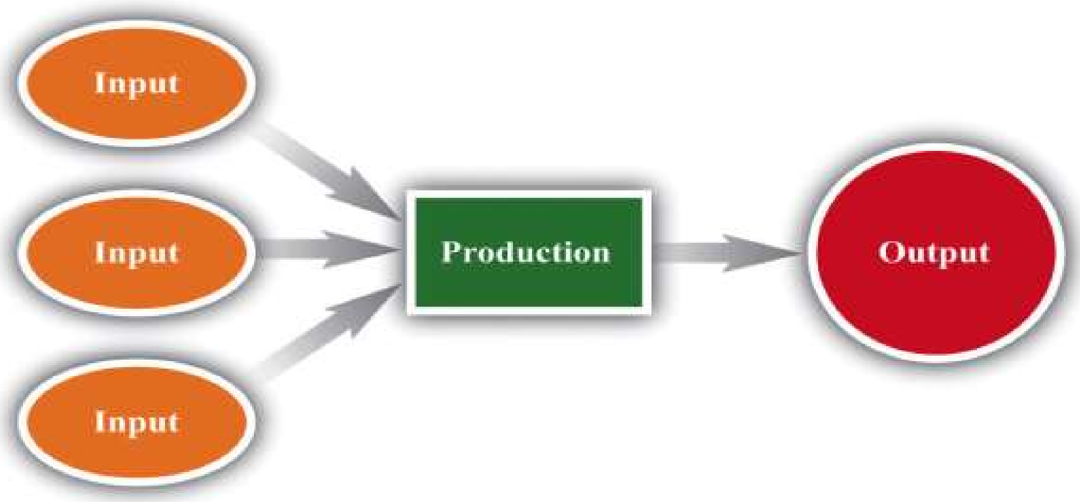

Fig. 3.2: From Inputs to Output

One of the main economic activities is production: the transformation of inputs (raw materials, labor time, etc.) into output (goods and services that people value).

We are interested in measuring how much production occurs in an economy. Obviously, however, we cannot hope to count all the times that people drop a teabag into a cup, and it would not make much sense to do so. *Economic* activity typically involves more than production; it also includes the notion of exchange—buying and selling. If you make a cup of tea for yourself at home, we do not think of this as economic activity. If you buy a cup of tea at your local coffee shop, we *do* think of this as economic activity. A very rough definition of economic activity is as follows.

Economic activity is the production of goods and services for sale.

Any definition this straightforward is bound to be too simple, and we will see that there are several subtleties in the actual measurement of economic activity, particularly since some goods and services are not actually bought and sold. Still, if you keep this idea in mind, it will help you as we progress through the basics of economic measurement in this chapter.

3.1 Measuring Economic Activity

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. What is the measure of total output of an economy?
2. What is the difference between real and nominal gross domestic product (GDP)?

Macroeconomics is data driven. Government statisticians and other organizations gather vast amounts of data on the performance of various aspects of the macroeconomy, and macroeconomists try to make sense of all this information.

If we want to explain economic data, then we first have to get the measurement right, and a big part of this is ensuring that we get the accounting right. To make sure that we do, we begin by constructing simple examples. This is not because a simple example is enough to describe an economy; but because cannot hope to understand the complicated accounting unless we do the simple accounting correctly.

3.1.1 The Pizza Economy

To understand the economic health of Argentina—or any other country—we begin by looking at production in the economy. Let us imagine that Argentina produces a single good—pizza. Each pizza is sold for 10 pesos (which is about US$3.33). To be concrete, suppose that every worker in the economy works in a pizza factory in which (1) each hour worked produces 1 pizza, (2) each worker works 40 hours per week, and (3) each worker works 50 weeks per year. Suppose there are about 15 million workers in the economy. We measure total economic activity by determining the *total value of the pizzas produced*in this economy. We obtain this by multiplying the previous numbers together. There are

40 pizzas per worker per week,

so there are

2,000 pizzas per worker per year (= 40 × 50),

which means that there are

30,000,000,000 pizzas per year (= 40 × 50 × 15,000,000).

The value of those pizzas is

300,000,000,000 pesos per year (= 40 × 50 × 15,000,000 × 10).

The total value of all the production in the economy is called **nominal gross domestic product (nominal GDP).** The word *nominal* indicates that something is being measured in terms of money—in this case, Argentine pesos. For this economy, nominal GDP is 300 billion pesos per year.

The economy we have just described is extremely stylized and somewhat dull from a culinary perspective. We begin with such a simple economy because it allows us to understand the basic workings of the economy without getting bogged down in a lot of details. We did, however, choose numbers that are the right order of magnitude for the Argentine economy in 2002: the total number of workers in Argentina in 2002 was about 15 million, and nominal GDP was about 300 billion pesos. In 2010, estimated GDP for Argentina was 1.4 trillion pesos, and the workforce was over 16 million.

3.1.2 Measuring Nominal GDP

We now consider a more formal definition of nominal GDP and go through it term by term.

Nominal GDP is the market value of the final goods and services produced by an economy in a given period of time.

3.1.3 Market Value

Our example pretended that there was only a single good produced in the economy—pizza. In real economies, millions of different goods and services are produced, ranging from cars at an assembly plant to haircuts sold by a local barber. If our goal is to measure the overall output of an economy, we are faced with the problem of how to add together these goods and services. How do you add 60,000 cubic meters of natural gas, 1,000 trucks, and 2,000 head of cattle (to pick just a few examples of goods produced in Argentina)? We need a common denominator. Economists use the *market value* of the goods and services. This means that the common denominator is dollars in the United States, pesos in Argentina, kroner in Sweden, euros in Portugal, and so on. Nominal GDP equals total output produced in a year, valued at the actual market prices prevailing in that year. We choose market value for two reasons. One is simplicity: data on the market prices of goods and services are relatively easy to come by. The second reason is much more important. Market value tells us how much people are willing to pay for different goods and services, which gives us a measure of the relative value of different commodities. For example, if a new laptop computer costs $2,000 and a new hardcover novel costs $20, then the market is telling us that people are willing to trade off these goods at the rate of 100 novels to 1 laptop. In effect, the market is telling us that the laptop is 100 times more valuable than the novel. [1]

Let's look at an example of the calculation.Table 3.1 Calculating Nominal GDP considers a very small economy that produces three goods and services: T-shirts, music downloads, and meals. We show data for two years. To calculate GDP in 2012, we take the market value of the T-shirts ($20 × 10 = $200), the market value of the music downloads ($1 × 50 = $50), and the market value of the meals ($25 × 6 = $150). Adding these, we discover that nominal GDP is $400:

```
($20 × 10) + ($1 × 50) + ($25 × 6) = $200 + $50 + $150 = $400.
```

1. We take as given here that the market price—which tells us how much people are willing to spend—is a reasonable measure of the value of a good or a service. More precisely, it measures the value of the good or service "at the margin," meaning it measures the value of having one more unit of the good or the service. Explaining why this is usually a sensible interpretation of the market price (and when it is not) is a topic covered in microeconomics courses.

Doing the same operations for 2013, we find that nominal GDP is $442:

```
($22 × 12) + ($0.80 × 60) + ($26 × 5) = $264 + $48 + $130 = $442.
```

We can see that lots of things changed between the two years. The price of T-shirts and meals slightly increased, while music downloads became cheaper. Firms produced more T-shirts and music downloads but fewer meals.

Year	T-shirts		Music Downloads		Meals		Nominal GDP($)
	Price($)	Quantity	Price($)	Quantity	Price($)	Quantity	
2012	20.00	10	1.00	50	25.00	6	400.00
2013	22.00	12	0.80	60	26.00	5	442.00

Table 3.1: Calculating Nominal GDP

On the surface, 2013 appears to have been a good year in this economy. Nominal GDP increased substantially relative to 2012. Dig a little deeper, however, and it is harder to interpret this change. Production increased for some products and decreased for others. Some prices increased, and others decreased. Was 2013 really better than 2012? We come back to this question shortly.

3.1.4 Final Goods and Services

In Table 3.1 Calculating Nominal GDP, we assumed that all of the goods and services purchased were purchased by their *final* users. That is, the T-shirts, music downloads, and meals were all purchased by households for consumption purposes. (Households are not the only group that consumes final goods and services in an economy. Firms, the government, and households in other countries can also be final consumers.) We term these final goods (Tshirts) and final services (music downloads and restaurant meals).

In contrast, **intermediate goods and services** are products such as raw materials and energy that are used—and completely used up—in the production of other goods and services. [2]We do not include intermediate goods in GDP. Think about a bottle of wine, for example. It might be bought by a consumer at a wine store, in which case it is counted in GDP. Alternatively, it might be bought by a restaurant to sell with its

2. There are two kinds of goods used in the production of other goods. Intermediate goods are completely used up as part of the production process. Capital goods—such as factories and machines—are not completely used up but live to produce another day. We discuss capital goods in more detail in Chapter 5 "Globalization and Competitiveness".

meals. In this case, the cost of the meal is included in GDP, and *the cost of the wine is already included in the cost of the meal*. The restaurant may have purchased the wine from a supplier, but that purchase is *not* included as part of GDP. If both the sale of wine to the restaurant and the sale of that wine to a customer of the restaurant were counted in GDP, the same bottle of wine would be counted twice. By excluding the sale of intermediate goods in calculating GDP, we avoid such double counting.

Being intermediate is therefore not a feature of the good itself. It depends on how the good is used. Wine sold to a consumer directly is a final good; wine sold to a restaurant is an intermediate good. This fits with the idea that we want GDP to measure goods as they are valued by consumers.

3.1.5 Produced by an Economy

Most of the time when we talk about an economy, we are speaking of a particular country. Thus we talk about US GDP, Argentine GDP, Indian GDP, or Uruguayan GDP. Similarly, most of the statistics that are collected refer to economic activity within a country. The term *economy* can be much more general, though, for it simply means a particular set of households and firms. We can speak of the world economy, the North Dakota economy, the Buenos Aires economy, or even the economy of a street of your hometown. The basic concepts are the same no matter what region we choose to discuss.

3.1.6 Over a Given Period

GDP is measured over a specified period of time. In principle, that time period could be anything—a week, a month, a quarter (three months), or a year. In the United States and many other countries, GDP is *measured* on a quarterly basis. However, it is typically *reported* on an annual basis. In other words, government statisticians might measure GDP for the first three months of 2012 and find that it was $4 trillion. That is, over that three-month period, $4 trillion worth of goods and services was produced. The number would typically be reported as “$16 trillion on an annual basis.”

It does not make any sense to talk about US GDP at the instant the clock strikes noon on February 29, 2012. The amount of GDP produced at any instant of time is, for all intents and purposes, zero. Instead, we think of GDP as a **flow**. We can count the number of pizzas produced only if we specify some interval of time. Other variables can be sensibly measured even at a given instant. For example, we could—in principle at least—count the number of pizza ovens in existence at any given time. The number of pizza ovens at a point in time is an example of a **stock**.

The requirement that we count goods and services produced in a certain period means that we should also ignore the *resale* of goods produced in earlier periods of time. If a construction company builds a new house and sells it to you, the production of that home is counted as part of GDP. By contrast, if you buy a house that is 10 years old, the sale of that house is not counted in GDP. (However, if you employed a real estate company to find the old house for you, payment to that company would be included as part of GDP.) In the same way, if you purchase a used textbook that was produced 3 years ago, that purchase is not counted in GDP.

3.1.7 Nominal GDP in the United States and Argentina

In macroeconomics, our data come to us in the form of *time series*. Time series are a sequence of dated variables: GDP in 2000, GDP in 2001, GDP in 2002, and so on. Usually these data are annual, but they could also be quarterly or monthly (or even daily or hourly). If we go to the *Economic Report of the President*(http://www.gpoaccess.gov/eop), we can find data for nominal GDP. In the United States, the Bureau of Economic Analysis (BEA; http://www.bea.gov/national/index.htm) in the Department of Commerce is responsible for calculating nominal GDP. Table 3.2 Nominal GDP in the United States, 2000–201 gives an example of a time series.

Year	Nominal GDP (Billions of Dollars)
2000	9,951.5
2001	10,286.2
2002	10,642.3
2003	11,142.1
2004	11,867.8
2005	12,638.4
2006	13,398.9
2007	14,061.8
2008	14,369.1
2009	14,119.0
2010	14,660.2

Table 3.2: Nominal GDP in the United States, 2000–201

It is often more revealing to show a time series as a picture rather than a list of numbers. Figure 3.3 Nominal GDP in the United States, 2000–2010 shows the data from Table 3.2 Nominal GDP in the United States, 2000–201 in a graph. Looking at this figure, we see immediately that the US economy grew over these years. The level of nominal GDP (in billions) was $9.8 trillion in 2000 and $13.2 trillion in 2006.

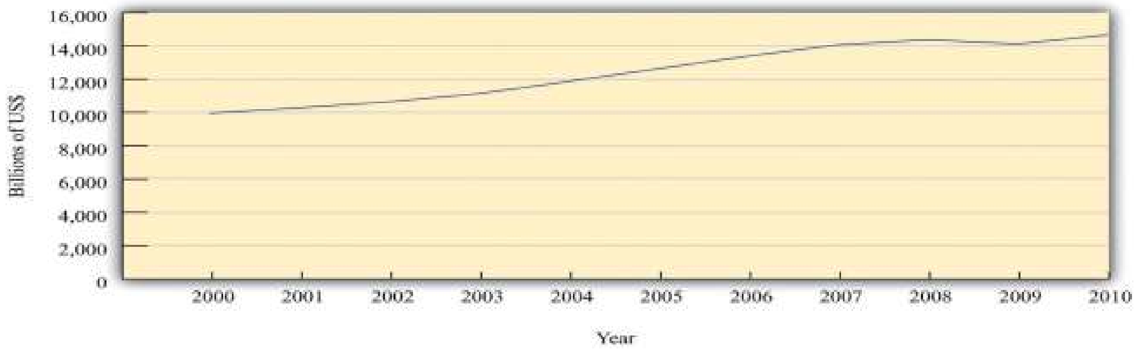

Fig. 3.3: Nominal GDP in the United States, 2000–2010

. Nominal GDP in the United States grew for most of the last decade but declined in 2009. Source: 2011 Economic Report of the President, accessed July 29, 2011,http://www.gpoaccess.gov/eop/tables11.html, Table B-1..

Let us return to your International Monetary Fund (IMF) mission in Argentina. From talking to other members of the team, you learn that the Argentine government has statistics on nominal GDP. This is good news, for it means you do have information on the total value of production in the economy. Figure 3.4 Nominal GDP in Argentina, 1993–2002 shows nominal GDP for Argentina over the decade prior to your arrival (1993–2002). In 1993, it was 237 billion pesos. In 2002, it was 313 billion pesos. Thus nominal GDP grew by about one-third over the course of the decade.

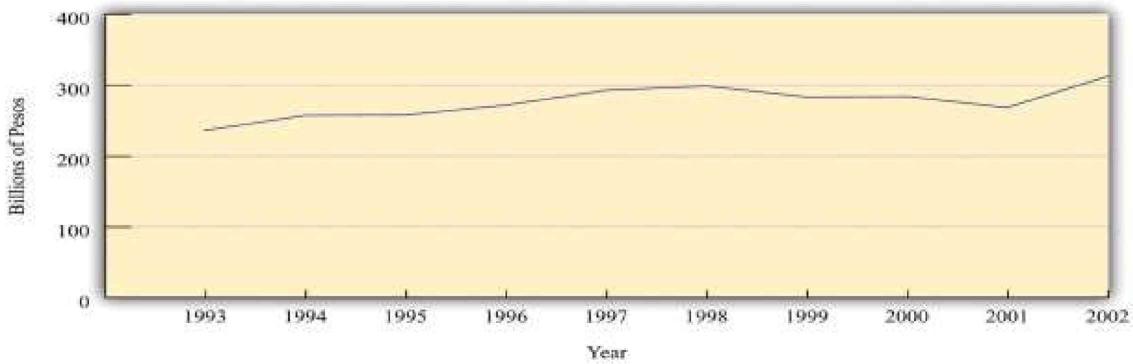

Fig. 3.4: Nominal GDP in Argentina, 1993–2002

(http://www.imf.org/external/pubs/ft/weo/2010/01/index.htm) . The graph shows nominal GDP in Argentina between 1993 and 2002. Nominal GDP grew overall during this period, although it decreased for several years in the second half of the decade. Source: International Monetary Fund World Economic Outlook database ()..

Now suppose that in your hotel room one morning you hear on the radio that government statisticians in Argentina forecast that nominal GDP next year will be 300 million pesos greater than this year. How should you interpret this news? Without some context, it is difficult to make any judgment at all.

The first thing to do is to work out if 300 million pesos is a big number or a small number. It certainly *sounds* like a big number or looks like a big number if we write it out in full (300,000,000). If we stacked 300 million peso bills on top of each other, the pile would be over 100 miles high. But the real question is whether this is a big number relative to existing nominal GDP. We have been told that the change in nominal GDP is 300 million, but we would like to know what this is as a **growth rate**, which is a *percentage change*.

Toolkit: Section 16.11 "Growth Rates"

A growth rate is a percentage change in a variable from one year to the next. That is, a growth rate is the change in a variable over time divided by its value in the beginning period.

For example, the growth rate of GDP is calculated as follows:

In our example for Argentina, the percentage change is equal to the change in nominal GDP divided by its initial value. Remember than nominal GDP in 2002 was about 300 billion pesos, so

$$\begin{aligned}\text{percentage change in GDP} &= \frac{\text{change in nominal GDP}}{\text{initial value of nominal GDP}}\\ &= \frac{\$300{,}000{,}000}{\$300{,}000{,}000{,}000}\\ &= 0.001\\ &= 0.1 \text{ percent}\end{aligned}$$

When we express this change in nominal GDP as a percentage, therefore, we see that it is in fact very small—one-tenth of 1 percent. If you heard on the radio that nominal GDP was expected to grow by 300 million pesos in a 300-billion peso economy, the correct conclusion would be that nominal GDP would hardly change at all. By contrast, if the news announced a projected increase in nominal GDP of 30 billion pesos, the percentage change is 30 billion/300 billion = 0.1 = 10 percent. This is a substantial change in nominal GDP.

3.1.8 Measuring Real GDP

In your bid to understand the economy of Argentina, you have seen that nominal GDP increased by one-third between 1993 and 2002. One possibility is that Argentina is producing one-third more pizzas than it was a decade ago—30 billion pizzas instead of 22.5 billion pizzas. This would be good news. Producing more pizzas is something we would normally think of as a good thing because it means that we are experiencing economic growth: there are more goods and services for people to consume.

In talking to people about the Argentine economy, however, you learn something disconcerting. They tell you that the prices of goods and services are greater this year than they were last year and much greater than they were a decade ago. You begin to wonder: perhaps Argentina is producing no more pizzas than before but instead pizzas have become one-third more expensive than they formerly were. We would typically feel very differently about this outcome. Yet another possibility is that there has been an increase in both the number of pizzas produced *and* the price of pizza, and the combined effect doubled nominal GDP. We need a way of distinguishing among these different possibilities.

3.1.9 Separating Nominal GDP into Price and Output

In our pizza economy, it is easy to tell the difference between an increase in production and an increase in prices. We can measure increased production by counting the number of pizzas, and we can measure increased prices by looking at the price of a pizza. We call the number of pizzas **real gross domestic product (GDP)** (the word *real* here indicates that we are effectively measuring in terms of goods and services rather than dollars), and we call the price of a pizza the **price level** in the economy.

Then it follows that

```
nominal GDP = price level × real GDP.
```

In our example, the price level is 10 pesos, and real GDP is 30 billion pizzas. Multiplying these numbers together, we find that nominal GDP is indeed 300 billion pesos. Sometimes, for shorthand, we use the term price to mean the price level in a given year and the term output to mean real GDP in a given year.

Real GDP is the variable that most interests us because it measures the quantity of goods and services produced in an economy. We would therefore like to find a way to decompose nominal GDP into the price level and the level of real GDP in actual economies. But real economies produce lots of different goods and services, the prices of which are continually changing. In addition—unlike our fictional economy, where it makes sense to measure real GDP as the number of pizzas—there is no "natural unit" for real GDP in an actual economy.

In fact, even in our pizza economy, there is still an arbitrariness about the units. Imagine that we cut each pizza into 10 slices. Then we could just as easily say that real GDP is 300 billion pizza slices instead of 30 billion pizzas, but that the price level—the price per slice—is 1 peso. We would still conclude that nominal GDP—the number of slices multiplied by the price per slice—was 300 billion pesos.

So is it possible to say, in a real economy producing multiple goods and services, that nominal GDP is equal to the product of the price level and the level of real GDP? Does it still make sense to write

```
nominal GDP = price level × real GDP
```

as we did for the pizza economy? The answer, as it turns out, is yes.

To see how this works, we begin by looking at how prices and output change from one year to another. Specifically, we divide 2013 nominal GDP by 2012 nominal GDP. This is one measure of the growth in nominal GDP from 2012 to 2013. [***Specifically, this measures the gross growth rate of nominal GDP. It is equal to 1 + the percentage change in nominal GDP. See the toolkit for details of the mathematics of growth rates.

***] Remember that nominal GDP equals total output produced in a year, valued at the prices prevailing in that year. Comparing nominal GDP in 2012 and 2013 therefore gives us

$$\frac{\text{nominal GDP in 2013}}{\text{nominal GDP in 2012}} = \frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2012 valued at 2012 prices}}.$$

Now we use a trick. Multiply above and below the line by "output in 2013 valued at 2012 prices" and then rearrange:

$$\begin{aligned}\frac{\text{nominal GDP in 2013}}{\text{nominal GDP in 2012}} &= \frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2012 valued at 2012 prices}} \times \frac{\text{output in 2013 valued at 2012 prices}}{\text{output in 2013 valued at 2012 prices}} \\ &= \frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2013 valued at 2012 prices}} \times \frac{\text{output in 2013 valued at 2012 prices}}{\text{output in 2012 valued at 2012 prices}}.\end{aligned}$$

Look carefully at this calculation to make sure you understand what we did here.

Now examine the two ratios on the right-hand side of the second line. The first compares the cost of the same bundle of goods (output in 2013) at two different sets of prices—those prevailing in 2013 and those prevailing in 2012. Think of the bundle as being a grocery cart full of goods. If you compare how much it costs to buy *exactly the same collection of goods at two different times*, you have a measure of what has happened to prices.

The second ratio on the right-hand side is a measure of the increase in real GDP. It uses the same prices to compare the value of output in 2012 and 2013. In other words, it tells you how much it costs to buy *two different collections of goods at exactly the same prices*.

To reiterate, the first ratio compares the same bundle of goods at two different sets of prices. The second ratio compares two different bundles of goods at the same prices. We have succeeded in separating the change in nominal GDP into two components: a price change and a change in real GDP.

Measuring Real GDP and the Price Level

We can illustrate this technique using the data in Table 3.1 Calculating Nominal GDP. In that example, the growth in nominal GDP equals 10.5 percent because

$$\frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2012 valued at 2012 prices}} = \frac{\$442}{\$400} = 1.105.$$

Now we choose an arbitrary year that we call the base year. For the base year, we set the price level equal to 1. In our calculations, we choose 2012 as our base year. Because nominal GDP equals the price level times real GDP, this means that real GDP in 2012 is $400. When we choose 2012 as our base year, we use the prices of T-shirts, music downloads, and meals in 2012 for our calculations of real GDP for 2012 and 2013. Table 3.3 Real GDP Using 2012 as the Base Year shows what we find. The first row is exactly the same as in Table 3.1 Calculating Nominal GDP. Nominal GDP in 2012 is—by definition—the same as real GDP in 2012 because we are using 2012 as the base year. The second row of the table calculates real GDP for 2013; it uses 2013 quantities but 2012 prices. Notice also the heading in the final column of the table: "Real GDP (Year 2012 dollars)." The term in parentheses tells us that everything is being measured according to the prices that prevailed in our base year of 2012.

Year	T-shirts		Music Downloads		Meals		Nominal GDP($)
	Price($)	Quantity	Price($)	Quantity	Price($)	Quantity	
2012	20	10	1.	50	25	6	400.00
2013	22	12	1	60	25	5	425.00

Table 3.3: Real GDP Using 2012 as the Base Year

We previously calculated that 2013 nominal GDP—output in 2013 valued at 2013 prices—was $442. By contrast, Table 3.3 Real GDP Using 2012 as the Base Year shows that, when valued in year 2012 dollars, the total output of this economy in 2013 is $425. In other words,

$$\frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2012 valued at 2012 prices}} = \frac{\$425}{\$400} = 1.0625.$$

Nominal GDP increased by 10.5 percent between the two years, but real GDP is increased by only 6.25 percent. From this we see that not all of the increase in nominal GDP is due to increased output. Some of the increase is because prices increased between 2012 and 2013.

In our pizza economy, we said that nominal GDP was equal to the price per pizza multiplied by the quantity of pizza. In our example here, we have calculated something very similar. Nominal GDP equals the price level multiplied by real GDP. In the base year, the price level equals 1 (that is what it means to choose the base year), and so real GDP equals nominal GDP in that year. Because we can calculate the increase in the price level and the increase in real

GDP from one year to the next, we can obtain a time series for the price level and a time series for real GDP. In each year, nominal GDP equals the price level in that year times real GDP in that year.

There is, however, one difference between the calculation for our pizza economy and measurement in real economies. In the pizza economy, because there was a single good, we were able to measure real GDP in physical units—the number of pizzas. In real economies, there is no single good, and so we measure real GDP in base year dollars rather than as a physical quantity. The price level in, say, 2013 is not, strictly speaking, the price of real GDP in terms of 2013 dollars but rather is the price of a base year dollar in terms of 2013 dollars.

But this is a technical difference. From an intuitive point of view, it is simplest to think about real GDP as being a physical quantity—a number of pizzas. In this book we therefore imagine that real GDP is actually a bundle of goods and services all melded together to create a composite good. We call that good "units of real GDP," and we call the price level the price of a unit of GDP. In fact, we could think about the pizza economy in that same way. Even a basic pizza is itself composed of dough, sauce, and cheese: it is a bundle of items melded into one. So when we talk about the physical quantity of pizza, we are really talking about the number of bundles of these ingredients. Likewise, when we talk of real GDP, we are talking about a bundle of goods that we measure in base year dollars. Real GDP is our most basic measure of economic performance. It is a very broad measure because it tells us how much economic activity of any kind (at least, any kind that we can measure) is going on in our economy. Real GDP tells us how much we have produced of all the different goods and services that people enjoy and want to consume. For this reason, real GDP statistics are among the most closely watched of all the figures released by a government.

3.1.10 Real GDP in the United States and Argentina

Figure 3.5 Real GDP in the United States, 1929–2009 shows real GDP for the US economy from 1929 to 2008 in year 2000 dollars. The figure shows that the US economy grew substantially over those years. The level of real GDP was $865.2 in 1929 and $10,842 in 2008 (in billions of $2000). [3]

Fig. 3.5: Real GDP in the United States, 1929–2009

(Source: http://www.bea.gov/national/Index.htm) .

Figure 3.6 Real GDP (in 1993 Pesos) in Argentina in the 10 Years Prior to 2002 shows real GDP in Argentina and thus reveals that our earlier data for nominal GDP were indeed misleading. Nominal GDP may have increased between 1993 and 2002, but real GDP in 2002 was at the same level as in the previous decade. Moreover, real GDP had been decreasing for the prior four years before the IMF visit.

3. Specifically, this measures the gross growth rate of nominal GDP. It is equal to 1 + the percentage change in nominal GDP. See the toolkit for details of the mathematics of growth rates. [*** If you look at this figure, you will see that real GDP is listed as "chain weighted." This method of calculating real GDP averages growth rates by using different base years. By averaging, this measure has the virtue that calculations of real GDP are less sensitive to the selection of an arbitrary base year. For more information on chain-weighted measures, see Charles Steindel, "Chain-Weighting: The New Approach to Measuring GDP," Current Issues in Economics and Finance 1, no. 9 (1995): 1–6, accessed June 28, 2011,http://www.newyorkfed.org/research/current_issues/ci1-9.pdf.

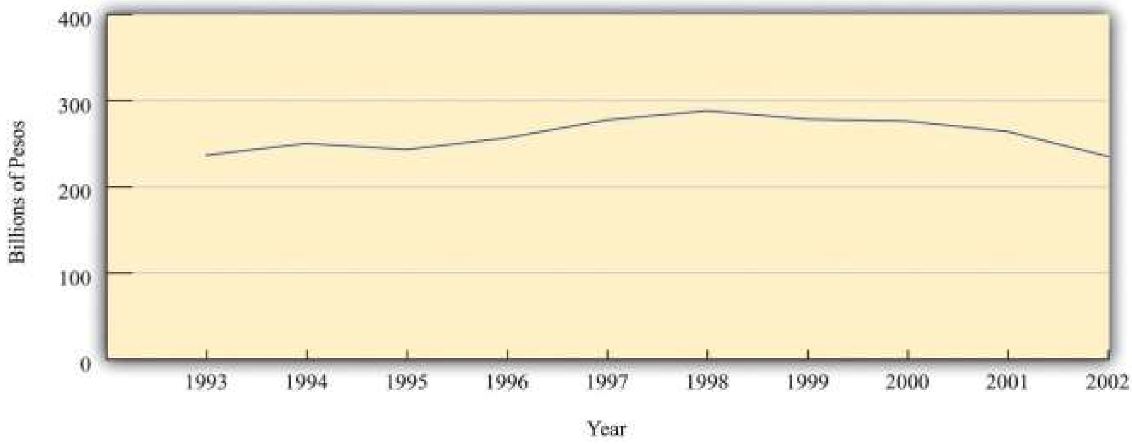

Fig. 3.6: Real GDP (in 1993 Pesos) in Argentina in the 10 Years Prior to 2002

. Real GDP in Argentina was essentially flat between 1993 and 2002. Source: International Monetary Fund World Economic Outlook database (http://www.imf.org/external/pubs/ft/weo/2010/01/index.htm)..

This helps you to make sense of your contradictory impressions of Buenos Aires. Argentina became poorer, not richer, in the late 1990s and early 2000s. The presence of luxury goods stores, for example, is a reminder that Argentina was a relatively rich country, but the absence of shoppers in those stores tells you that people are not feeling very rich at this time.

KEY TAKEAWWAYS

- Economists and policymakers measure output as GDP. This is a measure of the total value of all production in an economy.
- Nominal GDP measures the total value of all production using current prices, while real GDP measures total output and corrects for changes in prices relative to a base year.

Checking Your Understanding

1. Why is there no "natural unit" for calculating real GDP in an actual economy compared to the pizza economy?
2. If your income is currently $150 each week and you received a raise of $50, what is the percentage change in your weekly income?

3.2 Measuring Prices and Inflation

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. How are price indices such as the Consumer Price Index (CPI) calculated?
2. What is the difference between the CPI and gross domestic product (GDP) deflator?
3. What are some of the difficulties of measuring changes in prices?

If nominal GDP increased in Argentina but real GDP did not, then prices must have increased. So now we look in more detail at the measurement of prices.

3.2.1 The Price Index

Remember that we defined the change in prices as follows:

$$\frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2012 valued at 2012 prices}}.$$

We can use the data in Table 3.1 Calculating Nominal GDP to calculate this ratio as well. This time, however, we compare the cost of the *same* basket of goods (in this case, output in 2013) according to the prices prevailing at two different times. The basket of goods in 2013 is shown in Table 3.4 Calculating the Price Index as the quantities of the three goods and services produced that year: 12 T-shirts, 60 music downloads, and 5 meals. As we saw earlier, the cost in dollars of this basket of goods and services is $442.

Year	T-shirts		Music Downloads		Meals		Cost of 2013 Basket ($)
	Price($)	Quantity	Price($)	Quantity	Price($)	Quantity	
2012	20	12	1.	60	25	5	425
2013	22	12	0.80	60	26	5	442

Table 3.4: Calculating the Price Index

Table 3.4 Calculating the Price Index also shows the total cost of consuming the 2013 basket in 2012, which we already know is $425. Thus the price index for 2012 is $425/$425 = 1, and the price index for 2013 is $442/$425 = 1.04. [4] For the simple three-good economy described in Table 3.1 Calculating Nominal GDP, we therefore have the following:

$$\begin{aligned}\frac{\text{nominal GDP in 2013}}{\text{nominal GDP in 2012}} &= \frac{\text{output in 2013 valued at 2013 prices}}{\text{output in 2013 valued at 2012 prices}} \times \frac{\text{output in 2013 valued at 2012 prices}}{\text{output in 2012 valued at 2012 prices}}\\ &= \left(\frac{442}{425}\right) \times \left(\frac{425}{400}\right)\\ &= 1.04 \times 1.0625\\ &= 1.105.\end{aligned}$$

Prices increased by 4 percent, real GDP increased by 6.25 percent, and nominal GDP increased by 10.5 percent.

To summarize, the basic principle for calculating inflation is as follows: (1) We decide on a bundle of goods and look at how much it costs in a given year. (2) Then we look at the *same bundle of goods in the following year* and see how much it costs. (3) The ratio of the two is called a **price index** and provides a measure of one plus the **inflation rate**.

Toolkit: Section 16.5 "Correcting for Inflation"

A price index for a given year is calculated as the cost of a bundle of goods in that year divided by the cost of the same bundle in the base year. The growth rate of the price index from one year to the next is a measure of the inflation rate.

3.2.2 Different Price Indices

There are many different price indices that are constructed and used for different purposes. They can be constructed for particular categories of goods or regions, for

4. Frequently, the value for the price index is multiplied by 100, so the price index for 2013 would be given as 104.

example. If you listen to the news, you may hear references to the Producer Price Index or the Wholesale Price Index. Ultimately, the differences among different price indices simply come down to the bundle of goods that is chosen.

Figure 3.7 An Example of a Price Index shows an example of a very particular price index that was used by a supermarket in Thailand to advertise its prices. The store placed two supermarket carts at the entrance with the same bundle of goods in each. The one on the left, with the black label, showed the cost of this cartload of goods at the old prices. It used to cost 1,059.50 Thai baht (approximately US$28). The one on the right, with the red label, showed that the cost of this same bundle of goods was now 916.00 Thai baht. The reduction in price for the basket of goods was 143.50 Thai baht, or about 13.5 percent.

Fig. 3.7: An Example of a Price Index

. A supermarket in Phuket, Thailand, used an actual basket of groceries to show that its prices had been reduced. This is an example of a price index. Source: Image taken by the authors..

3.2.3 The Consumer Price Index

In this book, we use price indices that measure the general level of inflation. There are several such measures, but we do not need to worry about this. The differences among these different measures are usually small and typically unimportant for our basic understanding of the economy. The measure of inflation that we have used so far is called the **GDP deflator**, a price index that uses as the bundle of goods everything that goes into GDP. A more common measure of inflation is the **Consumer**

Price Index (CPI), which uses as the bundle of goods the typical purchases of households.

The CPI is the most familiar measure of prices. When economic commentators speak of inflation, they usually mean the percentage change in the CPI. As the name suggests, the CPI is intended to measure inflation as consumers experience it. The bundle of goods included in the CPI is supposed to correspond to the bundle of goods purchased by a typical household. This means that certain goods that are included in GDP do not show up in the CPI. For example, an increase in the price of stealth bombers does not show up in the CPI because (we hope!) households do not buy stealth bombers. However, stealth bombers do show up in the GDP deflator. At the same time, certain goods that are not part of GDP are included in the CPI—most importantly, consumer goods that are imported from other countries. Because imported goods are not produced in the domestic economy, they do not show up in the GDP deflator; however, because domestic consumers purchase imported goods, they do show up in the CPI.

Households differ dramatically in their consumption patterns, so different households have very different experiences of inflation. An individual who drives 100 miles daily to get to work views variations in the price of gasoline very differently from someone who rides a bicycle to work. The CPI captures the average experience of all households, which can be quite different from the actual experience of an individual household.

Figure 3.8 The Inflation Rate in the United States, 1914–2008 shows the CPI inflation rate (that is, the percentage change of the CPI) from 1914 to 2008 in the United States.[5] In some early years, prices actually decreased from one year to the next, meaning that the inflation rate was negative. Since 1960, however, the United States has experienced a positive inflation rate.

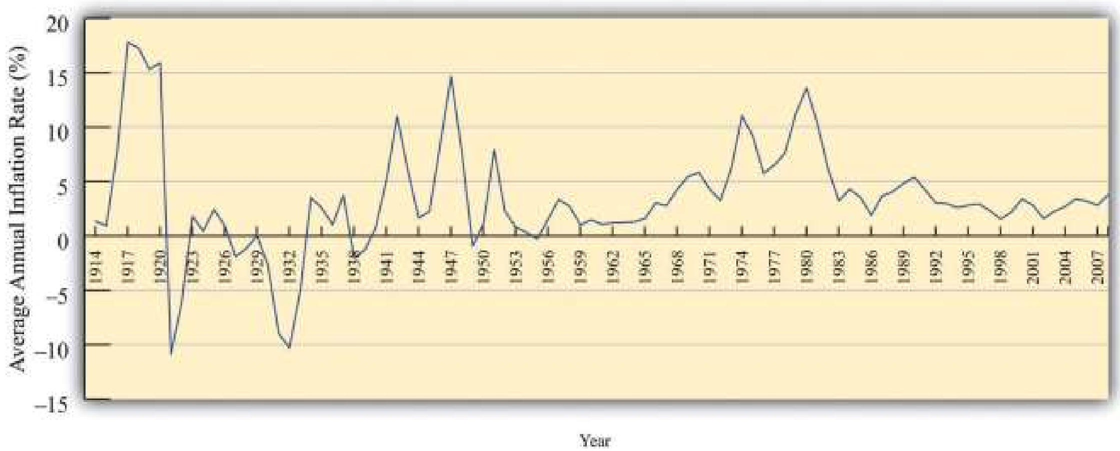

Fig. 3.8: The Inflation Rate in the United States, 1914–2008

. Source: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt.

Figure 3.9 The Price Level in Argentina shows the price level in Argentina between 1993 and 2002. The most striking thing about this picture is that there was very little

5. Inflation data and more details about the construction of price indices can be found at the website of the Bureau of Labor Statistics (BLS; http://www.bls.gov).

inflation for most of this period. In the final year, however, prices increased substantially. Notice that our picture for the United States shows the inflation rate, whereas for Argentina we are looking at the level of prices. Either way of presenting the data is valid, but it is critical to understand the difference between them. Make sure you understand the difference between the *level* of prices and the *percentage change* in prices.

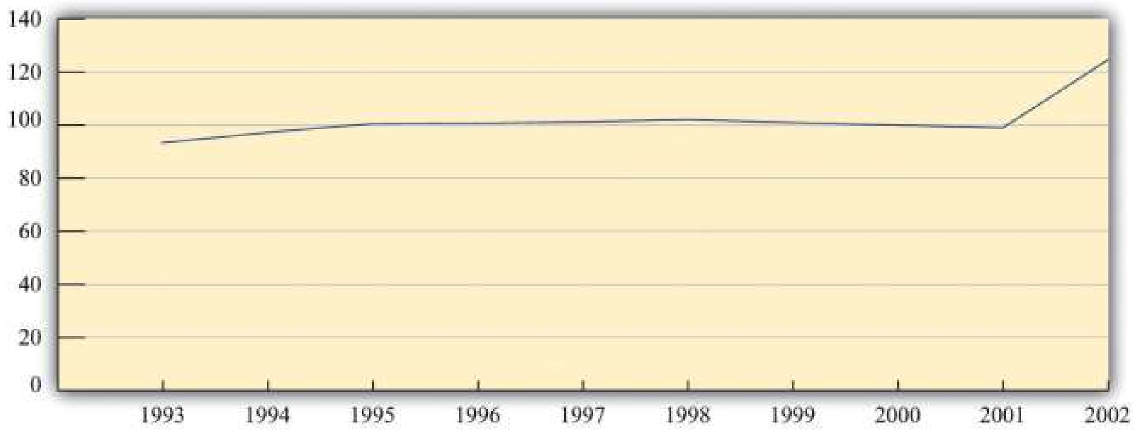

Fig. 3.9: The Price Level in Argentina

. The price level in Argentina was roughly constant between 1993 and 2001. However, there was a big jump in the price level in 2002. Source: International Monetary Fund World Economic Outlook database (http://www.imf.org/external/pubs/ft/weo/2010/01/index.htm)..

3.2.4 Calculation of the CPI in Practice

The actual calculation of the CPI is more complicated than our example suggests. The Bureau of Labor Statistics (BLS; http://www.bls.gov/cpi) is the US government agency that is responsible for this calculation, while other countries have similar agencies. The BLS procedure is, in essence, the one we have described: it compares the cost of the same bundle of goods in different years. However, the BLS confronts several difficulties that we have ignored so far.

1. **Quality changes.** Imagine that you now work for the BLS (you took this job after you left the International Monetary Fund [IMF]) and are asked to look at changes in the price of laptop computers. [6] You decide to use the IBM ThinkPad computer. You discover that in 1992 a ThinkPad cost $4,300 on average. Then you find that it is possible to purchase a ThinkPad in 2011 for $899. You calculate the percentage change in the price as ($899 − $4,300)/$4,300 = −$3,401/$4,300 = −0.79 and conclude that the ThinkPad is 79 percent cheaper than two decades previously. You report this to your boss and then go home. But then you start to worry. The 2011 ThinkPad is nothing like the 1992 version. The 1992 computer had 120 MB of

6. For the history of the ThinkPad, see "ThinkPad: A Brand That Made History," Lenovo, accessed June 28, 2011, http://www.pc.ibm.com/ca/thinkpad/anniversary/history.html; for the 2011 specifications and prices, see "Lenovo Announces Premium ThinkPad Edge E220s, E420s SMB Notebooks," ThinkPads.com, January 3, 2011, accessed July 20, 2011,http://www.thinkpads.com/2011/01/03/lenovo-announces-premium-thinkpad-edgee220s- e420s-smb-notebooks.

memory and weighed over 5.5 pounds. The 2011 ThinkPad has 4 GB of memory and weighs 2 pounds less. It has a vastly bigger hard drive, wireless Internet connection, and a superior display. In short, there were huge quality improvements over this period. A computer with the specifications of the 1992 ThinkPad would be worth much less than $899. By ignoring the improvements in quality, you have understated how much the price of computers has fallen. This problem is particularly acute for computers, but it applies to all sorts of different goods. The new car that you purchase today is very different from a car that your mother or your grandfather might have bought. Cars today come equipped with computerized braking systems, global positioning system (GPS) navigational tools, and numerous other sophisticated engineering features. They are also much more reliable; your grandparents will tell you that cars used to break down all the time, whereas now that is a relatively rare event. It would be a big mistake to say that a 2012 automobile is the same as a 1961 automobile.

2. **New goods and old goods.**The typical basket of goods bought by consumers is changing. In 1970, no one had a mobile phone, an MP3 player, or a plasma television. Similarly, people today are not buying vinyl records, videocassette recorders, or Polaroid cameras. The BLS needs to keep up with every change. As the economy evolves and new goods replace old ones, they must change the basket of goods.
3. **Changes in purchasing patterns.**The bundle purchased by the typical household also changes over time because of changes in the prices of goods and services. The typical household will substitute away from expensive goods to relatively cheaper ones. If the basket of goods is held fixed, the calculation of the CPI will overstate the increase in the cost of living. This effect is most severe if there are two goods that are very close substitutes and the price of one increases significantly relative to another.

Perhaps these seem like minor details in the calculation of the CPI. They are not. A government commission chaired by the economist Michael Boskin provided an extensive report on biases in computing the CPI in 1996. The Boskin Commission concluded the following: “The Commission’s best estimate of the size of the upward bias looking forward is 1.1 percentage points per year. The range of plausible values is 0.8 to 1.6 percentage points per year.” That is, the Boskin Commission concluded that if inflation as measured by the CPI was, say, 3.1 percent, the true inflation rate was only 2 percent. In response to these concerns with measurement, the BLS responded by taking actions to reduce the biases in the measurement of the CPI and deal more effectively with the introduction of new goods. [7]

3.2.5 Correcting for Inflation

The data on nominal and real GDP in Argentina illustrate the dangers of looking at nominal rather than real variables. Had you looked at only nominal GDP, you would

7. For the complete Boskin Commission Report, see Advisory Commission to Study the Consumer Price Index, “Toward a More Accurate Measure of the Cost of Living,” Social Security Administration, December 4, 1996, accessed June 28, 2011,http://www.ssa.gov/history/reports/boskinrpt.html. For the BLS response to the report, Saylor URL: http://www.saylor.org/books Saylor.org 54 see “Consumer Price Index: Executive Summary,” Bureau of Labor Statistics, October 16, 2011, accessed June 28, 2011, http://www.bls.gov/cpi/cpi0698b.htm.

have concluded that the Argentine economy had been growing between 1993 and 2002, when it was actually stagnating.

But many economic statistics—not only nominal GDP—are typically quoted in terms of dollars (pesos, euros, ringgit, or whatever the currency of the country is). To make sense of such statistics, we must understand whether changes in these statistics represent real changes in the economy or are simply a result of inflation.

Toolkit: Section 16.5 "Correcting for Inflation"

If you have some data expressed in nominal terms (for example, in dollars) and you want to covert them to real terms, use the following steps.

1. Select your deflator. In most cases, the CPI is the best deflator to use.
2. Select your base year. Find the value of the index in that base year.
3. For all years (including the base year), divide the value of the index in that year by the value in the base year. (This means that the value for the base year is 1.)
4. For each year, divide the value in the nominal data series by the number you calculated in Step 3. This gives you the value in base year dollars.

Here is an example of how to correct for inflation. Suppose that a sales manager wants to evaluate her company's sales performance between 2000 and 2005. She gathers the sales data shown in Table 3.5 Sales, 2000–2005.

Year	Sales (Millions of Dollars)
2000	21.0
2001	22.3
2002	22.9
2003	23.7
2004	24.1
2005	24.7

Table 3.5: Sales, 2000–2005

At first glance, these numbers look reasonably encouraging. Sales have grown every year between 2000 and 2005. But then she remembers that these data are in nominal terms, and there was also some inflation over this time period. So she decides to correct for inflation. She first goes to the Economic Report of the President and downloads the data in Table 3.6 Consumer Price Index, 2000–2005. [8]She decides to

8. See Economic Report of the President, 2011, Table B-60, accessed June 28, 2011,http://www.gpoaccess.gov/eop.

use 2000 as the base year—she wants to measure sales in year 2000 dollars. So there are two steps to her calculations, as shown in Table 3.7 Sales Data Corrected for Inflation, 2000–2005. First, she takes the CPI series and divides every term by the 2000 value (that is, 172.2). This gives the third column of Table 3.7 Sales Data Corrected for Inflation, 2000–2005, labeled “Price Index.” Then she divides each of the sales figures by the corresponding price index to obtain the real (that is, corrected for inflation) value of sales. These are given in the final column of the table.

Year	CPI
2000	172.2
2001	177.1
2002	179.9
2003	184.0
2004	188.9
2005	195.3

Table 3.6: Consumer Price Index, 2000–2005

(Source: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt) .

Year	CPI	Price Index	Sales	Real Sales
		(Base=2000)	(Millions of Dollars)	(Millions of Year 2000 Dollars)
2000	172.2	1.00	21.0	21.0
2001	177.1	1.03	22.3	21.7
2002	179.9	1.04	22.9	21.9
2003	184.0	1.06	23.7	22.2
2004	188.9	1.10	24.1	22.0
2005	195.3	1.13	24.7	21.8

Table 3.7: Sales Data Corrected for Inflation, 2000–2005

We can see that the sales data are much less rosy after we account for inflation. Sales were increasing between 2000 and 2003 in real terms, but real sales decreased in 2004 and 2005. Had she just looked at the dollar measure of sales, she would have completely missed the fact that the business had experienced a downturn in the last two years.

Economic statistics reported in the news or used by businesspeople are very often given in nominal rather than real terms. Perhaps the single most important piece of "economic literacy" that you can learn is that you should always correct for inflation. Likewise, you should be on your guard for misleading statistics that fail to make this correction. Here is an example from an article that appeared in the Washington Post. "The Clinton recovery has been far less egalitarian than the much-criticized Reagan 'era of greed.' Between 1990 and 1995, the [real average] family income actually declined slightly while the number of people with a net worth over $1 million more than doubled." [9]

Can you see why this sentence is so misleading? It mixes together a real measure and a nominal measure in the same sentence. Real family income—that is, family income corrected for inflation—declined in the first half of the 1990s. But the number of millionaires is a nominal measure. In a time of inflation, we would expect to have more millionaires, even if people are not really getting any richer.

9. See J. Kotkin and D. Friedman, "Keep the Champagne on Ice," The Washington Post, reprinted in The Guardian Weekly, June 7, 1998. In fact, the quote in the newspaper was even more misleading because it did not even make it clear that the family income figure was adjusted for inflation.

KEY TAKEAWAY

- A price index is created by calculating the cost of purchasing a fixed basket of goods in different years.
- The CPI is a price index for goods and services, including imported goods, consumed by households, while the GDP deflator is based on all the goods and services that compose GDP.
- Calculating a price index is difficult due to the introduction of new products, quality changes, and changes in purchasing patterns.

Checking Your Understanding

1. The BLS has an inflation calculator on its website (http://data.bls.gov/cgi-bin/cpicalc.pl), which is shown in Figure 3.10 "BLS Inflation Calculator".

Fig. 3.10: BLS Inflation Calculator

You enter an amount and two different years, and then it tells you the other amount. Explain the calculation that this program performs.

2. In Table 3.7 Sales Data Corrected for Inflation, 2000–2005, calculate the inflation rate (that is, the percentage change in the price index) and the growth rate of sales in each year. What is the relationship between these two variables (a) when real sales are increasing and (b) when real sales are decreasing?

3.3 The Circular Flow of Income

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. What is the circular flow of income?
2. What is the national income identity?

Looking at some basic measurements of the economy has allowed you to be more concrete about the problems in Argentina. You report back to the International Monetary Fund (IMF) team that production has been declining in recent years. You also report that there was a recent increase in the price level. As yet, though, you do not know anything about either the causes or the consequences of these events. Measurement of the economy tells you *what* has happened, but it tells you neither why it happened nor what it means. Measurement is not enough. We need frameworks to help us make sense of the data that we gather.

Economists use many different kinds of frameworks to make sense of an economy. One of the most important is called the **circular flow of income**. To understand the circular flow, recall our working definition of economic activity: “goods and services produced for sale.” So far, we have focused on production. Now we think about the “for sale” part.

Toolkit: Section 16.16 "The Circular Flow of Income"

As individuals and firms buy and sell goods and services, money flows among the different sectors of the economy. The circular flow of income describes these flows of dollars. From a simple version of the circular flow, we learn that, as a matter of accounting,

```
gross domestic product (GDP) = income = production = spending.
```

This relationship lies at the heart of macroeconomic analysis.

There are two sides to every transaction. When you purchase a piece of computer software, you give money to the seller, and the seller gives the software to you. (You might literally hand over dollar bills and receive a CD, or you might enter a credit card number into a website entitling you to a download. The idea is the same either way.) There is a flow of money from you to the seller and a flow of goods or services from the seller to you. This is true for all transactions: as individuals and firms buy and sell goods and services, money flows among the different sectors of the economy. Macroeconomists follow the money. By tracking these flows, we can understand the links between different markets; by understanding these links, we gain insight into the functioning of an economy.

One linkage is between income and spending. The spending by households on goods and services is funded by the income that households earn. But this income comes from firms, and they get *their* income from the spending of households. Thus there is a circular flow of income in an economy as a whole.

Household income comes from two main sources: (1) Households contain workers who sell their time to firms and receive wages in return. (2) Households are the ultimate owners of the firms—shareholders live in houses too—and thus any profits that firms make are returned to households. All firms in an economy are owned by someone, and any profits they make do not vanish into thin air but must eventually show up as someone's income.

Households take this income and do one of two things: they either spend it or save it. To start, let us figure out what would happen if no household income is saved. Households spend all their income, and this money becomes the revenue of firms. Firms send these revenues back to households, either as labor income or profits, and so the circular flow continues.

3.3.1 The Simplest Version of the Circular Flow

We can make this idea more precise, using the pizza economy to illustrate. Imagine that our economy is composed of two *sectors*, which we call households and firms. Households supply labor to firms and are paid wages in return. Firms use that labor to produce pizzas and sell those pizzas to households. There is a flow of goods (pizzas) from firms to households and a flow of labor services (worker hours) from households to firms. Because there are two sides to every transaction, there is also a flow of dollars from households to firms, as households purchase pizza, and a flow of dollars from firms to households, as firms pay workers.

For now, think of firms as very simple entities that pay out all the income they receive in the form of wages to workers. As a result, 300 billion pesos flow from the household sector to the firm sector (the purchase of pizzas) each year, while 300 billion pesos flow from the firm sector to the household sector (the payment of wages). These flows of pesos are illustrated in Figure 3.11 The Simplest Version of the Circular Flow . Think of this diagram as representing the interaction of many households with many firms. A particular household works for one (or perhaps a few firms) but purchases goods and services from many firms. (If you like, imagine that different firms specialize in different kinds of pizza.) A feature of modern economies is that individuals *specialize in production* of goods and services but *generalize in consumption* by consuming many varieties of goods and services.

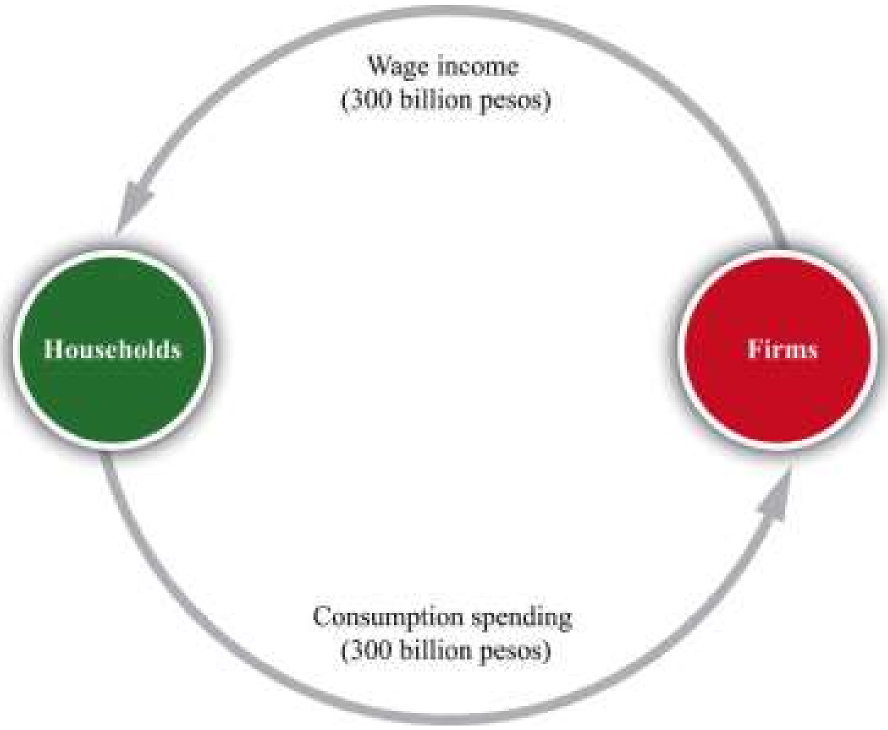

Fig. 3.11: The Simplest Version of the Circular Flow

The circular flow of income follows the money in an economy. In the pizza economy, firms produce pizzas and sell them to households, while households sell labor to firms and purchase pizzas from them.

The circular flow reveals that there are several different ways to measure the level of economic activity. From the household perspective, we can look at either the amount of income earned by households or their level of spending. From the firm perspective, we can look at either the level of revenues earned from sales or the amount of their payments to workers and shareholders. In all cases, the level of nominal economic activity would be measured at 300 billion pesos.

Corresponding to the flows of pesos shown in Figure 3.11 The Simplest Version of the Circular Flow , there are flows of goods and services between these sectors, as shown in Figure 3.12 The Flows of Goods and Labor within the Circular Flow . The wage income received by consumers is payment for labor services that flow from households to firms. The consumption spending of households is payment for the goods that flow from firms to households.

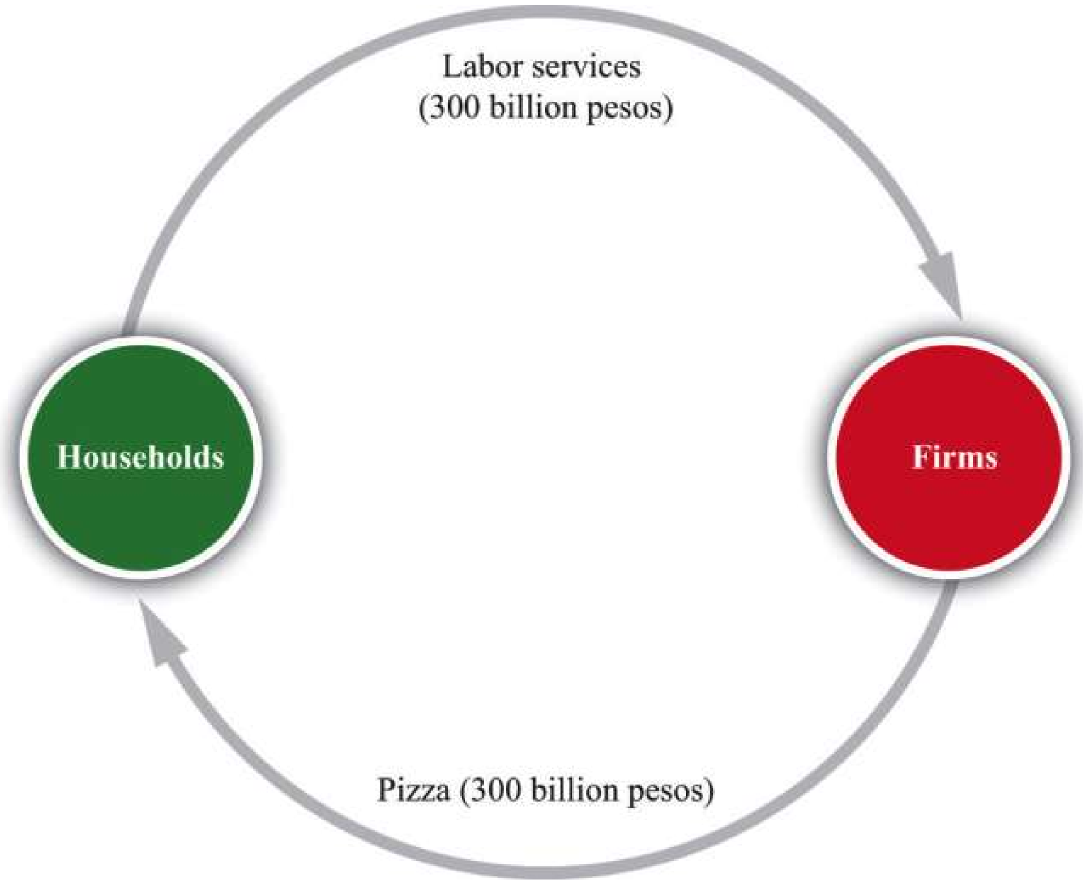

Fig. 3.12: The Flows of Goods and Labor within the Circular Flow

There are flows of goods and labor services that correspond to the flows of pesos shown in Figure 3.11 The Simplest Version of the Circular Flow . Three hundred billion pesos worth of pizza flows from firms to households, and 300 billion pesos worth of labor services flow from households to firms.

Of course, there are also flows of dollars *within* the household and firm sectors as well as between them. Importantly, firms purchase lots of goods and services from other firms. One of the beauties of the circular flow construct is that it allows us to describe overall economic activity without having to go into the detail of all the flows among firms.

Figure 3.13 Income, Spending, Payments to Inputs, and Revenues in the Simple Circular Flow shows us that the flows in and out of each sector must balance. In the household sector, total spending by the household equals total income for the household. If spending equals income for each individual household, then spending also equals income for the household sector as a whole. Similarly, each firm has a balance sheet. Accounting rules ensure that all of a firm's revenues must ultimately show up on the other side of the balance sheet as payments for the inputs that the firm uses (in our simple example, the firm's only input is labor). As this is true for each individual firm, it is also true for the sector as a whole.

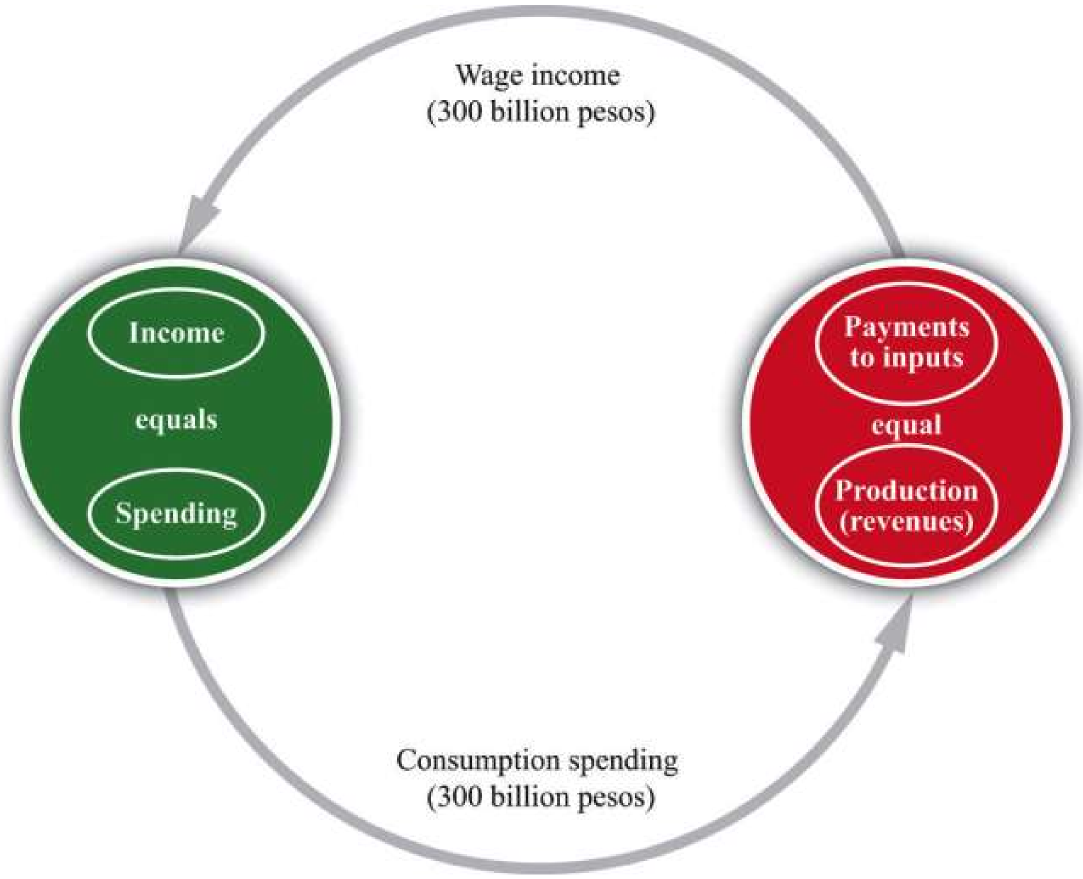

Fig. 3.13: Income, Spending, Payments to Inputs, and Revenues in the Simple Circular Flow

In each household, and thus in the household sector as a whole, income must equal spending. In each firm, and thus in the firm sector as a whole, revenues must equal payments to inputs. GDP measures the production of the economy *and total income in the economy. We can use the terms production, income, spending, and GDP interchangeably.*

Although this version of the circular flow is simple, it teaches us four key insights that remain true (albeit in slightly refined forms) in more sophisticated versions as well.

1. **Spending = production.** The total value of all spending by households becomes an inflow into the firm sector and thus ends up on the revenue side of a firm's balance sheet.The revenues received by firms provide us with a measure of the total value of production in an economy.
2. **Production = payments to inputs.** Flows in and out of the firm sector must balance. The revenues received by firms are ultimately paid out to households.
3. **Payments to inputs = income.** Firms are legal entities, not people. We may talk in common speech of a firm "making money," but any income generated by a firm must ultimately end up in the hands of real people—that is, in the household sector of an economy. The total value of the goods produced by firms becomes an outflow of dollars from the firm sector. These dollars end up in the hands of households in the form of income. (This ownership is achieved through many forms, ranging from firms that are owned and operated by individuals to giant corporations whose ownership is determined by stock holdings. Not all households own firms in this way, but in macroeconomics it is sufficient to think about the average household that does own stock in firms.)

4. **Income = spending.** We complete the circle by looking at the household sector. The dollars that flow into the household sector are the income of that sector. They must equal the dollars that flow out of the household sector—its spending.

The circular flow of income highlights a critical fact of national income accounting:

```
GDP = income = spending = production.
```

Earlier, we emphasized that GDP measures the production of an economy. Now we see that GDP is equally a measure of the income of an economy. Again, this reflects the fact that there are two sides to each transaction. We can use the terms *income*, *spending*,*production*, and *GDP* completely interchangeably.

What does this mean for your assessment of Argentina? For one thing, it tells you that the decline in real GDP implies a corresponding decline in income. Economists pay a great deal of attention to real GDP statistics for exactly this reason: such statistics provide information on the total amount of income earned in an economy.

3.3.2 The Complete Circular Flow

Figure 3.14 The Complete Circular Flow shows a more complete version of the circular flow. It includes five sectors: the household and firm sectors that we have seen already, a government sector, a financial sector, and a foreign sector. In every sector of the circular flow, accounting rules tell us that the flow of money in must equal the flow of money out. When we look at this sector by sector, we discover five accounting relationships, each playing an important role in macroeconomics. For now, we take a very quick look at each one in turn. [10]

10. When we revisit each sector in different chapters of this book, we include more precise definitions and more detailed discussion of the individual flows (such as consumption or government purchases).

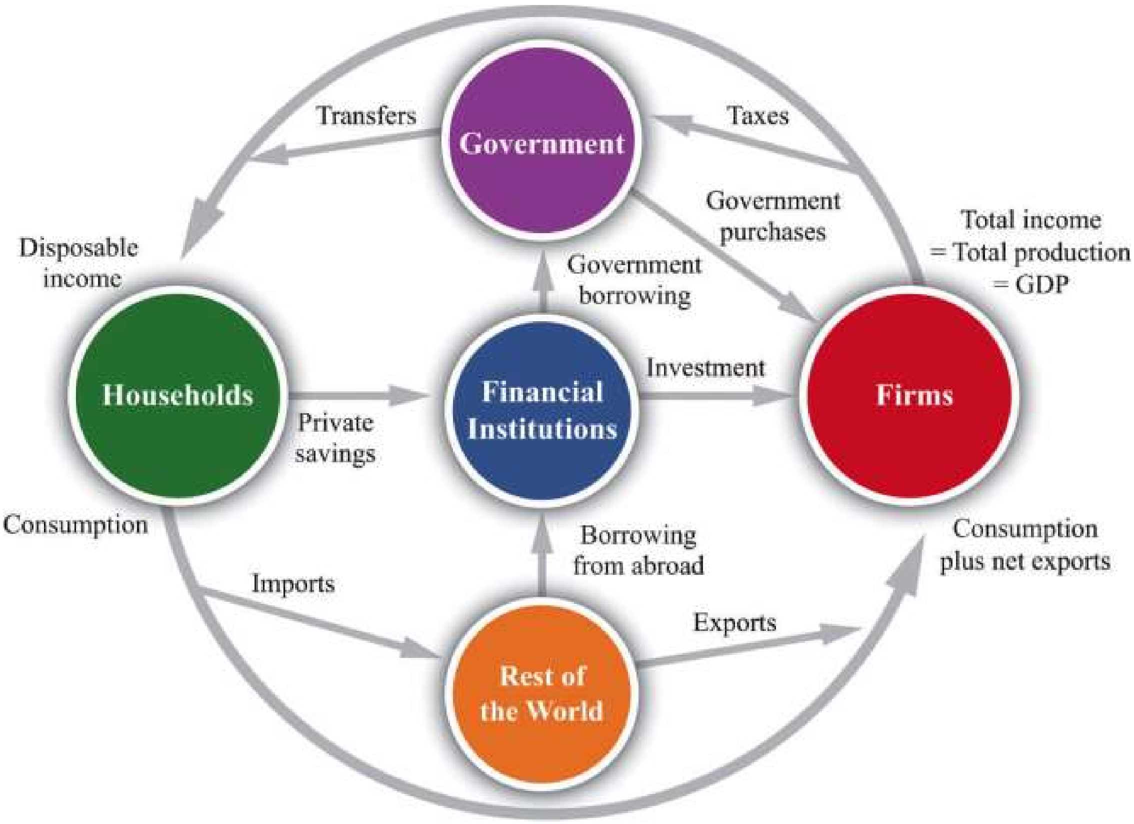

Fig. 3.14: The Complete Circular Flow The circular flow of income describes the flows of money among the different sectors of an economy. This representation includes the five main sectors: households, firms, government, the financial sector, and the rest of the world.

3.3.3 The Firm Sector

The flows in and out of the firm sector of an economy must balance. The total flow of dollars from the firm sector measures the total value of production in the economy. The total flow of dollars into the firm sector equals total expenditures on GDP, which we divide up into four categories.

Toolkit: Section 16.16 "The Circular Flow of Income" The **national income identity** is the condition that

```
production = consumption + investment + government purchases + net
exports.
```

It is the most fundamental relationship in the national accounts.

Consumption refers to total expenditures by households on final goods and services.Investment refers to the purchase of goods and services that, in one way or another, help to produce more output in the future. Government purchases are all the purchases of goods and services by the government. Net exports are the difference between exports and imports: they measures the total expenditure flows associated with the rest of the world. [11]

11. These terms are explained in detail in Chapter 7 "The Great Depression"

3.3.4 The Household Sector

Households receive income from firms. They also receive money from the government (transfers) and must pay money to the government (taxes). Households spend some of their disposable income and save the rest. In other words,

```
income + transfers − taxes = consumption + private savings.
```

There are many different ways of saving, but we do not focus on these differences. We simply imagine that households take their savings to financial markets to purchase interest-bearing assets. Some individual households are net borrowers, but, overall, the household sector saves. There is, on net, a flow of dollars from the household sector to the financial sector of an economy. These dollars are then available for firms to borrow to build new factories, install up-to-date equipment, and so on. That is, they are available for investment. [12]

3.3.5 The Government Sector

From a macroeconomic perspective, the key functions of government are as follows:

- It purchases goods and services.
- It collects revenues through personal and corporate taxes and other fees.
- It gives transfers to households.

The amount that the government collects in taxes does not need to equal the amount that it pays out for government purchases and transfers. If the government spends more than it gathers in taxes, then it must borrow from the financial markets to make up the shortfall.

Figure 3.14 The Complete Circular Flow shows two flows into the government sector and one flow out. Since the flows in and out of the government sector must balance, we know that

```
government purchases = tax revenues − transfers + government
borrowing.
```

Government borrowing is commonly referred to as the budget deficit. It is also possible that the government takes in more than it spends, in which case the government is saving rather than borrowing, so there is a budget surplus rather than a deficit. [13]

12. The flows in and out of the household sector are discussed in Chapter 12 "Income Taxes".
13. Government finances are discussed in Chapter 14 "Balancing the Budget".

3.3.6 The Financial Sector

The financial sector of an economy is at the heart of the circular flow. It summarizes the behavior of banks and other financial institutions. Most importantly, this sector of the circular flow shows us that the savings of households provide the source of investment funds for firms. On the left-hand side, the figure shows a flow of dollars from the household sector into financial markets, representing the saving of households. (Though we have not included it in Figure 3.14 The Complete Circular Flow , firms also save, by means of profits that they retain to finance new investment rather than distribute to their shareholders. As far as the national accounts are concerned, it is as if firms sent these funds to the financial market and then borrowed them back again.) When we borrow from other countries, there is a second flow of dollars into the financial markets. On the right-hand side, there is a flow of money from the financial sector into the firm sector, representing the funds that are available to firms for investment purposes. The linkage between the saving of households and the investment of firms is one of the most important ideas in macroeconomics.

The financial sector is also linked to the government sector and the foreign sector. These flows can go in either direction. As we have already seen, if the government runs a deficit, it does so by borrowing from the financial markets. There is a flow from the financial sector to the government sector. This is the case we have drawn in Figure 3.14 The Complete Circular Flow . If the government were to run a surplus, the flow would go in the other direction: government would provide an additional source of saving. The foreign sector can provide an additional source of funds for investment, if those in other countries decide they want to use some of their savings to purchase assets in our economy. In this case, there is a flow from the foreign sector into the financial sector. Again, this is the case we have drawn. If we lend to other countries, then the flow goes in the other direction.

The flows in and out of the financial sector must balance, so

```
investment + government borrowing = private savings + borrowing from
other countries.
```

3.3.7 The Foreign Sector

The foreign sector is perhaps the hardest part of the circular flow to understand because we have to know how international transactions are carried out.

Some of the goods produced in an economy are not consumed by domestic households or firms in an economy but are instead exported to other countries.

Whenever one country sells something to another country, it acquires an asset from that country in exchange. For example, suppose a US movie company sells DVDs to an Australian distributor. The simplest way to imagine this is to suppose that the distributor hands over Australian dollar bills to the movie company. The movie company—and, more generally, the US economy—has now acquired a foreign asset—Australian dollars.

Because these Australian dollars can be used to purchase Australian goods and services at some time in the future, the US economy has acquired a claim on Australia. In effect, the United States has made a loan to Australia. It has sent goods to Australia in exchange for the promise that it can claim Australian products at some future date.

Similarly, some of the goods consumed in our economy are not produced locally. For example, suppose that a US restaurant chain purchases Argentine beef. These are imports. We could imagine that the restaurant chain hands over US dollars to the Argentine farmers. In this case, the United States has borrowed from Argentina. It has received goods from Argentina but has promised that it will give some goods or services to Argentina in the future.

Of course, international transactions in practice are more complicated than these simple examples. Yet the insight we have just uncovered remains true no matter how intricate the underlying financial transactions are. Exports are equivalent to a loan to the rest of the world. Imports are equivalent to borrowing from the rest of the world.

If we import more than we export, then we are borrowing from the rest of the world. We can see this by looking at the flows in and out of the foreign sector:

```
borrowing from abroad = imports − exports.
```

If we export more than we import, then—on net—we are lending to the rest of the world, and there is a flow of dollars from the financial markets to the rest of the world.

3.3.8 The Causes of a Decrease in Real GDP

We saw that, in Argentina, real GDP decreased between 1998 and 2002. The circular flow of income tells us that when real GDP decreases, it must also be the case that real production decreases and real spending decreases. The IMF team in 2002 wanted to understand *why* real GDP decreased. We are not going to answer that question in this chapter—after all, we are still at the very beginning of your study of macroeconomics. Still, the circular flow still teaches us something very important. If real GDP decreased, then there are really only two possibilities:

1. For some reason, firms decided to produce less output. As a consequence, households reduced their spending.
2. For some reason, households decided to spend less money. As a consequence, firms reduced their production.

Of course, it could be the case that both of these are true. This insight from the circular flow is a starting point for explaining what happened in Argentina and what happens in other countries when output decreases.

KEY TAKEAWAY

- The circular flow of income illustrates the links between income and spending in an economy. In its simplest form, revenue earned by firms by selling their output ultimately flows to households, which spend this income on the output produced by firms.
- The national income identity says that total spending must equal total output and also must equal total income.

Checking Your Understanding

1. What changes in Figure 3.14 The Complete Circular Flow if the government takes in more revenue than it spends?
2. We said that borrowing from abroad equals imports minus exports. Is there an analogous relationship that holds for an individual?

3.4 The Meaning of Real GDP

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

1. When the focus is on real gross domestic product (real GDP), what aspects of economic welfare are then missed?
2. What are some other useful measures of economic welfare?

As you leave Argentina, you might well find yourself wondering about the implications of your work. You know that real GDP decreased, and from your study of the circular flow, you know that income decreased as well. Argentines have become poorer, as you might have guessed from the boarded-up stores you saw when you arrived in the country. You hope that, with the help of your observations, the International Monetary Fund (IMF) and the Argentine government will together find a way to enact good policies to increase the welfare—that is, happiness—of the individuals who live and work in the economy.

Our happiness is surely influenced by our material well-being—our ability to live in comfort; enjoy good food; have access to books, music, computers, and videogames; and so forth. In addition, it depends on our having the leisure time to enjoy these comforts; socialize with our friends; and go to movies, plays, and restaurants. However, our happiness depends on many other factors that are beyond the purview of economics and the influence of economic policymakers. Our happiness depends on our friends, families, health, and much more. Economics cannot help us very much with such matters. So, you wonder, is it enough to look at real GDP?

3.4.1 Real GDP and Economic Welfare

Real GDP is certainly a useful indicator of how well an economy is performing. This does not necessarily mean that it tells us about the welfare of those who live there. Some countries, such as China or India, have a large real GDP simply because they have large populations. Living standards in these countries are nonetheless relatively low because the large GDP must be shared by a very large number of people. To correct for this, we look at real GDP *per person*, which measures how much GDP would be available if we shared it equally across the entire population.

If two countries have substantially different levels of real GDP per person, we can fairly reliably infer that the richer country, by this measure, is also the country with higher living standards. Real GDP per person in Germany is about 25 times greater than real GDP per person in Kenya. Even a few minutes spent in the streets of Nairobi and Berlin would confirm that Germany enjoys much higher material living standards. However, when we compare countries with similar levels of real GDP per person, it is rash to assume that a richer country necessarily enjoys a higher standard of living. This is because there are several ways in which real GDP per person is flawed as an indicator of economic welfare.

Remember, first, that GDP measures market transactions only. National income accounts can measure activities that are traded only in markets. If people clean their own homes, tend their own gardens, repair their own cars, or cook their own meals, these activities are not included in our measurement of GDP. (There are a few exceptions. Most notably, GDP statistics impute a value to owner-occupied housing: GDP statistics effectively pretend that homeowners rent their houses from themselves.)

This leads to some unfortunate inconsistencies in GDP accounting. Suppose you and your neighbor both work as auto mechanics. If you each maintain and repair your own cars, these activities do not show up in GDP. But if you hire your neighbor to maintain your car, and she hires you to repair her car, then GDP *does* include this economic activity. Yet another possibility is that you barter with your neighbor, so she looks after your car and you look after hers but no money changes hands. Again, this work goes unrecorded in national accounts. Barter is more prevalent in developing countries than in developed countries and causes more of a problem for measurement of GDP in poorer countries. It is a particular source of difficulty when we want to compare economic activity in different countries.

People also value their leisure time. GDP measures the goods and services that people consume but does not tell us anything about how much time they must give up to produce those goods. For example, people in the United States are richer, on average, than people in Spain. But people in the United States work longer hours than people in Spain, and Spanish workers also enjoy much longer vacations. If we use measures of GDP to compare welfare in the United States and Spain, we will capture the fact that Americans can afford more DVD players, but we will miss the fact that they have less time to watch DVDs. GDP measures *material* well-being rather than *overall* welfare.

The economic activity that goes into the production of GDP also often has negative consequences for economic welfare that go unmeasured. A leading example is pollution. Coal-generated power plants generate sulfur dioxide as a by-product of the production of electricity. When sulfur dioxide gets into the atmosphere, it leads to acid rain that damages forests and buildings. This damage is not accounted for in GDP. Emissions from automobiles contribute to the buildup of greenhouse gases in the atmosphere, contributing to global climate change. They also generate smog (technically, particulate matter) that is damaging to health. These adverse effects are not accounted for in GDP. [14]

Critics sometimes argue that GDP not only fails to measure negative effects from production but also erroneously includes measures taken to offset those measures. This criticism is misplaced. Consider the 2010 oil spill in the Gulf of Mexico. The environmental damage from that spill is not included in GDP, which is indeed a problem with using GDP to measure welfare. The costs of cleaning up the gulf are included in GDP, and the inclusion of cleanup costs *does* make GDP a better measure of welfare. To clean up means to produce a cleaner environment from a dirty environment, which increases economic welfare. The problem is the failure to include the original environmental damage, not the inclusion of the cleanup costs.

Finally, real GDP is an aggregate measure. It does not reflect the ways in which goods and services are distributed across the many households of an economy. In comparing two economies, we may feel differently about an economy in which resources are distributed relatively equitably compared to one in which some people are very rich and others are very poor, even if overall real GDP per person is the same. Similarly, we may feel quite differently about changes in real GDP depending on who is reaping the benefit of those changes.

In summary, real GDP is far from a perfect measure of economic welfare, but then again it is not designed to be. It is designed to measure economic activity, and it is—at best—an imperfect measure of material well-being. Nevertheless, when we want to understand what is happening to overall economic well-being or get an idea of comparative welfare in various countries, we begin with real GDP per person. For all its flaws, it is the best single indicator that we have.

3.4.2 Other Indicators of Societal Welfare

Because real GDP is an imperfect a measure of well-being, we look at other statistics as well to gauge overall economic welfare. Here are some examples of economic statistics that we also use as indicators of economic welfare.

14. There have been many attempts by economists to amend the GDP measure to take environmental issues into account. For an early discussion on this issue, see William D. Nordhaus and James Tobin, "Is Growth Obsolete?" Yale University, Cowles Foundation paper 398, accessed June 28, 2011, http://cowles.econ.yale.edu/P/cp/p03b/p0398a.pdf

3.4.3 Unemployment

The **unemployment rate** is one of the most frequently cited statistics about the macroeconomy; it is the percentage of people who are not currently employed but are actively seeking a job. It signals the difficulty households face in finding employment. GDP data are reported on a quarterly basis only, but unemployment statistics are reported monthly and so contain more up-to-date information than GDP. [15]

Figure 3.15 The Unemployment Rate in the United States shows the unemployment rate in the United States from 1940 to 2010. On average, the rate of unemployment over this period was 6.0 percent. The unemployment rate was at its highest—14.6 percent—in 1940 and its lowest—1.2 percent—in 1944. The low unemployment in 1944 was largely due to World War II (and is an indication that low unemployment is not always a sign that all is well in an economy). From 1995 to 2008, the unemployment rate was never above 6 percent, but it jumped to 9.3 percent in the major recession of 2008 and by mid-2011 had still not fallen back below 9 percent.

Fig. 3.15: The Unemployment Rate in the United States

(Source: http://www.bls.gov/cps/home.htm) .

In the United States, defining and measuring the unemployment rate and other labor market variables is the job of the Bureau of Labor Statistics (BLS;http://www.bls.gov/cps/home.htm). Each month, about 60,000 households are asked about their recent employment experience. The BLS takes care to be sure that the sample is representative of the entire population of the United States. Notice that it is *households*who are interviewed, not people. So when a household is interviewed, information is acquired about all household members age 16 and over. [16] As a consequence of the interview, individuals are placed in one of three categories: (1) out of the labor force, (2) in the labor force and working, and (3) in the labor force and

15. Chapter 8 "Jobs in the Macroeconomy" contains more discussion of the definition and measurement of the unemployment rate
16. To be more precise, in addition to being age 16 or older, the survey excludes people in an institution (such as prison) or in the armed forces.

looking for a job. Similar surveys are conducted to measure unemployment in other countries.

The (civilian) **labor force** is all individuals who are either working or actively looking for work. That is, it comprises all employed and unemployed workers. Individuals who are not in the labor force are neither employed nor looking for a job. These include those at school or choosing to stay at home. Individuals in the labor force are either employed or seeking work. Employment can be temporary or even part time; as long as someone has a job, he or she is counted as employed. Those who are not at work due to vacation, illness or family issues but who still have jobs are also counted as employed.

The other group in the labor force is a bit more problematic: what exactly does it mean to be looking for a job? The BLS considers you unemployed if you do not have a job and have been seeking one during the past four weeks. Here, "seeking" is intended to be active (going out for job interviews), not passive (reading want ads). Individuals on temporary layoff are considered to be unemployed even if they are not actively looking for a new job. The BLS does not directly ask individuals to classify themselves into one of these three categories. Instead, BLS interviewers ask a series of questions to facilitate the classification. The sum of the civilian labor force and those out of the labor force equals the civilian working age population. Figure 3.16 The Unemployment Rate in Argentinashows the unemployment rate in Argentina between 1993 and 2002. Unemployment was quite high throughout this period: it was in excess of 10 percent in every year from 1994 onward. In addition, the unemployment rate increased substantially in the period when real GDP was decreasing, from 12.8 percent in 1998 to almost 20 percent in 2002. The economic distress you witnessed on the streets of Buenos Aires is reflected in this statistic.

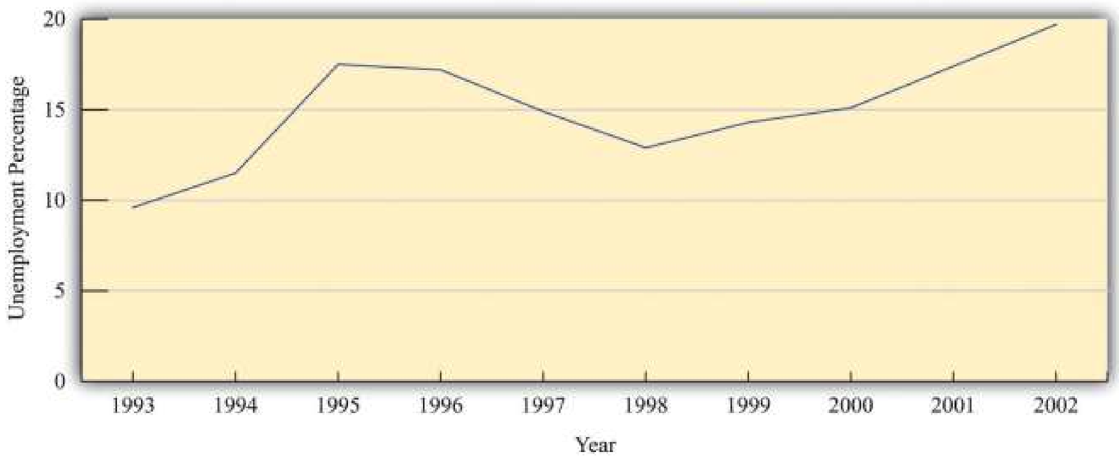

Fig. 3.16: The Unemployment Rate in Argentina The unemployment rate in Argentina was about 10 percent in 1993. It increased sharply over the next two years, decreased somewhat in the mid to late 1990s, and then increased again to almost 20 percent in 2002. Source: Ministra de Economía y Producción de Argentina.

3.4.4 Real Wages

Average real GDP figures tell us nothing about how GDP is shared in an economy. They tell us how big the pie is but not who has the largest and smallest slices. Economists therefore also look at other measures that tell us about the economic environment as it is experienced by workers and households.

Wages in an economy provide a sense of how workers are doing. However, the wage in dollars—the nominal wage—is not the best indicator. While salaries and pay scales for jobs are quoted in dollar terms, decisions on whether or not to take a job and how many hours to work at that job depend on what those dollars can buy in terms of goods and services. If all prices in the economy were to double, then $10 would buy only half as much as it used to, so a job paying $10 an hour would seem much less attractive than it did before.

For this reason, we instead look at the **real wage** in the economy. As with real GDP, *real* here refers to the fact that we are correcting for inflation. It is real wages—not nominal wages—that tell us how an economy is doing. To convert nominal wages to real wages, we need a price index, and because we are looking at how much households can buy with their wages, we usually choose the Consumer Price Index (CPI) as the index.

Toolkit: Section 16.1 "The Labor Market"

The real wage is the wage corrected for inflation. To obtain the real wage, simply divide the wage in dollars—the nominal wage—by the price level:

$$\text{real wage} = \frac{\text{nominal wage}}{\text{price level}}.$$

Figure 3.17 Real and Nominal Wages shows the nominal (hourly) wage paid to private sector industrial workers from 1964 to 2010. Over this period, the nominal wage rate increased almost eightfold from a low of $2.50 in January 1964 to nearly $19.00 by the end of the period. [17] The real wage series in Figure 3.17 Real and Nominal Wages shows the nominal wage divided by the CPI (times 100 so that the real and nominal wages are equal in the base year of the CPI). The nominal wage increased over this period by over five times, but the real wage actually decreased at times. It peaked at near $9.50 in 1973, decreased to $7.62 in 1995, and has risen only slowly since that time.

17. Average Hourly Earnings: Total Private Industries" from the Bureau of Labor Statistics, The Employment Situation, which is seasonally adjusted. The CPI is the "Consumer Price Index for All Urban Consumers: All Items CPIAUCNS," Bureau of Labor Statistics Consumer Price Index, 1982 − 84 = 100.

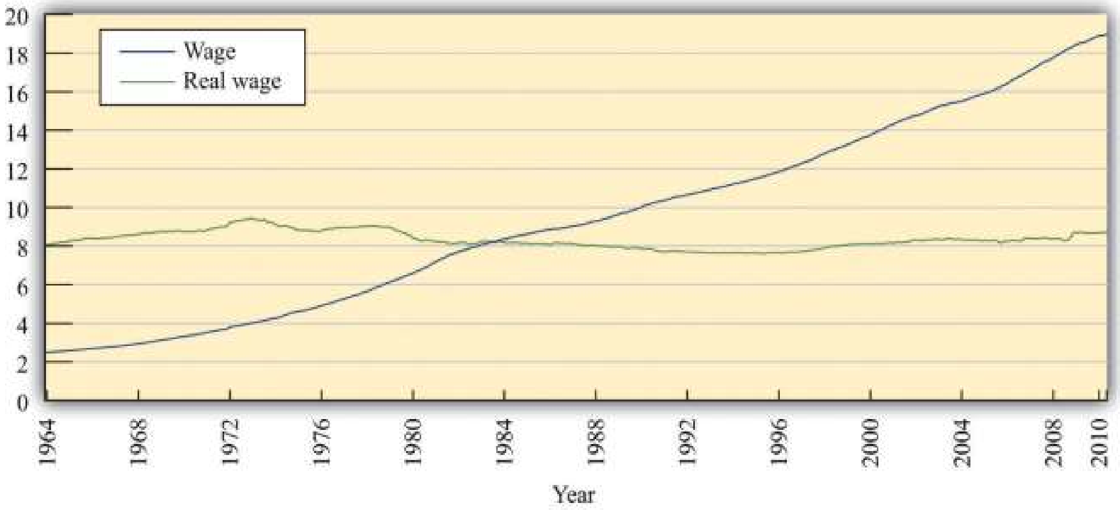

Fig. 3.17: Real and Nominal Wages

(Source: US Department of Labor, Bureau of Labor Statistics, http://stats.bls.gov/lpc/data.htm) .

It is a remarkable fact that, even though US real GDP is now more than 150 percent greater than it was in the early 1970s, real wages are still significantly lower than they were at that time. What is going on here? Part of the story is that other forms of nonwage compensation have become increasingly significant over the past few decades. The most important of these are health-care benefits. When these and other benefits are included, we find that overall compensation has increased reasonably steadily and is about 50 percent greater now than in the early 1970s. [18]Total compensation is, in fact, a better measure than real wages. Even so, total compensation has been increasing at a far slower rate than real GDP over the last few decades.

3.4.5 Noneconomic Indicators of Welfare

We turn finally to some noneconomic measures of societal welfare, such as statistics on health and education. Table 3.8 Noneconomic Indicators of Welfare shows some examples of indicators for four countries. [19] Large differences in GDP per person, such as the difference between the United States and Argentina, are reflected in these other measures. GDP per person is about three times greater in the United States than in Argentina, and the United States also has higher adult literacy, higher secondary school enrolment, lower infant mortality, and higher life expectancy.

18. More precisely, real hourly compensation in the nonfarm business sector increased by 51.7 percent between 1970 and 2007. See "Labor Productivity and Costs," Bureau of Labor Statistics, accessed June 28, 2011, http://stats.bls.gov/lpc/data.htm.
19. The World Factbook," Central Intelligence Agency, accessed June 28, 2011,https://www.cia.gov/library/publications/the-world-factbook/index.html; "The Complete World Development Report Online," World Bank, accessed June 28, 2011,http://wdr2011.worldbank.org/WDR2011_Data.

Indicator	United States	United Kingdom	Greece	Argentina
GDP per person, 2005($US)	42,000	30,900	22,800	13,700
Infant mortality rate, 2006 (deaths per 1,000 live births)	6.43	5.08	5.43	14.73
Life expectancy at birth, 2006 (years)	77.85	78.54	79.24	76.12
Adult literacy rate, 2003(%)	99.0	99.0	97.5	97.1
Secondary school enrollment ratio, 2002-3(%)	88	95	86	81

Table 3.8: Noneconomic Indicators of Welfare

Differences in GDP per person are a much less reliable guide when we compare relatively rich countries. For example, the United States has greater GDP per person than the United Kingdom or Greece. But both of those countries have lower infant mortality rates and higher life expectancy. They also have similar rates of literacy and school enrollment. In fact, based on these measures, the United Kingdom looks like a more attractive country to live in than the United States, even though its GDP per person is 25 percent lower.

KEY TAKEAWAY

- Real GDP measures total output and thus total income in an economy, but it does not measure economic activity at home, ignores income distribution, and excludes the effects of economic activity on the environment.
- Measures of unemployment, real wages, and indicators of health and education are also useful indicators of economic welfare.

Checking Your Understanding

1. If there is an increase in investment and an associated increase in real GDP, why does this increase economic welfare?
2. If there is a decrease in real wages and an offsetting increase in a firm's profits, does this affect overall household income? If not, what effect does it have on the household sector?

3.5 End-of-Chapter Material

In Conclusion

Understanding the meaning and measurement of macroeconomic variables is vital for your ability to evaluate the abundance of information you receive through various forms of the media about the state of the aggregate economy. The difficulties faced by the team of International Monetary Fund (IMF) economists with which we opened the chapter are not that different from the problems each of us faces in understanding what is happening in the economy. The concepts and variables you have discovered in this chapter are used over and over again in the various applications discussed in this book. We use the concepts of real gross domestic product (real GDP), the inflation rate, the unemployment rate, and so forth almost everywhere in our study of macroeconomics.

3.5.1 Key Links

- Economic Report of the President: http://www.gpoaccess.gov/eop/tables06.html
- Bureau of Labor Statistics (BLS): http://www.bls.govUnemployment:
    - http://www.bls.gov/cps/home.htm
    - CPI: http://www.bls.gov/cpi
- Bureau of Economic Analysis (BEA): http://www.bea.gov
- World Economic Outlook, International MonetaryFund:http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/index.aspx
- World Bank: http://www.worldbank.org

EXERCISES

1. Which of the following variables are stocks? Which are flows?
    1. The number of cars parked on the street where you live.
    2. The number of cars that drive past your house every day.
    3. The number of people losing their jobs and becoming unemployed. The blue jeans on the shelves of a GAP store.
    4. The amount of water in a reservoir.
    5. The amount of money you have on your person right now.
    6. The amount of money you spent this week.
2. Suppose an economy produces at least as much—and maybe more—of every good and service this year compared to last year. Also suppose that the price of every single good and service is at least as high this year as it was last year. What, if anything, can you conclude about nominal GDP, real GDP, and the price level between the two years?
3. Why do we exclude intermediate goods when calculating GDP?
4. Redo Table 3.3 "Real GDP Using 2012 as the Base Year" assuming that 2013 is the base year.
5. Suppose that Australia had nominal GDP last year equal to 1 trillion Australian dollars and that in the first quarter of this year, its nominal GDP is 252 billion Australian dollars. What is Australia's annualized growth rate of nominal GDP?
6. Suppose that, between 2012 and 2013, a country experiences 3 percent negative inflation (this is known as deflation). In other words, prices are on average 3 percent lower in 2013 compared to 2012. However, the economy also experiences real economic growth of 5 percent. Is nominal GDP in 2013 greater or less than in 2012?
7. If nominal GDP in country A grows faster than nominal GDP in country B, what, if anything, can you conclude about the inflation rates in the two countries?
8. Suppose that the price of Brazilian coffee decreases. What does that imply for the Consumer Price Index (CPI) in Germany? What does that imply for the GDP deflator in Japan?
9. Is it possible for prices to be increasing and the inflation rate to be decreasing at the same time? Explain why or why not.
10. Is it possible for an economy's production to increase at the same time that total income in the economy decreases? Explain why or why not.
11. Which of the following people are classified as unemployed?
    1. A full-time student who also works part time in a store selling Cds.
    2. A worker who would like a job but has given up looking because she was unable to find one.
    3. An autoworker who was recently laid off and is looking for a new job.
    4. A member of the military who is not currently on active duty.

5. A woman on maternity leave from her job.
6. A 70-year-old man who is actively applying for jobs.

12. Give three reasons why real GDP is an imperfect measure of economic welfare.

Economics Detective

1. Update Table 3.2 Nominal GDP in the United States, 2000–201 and Figure 3.3 Nominal GDP in the United States, 2000–2010 using data from the Bureau of Economic Analysis (BEA). Using the IMF World Economic Outlook Database (http://www.imf.org/external/pubs/ft/weo/2010/01/weodata/index.aspx), create tables to show nominal GDP, the GDP price deflator, and real GDP for Argentina.
2. A version of GDP that takes into account environmental effects is called "environmental accounting" or "green accounting." Use the Internet to find a discussion of this alternative way of calculating GDP. List some of the differences between the usual way of calculating GDP and the environmental or green accounting method. Do other countries employ these alternative measures?
3. Try to find out whether people in richer countries are happier than those in poorer countries.

Spreadsheet Exercise

Year	T-shirts		Music Downloads		Meals	
	Price ($)	Quantity	Price ($)	Quantity	Price ($)	Quantity
2012	20	12	1	60	25	5
2013	30	10	1.80	50	23	2

Table 3.9: DATA

Using the data in the preceding table, reconstruct Table 3.1 Calculating Nominal GDP to calculate nominal GDP, Table 3.3 Real GDP Using 2012 as the Base Year to calculate real GDP, and Table 3.4 Calculating the Price Index to calculate a price index and the inflation rate.

Chapter 4 The Interconnected Economy

A Financial Crisis in the News

Here are some headlines from the fall of 2008. If you were following the news during this time period, you probably saw stories like these. The first excerpt talks about houses in the United States.

Fallout from Financial Crisis Hammers Housing

The nation is on track to build fewer homes this year than at any time since the end of World War II, adding to the woes of an economy that analysts said Friday has almost certainly entered a recession.

[...]

David Seiders, chief economist for the group, said builders are being hit by a double whammy from the financial turmoil: It's harder for them to get loans to pursue new houses, and more difficult to sell those they do build.

[...] [***Martin Crutsinger, "Fallout from Financial Crisis Hammers Housing," USA Today, Money, October 17, 2008, accessed June 28, 2011, http://www.usatoday.com/money/topstories/2008-10-16-3784489146_x.htm.***]

The next excerpt also concerns housing but this time in the United Kingdom.

Financial Crisis: House-Price Slump to Cost Economy £50 Billion

House prices are set to fall 35 per cent from last year's peak, as the property slump costs the wider economy almost £50bn as people stop buying homes, economists warned.

With house prices predicted to make their biggest fall in British history by dropping 35 per cent by autumn next year, the associated consumer spending is expected to plunge, they said.

[...]

This is expected to have a huge impact on the wider economy as each house sale triggers around £4,000 in new spending on household goods, on items such as washing machines and other white goods.

[...]

The lack of spending in these areas will hit employment, with some analysts forecasting that the construction sector alone could see a loss of up to 350,000 jobs within the next five years.

[...] [***Myra Butterworth, “Financial Crisis: House-Price Slump to Cost Economy £50 Billion,” The Telegraph, October 21, 2008, accessed June 28, 2011,http://www.telegraph.co.uk/finance/economics/houseprices/3235741/Financial-crisisHouse-price-slump-to-cost-economy-50-billion.html.***]

Taking these excerpts together, we notice four things: (1) There was a housing slump—fewer houses being bought and sold, and house prices decreasing—in both the United Kingdom and the United States at around the same time. (2) Both are linked to a financial crisis. (3) These slumps affect other parts of the economy. (4) The housing problems lead to job losses.

The next excerpt tells us that the crisis also affected the value of the US dollar.

Financial Crisis Has One Beneficiary: The Dollar

The great market upheaval of 2008 has stripped 45 percent from the value of global equities, led bank lending to nearly dry up and caused commodity prices to crash from stratospheric heights. And now, paradoxically, it is helping to lift the long-suffering dollar.

[...] [***See David Jolly, “Global Financial Crisis Has One Beneficiary: The Dollar,” New York Times, October 22, 2008, accessed June 28, 2011,http://www.nytimes.com/2008/10/22/business/worldbusiness/22ihtdollar.4.17174760.html. ***]

This excerpt tells us that the financial crisis has also affected other prices in the economies of the world. The price of equities—shares in companies—decreased, as did the price of goods such as basic minerals (copper and tin, for example) and basic foods (rice and coffee, for example). But even as these items became less valuable, the US dollar became more valuable. The price of the US dollar increased.

The Chinese economy was also affected by the crisis:

Agricultural Products Export Growth Slows Down in 2008

China’s agricultural products exports rose 9.8 percent year-on-year in 2008 to $40.19 billion, the General Administration of Customs said on Wednesday.

According to the statistics, export growth declined 8.2 percentage points from a year earlier. Exports in the last two months of 2008 fell 6.9 percent and 7.2 percent to $3.47 billion and $3.76 billion respectively over the same period of 2007.

Although the country has increased export rebates for some agricultural products and lowered or even canceled the export tax, exports are unlikely to see a quick rebound in the near future. Poor overseas demand and falling prices in the international market amid the financial crisis, as well as the increasing distrust in China’s food quality are likely to stifle export growth, the General Administration of Customs said.

[...] [***See Tong Hao, “Agricultural Products Export Growth Slows Down in 2008,” China Daily, February 11, 2009, accessed June 28, 2011, http://www.chinadaily.com.cn/bizchina/200902/11/content_7467089.htm.***]

The excerpt tells us that China’s exports of agricultural products have been growing rapidly, reaching a growth rate of nearly 10 percent in 2008. But they had been growing even faster in the previous year. The effects of the financial crisis and the economic downturn are clear: the amount of exports decreased at the end of 2008 (and in fact fell throughout 2009 as well).

We have shown a few headlines about the impact of the 2008 financial crisis. We could have picked thousands of others. For example, if you enter into a search engine the terms *financial crisis* and *XYZ*, where XYZ is just about any product or international currency, you will probably find dozens, perhaps hundreds, of articles. The financial crisis of 2008 affected just about every market—all around the world.

Our task in this chapter is certainly not to fully understand these events. Our goals here are much more modest. First, we want to develop the supply-and-demand framework—perhaps the most basic tool in economics—to understand how an event affecting some good or service leads to changes in the price of that good or service as well as changes in the quantity that is bought and sold. Second, we want to explore some of the ways in which different markets in the economy are linked, for linkages across markets are among the most important features of macroeconomic analysis. The financial crisis is a good illustration because this single event affected so many markets.

Understanding the sources and consequences of changing prices and quantities in the economy is one of the key tasks of an economist. There is an almost endless list of such analyses in economics. In fact, most of the applications in this textbook ultimately come down to understanding, explaining, and predicting changes in prices and quantities. The two questions that motivate this chapter are as follows:

What determines price and quantity in a market?

How are markets interconnected?

Road Map

The story of the crisis of 2008 is fascinating and worth understanding in some detail. We begin with the basics of supply and demand, looking at a single market—the market for houses. We explain how the equilibrium price and quantity in this market are determined, which allows us to understand why the price of housing changes. This is a first step to understanding the crisis of 2008 because the housing market was central to that story.

The story began in the housing market but did not end there. It spread across the economy and across the world. Hence we next look at three significant markets in the economy: the labor market, the credit market, and the foreign exchange market. Understanding how these three markets work is necessary for a good understanding of macroeconomics. We use these markets to provide more illustrations of supply and demand in action. Finally, we look at how markets are linked together to see how what might have seemed like a minor problem in one market turned into a cataclysmic event for the world's economies.

Throughout this chapter, we use the term "the crisis of 2008" as shorthand, but the first signs of the crisis emerged well before that year, and the effects of the crisis are still being felt several years later. The crisis was a complex event, and right now, at the beginning of your studies of macroeconomics, we are not yet ready to delve deeply into a detailed analysis of those events. We return to the crisis in Chapter 15 "The

Global Financial Crisis", which is a capstone chapter that brings together most of the tools of macroeconomics from this book.

4.1 Housing Supply and Demand

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What factors underlie the demand for housing?

What factors underlie the supply of housing?

What determines the amount of housing traded and the price of housing?

The first two articles we quoted from made it clear that the housing market was heavily affected by the financial crisis. More than that, it was where the crisis began—and so it is where we begin our story.

We start with the market for new homes, which are part of real gross domestic product (real GDP). (The buying and selling of existing homes is not counted in GDP.) New homes are supplied by construction firms and demanded by families wishing to live in a new home. New homes are also bought by speculators who purchase houses in the hope that they can resell them for a higher price in the future.

Toolkit: Section 16.6 "Supply and Demand"

Supply and demand is a framework we use to explain and predict the equilibrium price and quantity of a good. A point on the market supply curve shows the quantity that suppliers are willing to sell for a given price. A point on the market demand curve shows the quantity that demanders are willing to buy for a given price. The intersection of supply and demand determines the equilibrium price and quantity that will prevail in the market.

The toolkit contains a presentation of supply and demand that you can use for reference purposes in this and the following chapters.

The supply-and-demand framework applies to the case that economists call a**competitive market**. A market is said to be competitive, or, more precisely, to exhibit perfect competition, under two conditions:

1. There are many buyers and many sellers, all of whom are small relative to the market.
2. The goods that sellers produce are perfect substitutes.

In a competitive market, buyers and sellers take the price as given; they think their actions have no effect on the price in the market.

4.1.1 Demand

The market demand for housing is shown in ***Figure 4.1 "The Market Demand for Houses". We call this the **market demand curve** because it reflects the choices of the many households in the economy. In macroeconomics, we typically look at markets at this level of aggregation and do not worry much about the individual decisions that underlie curves such as this one.

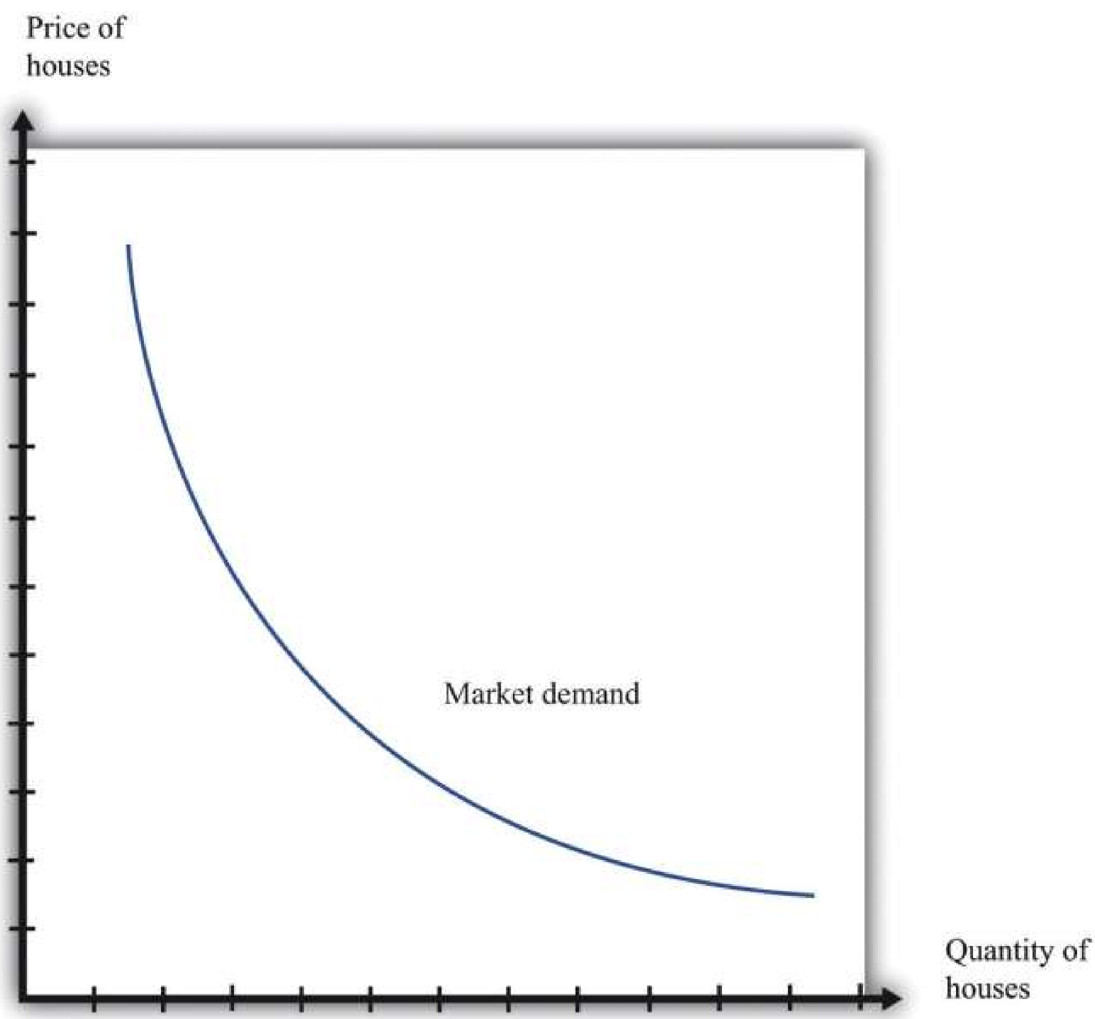

Fig. 4.1: Figure 4.1 The Market Demand for Houses The market demand curve shows the quantity of houses demanded at each price.

As the price of housing decreases, the quantity demanded increases. This is an example of the law of demand, which derives from two effects:

1. As the price of a good or service decreases, more individuals choose to buy a positive quantity rather than zero.
2. As the price of a good or a service decreases, individuals choose to buy a larger quantity.

In the case of the market for housing, the first of these is more important. Most people own either zero houses or one house. As houses become cheaper, more people decide that they can afford a house, so the quantity demanded increases. A few people might decide to buy an additional house, but they would presumably be in the rich minority. For other goods, such as chocolate bars or shoeshines, the second effect is more important: as price decreases, people increase the quantity that they buy.

4.1.2 Shifts in Demand

When we draw a demand curve, we are varying the price but *holding everything else fixed*. In particular, we hold fixed the level of income, the prices of other goods and services in the economy, and the tastes of households. If these other factors change, then the market demand curve will *shift*—that is, the quantity demanded will change at each price.

A leftward shift of the market demand curve for houses, as indicated in ***Figure 4.2 "A Shift in the Market Demand Curve", could be caused by many factors, including the following:

- A decrease in the incomes of households in the market
- Concerns about the future health of the economy
- A reduction in the price of a typical apartment rental
- An increase in the interest rates for mortgages
- A change in social tastes so that buying a house is no longer viewed as a status symbol

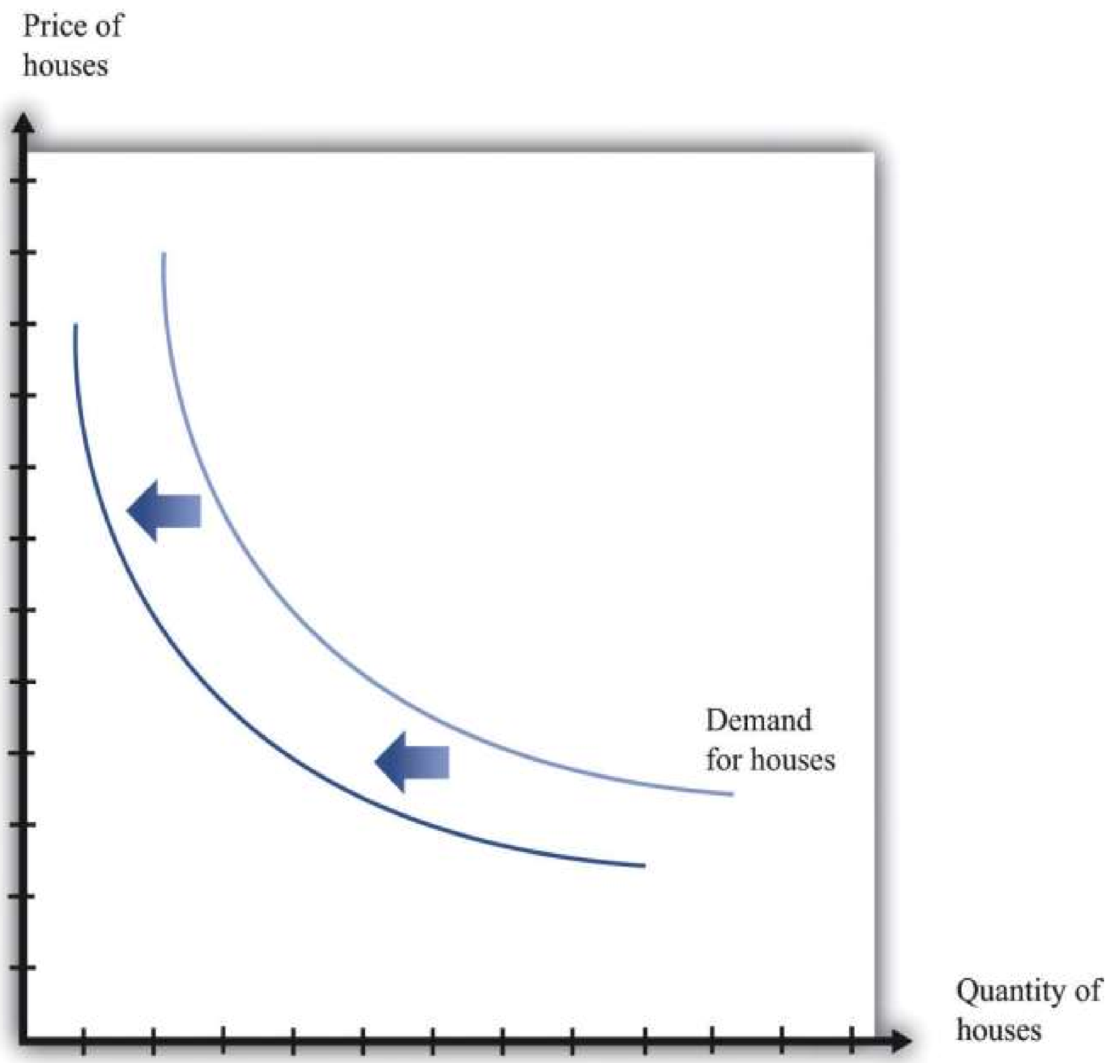

Fig. 4.2: Figure 4.2 A Shift in the Market Demand Curve If there is a decrease in demand for houses, then fewer houses are demanded at each price. The demand curve shifts leftward.

4.1.3 Supply

The counterpart to the market demand curve is the **market supply curve**, which is obtained by adding together the individual supply curves in the economy. The supply curve slopes upward: as price increases, the quantity supplied to the market increases. As with demand, there are two underlying effects.

1. As price increases, more firms decide to enter the market—that is, these firms produce some positive quantity rather than zero.
2. As price increases, firms increase the quantity that they wish to produce.

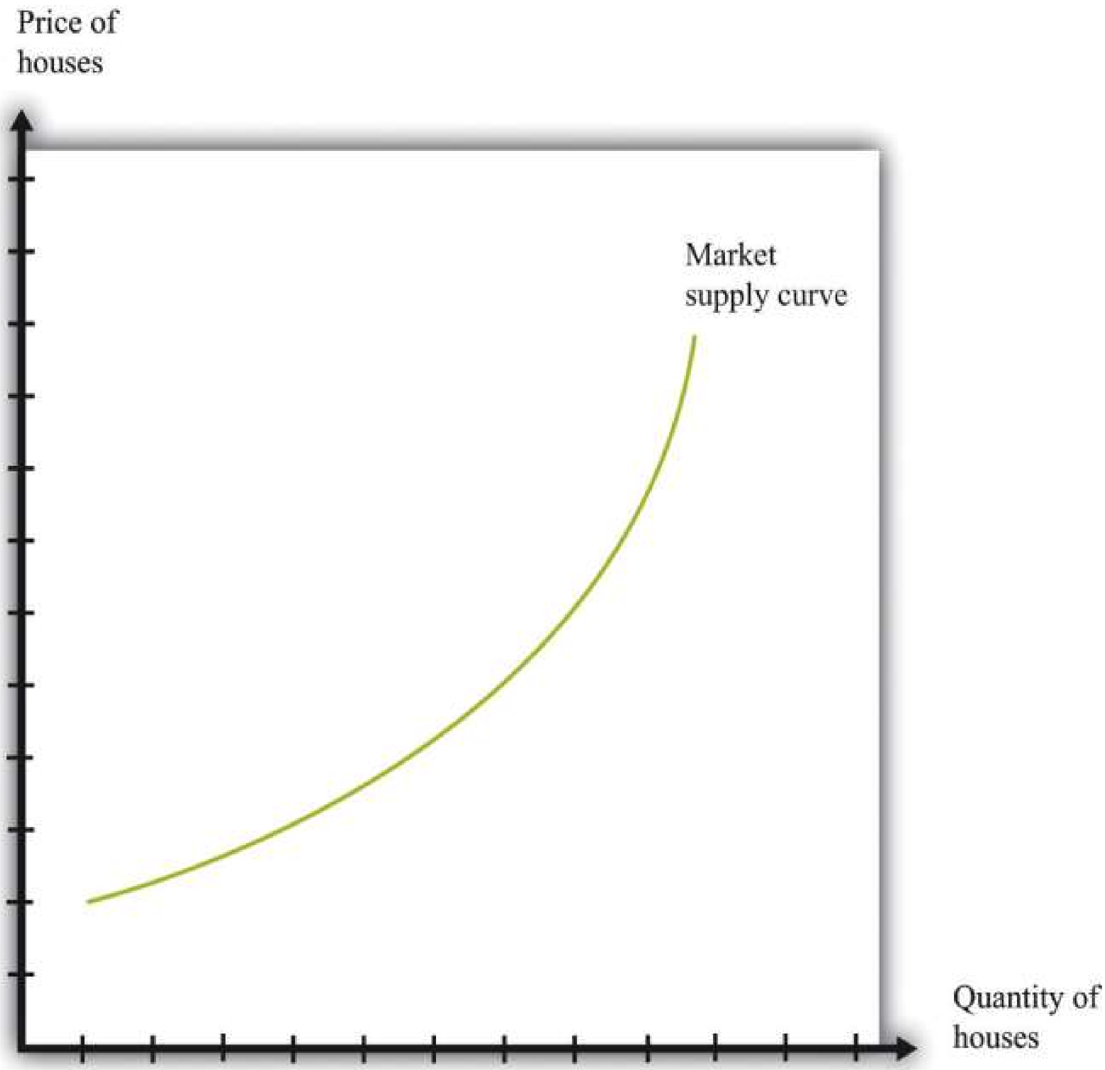

Fig. 4.3: Figure 4.3 The Market Supply of Houses The market supply curve shows the quantity of houses supplied at each price. It has a positive slope: as the price of houses increases, the number of houses supplied to the market increases as well.

4.1.4 Shifts in Supply

When we draw a supply curve, we again vary the price but hold everything else fixed. A change in any other factor will cause the market supply curve to shift. A leftward shift of the market supply curve for houses, as indicated in ***Figure 4.4 "A Shift in Supply of Houses", could be caused by many factors, including the following:

- Increases in the costs of production, such as wages, the cost of borrowing, or the price of oil
- Bad weather that delays or damages construction in process
- Changes in regulations that make it harder to build

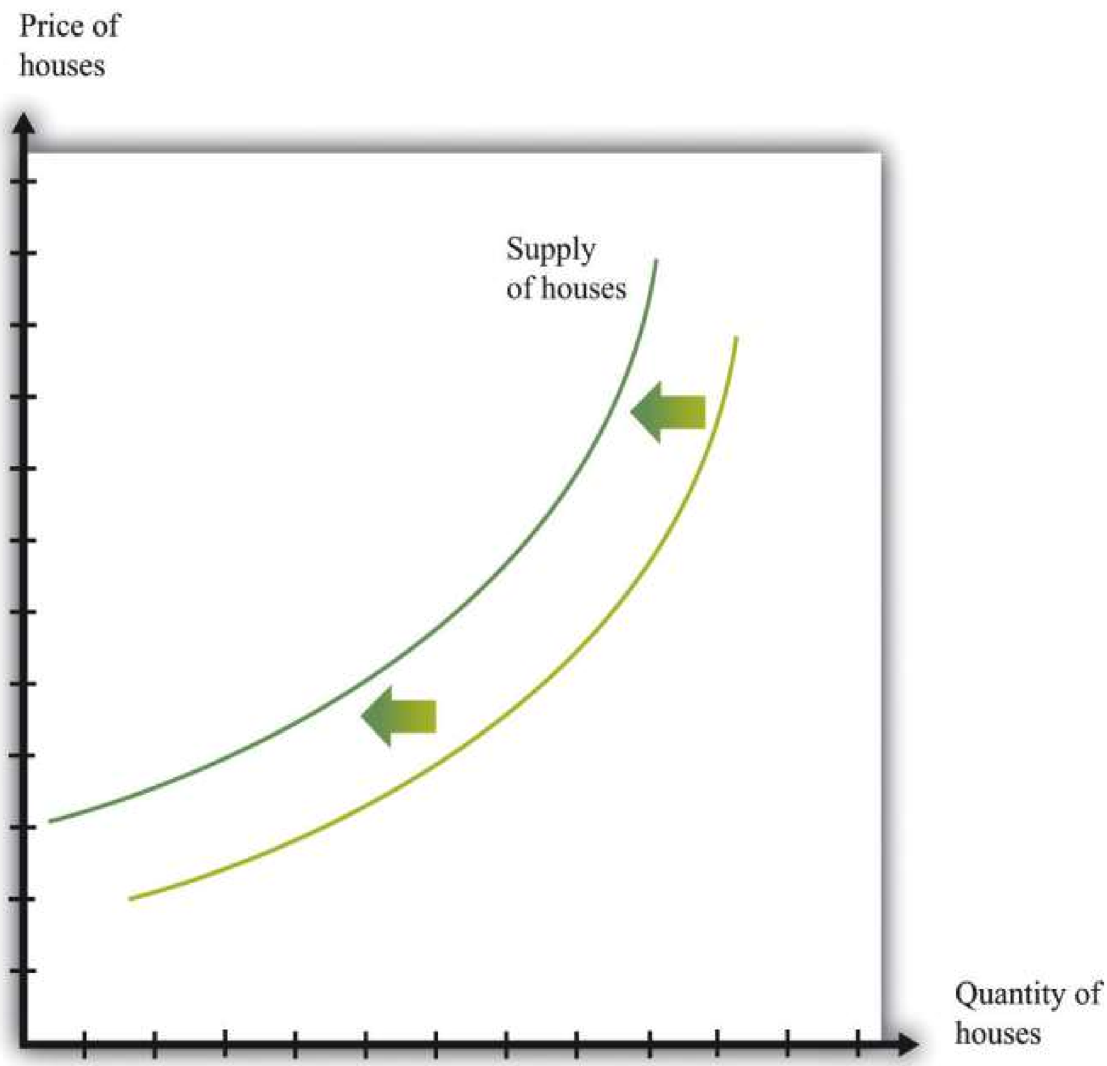

Fig. 4.4: Figure 4.4 A Shift in Supply of Houses If there is a decrease in supply of houses, then fewer houses are supplied at each price. The supply curve shifts leftward.

4.1.5 Market Equilibrium: What Determines the Price of Housing?

We now put the market demand and market supply curves together to give us the supply-anddemand picture in ***Figure 4.5 "Market Equilibrium". The point where supply and demand meet is the equilibrium in the market. At this point, there is a perfect match between the amount that buyers want to buy and the amount that sellers want to sell.

Toolkit: Section 16.6 "Supply and Demand"

Equilibrium in a market refers to an equilibrium price and an equilibrium quantity and has the following features:

- Given the equilibrium price, sellers supply the equilibrium quantity.
- Given the equilibrium price, buyers demand the equilibrium quantity.

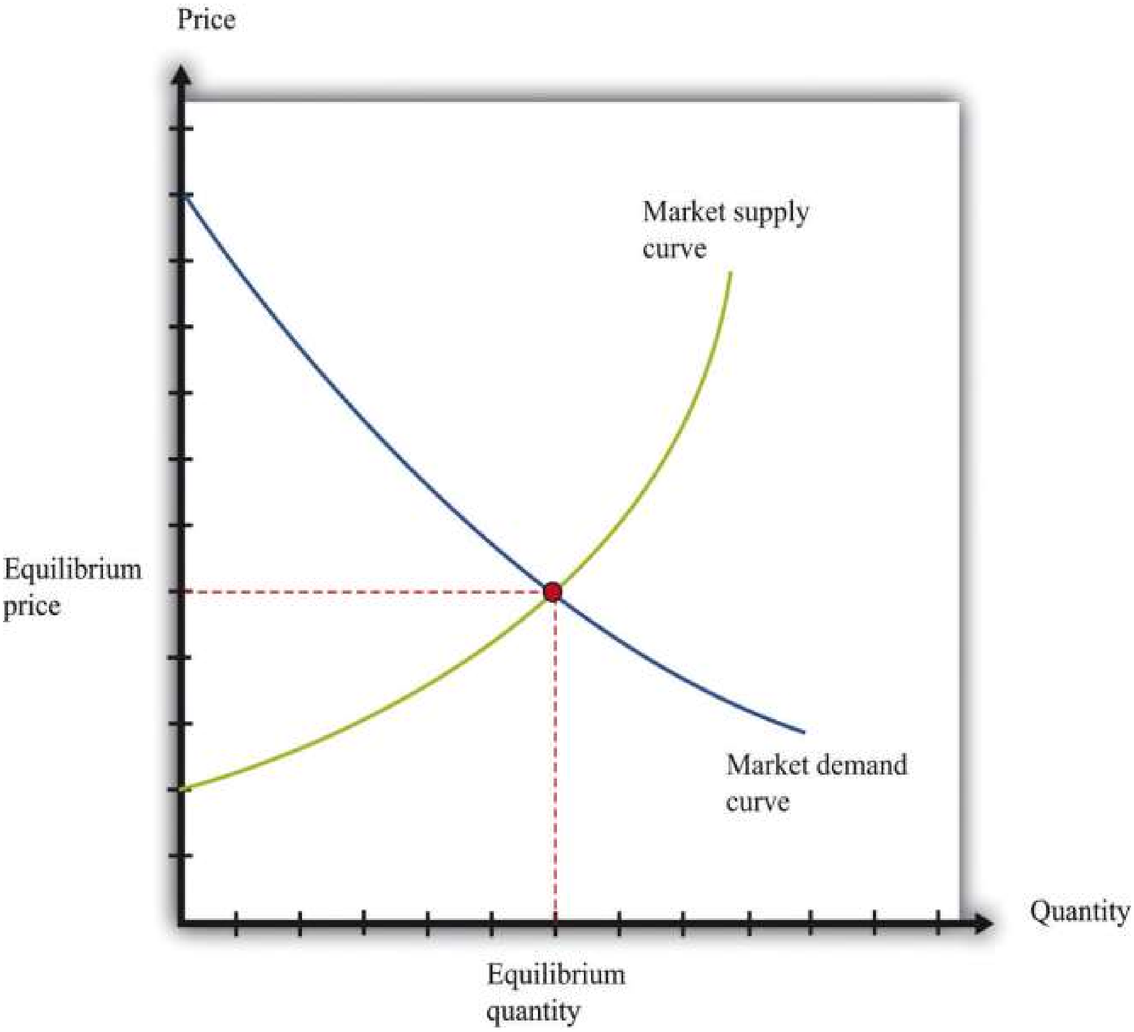

Fig. 4.5: Figure 4.5 Market Equilibrium In a competitive market, equilibrium price and quantity are determined by the intersection of the supply and demand curves.

We speak of equilibrium because there is a balancing of the forces of supply and demand in the market. At the **equilibrium price**, suppliers of the good can sell as much as they wish, and demanders of the good can buy as much of the good as they wish. There are no disappointed buyers or sellers. Because the demand curve has a negative slope and the supply curve has a positive slope, supply and demand will cross once, and both equilibrium price and **equilibrium quantity** will be positive.

***Table 4.1 "Market Equilibrium: An Example" provides an example of market equilibrium. It gives market supply and market demand for four different prices. Equilibrium occurs at a price of $100,000 and a quantity of 50 new houses.

Table 4.1 Market Equilibrium: An Example

Price ($)	Market Supply	Market Demand
10,000	5	95
50,000	25	75
100,000	50	50
200,000	100	0

Economists typically believe that a perfectly competitive market is likely to reach equilibrium. The reasons for this belief are as follows:

- If price is different from the equilibrium price, then there will be an imbalance between demand and supply. This gives buyers and sellers an incentive to behave differently. For example, if price is less than the equilibrium price, demand will exceed supply. Disappointed buyers might start bidding up the price, or sellers might realize they could charge a higher price. The opposite is true if the price is too high: suppliers might be tempted to try cutting prices, while buyers might look for better deals.
- There is strong support for market predictions in the evidence from experimental markets. When buyers and sellers meet individually and bargain over prices, we typically see an outcome very similar to the market outcome in Figure 4.5 "Market Equilibrium".
- The supply-and-demand framework generally provides reliable predictions about the movement of prices.

Pictures like ***Figure 4.5 "Market Equilibrium" are useful to help understand how the market works. Keep in mind, however, that firms and households in the market do not need any of this information. This is one of the beauties of the market. All an individual firm or household needs to know is the prevailing market price. All the coordination occurs through the workings of the market.

KEY TAKEAWAY

The primary factor influencing demand for housing is the price of housing. By the law of demand, as price decreases, the quantity of housing demanded increases. The demand for housing also depends on the wealth of households, their current income, and interest rates.

The primary factor influencing supply of housing is the price of housing. As price increases, the quantity supplied also increases. The supply of housing is shifted by changes in the price of inputs and changes in technology.

The quantity and price of housing traded is determined by the equilibrium of the housing market.

***

Checking Your Understanding

What would be the impact of a decrease in the cost of borrowing on the market supply curve of housing? What would be the impact of a decrease in the cost of borrowing on the market demand curve?

Name two events that would cause the housing market supply curve to shift rightward. Name two events that would cause the housing market demand curve to shift rightward.

4.2 Comparative Statics: Changes in the Price of Housing

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are exogenous and endogenous events?

How does the equilibrium of a market respond to changes in exogenous variables?

What is comparative statics, and how is it used?

A driving factor in the crisis of 2008 was a decrease in the price of new housing. We can use our supply-and-demand tool to help us understand that. We use the framework to make predictions about the effects of events on economic outcomes. More precisely, economists predict the effects of exogenous events on equilibrium prices and quantities.

Toolkit: Section 16.8 "Comparative Statics"

An **exogenous** variable is something that comes from outside a model and is not explained in our analysis. An **endogenous** variable is one that is explained within our analysis. When using the supply-and-demand framework, price and quantity are endogenous variables; everything else is exogenous.

4.2.1 A Shift in Demand for Housing

The following is a typical account of the housing market crisis in 2008:

The immediate cause or trigger of the crisis was the bursting of the United States housing bubble which peaked in approximately 2005–2006. High default rates on “subprime” and adjustable rate mortgages (ARM), began to increase quickly thereafter.

An increase in loan incentives such as easy initial terms and a long-term trend of rising housing prices had encouraged borrowers to assume difficult mortgages in the belief they would be able to quickly refinance at more favorable terms. […] However, once interest rates began to rise and housing prices started to drop moderately in 2006–2007 in many parts of the U.S., refinancing became more difficult. Defaults and foreclosure activity increased dramatically as easy initial terms expired, home prices failed to go up as anticipated, and ARM interest rates reset higher. Falling prices also resulted in 23% of U.S. homes worth less than the mortgage loan by September 2010, providing a financial incentive for borrowers to enter foreclosure. [***“Subprime Mortgage Crisis,” Wikipedia, accessed June 28, 2011,http://en.wikipedia.org/wiki/Subprime_mortgage_crisis.***]

This quote identifies two forces that influenced the demand for housing in 2007–8. The first was expectations of future home prices. One of the gains from owning a house is the possibility that you can sell it at a higher price in the future. Prior to 2007, there had been a fairly consistent tendency for house prices to increase, but the quote seems to indicate that people began to doubt that this trend would continue. As a consequence, the demand for new homes decreased. The second force in the market for new housing was the availability of credit. Most households buy a new home by obtaining a loan (a mortgage) to cover some of the price of the house. During 2007 and 2008, it became increasingly difficult to obtain a mortgage. This was in contrast to a few years earlier when lending standards were easier, and many households easily qualified for mortgages.

These forces affect market demand. The anticipation of lower home prices in the future implies that fewer individuals will choose to buy a home now. Further, if financing is more expensive, then less housing will be purchased. These effects operate *given* the current price of housing. That is, at any given current price of houses, a smaller quantity of houses is demanded. The market demand curve shifts leftward: at each given price, market demand is lower.

The shift in demand is shown in ***Figure 4.6 "A Decrease in Demand for Housing". Once the demand curve shifts, the market for new houses is no longer in equilibrium. At the original price, there is now an imbalance between supply and demand: at that price, buyers want to purchase fewer homes than sellers wish to sell. To restore equilibrium in the market, there needs to be a reduction in housing prices and a reduction in the quantity of new houses produced. The decrease in production comes about because the lower price of houses makes suppliers less willing to produce houses for the market. The shift in the demand curve leads to a *movement along* the supply curve.

Figure 4.6 A Decrease in Demand for Housing A decrease in demand for houses means that the demand curve shifts leftward, leading to a decrease in both the price of houses and the quantity of houses that are produced and sold.

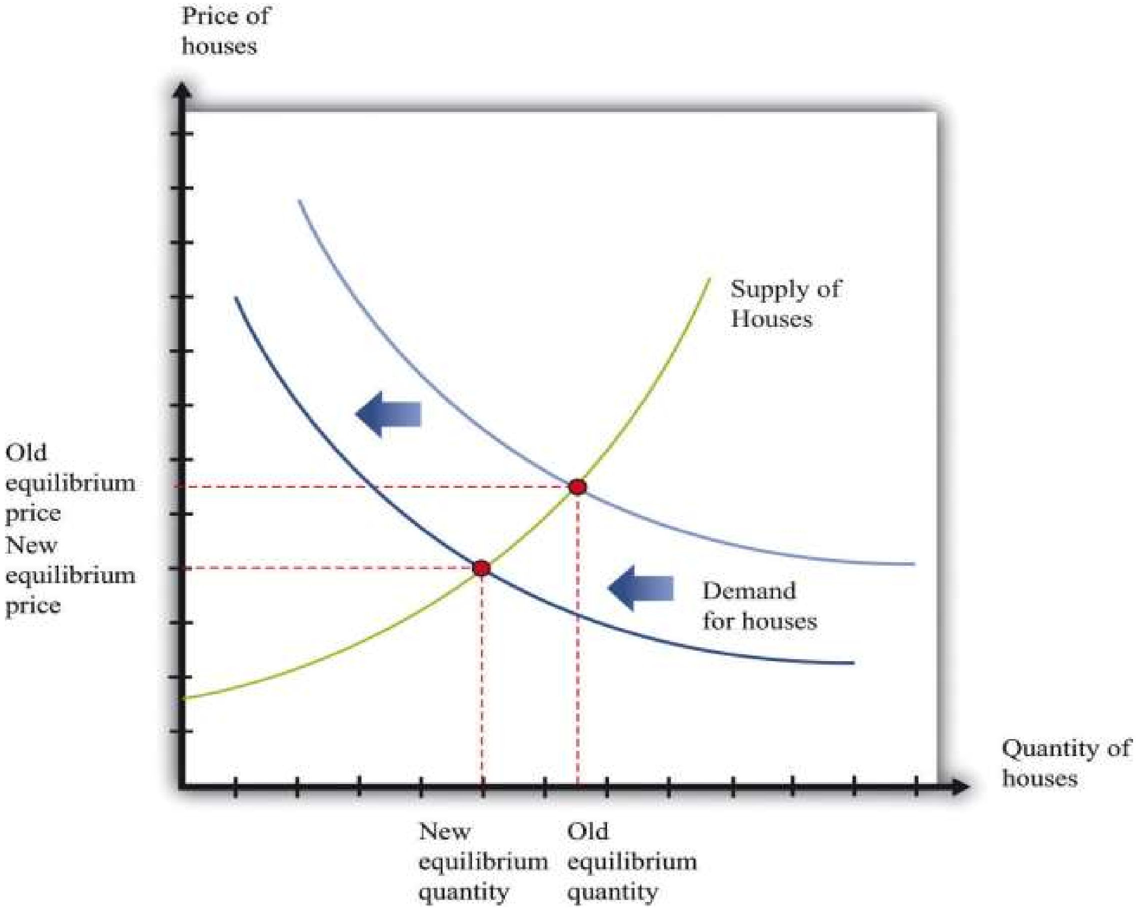

Fig. 4.6:

4.2.2 Shifts in a Curve versus Movements along a Curve

Understanding the distinction between moving along a curve (either supply or demand) and shifting the curve is the hardest part about learning to use the supply-and-demand framework. Journalists and others frequently get confused about this—and no wonder, for it requires practice to learn how to use supply and demand properly.

First, consider the market demand curve. As the price of houses increases, the quantity demanded will decrease. This is a *movement along the market demand curve*. Changes in anything else—anything other than price—that affects the quantity demanded appears as a *shift in the market demand curve*. That is, at each given price, the quantity demanded changes.

Analogously, as the price of houses increases, the quantity supplied will increase. This is a *movement along the market supply curve*. If a change in anything else leads to a change in the quantity supplied, this appears as a *shift in the market supply curve*. That is, at each given price, the quantity supplied changes.

4.2.3 Comparative Statics

The example that we just discussed is an illustration of a general technique used by economists for two purposes. First, we use it to *explain* changes in prices and quantities that we have observed in the past. Second, we use it to *predict* what will happen to market prices and quantities in the future. The technique is called **comparative statics**.

Toolkit: Section 16.8 "Comparative Statics"

Comparative statics is a technique that allows us to describe how market equilibrium prices and quantities depend on exogenous events. As such, much of economics consists of exercises in comparative statics. In a comparative statics exercise, you must do the following:

1. Begin at an equilibrium point where the quantity supplied equals the quantity demanded.
2. Based on a description of an event, determine whether the change in the exogenous factor shifts the market supply curve or the market demand curve.
3. Determine the direction of this shift.
4. After shifting the curve, find the new equilibrium point.
5. Compare the new and old equilibrium points to predict how the exogenous event affects the market.

The most difficult part of a comparative statics exercise is to determine, from a description of the economic problem, whether it is the supply or demand curve (or both) that shifts. Once you conquer the economics of determining which curve is shifting, then it is a matter of mechanically using the framework to find the new equilibrium. A comparison of the old and new equilibrium points allows you to predict what will happen to equilibrium prices and quantities following an exogenous change.

KEY TAKEAWAY

Exogenous variables are determined from outside a framework, while endogenous variables are determined within the framework.

Changes in exogenous variables lead to shifts in market supply and/or market demand curves. These shifts in supply and demand then lead to changes in quantities and prices.

Comparative statics is a technique that describes how changes in exogenous variables influence equilibrium quantities and prices. It is used to answer questions about how markets respond to changes in exogenous variables.

***

Checking Your Understanding

Name two exogenous variables that might affect the equilibrium outcome in the market for used cars.

Draw the market for housing when there is a decrease in supply *and* a decrease in demand. What happens to the price? Why can you not say for sure what happens to the quantity of houses bought and sold?

4.3 Three Important Markets

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is the credit market, and what determines the interest rate?

What is the labor market, and what determines the real wage?

What is the foreign currency market, and what determines the exchange rate?

The financial crisis of 2008 began in the housing market. But as the excerpts at the beginning of this chapter make clear, its effects rapidly spread beyond that market. Those excerpts talked of credit, jobs, and the impact of the crisis on foreign countries. We now look at the knock-on effects of the crisis and, in the process, describe three key macroeconomic markets: the credit market, the labor market, and the foreign exchange market. [***These markets are used in several places in the book. In particular, we look at labor in Chapter 8 "Jobs in the Macroeconomy", and credit and foreign exchange in Chapter 9 "Money: A User's Guide".***]

4.3.1 The Credit Market

A **credit market (or loan market)** is a market in which credit is extended by lenders to borrowers. These credit arrangements, also called loans, are a specific kind of contract. A simple credit contract specifies three things: (1) the amount being borrowed, (2) the date(s) at which repayment must be made, and (3) the amount that must be repaid. [***Of course, since credit contracts are legal documents, lots of other details will be written into the contract as well. Here we focus on the most important features of the contract.***]

To be specific, suppose you go to your bank to inquire about a loan for $1,000, to be repaid in one year. In this case the lender—the bank—is a supplier of credit, and the borrower—you—is a demander of credit. The higher is the repayment amount, the more attractive this loan contract will look to the bank. Conversely, the lower is the repayment amount, the more attractive this loan contract looks to you. The relationship between the current price and the future repayment can be summarized in a single number, known as the **nominal interest rate**.

Toolkit: Section 16.4 "The Credit (Loan) Market (Macro)"

The nominal interest rate is the number of additional dollars that must be repaid for every dollar that is borrowed. It is generally specified in annual terms; that is, it is the amount that must be paid per year.

For the one-year loan we are considering,

****FORMULA 6

For example, suppose the repayment amount is $1,050. Then the left-hand side of this expression is 1,050/1,000 = 1.05. It follows that the nominal interest rate is 0.05, or 5 percent.

Financial markets are typically good examples of competitive markets. Loans are homogeneous, and there are potentially many buyers and sellers. So if we imagine that there are lots of banks that might be willing to supply credit, and lots of people like you who might demand credit, then we could draw supply and demand curves as in Figure 4.7 "A Market for $1,000 Loans". In this case, the units on the quantity axis are one-year $1,000 loans. The price on the vertical axis is the interest rate, which tells us the amount of the repayment per dollar loaned. The higher the repayment is, the more willing are banks to supply credit, so the supply curve slopes upward. The higher the repayment, the less willing are people to take out these loans, and so the demand curve slopes downward. If the repayment price were acceptable to you, you would “buy” one of these $1,000 loans. The equilibrium nominal interest rate is shown at the crossing of supply and demand.

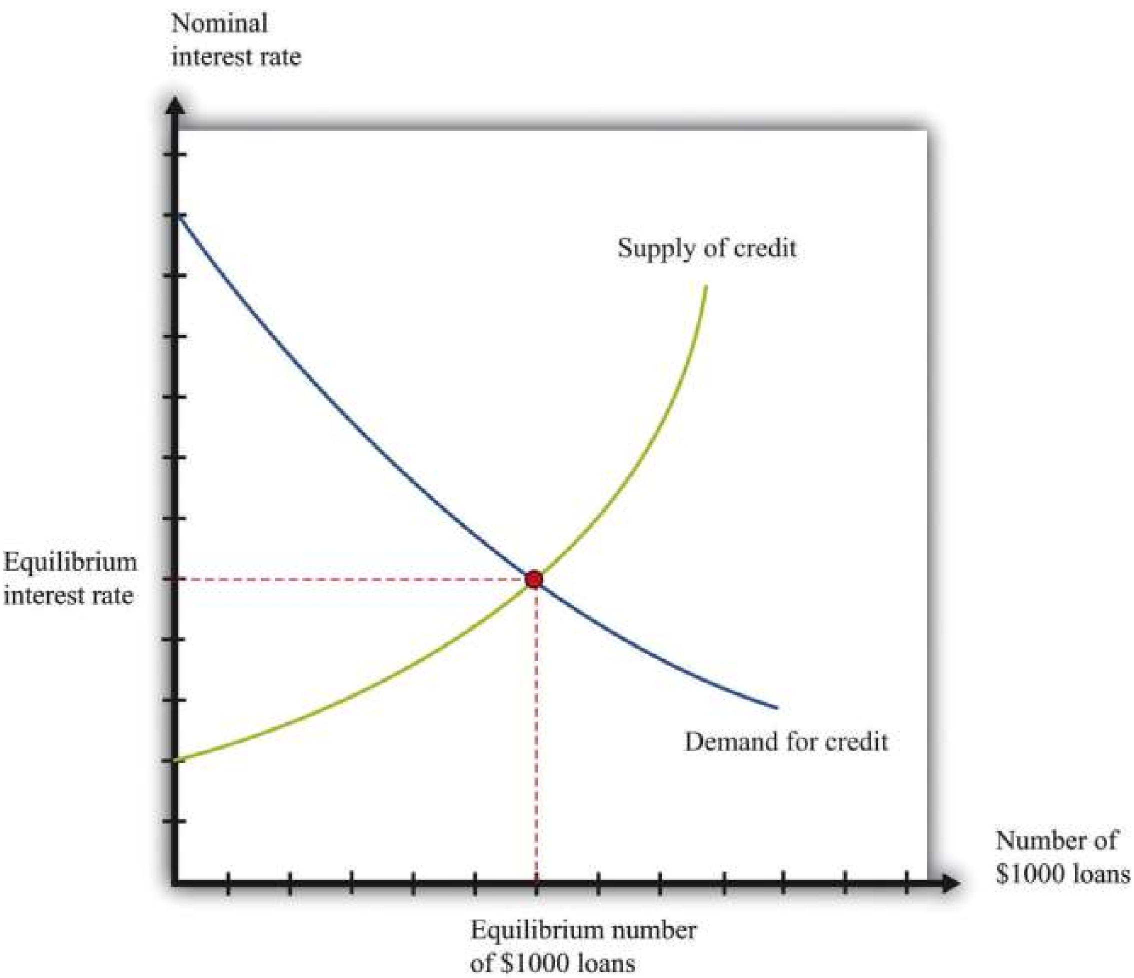

Fig. 4.7: Figure 4.7 A Market for $1,000 Loans In this credit market, lenders offer $1,000 loans to borrowers. The equilibrium nominal interest rate is where the quantity of credit supplied equals the quantity of credit demanded.

4.3.2 The Credit Market in the 2008 Crisis

At the height of the financial crisis of 2008, credit became much more expensive—that is, interest rates increased. Why? As housing prices collapsed in the United States and elsewhere, a substantial number of mortgage loans became *nonperforming*. This means that borrowers were unable or unwilling to repay these loans and defaulted on them instead. In addition, because banks had sold and resold some of these mortgage loans, it was hard to identify which loans would be repaid and which would not. Some financial institutions that were holding a lot of bad loans went bankrupt, and others were in danger of going under as well.

As a consequence, lenders became much more cautious about the types of loans they made— not only in mortgage markets but also throughout the economy. They were more careful about evaluating the likelihood that borrowers would repay their loans. This led to a reduction in the market supply of credit. The reduced supply of loans in the mortgage market was particularly acute. This appears as a leftward shift of the supply curve in ***Figure 4.8 "A Reduction in Supply in the Mortgage Market". Nominal interest rates increased, and the quantity of mortgages extended decreased.

(The full story of what happened in credit markets is more complicated because central banks around the world also took actions to offset these changes and keep interest rates low.)

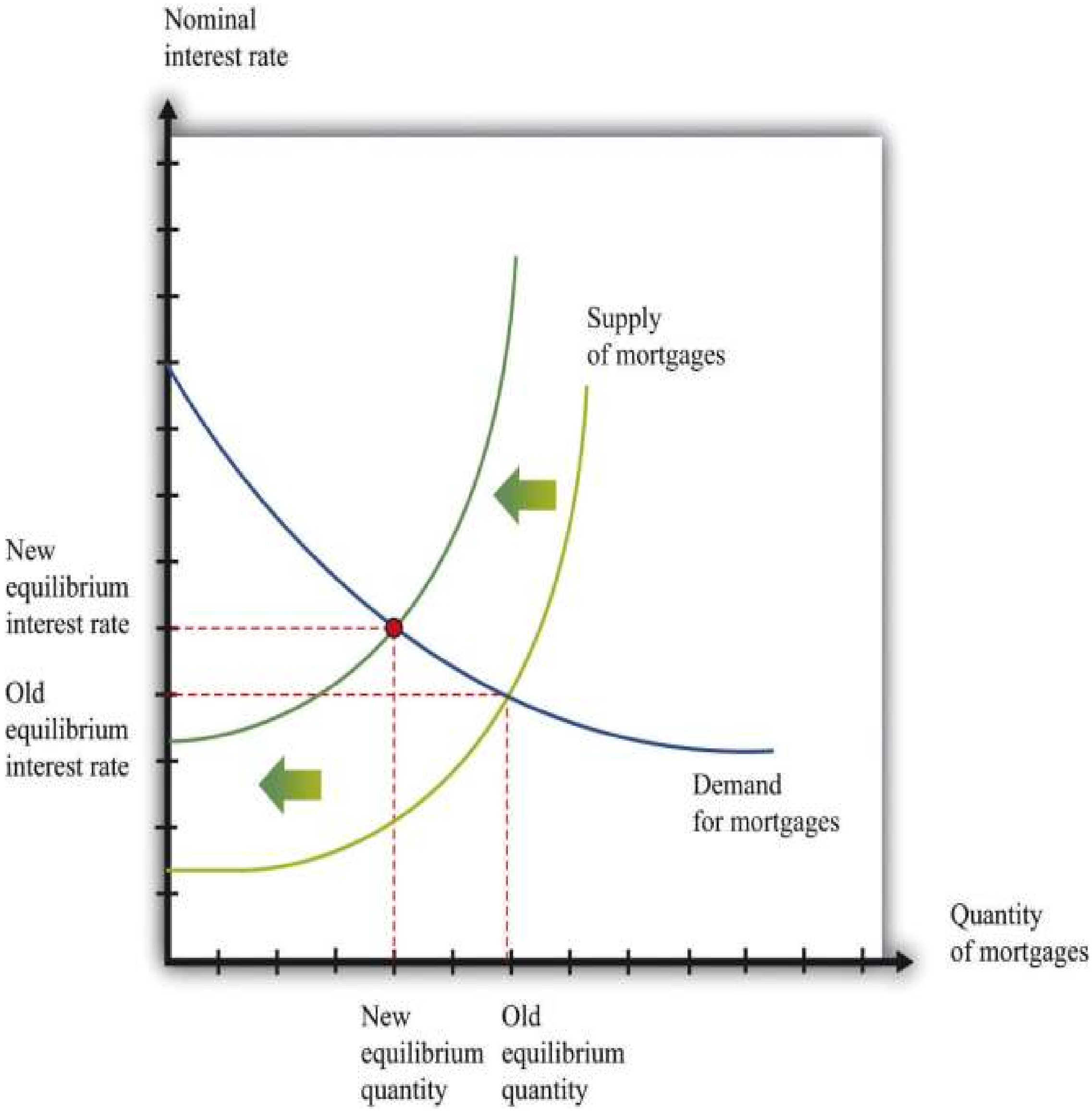

Fig. 4.8: Figure 4.8 A Reduction in Supply in the Mortgage Market As lenders became more cautious about making loans, the supply of mortgage loans shifted leftward. Interest rates in the economy increased, and the quantity of mortgages decreased.

4.3.3 Nominal Interest Rates and Real Interest Rates

Mortgage rates and other interest rates are based on underlying dollar amounts; the interest rate tells you how many dollars borrowers must pay to lenders for each dollar that they borrow. Because they are based on dollar amounts, they are called nominal interest rates. When you see a mortgage rate quoted by a bank or a rate on a credit card, it is a nominal rate.

The nominal rate does not tell us the true cost of borrowing, or return on lending, when there is inflation in an economy. For example, suppose that the nominal interest rate is 5 percent, but inflation is also 5 percent. If you took out a $1,000 loan, you would have to pay back $1,050 next year. But that $1,050 would buy exactly the same amount of **real gross domestic product (real GDP)** next year as $1,000 does this year—that is what it means to have 5 percent inflation. So, in terms of actual goods and services, you have to pay back the same amount that you borrowed. The **real interest rate**—that is, the interest rate corrected for inflation—is zero.

Toolkit: Section 16.5 "Correcting for Inflation"

The **Fisher equation** is a formula for converting from nominal interest rates to real interest rates, as follows:

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real interest rate ≈ nominal interest rate − inflation rate.
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The real interest rate gives the true cost of borrowing and lending; it is the real interest rate that actually matters for the decisions of savers and borrowers. [***We derive the Fisher equation more fully in Chapter 9 "Money: A User's Guide".***] That doesn't mean, by the way, that our previous two diagrams were incorrect because they used the nominal interest rate. Provided that the inflation rate doesn't change, a comparative static exercise using the nominal interest rate will give you exactly the same conclusion as one using the real interest rate.

4.3.4 Individual Credit Markets and the Aggregate Credit Market

We have described a market for a particular kind of loan, but more generally we know that there are all kinds of different ways in which credit is offered in an economy. Households borrow from banks to buy houses or cars. Households and firms make purchases using credit cards. Firms borrow from financial institutions to buy new equipment. The government borrows to finance its spending, and so on. There is a very large number of credit markets in the economy, each offering a different kind of credit, and each with its own equilibrium interest rate.

These different credit markets are linked because most households and firms buy or sell in more than one market. Financial institutions in particular trade in large numbers of different credit markets. For much of what we do in macroeconomics, however, the distinctions among different kinds of credit are not critical, and it is sufficient to imagine a single aggregate credit market and a single real interest rate. [***In Chapter 9 "Money: A User's Guide", we look in more detail at the different kinds of credit—and the associated different interest rates—that we see in an economy. We also investigate in more detail how these markets are linked together.***] ***Figure 4.9 "The Aggregate Credit Market" shows the credit market for an entire economy. This is the market where all the savers in the economy bring funds to financial intermediaries, who then lend those funds to firms, households, and governments. The supply of credit increases as the interest rate increases. As the interest rate increases, other things being equal, households will generally save more and thus supply more to the credit market. The quantity of credit demanded decreases as the interest rate increases. When it is expensive to borrow, households and firms will borrow less.

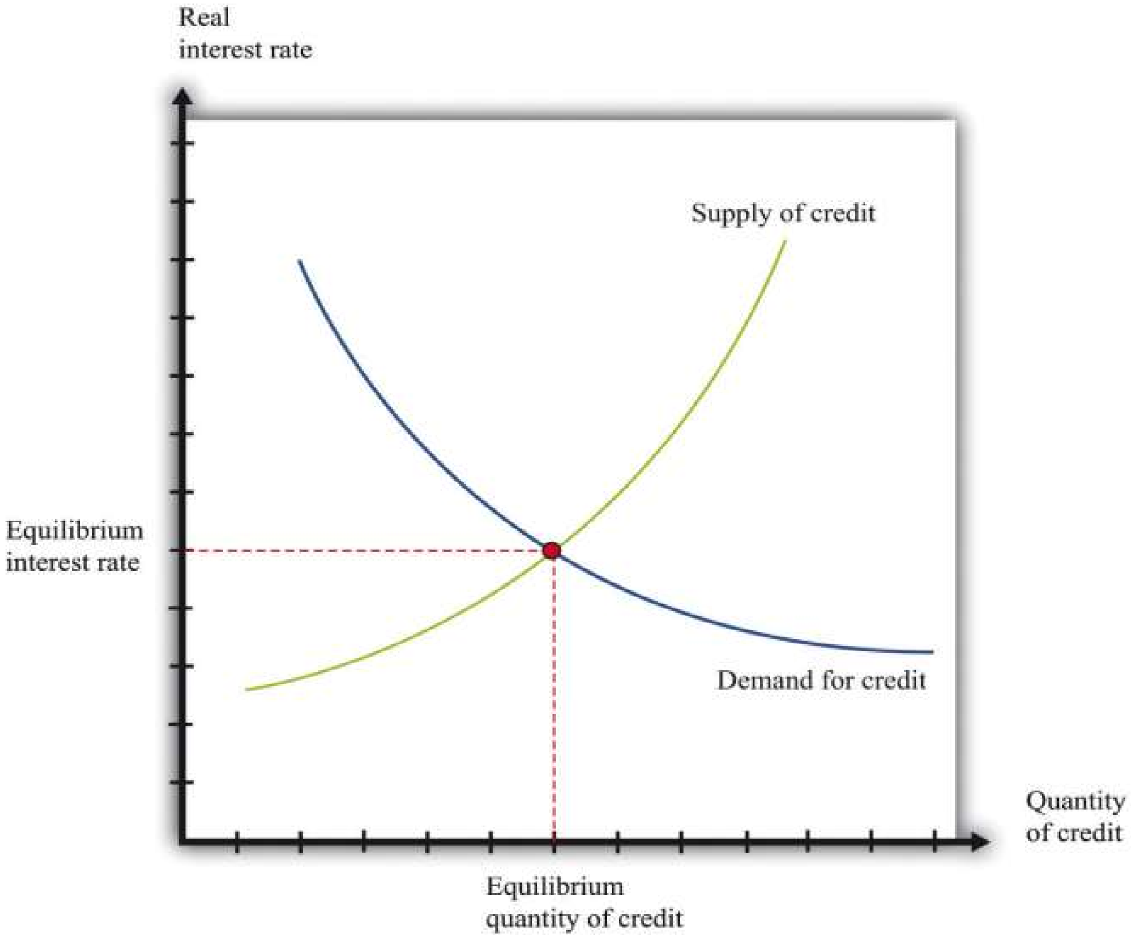

Fig. 4.9: Figure 4.9 The Aggregate Credit Market In the credit market, the equilibrium real interest rate is where the quantity of credit supplied equals the quantity of credit demanded.

Toolkit: Section 16.4 "The Credit (Loan) Market (Macro)"

The credit market brings together suppliers of credit, such as households who are saving, and demanders of credit, such as businesses and households who need to borrow. The real interest rate is the price that brings demand and supply into balance. At the equilibrium interest rate, the amount of credit supplied and the amount of credit demanded are equal.

Two of the most important players in the credit market are the government and the monetary authority. If the US federal government borrows more, this shifts the demand for credit outward and increases the interest rate. (Notice that the government is a big player in this market, so its actions affect the interest rate.) The monetary authority, meanwhile, buys and sells in credit markets to influence interest rates in the economy. [***We study the actions of the Federal Reserve and other monetary authorities in Chapter 10 "Understanding the Fed".***] In the 2008 crisis, the Federal Reserve Bank, which is the monetary authority in the United States, took many actions to increase the supply of credit and ease the problems in the credit market.

4.3.5 The Labor Market

The story about the housing market in the United Kingdom at the beginning of this chapter contained some dire predictions about employment:

The lack of spending in these areas will hit employment, with some analysts forecasting that the construction sector alone could see a loss of up to 350,000 jobs within the next five years.

To understand this prediction, we need to look at another market—the **labor market**.

In the markets for goods and services, the supply side usually comes from firms, and the demand side comes from households. In the labor market, by contrast, firms and households switch roles: firms demand labor, and households supply labor. Supply and demand curves for construction workers are shown in ***Figure 4.10 "Equilibrium in the Market for Construction Workers". Here the price of labor is the hourly **real wage** that is paid to workers in this industry.

Toolkit: Section 16.1 "The Labor Market"

The real wage is the wage corrected for inflation. To obtain the real wage, simply divide the wage in dollars—the nominal wage—by the price level:

The individual demand for labor by firms comes from the fact that workers' time is an input into the production process. This demand curve obeys the law of demand: as the real wage increases, the quantity of labor demanded decreases. At a higher real wage, a firm will demand less labor services (by hiring fewer workers and/or reducing the hours of workers) and will respond to the higher labor cost by reducing production.

Workers care about the real wage because it tells them how much they can obtain in terms of goods and services if they give up some of their time. The supply of labor comes from households who allocate their time between work and leisure activities. In ***Figure 4.10 "Equilibrium in the Market for Construction Workers", the supply of labor is upward sloping. As the real wage increases, households supply more labor because (1) higher wages induce people to work longer hours, and (2) higher wages induce more people to enter the labor force and look for a job.

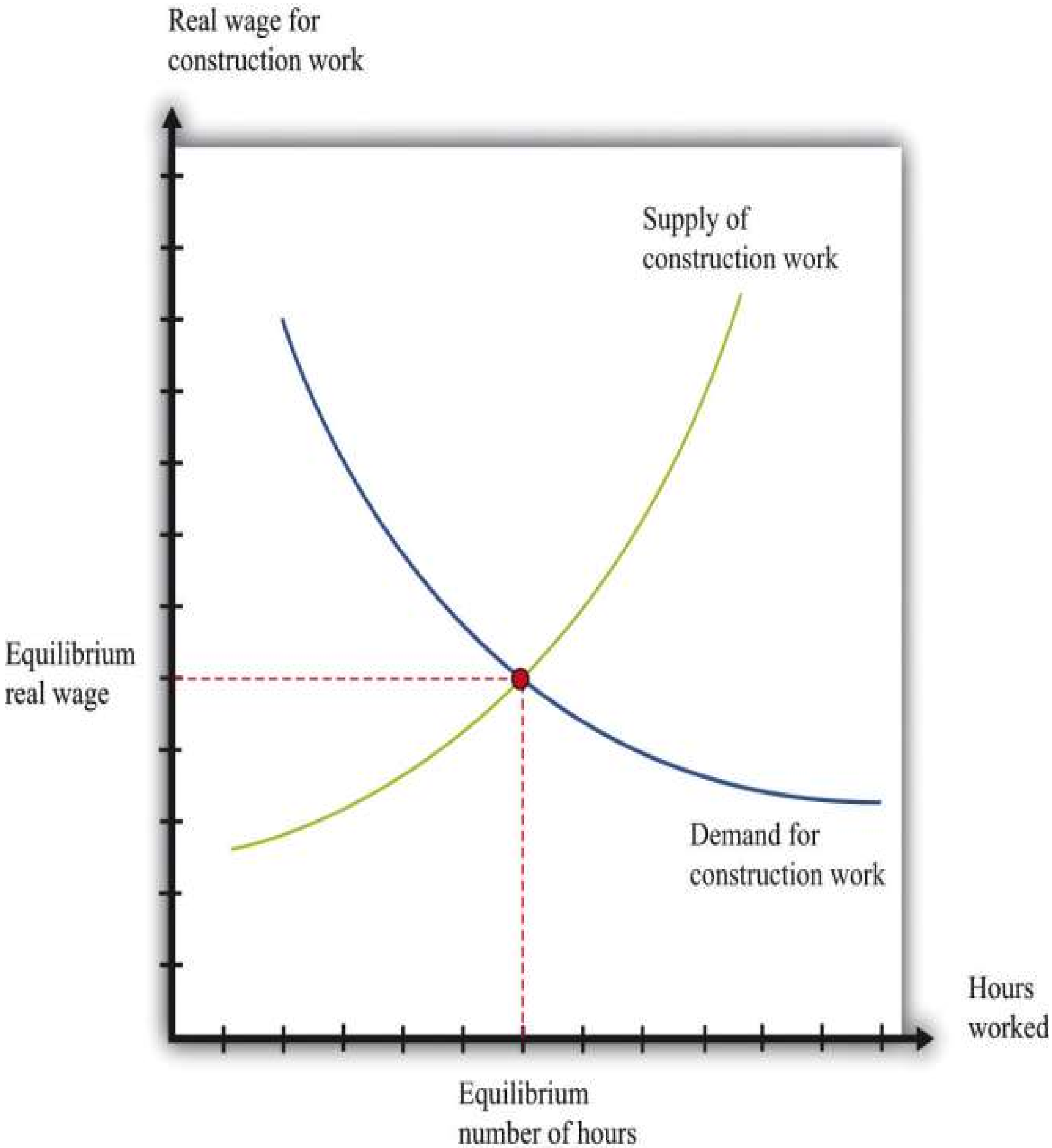

Fig. 4.10: Figure 4.10 Equilibrium in the Market for Construction Workers This picture shows the supply of and demand for hours of work in the construction industry.

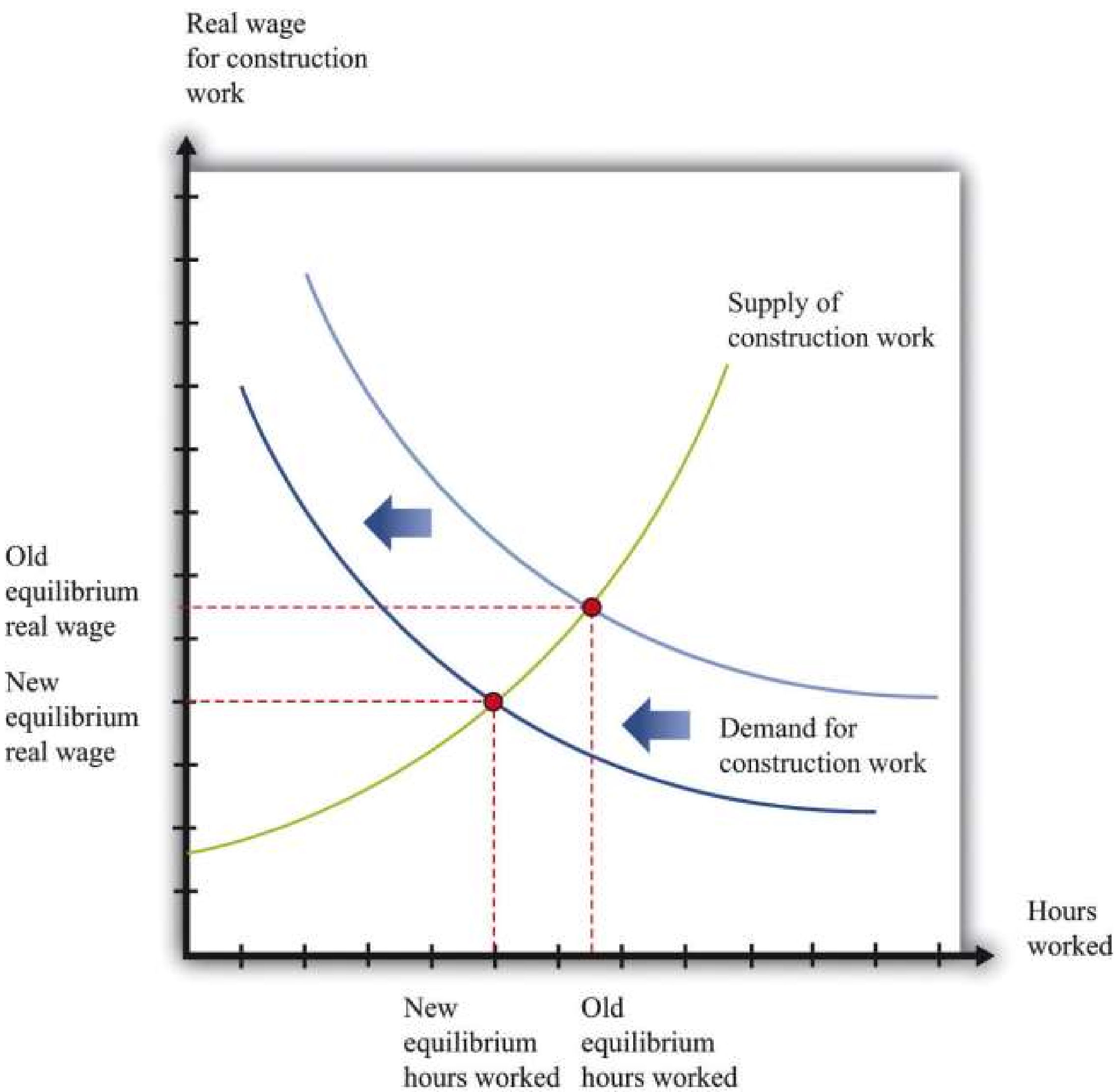

Fig. 4.11: Figure 4.11 A Decrease in Demand for Construction Workers Because builders are building fewer houses, they hire fewer construction workers, causing the labor demand curve to shift leftward.

4.3.6 The Labor Market in the 2008 Crisis

In the United Kingdom, there was a leftward shift in demand for housing (just like we showed in ***Figure 4.6 "A Decrease in Demand for Housing"). The response of homebuilders to such a shift is to build fewer homes and, therefore, demand less labor. As a result, there is a leftward shift in the demand curve for construction workers. Based on the supply-and-demand framework, we predict both lower wages and a reduction in employment in the construction sector of the economy, as shown in ***Figure 4.11 "A Decrease in Demand for Construction Workers".

Similar reductions in demand for labor occurred in the United States and many other countries around the world. There was a consequent reduction in employment and an increase in unemployment. The crisis was not restricted just to financial markets, in other words. It had consequences for the "real" economy as well.

4.3.7 Individual Labor Markets and the Aggregate Labor Market

Because there are many different jobs and many different kinds of workers, there is no single labor market and no single wage. Instead, you can think of there being many different labor markets just as there are many different credit markets. Like different credit markets, different labor markets are linked: households may participate in more than one labor market, and most firms purchase many different kinds of labor. As with the credit market, we sometimes look at the market for a particular kind of labor and the economy as a whole. Most of the time in macroeconomics, it is sufficient to think about an aggregate labor market, as shown in ***Figure 4.12 "Equilibrium in the Labor Market". [***In Chapter 8 "Jobs in the Macroeconomy", we pay more attention to the fact that workers and jobs are not all identical.***] As the real wage increases, households supply more hours, and more households participate in the labor market. For both of these reasons, as the real wage increases, the quantity of labor supplied also increases. Labor demand comes from firms. As the real wage increases, the cost of hiring extra labor increases, and firms demand fewer labor hours. That is, the firm's labor demand curve is downward sloping.

Toolkit: Section 16.1 "The Labor Market"

The labor market is the market in which labor services are traded. The supply of labor comes from households. At the equilibrium real wage, the number of hours supplied and the number of hours demanded are equal.

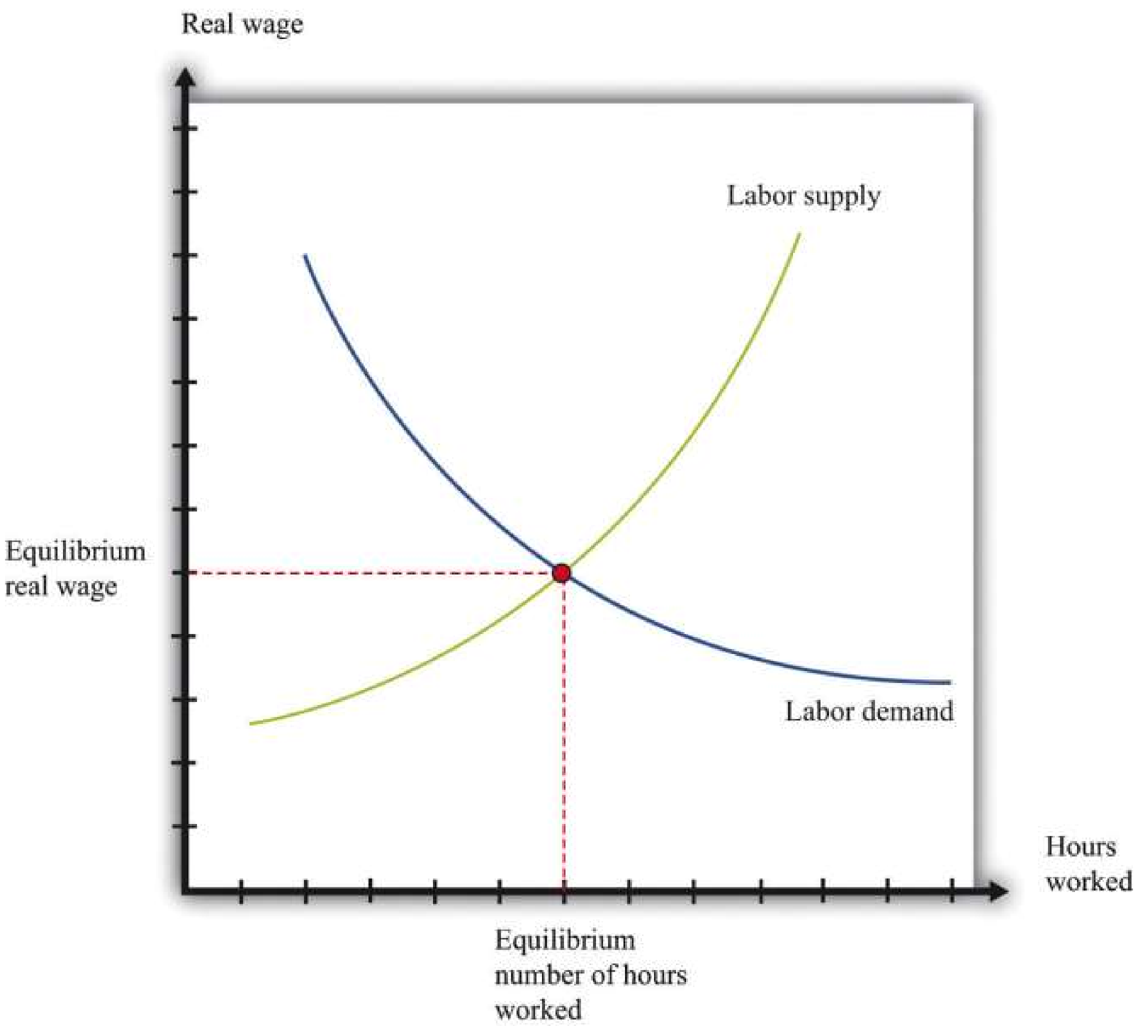

Fig. 4.12: Figure 4.12 Equilibrium in the Labor Market The labor market is the market in which firms hire workers. The equilibrium real wage is the price where the quantity of labor supplied equals the quantity of labor demanded.

4.3.8 The Foreign Exchange Market

The excerpts at the beginning of this chapter reveal that the financial crisis also impacted other countries. For example, we included an excerpt about the effects of the crisis on the value of a dollar and also an excerpt about exports from China. We could have also cited effects of the crisis on other countries: for example, India's information technology sector and Canada's lumber industry were both affected. To understand the transmission of the crisis to other countries, we have to learn about another market—the market where different currencies are bought and sold.

If you travel abroad, you must acquire the currency used in that region of the world. For example, if you take a trip to Finland, Russia, and China, you will buy euros, rubles, and yuan along the way. To do so, you need to participate in various **foreign exchange markets**.

Toolkit: Section 16.10 "Foreign Exchange Market"

The foreign exchange market is the market where currencies are traded. The price in this market is the price of one currency in terms of another and is called the **nominal exchange rate**.

Dollars are supplied to foreign exchange markets by US households, firms, and governments who wish to purchase goods, services, or financial assets that are denominated in the currency of another economy. For example, if a US auto importer wants to buy a German car, it must sell dollars and buy euros. As the price of a dollar increases, the quantity supplied of that currency will increase.

Foreign currencies are supplied by foreign households, firms, and governments that wish to purchase goods, services, or financial assets (such as stocks or bonds) denominated in the domestic currency. For example, if a Canadian bank wants to buy a US government bond, it must sell Canadian dollars and buy US dollars. The law of demand holds: as the price of a dollar increases, the quantity of that currency demanded decreases.

***Figure 4.13 "Equilibrium in the Foreign Exchange Market Where Dollars and Euros Are Exchanged" shows an example of a foreign exchange market: the market in which euros are bought with and sold for US dollars. The horizontal axis shows the number of euros bought and sold on a particular day. The vertical axis shows the exchange rate—the price of a euro in dollars. This market determines the dollar price of euros just like the gasoline market determines the dollar price of gasoline.

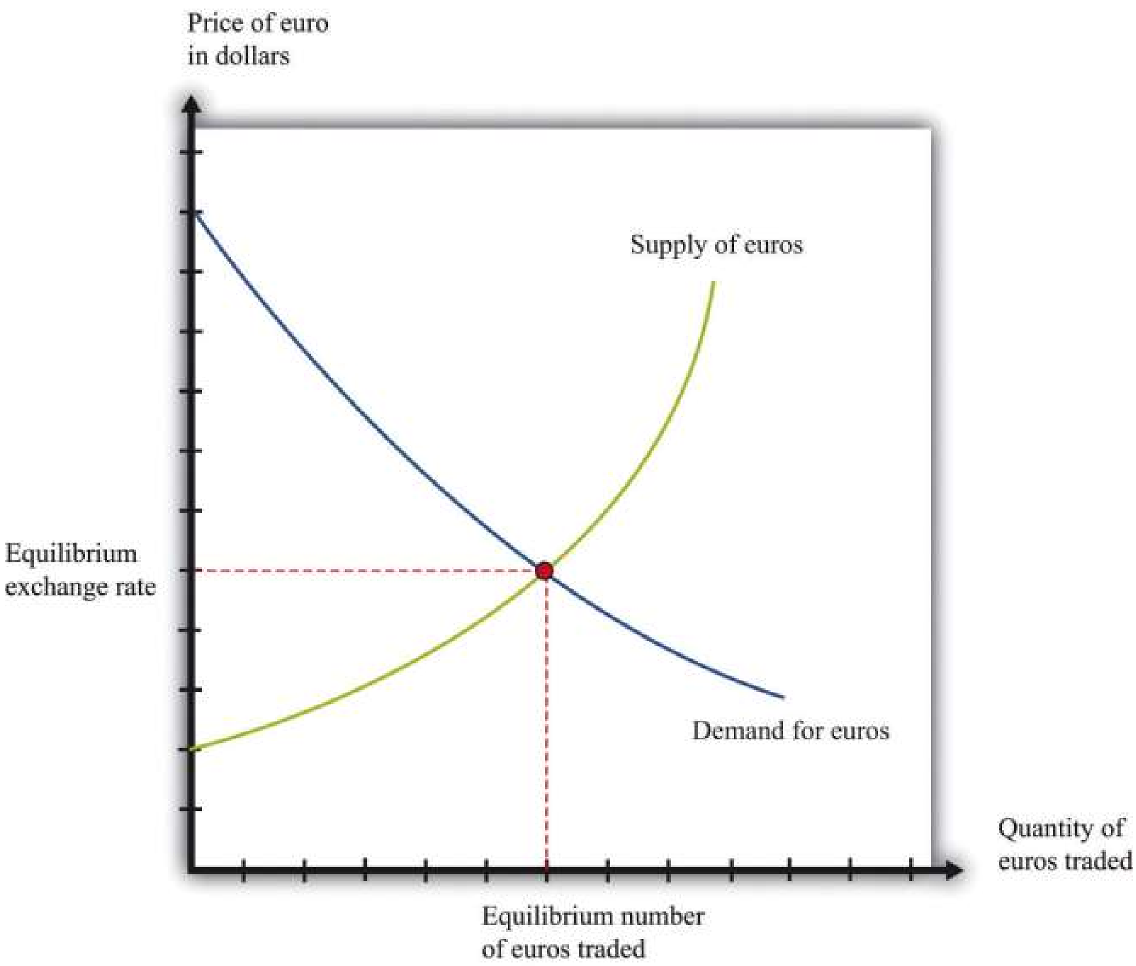

Fig. 4.13: Figure 4.13 Equilibrium in the Foreign Exchange Market Where Dollars and Euros Are Exchanged Currencies are traded in foreign exchange markets, such as the market shown here in which dollars and euros are exchanged. The equilibrium exchange rate is the price where the quantity of euros supplied equals the quantity of euros demanded.

On the supply side, there are households and firms in Europe who want to buy US goods and services. To do so, they need to buy dollars and, therefore, must supply euros to the market. This supply of euros need not come only from European households and firms. Anyone holding euros is free to sell them in this market. On the demand side, there are households and firms who are holding dollars and who wish to buy European goods and services. They need to buy euros.

There is another source of the demand for and the supply of different currencies. Households and, more importantly, firms often hold assets denominated in different currencies. You could, if you wish, hold some of your wealth in Israeli government bonds, in shares of a South African firm, or in Argentine real estate. But to do so, you would need to buy Israeli shekels, South African rand, or Argentine pesos. Likewise, many foreign investors hold US assets, such as shares in Dell Inc. or debt issued by the US government. Thus the demand for and the supply of currencies are also influenced by the asset choices of households and firms. In practice, banks and other financial institutions conduct the vast majority of trades in foreign exchange markets.

As well as households and firms, monetary authorities also participate in foreign exchange markets. For example, the US Federal Reserve Bank monitors the value of the dollar and may even intervene in the market, buying or selling dollars in order to influence the exchange rate.

4.3.9 Foreign Exchange Markets in the 2008 Crisis

One of the articles we used to open this chapter dealt with changes in the value of the dollar in the fall of 2008. The article pointed out that the dollar was getting stronger relative to other currencies, such as the euro. This means that the price of a dollar in euros was increasing or, equivalently, the price of a euro in dollars was decreasing. In fact, the euro price of a dollar was about 0.67 in late September 2008; the price increased to nearly 0.81 by late October and then decreased again through December 2008. We can use the foreign exchange market to understand these events. *** Figure 4.14 "Comparative Statics in the Euro Market" shows the dollar market for euros once again. The increase in the value of the dollar discussed in the article is seen here as a rightward shift in the supply of euros, which decreases the value of the euro and—equivalently—increases the value of the dollar.

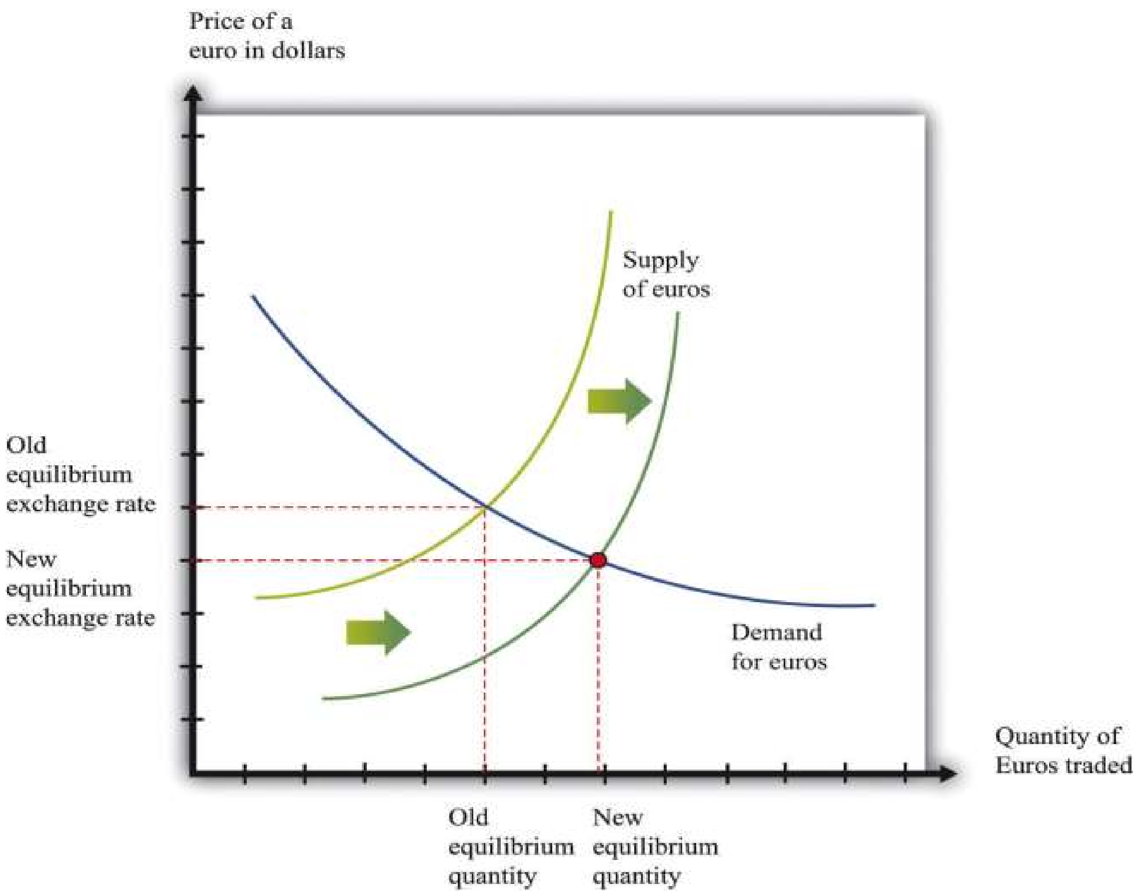

Fig. 4.14: Figure 4.14 Comparative Statics in the Euro Market The rightward shift in the supply of euros leads to a decrease in the price of a euro in terms of dollars.

There are two consequences of this shift in the supply curve. First, the shift in supply decreases the dollar price of the euro. So people in the United States who are planning to visit, say, France will find that they can obtain more euros for a given amount of dollars. Second, the quantity of euros actually bought and sold is higher.

This is not inconsistent with the lower dollar price of a euro since the supply curve shifts along the demand curve for euros.

4.3.10 Individual Foreign Exchange Markets and the Aggregate Foreign Exchange Market

We sometimes look at an individual exchange rate (e.g., dollar-euro) by thinking of the market where dollars are exchanged for euros. However, there are many different currencies that are exchanged for the US dollar. There are markets where dollars are exchanged for British pounds, Japanese yen, and so on. We can combine these into an aggregate foreign exchange market. Think of this as being the market where US dollars are bought with and sold for all the other currencies in the world. In this market, there is an aggregate exchange rate, w hich you can think of as an average of the exchange rates in all the individual markets. [***More precisely, you should think of a weighted average. Because the United States trades much more with Canada than with, say, South Africa, movements in the US dollar–Canadian dollar exchange rate matter more than movements in the US dollar–South African rand exchange rate. Chapter 9 "Money: A User's Guide" has more on exchange rates.***] We show this market in ***Figure 4.15 "Foreign Exchange Market Equilibrium".

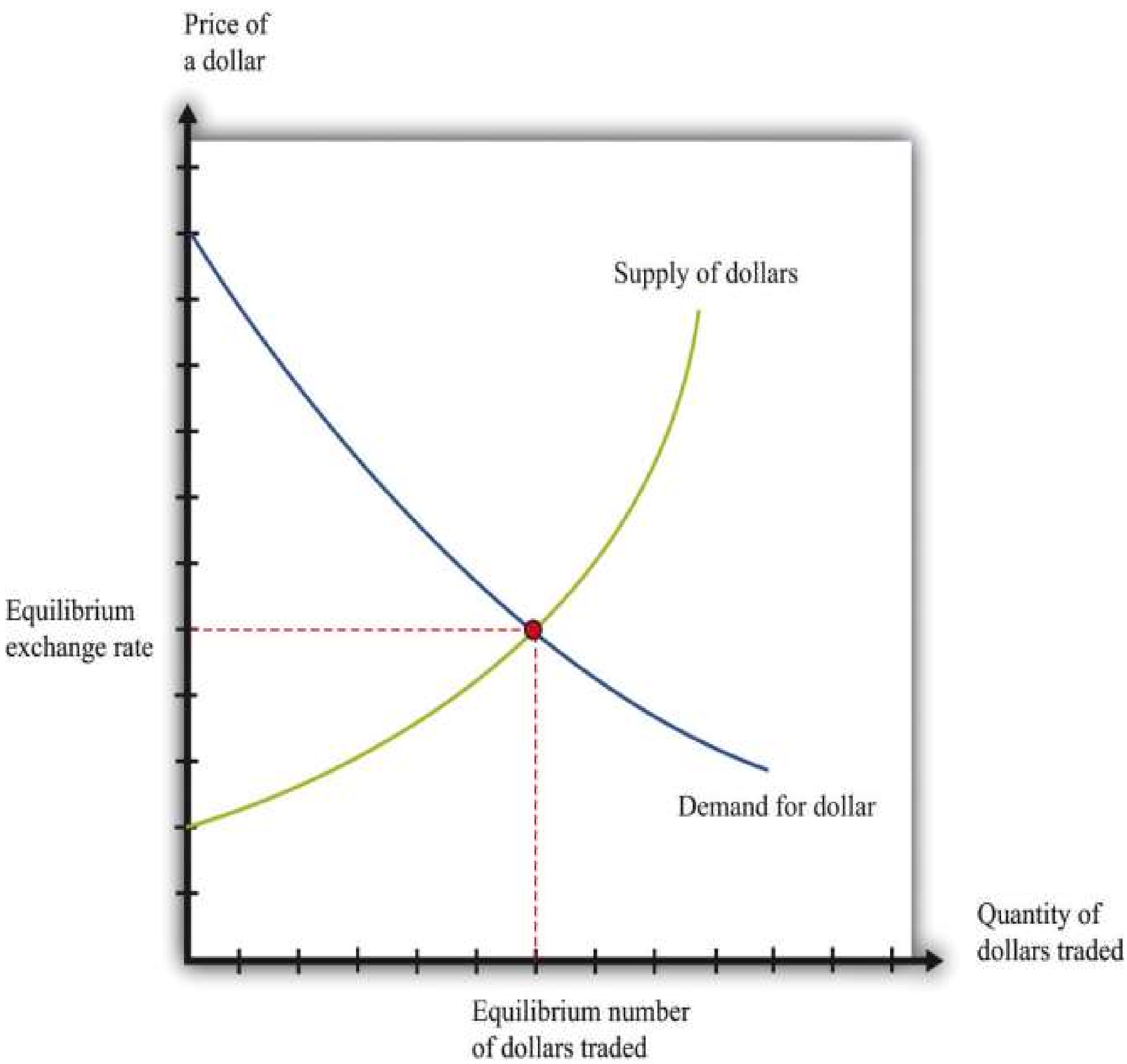

Fig. 4.15: Figure 4.15 Foreign Exchange Market Equilibrium Currencies are traded in foreign exchange markets, such as the market shown here in which dollars are bought and sold.

KEY TAKEAWAY

The credit market brings together the suppliers of credit (households) with those who are demanding credit (other households, firms, and the government). The interest rate adjusts to attain a market equilibrium.

The labor market is where labor services are traded. Households supply labor, and firms demand labor. The real wage adjusts to attain a market equilibrium.

The foreign exchange market brings together demanders and suppliers of foreign currency. The exchange rate, which is the price of one currency in terms of another, adjusts to attain a market equilibrium.

***

Checking Your Understanding

***Figure 4.13 "Equilibrium in the Foreign Exchange Market Where Dollars and Euros Are Exchanged" shows the market where euros are bought and sold using dollars. We could equivalently think about this as the market where dollars are bought and sold using euros. Draw the graph for this market. How are the supply and demand curves in the two markets related to each other?

4.4 Linkages across Markets

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How are the markets for goods, labor, credit, and foreign currency linked?

How do we use those links to understand the crisis that began in 2008?

In "Three Important Markets", we talked about the markets for credit, labor, and foreign exchange. We explained that we sometimes look at individual examples of these markets and sometimes at versions of these markets that apply to the economy as a whole.

But the story of the economic crisis in 2008 was not about a single market. Instead, what started as a problem in the US mortgage market was felt in the housing market in England, the labor market in China, the foreign exchange market in Europe, and many other markets. These different markets are connected; in this section, we explore these linkages. We do so through the **circular flow of income**, shown in ***Figure 4.16 "The Circular Flow of Income". That model of the economy reveals the linkages across markets that the global financial crisis made so evident.

Toolkit: Section 16.16 "The Circular Flow of Income"

You can review the circular flow of income in the toolkit.

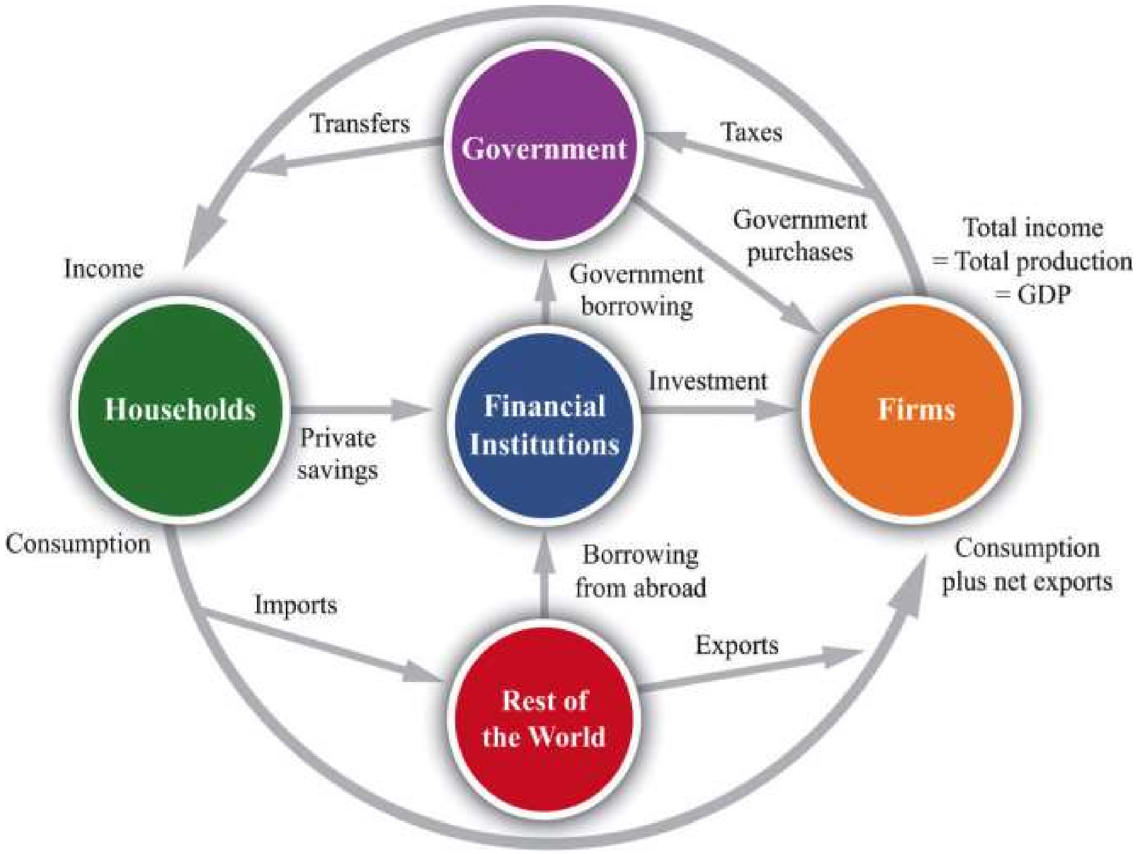

Fig. 4.16: Figure 4.16 The Circular Flow of Income

We know from the circular flow that the production of goods and services generates income in an economy. Some of that income is paid to the government in the form of taxes, but the rest finds its way to households. Much of the flow of dollars from firms to households takes place through the labor market because firms demand labor to produce goods. If firms are producing large quantities of goods and services, then they demand lots of labor, and income from the sale of labor services in the economy is high.

Some of the income that households earn from selling labor services is saved. There is therefore a link, through the household sector, between the labor market and the credit market. So we can follow a connection from the production of goods and services to the supply of credit: if firms produce more, they generate more labor income, so there is more saving supplied by households to the credit market. There is also a link from the markets for goods and services to the *demand* for credit: firms borrow to purchase investment goods.

These markets are also linked—directly or indirectly—to foreign exchange markets. Whenever firms purchase imported goods, such as oil, this generates a demand for foreign exchange. When firms expand output, demand more labor, and so generate additional household income, households spend some of this income on imports, again generating a demand for foreign exchange. When households and firms in other countries want to buy our goods and services, that generates a supply of foreign exchange. And many transactions in credit markets also generate a demand for or supply of foreign exchange.

4.4.1 Comparative Statics in an Interconnected World

We could go on, but the point should be clear: the markets in every economy are intimately interconnected. This has a critical implication for our study of macroeconomics, which is that it both complicates and enriches our comparative static analyses. When a shift in supply or demand in one market affects the equilibrium price and quantity in that market, there are changes in other markets as well. [***There is a second, more abstract implication: we have to worry about whether all the markets in the economy are in equilibrium at the same time. In our analyses, we have looked at only one market at a time. But we now know that the outcome in one market (for example, the real wage) can affect supply and demand in other markets (for example, the supply of credit). In advanced studies in economics, we use complicated mathematics to see if there are prices that are consistent with all the markets being in equilibrium at once. The bottom line is good news: we can usually be confident that there is an equilibrium for all markets. But because this is such an advanced area of economics, we do not worry about it further in this book.***] In this section, we show how these interactions across markets help us understand the propagation of the 2008 crisis from the US housing market to the economies of the world. We have already hinted at some of these linkages, but now we make them more explicit.

4.4.2 Housing and Credit Markets in the 2008 Crisis

The story began with the first comparative static example that we looked at: a leftward shift in demand for housing. Potential buyers of houses started worrying that the *future*price of houses would decrease. This made people more reluctant to buy houses. Meanwhile, a tightening of lending standards made it harder for people to obtain loans. Both of these caused the demand for housing to shift leftward. Part (a) of ***Figure 4.17, which we already saw earlier in the chapter, shows us that this led to a decrease in both the price and the quantity of houses.

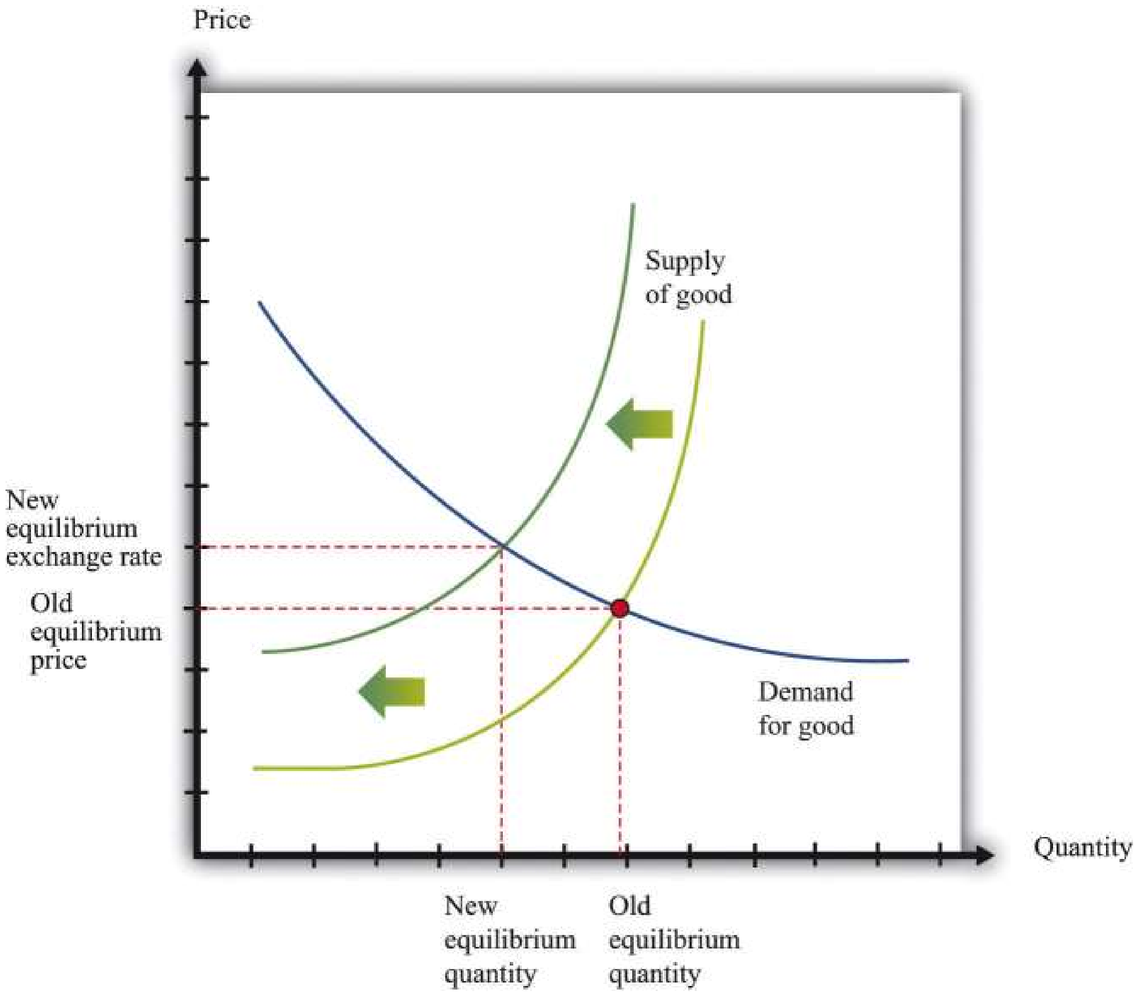

Fig. 4.17: Figure 4.17

A decrease in demand for housing led to a decrease in supply of credit. (a) Worsening expectations about future house prices, together with tighter lending conditions, led to a decrease in demand for housing. (b) In the credit market, banks and other lending institutions found themselves with bad debt, so the supply of credit decreased.

Part (b) of ***Figure 4.17 also appeared earlier in the chapter. The decrease in housing prices, combined with the complicated way in which mortgages had been sold and resold by financial institutions, meant that many financial institutions found themselves in trouble. Some went bankrupt. This made financial institutions cautious about lending to each other, so the supply of credit shifted to the left. Interest rates rose. (Interest rates in the crisis were also affected by the actions of the US Federal Reserve and other monetary authorities around the world. [***We discuss such policies in detail when we return to the crisis in Chapter 15 "The Global Financial Crisis".***])

4.4.3 A Shift in the Supply of Goods

If you run a business, you often have to rely on credit (loans) to finance the purchase of your inputs into the production process. For example, suppose you run a boutique clothing store.

You have to buy the clothes to put on display first, and you get your revenues only when you sell the clothes. Weeks or even months may pass between the time you incur your costs and the time you get your revenues. Unless you have the funds available to buy all your stock up front, you will need to borrow. The same is true in many other businesses. Firms regularly take out short-term loans to pay for some of their costs of operation.

When interest rates increase, businesses see their costs increase. Higher costs make it less profitable to produce at any given price, so most businesses cut back on their production. Some may even leave the market altogether. As a consequence, the supply curve for most goods and services shifts leftward, as shown in Figure 4.18. We see that the equilibrium price increases, and the equilibrium quantity decreases. Going back to an individual producer, what does this mean? The producer sees costs increase. In the new equilibrium, the producer also obtains a higher price. However, the increase in price is not as big as the increase in cost.

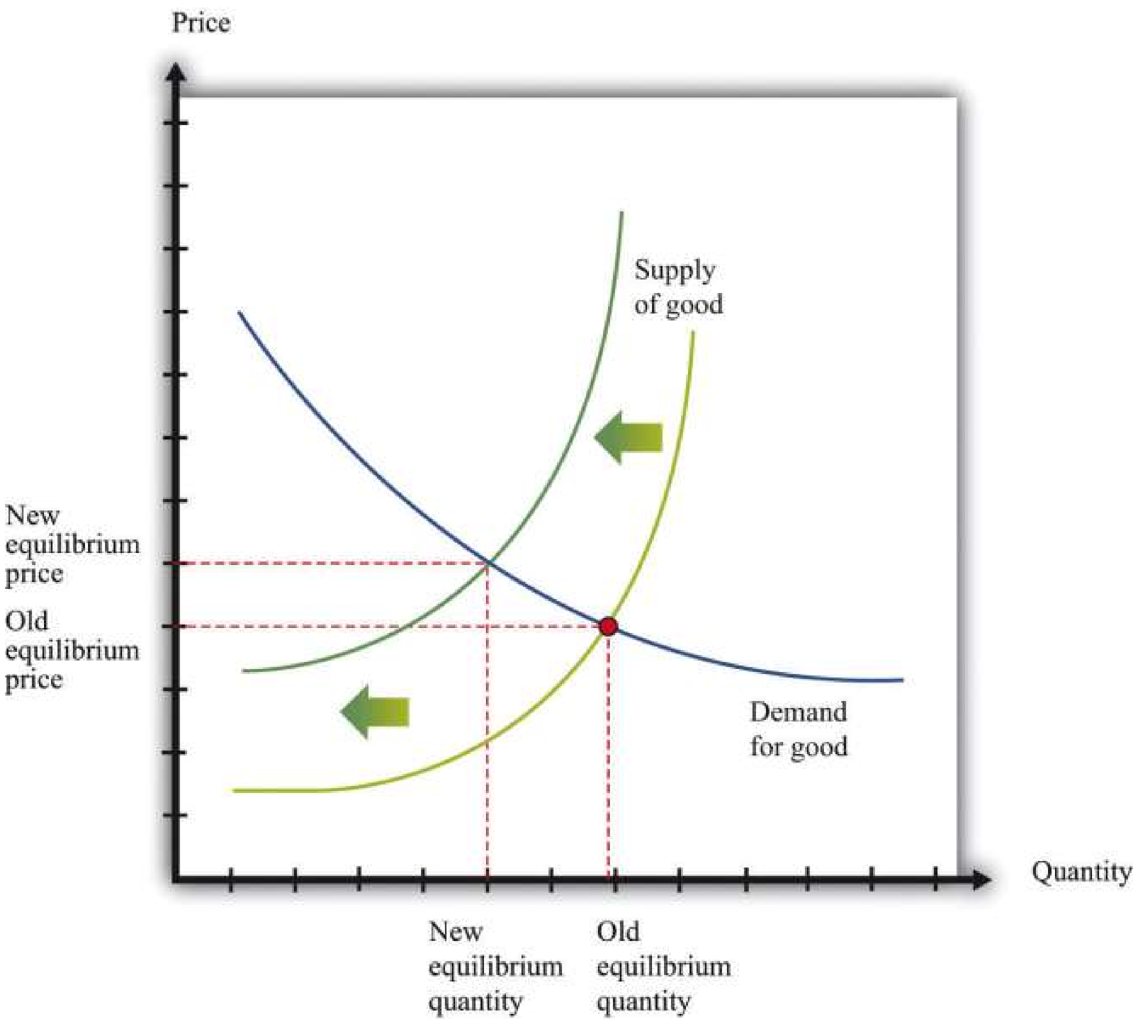

Fig. 4.18: Figure 4.18 Higher interest rates lead to higher prices and lower quantities for most goods and services. Higher interest rates increase the cost of doing business, so the supply curve for a typical good or service shifts leftward.

4.4.4 A Shift in Demand for Labor

The effect of the higher interest rates on the output decisions of firms also leads them to demand less of all their inputs, including labor. Decreases in production lead to decreases in labor demand, as shown in ***Figure 4.19 "A Decrease in Demand for Labor". In turn, decreases in wages and employment (more generally, a decrease in income) lead to decreased demand for goods.

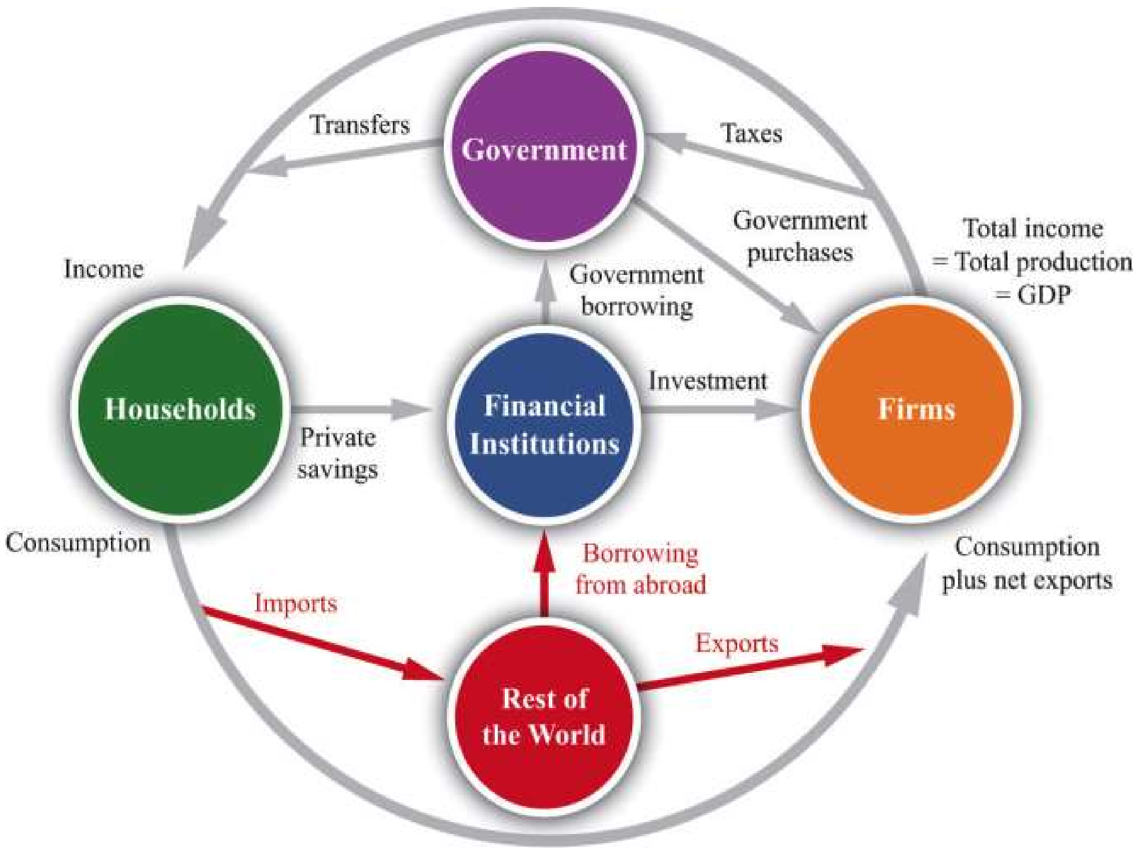

Fig. 4.19: Figure 4.19 A Decrease in Demand for Labor A decrease in demand for labor causes the labor demand curve to shift leftward.

4.4.5 A Shift in Demand for Goods

Notice the connection back and forth between households and firms. As firms reduce their demand for labor services, less income flows to households. This reduction in income leads to a reduction in the demand for goods and services, leading firms to reduce output and employment even further. The interaction between income and spending on goods and services can lead to much larger reductions in output and employment than the original shift in demand in the original market (in this case, the housing market). This means that ***Figure 4.18 does not tell the whole story of goods markets. That figure shows the effects of interest rates on the supply of goods but does not include the reduction in demand stemming from the interaction of income and spending in the circular flow.Figure 4.20 completes the story by adding the shift in demand.

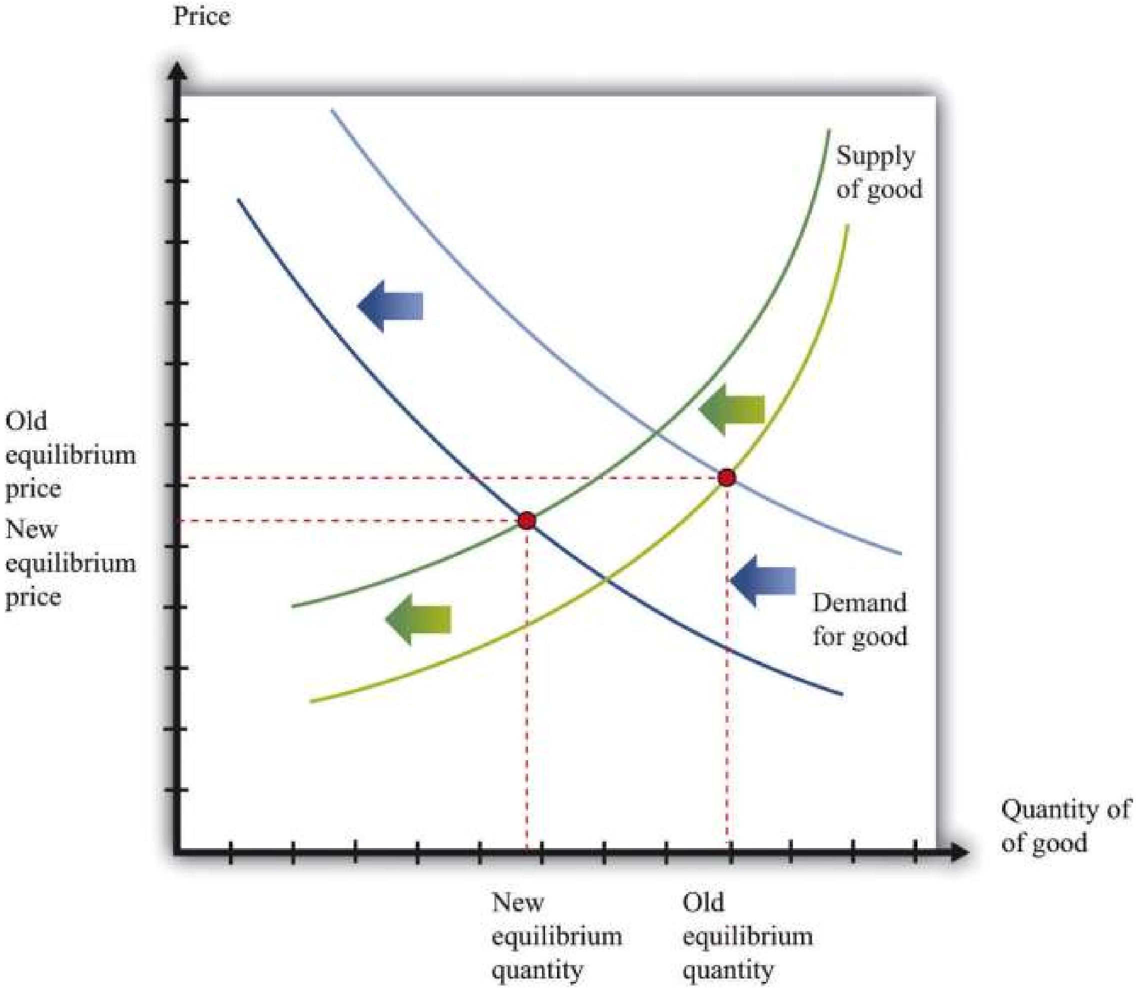

Fig. 4.20: Figure 4.20 Higher interest rates lead to a leftward shift in supply, and lower income leads to a leftward shift of demand, resulting in lower quantities for most goods and services. Higher interest rates increase the cost of doing business. Lower income decreases the demand for goods and services.

4.4.6 How to Tell Business Is Cutting Back

From fewer shoe shines to a slowdown in corporate art purchases, subtle bellwethers can help take the temperature of business activity.

Nelson Villanova doesn't need to watch the stock market indexes...or gross domestic product to gauge the health of the economy. He just has to look down. If he sees scuffed shoes, then he knows things are bad.

Villanova, general manager of Eddie's Shoe Repair in New York's Grand Central Terminal, has seen business drop 25% to 30% since August. The 15-year-old company employs 40 people across five locations in the sprawling train station, shining and repairing shoes and luggage. But lately, selling $4 shines seems to be as hard as unloading mortgage-backed securities.

[...] [***John Tozzi, "How to Tell Business Is Cutting Back," Bloomberg BusinessWeek, October 21, 2008, accessed June 28, 2011,http://www.businessweek.com/smallbiz/

content/oct2008/sb20081020_372369.htm?c
han=top$+$news_top+news+index+-+temp_small+ business.***]

***Figure 4.21 "A Decrease in Demand for Shoeshines" shows the shoeshine market. Traders working on Wall Street started purchasing fewer shoeshines. This was not because shoeshines became more expensive. Rather, it was a shift in the demand for shoeshines because these traders saw that their incomes were decreasing.

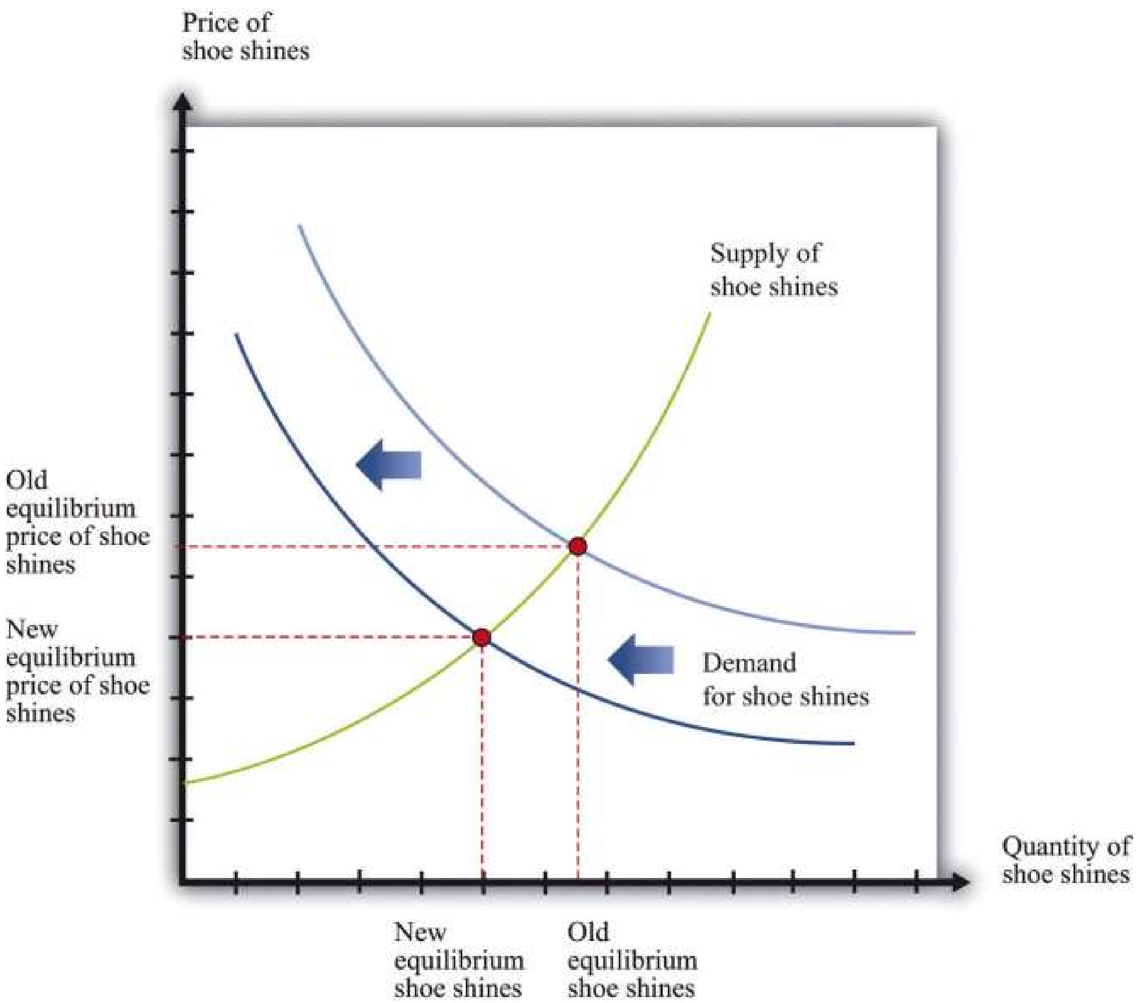

Fig. 4.21: Figure 4.21 A Decrease in Demand for Shoeshines A decrease in income leads to a decrease in demand (a leftward shift) for shoeshines.

4.4.7 Trade Flows and a Shift in the Demand for Foreign Exchange

One of the excerpts we used to introduce this chapter touched on the effects of the crisis on exports from China. We now broaden our discussion to include those effects as well. Looking back at ***Figure 4.19 "A Decrease in Demand for Labor", recall that part of household spending goes toward the purchase of goods and services produced in other countries. A significant fraction of imports to the United States come from China. China also sells goods and services to Japan, Europe, and most of the world.

When demand from these economies slumps, as it did in 2008, exports from China also decrease. Since exports are a part of overall spending, this leads firms in China to cut back their production and employment. Thus the Chinese economy was also slowed down by the effects of the financial crisis.

The reduced demand for imports has another effect. Because the demand for foreign currency is partly motivated by the desire to buy goods from that country, a decrease in the import of Chinese goods to the United States and other countries leads to a decrease in demand for the Chinese yuan. There is a leftward shift in the demand for that currency and thus a lower price in dollars. (As with all comparative static exercises, this assumes that nothing else is changing to offset these effects on the demand for the yuan.)

The **current account balance** is (roughly speaking) the difference between the value of exports and imports of goods and services. A country has a current account surplus if the value of exports of goods and services exceeds the value of its imports. A country has a current account deficit if the value of imports of goods and services exceeds the value of its exports. Looking at the United States and China, one sees very different behavior for the current account. [***This discussion draws on data from the International Monetary Fund. See Stephan

Danninger and Florence Jaumotte, "Divergence of Current Account Balances across Emerging Economies," World Economic Outlook, Chapter 6, accessed June 28,

2011,http://www.imf.org/external/pubs/ft/weo/2008/02/pdf/c6.pdf. ***] In recent years, the United States has run a current account deficit of nearly 5 percent of its gross domestic product (GDP). China, in contrast, has run a current account surplus of about 6.1 percent of its GDP since 2002.

The reduced demand for imports from China has an effect on the current account balance of China. We would expect to see a reduction in the current account surplus of China due to the reduction in economic activity of its trading partners.

You might also wonder how the persistent deficits of the United States are paid for. When a country runs a current account deficit, it is borrowing from other countries. This is just like a household that pays for consumption above its income by means of borrowing. The rules of national income accounting tell us that the flows in and out of each sector must always be in balance. If we look at the flows in and out of the foreign sector we see that

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borrowing from abroad = imports − exports
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or

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lending to abroad = exports − imports.
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Net exports (sometimes called the trade surplus) equal exports minus imports. So lending to other countries equals net exports. The circular flow of income tells us something powerful: whenever we import more than we export, we *must*, on net, be borrowing from abroad. On reflection, this is not so surprising. Other countries are giving us more goods and services than we are giving to them. This is not done out of generosity; they do so because they expect to be repaid at some point in the future. If we export more than we import, then this flow goes in the other direction, and we are lending to abroad.

Both China and the United States trade with many other countries, so this pattern of trade holds true bilaterally (that is, between them) as well. China has run systematic current account surpluses with the United States, meaning that China is lending to the United States. Those loans take many forms, with commentators highlighting Chinese purchases of US government debt. US Secretary of State Hilary Clinton alluded to this connection between the two economies during a visit to China in early 2009.

US Secretary of State Hillary Clinton yesterday urged China to keep buying US debt as

she wrapped up her first overseas trip, during which she agreed to work closely with Beijing on the financial crisis.

[...]

By continuing to support American Treasury instruments the Chinese are recognizing our interconnection... [***"Keep Buying US Treasury Bills, Clinton Urges China," Taipai Times, February 23, 2009, accessed June 28, 2011,http://www.taipeitimes.com/News/front/print/2009/02/23/2003436802.***]

4.4.8 The Crisis of 2008: A Brief Summary

The crisis began with a reduction in the demand for houses and a consequent decrease in the value of houses. This reduced the value of assets, particularly mortgage-backed securities, and meant that the supply of credit in the economy shifted inward. The consequence was higher interest rates and reduced credit. Since many firms in the economy borrow to finance production, the increased interest rates increased their marginal costs of production. Supply curves throughout the economy shifted inward, leading to lower output. Firms needed fewer workers, so there was a reduction in employment.

The spread to other countries came through a couple of avenues. First, households and firms in other countries were one source of credit to the US economy. When asset prices decreased, the portfolios of foreign banks were also adversely affected. This led to higher interest rates and lower output in those countries. In addition, as the US economy went into recession, it purchased fewer imports from other countries. This led to lower production in those countries.

Our description of the crisis is of necessity a simple one. We have neglected many details, and we have not discussed how government policies also affected interest rates and the demand for goods and services. Later chapters in the book provide more tools for understanding these aspects of the crisis, so when we return to the topic in Chapter 15 "The Global Financial Crisis", we can provide a more complete analysis of the crisis.

KEY TAKEAWAY

Markets are linked because supply and demand in one market generally depend on the outcomes in other markets. The circular flow of income illustrates some of these connections across markets.

Although the crisis in 2008 may have started in the housing market, it did not end there. Instead, the crisis impacted markets for labor, credit, and foreign exchange.

***

Checking Your Understanding

We have explained that increases in interest rates shift the supply of goods leftward, and decreases in incomes shift the demand for goods leftward. Draw diagrams with both shifts at once and show that the quantity definitely decreases, but the price may increase or decrease.

Can you think of a good for which the demand curve might shift rightward when incomes decrease?

4.5 End-of-Chapter Material

In Conclusion

The supply-and-demand framework is almost certainly the most powerful model in the economist's toolkit. Armed with an understanding of this framework, you can make sense of much economic news, and you can make intelligent predictions about future changes in prices.

A true understanding of this framework is more than just an ability to shift curves around, however. It is an understanding of how markets and prices are one of the main ways in which the world is interlinked. Markets are, quite simply, at the heart of economic life. Markets are the means by which suppliers and demanders of goods and services can meet and exchange their wares. Since exchange creates value—because it makes both buyers and sellers better off—markets are the means by which our economy can prosper. Markets are the means by which economic activity is coordinated in our economy, allowing us to specialize in what we do best and to buy other goods and services.

Economists regularly point to these features of markets, but this should not blind us to the fact that markets can go wrong. There are many ways in which market outcomes may not be the most desirable or efficient, as the global financial crisis revealed. In the remainder of this book, we look in considerable detail at all the ways that markets can fail us as well as help us.

4.5.1 Key Links

- International Monetary Fund (IMF):www.imf.org/external/pubs/ft/weo/2008/01/pdf/c3.pdf
- IMF video on its response to the crisis: http://www.youtube.com/watch?v=f0z6nWQfvuA&feature=channel_page
- Federal Reserve Bank of San Francisco:http://www.frbsf.org/publications/economics/letter/2008/el2008-21.html
- New York University Stern blog on the financial crisis:http://sternfinance.blogspot.com/search/label/overview/

EXERCISES

What would the impact be on the market demand curve for new homes if there were an increase in the price of old homes?

Name two factors that cause market demand curves to shift outward.

Fill in the blanks in the following table. What can you say about the missing price in the table?

If the income levels of all households increase, what happens to the individual demand curves? What happens to market demand?

Suppose the price of coffee increases. Household 1 always eats a chocolate bar while drinking coffee. What will happen to Household 1's demand for chocolate bars when the price of coffee increases? Household 2 has either coffee or a chocolate bar for dessert. What happens to Household 2's demand for chocolate bars when the price of coffee increases? What happens to the market demand for chocolate bars when the price of coffee increases?

(Advanced) In Figure 4.3 "The Market Supply of Houses" we showed the market supply curve for new houses. Suppose that a change in government regulations makes it easier for people to become qualified electricians. What will happen to the supply curve for houses?

We said that the equilibrium price and quantity in a market is always positive. More precisely, this is true as long as the vertical intercept of the demand curve is bigger than the vertical intercept of the supply curve. If this is not the case, then the most that any buyer is willing to pay is less than the least any seller is willing to accept. Draw a version of Figure 4.5 "Market Equilibrium" to illustrate this possibility. How much trade do you expect in this market?

Suppose that households become worried about losing their jobs and decide to save more. What happens in the credit market? Do you expect interest rates to increase or decrease?

When interest rates decrease, firms find it cheaper to borrow. What do you think happens to the demand for labor? What happens to the real wage?

What happens to the value of the US dollar if a) foreign investors decide they want to buy more US assets. b) there is a recession in other countries that buy goods produced in the United States.

What do you think will be the effect on the markets for used homes and apartments if there is a reduction in expected capital gains from owning a new home? The shift in the supply curve came from an increase in the cost of credit. Where might the increase in the cost of credit come from?

Think about your hometown as an economy. What does it import (i.e., what goods and services does it purchase from outside the town)? What does it export (i.e., what goods and services are produced in the town and sold outside it)? What about the street you live on—what are its imports and exports?

Using supply and demand, explain how an increase in Chinese demand for Australian butter might be one of the factors causing the Australian dollar to appreciate. How might this affect the labor markets in Australia?

If oil prices increase, what will this do to the demand for apartments and houses in warm climates? What will happen to housing prices in cold climates? Use supply and demand to illustrate.

Economics Detective

Find three news articles that discuss the financial crisis. Which markets are discussed in these articles? Can you use a supply-and-demand picture to help you make sense of anything that is discussed in the articles you find?

Find one example of another country where there was a major decrease in housing prices, as in the United States and England. Find another country where housing prices did not seem to be affected.

Spreadsheet Exercise

1. Using a spreadsheet, construct a version of ***Table 4.1 "Market Equilibrium: An Example" assuming that market demand = 50 − 0.005 × price.

Fill in all the prices (in thousands) from 1,000 to 100,000. What is the equilibrium price and quantity in the market? How would you explain the difference between this equilibrium and the one displayed in ***Table 4.1 "Market Equilibrium: An Example"?

Price of Chocolate Bar	Household 1's Demand	Household 2's Demand	Market Demand
1	7		22
2		11	16
10	.5	3	3.5
	.75	4	4.75

Table 4.2 Individual and market demand

Chapter 5 Globalization and Competitiveness

Five Stories

We begin this chapter with five stories from around the world.

The United Kingdom

The following is a BBC report on Polish immigration to the United Kingdom.

So You're Polish and Want a Job...

If there was ever any doubt that the UK is in the grips of an extraordinary revolution, then hunt out the migrant worker recruitment fairs that are starting to spring up.

Last month, thousands of young Polish workers turned up at the third recruitment fair hosted by Polish Express, the London-based newspaper for the diaspora, [...]

As they queued to enter the hall that was filled to its legal safety capacity, they scribbled away at resumes, going over their pitch time and time again.

Most were in their mid-20s. Some had only recently arrived, having stuffed a few belongings into a backpack, bought a one-way no-frills airline ticket. [...]

[A] willingness to do jobs that employers say British workers don't want, was at the heart of the boom, said Bob Owen of Polcat, a Doncaster safety training firm targeting the Polish employees market.

"I must admit it, I have never seen a workforce like the Poles," said Mr Owen. "They want to work, you can see it in their eyes. But here's the thing—they're not in competition with the British workforce—they are finding ways of fulfilling a need that just wasn't being met and that's why they are being welcomed."

[...] [***See Dominic Casiani, "So You're Polish and You Want a Job," BBC News, September 25, 2006, accessed June 28, 2011, http://news.bbc.co.uk/1/hi/uk/5376602.stm.***]

United Arab Emirates

Figure 5.1 is a screenshot from a Dubai government website that promotes business and tourism in Dubai. [***See "Dubai for Business," Government of Dubai: Department of Tourism and Commerce Marketing, accessed July 27, 2011, http://www.dubaitourism.ae/definitely-dubai/dubaibusiness.***] It details many different ways in which Dubai is a desirable place for businesses to locate. For example, the website contains the following:

Fig. 5.1: Figure 5.1

Pro-Business Environment

Dubai offers incoming business all the advantages of a highly developed economy. Its infrastructure and services match the highest international standards, facilitating efficiency, quality, and service. Among the benefits are:

- Free enterprise system. •
- Highly developed transport infrastructure. •
- State-of-the-art telecommunications. •
- Sophisticated financial and services sector. •
- Top international exhibition and conference venue. •
- High quality office and residential accommodation. •
- Reliable power, utilities, etc. •
- First class hotels, hospitals, schools, and shops. •
- Cosmopolitan lifestyle.

The website goes on to talk about benefits such as the absence of corporate or income taxes, the absence of trade barriers, competitive labor and energy costs, and so on.

Vietnam

The following is an extract from the *Taipei Times*, April 9, 2007.

Compal Eyes Vietnam for Factory

Compal Electronics Inc, the world's second-largest laptop contract computer maker, is considering building a new factory in Vietnam. Compal could join the growing number of Taiwanese electronic companies investing in Vietnam—such as component maker

Hon Hai Precision Industry Co—in pursuit of more cost-effective manufacturing sites outside China.

[...]

Compal forecast last month that its shipments of notebook computers would expand around 38 percent to 20 million units this year, from 14.5 million units last year. The company currently makes 24 million computers a year at its factories in Kunshan, China. Compal, which supplies computers to Dell Inc and other big brands, could lack the capacity to match customers' demand next year if its shipments increase any faster,...

Lower wages and better preferential tax breaks promised by the Vietnamese government could be prime factors for choosing Vietnam, Compal chairman Rock Hsu said earlier this year.

[...] [***See "Compal Eyes Vietnam for Factory, Taipei Times, April 9, 2007, accessed June 28, 2011,http://www.taipeitimes.com/News/biz/print/2007/04/09/2003355949. We have corrected a minor grammatical error in the article.***]

Niger

In Niger, West Africa, the World Bank is funding a $300 million project to improve education: "The Basic Education Project for Niger's objectives are: (i) to increase enrollment and completion in basic education programs and (ii) to improve management at all levels by improving the use of existing resources, focusing on rural areas to achieve greater equity and poverty reduction in the medium to long term." [***For more details, see World Bank, "Basic Education Project" World Bank, accessed June 28, 2011, http://web.worldbank.org/external/projects/main?page PK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P061209.***] The World Bank website explains that the goals of the project are to improve access to primary education (including adult literacy), improve the quality of primary and secondary education, and improve the management capability of the Ministry of Education.

United States

President Obama recently established the President's Council on Jobs and Competitiveness, which is charged, among other things, with reporting "directly to the President on the design, implementation, and evaluation of policies to promote the growth of the American economy, enhance the skills and education of Americans, maintain a stable and sound financial and banking system, create stable jobs for American workers, and improve the long term prosperity and competitiveness of the American people." [***See "President's Council on Jobs and Competitiveness: About the Council," accessed July 27, 2011, http://www.whitehouse.gov/administration/advisory-boards/jobs-council/about. ***] In his concern with competitiveness, President Obama follows directly in the footsteps of President George W.

Bush, who, in 2006, established the American Competitiveness Initiative to Encourage American Innovation and Strengthen Our Nation's Ability to Compete in the Global Economy. [***George W. Bush, "State of the Union: American Competitiveness Initiative," White House Office of Communications, January 31, 2006, accessed June 28, 2011,http://www2.ed.gov/about/inits/ed/competitiveness/sou-competitiveness.pdf.***]

At first reading, these five stories seem to have little to do with each other. There is no obvious connection between the actions of the World Bank in Niger and Taiwanese computer manufacturers in Vietnam or between the marketing of Dubai and the arrival of Polish migrants in the United Kingdom. Yet they are indeed all connected. Think for a moment about the *consequences* of the following:

- • An influx of workers to the United Kingdom
- • A superior business environment in Dubai
- • Improved education in Niger
- • A new factory opening in Vietnam
- • An improved banking system in the United States

Of course, each story has many different implications. But they have something fundamental in common: every single one of them will increase the real gross domestic product (real GDP) of the country in question. They all therefore shed light on one of the most fundamental questions in macroeconomics:

What determines a country's real GDP?

As we tackle this question, we will see that it is indeed connected to our stories of Dubai, the United Kingdom, Niger, Vietnam, and the United States.

Our stories have something else in common as well. In each case, they concern not only the country in isolation but also how it interacts with the rest of the world. The funds for Niger's education program are coming from other countries (via the World Bank). The US policy is designed to ensure that America is "leading the global competition that will determine our success in the 21st century." [***"Obama Presses for an Economy in 'Overdrive': Will Jobs Soon Follow?," PBS NewsHour, January 21, 2011, accessed August 22, 2011, http://www.pbs.org/newshour/bb/business/janjune11/obamabusiness_01-21.html. ***] Dubai is trying to attract investment from other countries. The workers in the United Kingdom are coming from Poland. The factory in Vietnam is being built so that a Taiwanese company can supply other manufacturers throughout the world.

Road Map

Real GDP is the broadest measure that we have of the amount of economic activity in an economy. In this chapter, we investigate the *supply* of real GDP in an economy. Firms in an economy create goods and services by transforming inputs into outputs. For example, think about the manufacture of a pizza. It begins with a recipe—a set of instructions. A chef following this recipe might require 30 minutes of labor time to make the dough and assemble the toppings and then might need 15 minutes use of a pizza oven to cook the pizza. The inputs here are as follows: the pizza oven, the labor time, the skills of the chef, and the recipe. Given 15 minutes of capital time, 30 minutes of labor time, a skilled chef, and the instructions, we can make one pizza.

In macroeconomics, we work with the analogous idea that explains how the total production in an economy depends on the available inputs. We first explain the relationship between the available inputs in the economy and the amount of real GDP that the economy can produce.

Then we look at all the individual inputs in turn. If we can explain what determines the amount of each input in an economy and if we know the link from inputs to real GDP, then we can determine the level of real GDP. Finally, we look at a technique that allows us to quantify the relationship between inputs and output. Specifically, we look at how increases in different inputs translate into increases in overall GDP. Using this technique, we can see which inputs are particularly important.

5.1 The Production of Real GDP

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What determines the production capabilities of an economy?

What is the marginal product of an input?

How is competitiveness related to the aggregate production function?

Economists analyze production in an economy by analogy to the production of output by a firm. Just as a firm takes inputs and transforms them into output, so also does the economy as a whole. We summarize the production capabilities of an economy with an **aggregate production function**.

5.1.1 The Aggregate Production Function

Toolkit: Section 16.15 "The Aggregate Production Function"

The aggregate production function describes how aggregate output (**real gross domestic product [real GDP]**) in an economy depends on available inputs. The most important inputs are as follows:

- Physical capital: machines, production facilities, and so forth used in production •
- Labor: the number of hours that are worked in the entire economy •
- Human capital: the skills and education embodied in the work force of the economy •
- Knowledge: the blueprints that describe the production process •
- Natural resources: oil, coal, and other mineral deposits; agricultural and forest lands; and other resources
- Social infrastructure: the general business climate, the legal environment, and any relevant features of the culture

Output increases whenever there is an increase in one of these inputs, all else being the same.

Physical capital refers to goods—such as factory buildings, machinery, and 18-wheel trucks—that have two essential features. First, *capital goods are used in the production of other goods*. The production of physical capital does not increase our well-being in and of itself. It allows us to produce more goods in the future, which permits us to enjoy more consumption at some future date. Second, *capital goods are long lasting*, which means we accumulate a capital stock over time. Capital goods are thus distinct from intermediate goods, which are fully used up in the production process.

The **capital stock** of an economy is the total amount of physical capital in the economy. As well as factories and machines, the capital stock includes physical infrastructure—road networks, airports, telecommunications networks, and the like. These are capital goods that are available for multiple firms to use. Sometimes these goods are supplied by governments (roads, for example); sometimes they are provided by private firms (cellular telephone networks are an example). For brevity, we often simply refer to “capital” rather than “physical capital.” When you see the word *capital* appearing on its own in this book you should always understand it to mean physical capital.

Labor hours are the total number of hours worked in an economy. This depends on the size of the workforce and on how many hours are worked by each individual. [***We use the term workforce rather than labor force deliberately because the term labor force has a precise definition—those who are unemployed as well as those who are working. We want to include only those who are working because they are the ones supplying the labor hours that go into the production function. Chapter 8 "Jobs in the Macroeconomy" discusses this distinction in more detail.***]

Human capital is the term that economists use for the skills and training of an economy’s workforce. It includes both formal education and on-the-job training. It likewise includes technical skills, such as those of a plumber, an electrician, or a software designer, and managerial skills, such as leadership and people management.

Knowledge is the information that is contained in books, software, or blueprints. It encompasses basic mathematics, such as calculus and the Pythagorean theorem, as well as more specific pieces of knowledge, such as the map of the human genome, the formula for Coca-Cola, or the instructions for building a space shuttle.

Natural resources include land; oil and coal reserves; and other valuable resources, such as precious metals.

Social infrastructure refers to the legal, political, social, and cultural frameworks that exist in an economy. An economy with good social infrastructure is relatively free of corruption, has a functional and reliable legal system, and so on. Also included in social infrastructure are any relevant cultural variables. For example, it is sometimes argued that some societies are—for whatever reason—more entrepreneurial than others. As another example, the number of different languages that are spoken in a country influences GDP.

We show the production function schematically in ***Figure 5.2 "The Aggregate Production Function".

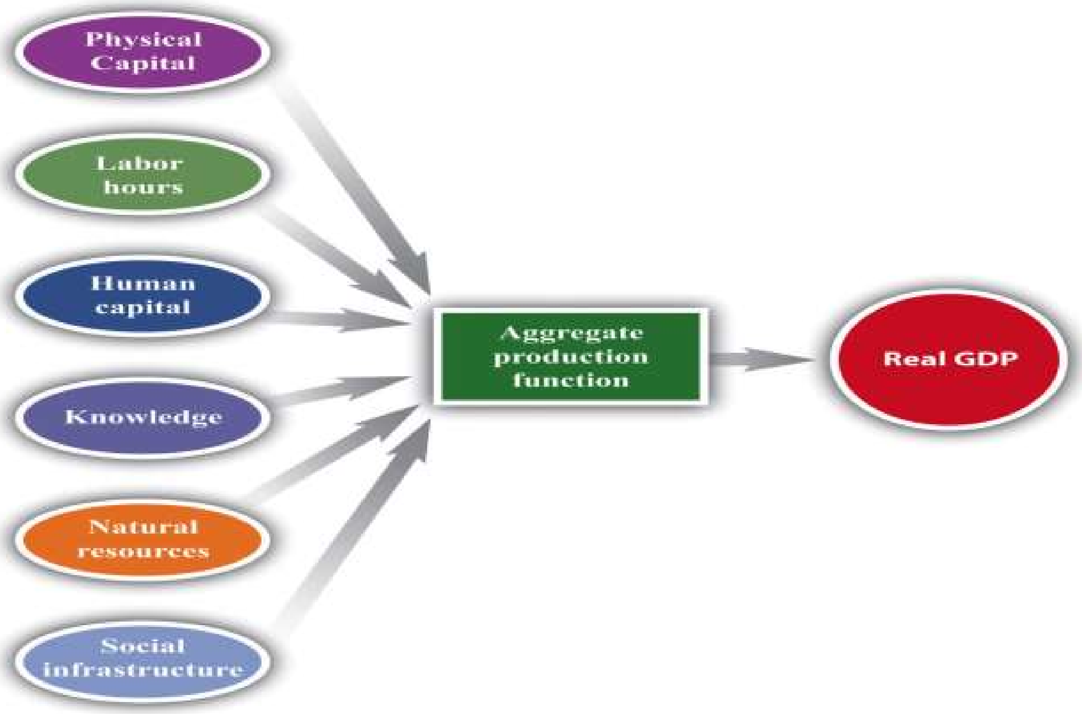

Fig. 5.2: Figure 5.2 The Aggregate Production Function The aggregate production function combines an economy's physical capital stock, labor hours, human capital, knowledge, natural resources, and social infrastructure to produce output (real GDP).

The idea of the production function is simple: if we put more in, we get more out.

- • With more physical capital, we can produce more output. If you want to dig a foundation for a house, you will be more productive with a backhoe than a shovel; if you want to deliver documents from Chicago to St. Louis, you will be more productive using a truck than a bicycle. •
- With more labor hours, we can produce more output. If there are more workers in an economy, or if they work longer hours, the economy will produce more real GDP. •
- With more education and skills, we can produce more output. Skilled workers can produce more from an hour's work than unskilled workers can produce.
- With more knowledge, we can produce more output. Inventions and innovations make an economy more productive.
- With more natural resources, we can produce more output. For example, if an economy discovers additional oil reserves, it can produce more with given labor and capital than can economies without such resources. Of course, this input more often decreases rather than increases over time, as economies use up their existing stocks of natural resources.
- With better institutions, we can produce more output. Economies in which it is easy to establish businesses, where corruption is limited, and where the laws are reliable get more out of their workers and capital.

We call the extra output that we get from one more unit of an input, holding all other inputs fixed, the **marginal product** of that input. For example, the extra output we obtain from one more unit of capital is the **marginal product of capital**, the extra output we get from one more unit of labor is the **marginal product of labor**, and so on.

Physical capital and labor hours are relatively straightforward to understand and measure. To measure labor hours, we simply count the number of workers and the number of hours worked by an average worker. Output increases if we have more workers or if they work longer hours. For simplicity, we imagine that all workers are identical. Aggregate differences in the type and the quality of labor are captured in our human capital variable. For physical capital, we similarly imagine that there are a number of identical machines (pizza ovens). Then, just as we measure labor as the number of worker hours, so also we could measure capital by the total number of machine hours. [***If this were literally true, we could measure capital stock by simply counting the number of machines in an economy. In reality, however, the measurement of capital stock is trickier. Researchers must add together the value of all the different pieces of capital in an economy. In practice, capital stock is usually measured indirectly by looking at the flow of additions to capital stock.***] We can produce more output by having more machines or by using each machine more intensively. The other inputs that we listed—human capital, knowledge, social infrastructure, and natural resources—are trickier to define and much harder to quantify. Economists have used measures of educational attainment (e.g., the fraction of the population that completes high school) to compare human capital across countries. [***We use an index of human capital in Chapter 6 "Global Prosperity and Global Poverty".***] There are likewise some data that provide some indication of knowledge and social infrastructure—such as spending on research and development (R&D) and survey measures of perceived corruption.

The measurement of natural resources is problematic for different reasons. Land is evidently an input to production: factories must be put somewhere, and agriculture requires fields and orchards, so the value of land can be measured in principle. But what about reserves of oil or underground stocks of coal, uranium, or gold? First, such reserves or stocks contribute to real GDP only if they are extracted from the earth. An untapped oil field is part of a nation's wealth but makes no contribution to current production. Second, it is very hard to measure such stocks, even in principle. For example, the amount of available oil reserves in an economy depends on mining and drilling technologies. Oil that could not have been extracted two decades ago is now available; it is likely that future advances in drilling techniques will further increase available reserves in the economy.

We simply accept that, as a practical matter, we cannot directly measure an economy's knowledge, social infrastructure, and natural resources. As we see later in this chapter, however, there is a technique for indirectly measuring the combined influence of these inputs.

One thing might strike you as odd. Our description of production does *not* include as inputs the raw materials that go into production. The production process for a typical firm takes raw materials and transforms them into something more valuable. For example, a pizza restaurant buys flour, tomatoes, pepperoni, electricity, and so on, and transforms them into pizzas. The aggregate production function measures not the total value of these pizzas but the *extra value* that is added through the process of production. This equals the value of the pizzas *minus* the value of the raw materials.

We take this approach to avoid double counting and be consistent with the way real GDP is actually measured. [***Reserves of natural resources are not counted as raw materials. The output of the mining sector is the value of the resources that have been extracted from the earth.***]

5.1.2 A Numerical Example of a Production Function

***Table 5.1 "A Numerical Example of a Production Function" gives a numerical example of a production function. The first column lists the amount of output that can be produced from the inputs listed in the following columns.

Table 5.1 A Numerical Example of a Production Function

Row	Output	Capital	Labor	Other Inputs
Increasing Capital				
A	100	1	1	100
B	126	2	1	100
C	144	3	1	100
D	159	4	1	100
Increasing Labor				
E	100	1	1	100
F	159	1	2	100
G	208	1	3	100
H	252	1	4	100
Increasing Other Inputs				
I	100	1	1	100
J	110	1	1	110
K	120	1	1	120
L	130	1	1	130

If you compare row A and row B of ***Table 5.1 "A Numerical Example of a Production Function", you can see that an increase in capital (from 1 unit to 2 units) leads to an increase in output (from 100 units to 126 units). Notice that, in these two rows, all other inputs are unchanged. Going from row B to row C, capital increases by another unit, and output increases from 126 to 144. And going from row C to row D, capital increases from 3 to 4 and output increases from 144 to 159. We see that increases in the amount of capital lead to increases in output. In other words, the marginal product of capital is positive.

Similarly, if you compare rows E–H of ***Table 5.1 "A Numerical Example of a Production Function", you can see that the marginal product of labor is positive. As labor increases from 1 to 4 units, and we hold all other inputs fixed, output increases from 100 to 252 units. Finally, rows I to L show that increases in other inputs, holding fixed the amount of capital and labor, likewise leads to an increase in output.

***Figure 5.3 "A Graphical Illustration of the Aggregate Production Function" illustrates the production function from ***Table 5.1 "A Numerical Example of a Production Function". Part (a) shows what happens when we increase capital, holding all other inputs fixed. That is, it illustrates rows A–D of ***Table 5.1 "A Numerical Example of a Production Function". Part (b) shows what happens when we increase labor, holding all other inputs fixed. That is, it illustrates rows E–H of ***Table 5.1 "A Numerical Example of a Production Function".

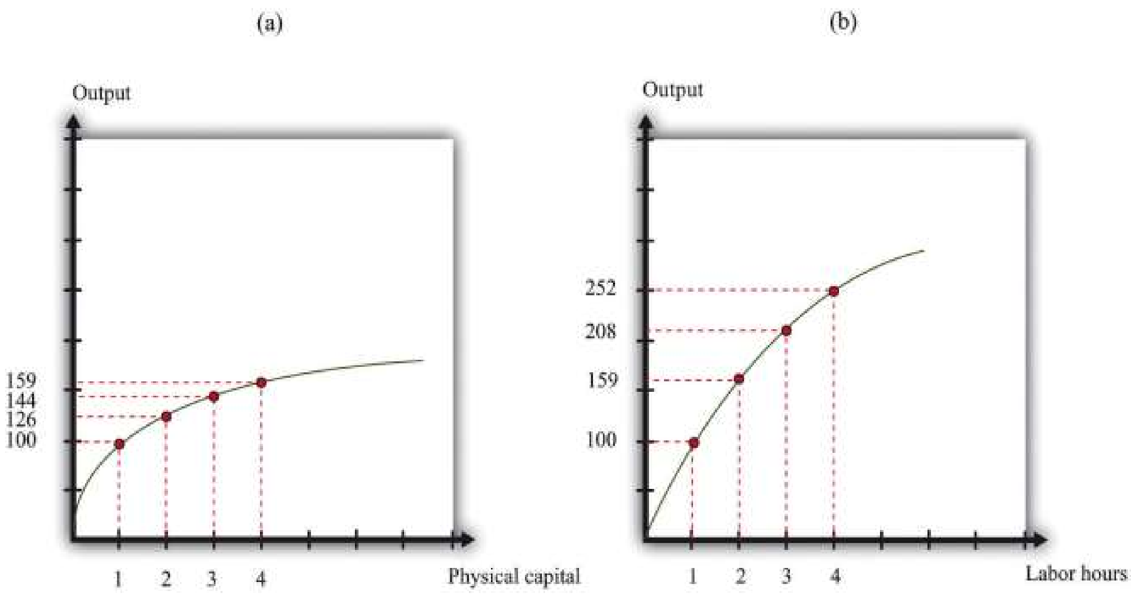

Fig. 5.3: Figure 5.3 A Graphical Illustration of the Aggregate Production Function The aggregate production function shows how the amount of output depends on different inputs. Increases in the amount of physical capital (a) or the number of labor hours (b)—all else being the same—lead to increases in output.

5.1.3 Diminishing Marginal Product

You may have noticed another feature of the production function from ***Figure 5.3 "A Graphical Illustration of the Aggregate Production Function" and ***Table 5.1 "A Numerical Example of a Production Function". Look at what happens as the amount of capital increases. Output increases, as we already noted—but by smaller and smaller amounts. Going from 1 unit of capital to 2 yields 26 extra units of output (= 126 − 100). Going from 2 to 3 units of capital yields 18 extra units of output (= 144 − 126). And going from 3 to 4 yields 15 extra units of output (= 159 − 144). The same is true of labor: each *additional* unit of labor yields less and less additional output. Graphically, we can see that the production function becomes more and more flat as we increase either capital or labor. Economists say that the production function we have drawn exhibits **diminishing marginal product**.

The more physical capital we have, the less additional output we obtain from additional physical capital. As we have more and more capital, other things being equal, additions to our capital stock contribute less and less to output. Economists call this idea **diminishing marginal product of capital**.

*The more labor we have, the less additional output we obtain from additional labor.*Analogously, this is called **diminishing marginal product of labor**. As we have more and more labor, we find that additions to our workforce contribute less and less to output.

Diminishing marginal products are a plausible feature for our production function. They are easiest to understand at the level of an individual firm. Suppose you are gradually introducing new state-of-the-art computers into a business. To start, you would want to give these new machines to the people who could get the most benefit from them—perhaps the scientists and engineers who are working in R&D. Then you might want to give computers to those working on production and logistics. These people would see a smaller increase in productivity. After that, you might give them to those working in the accounting department, who would see a still smaller increase in productivity. Only after those people have been equipped with new computers would you want to start supplying secretarial and administrative staff. And you might save the chief executive officer (CEO) until last.

The best order in which to supply people would, of course, depend on the business. The important point is that you should at all times give computers to those who would benefit from them the most in terms of increased productivity. As the technology penetrates the business, there is less and less additional gain from each new computer.

Diminishing marginal product of labor is also plausible. As firms hire more and more labor— holding fixed the amount of capital and other inputs—we expect that each hour of work will yield less in terms of output. Think of a production process—say, the manufacture of pizzas. Imagine that we have a fixed capital stock (a restaurant with a fixed number of pizza ovens). If we have only a few workers, then we get a lot of extra pizza from a little bit of extra work. As we increase the number of workers, however, we start to find that they begin to get in each others' way. Moreover, we realize that the amount of pizza we can produce is also limited by the number of pizza ovens we have. Both of these mean that as we increase the hours worked, we should expect to see each *additional* hour contributing less and less in terms of additional output.

In contrast to capital and labor, we do not necessarily assume that there are diminishing returns to human capital, knowledge, natural resources, or social infrastructure. One reason is that we do not have a natural or obvious measure for human capital or technology, whereas we do for labor and capital (hours of work and capital usage).

5.1.4 Globalization and Competitiveness: A First Look

Over the last several decades, a host of technological developments has reduced the cost of moving both physical things and intangible information around the world. The lettuce on a sandwich sold in London may well have been flown in from Kenya. A banker in Zurich can transfer funds to a bank in Pretoria with a click of a mouse. People routinely travel to foreign countries for vacation or work. A lawyer in New York can provide advice to a client in Beijing without leaving her office. These are examples of **globalization**—the increasing ability of goods, capital, labor, and information to flow among countries.

One consequence of globalization is that firms in different countries compete with each other to a much greater degree than in the past. In the 1920s and 1930s, the automobiles produced by Ford Motor Company were almost exclusively sold in the United States, while those produced by Daimler-Benz were sold in Europe. Today, Ford and DaimlerChrysler (formed after the merger of Chrysler and Daimler-Benz in 1998) compete directly for customers in both Europe and the United States—and, of course, they also compete with Japanese manufacturers, Korean manufacturers, and others.

Competition between firms is a familiar idea. Key to this idea of competition is that one firm typically gains at the expense of another. If you buy a hamburger from Burger King instead of McDonald's, then Burger King is gaining at McDonald's expense: it is getting the dollars that would instead have gone to McDonald's. The more successful firm will typically see its production, revenues, and profits all growing.

It is tempting to think that, in a globalized world, nations compete in much the same way that firms compete—to think that one nation's success must come at another's expense. Such a view is superficially appealing but incorrect. Suppose, for example, that South Korea becomes better at producing computers. What does this imply for the United States? It does make life harder for US computer manufacturers like Dell Inc. But, at the same time, it means that there is more real income being generated in South Korea, some of which will be spent on US goods. It also means that the cheaper and/or better computers produced in South Korea will be available for US consumers and producers. In fact, we expect growth in South Korea to be beneficial for the United States. We should welcome the success of other countries, not worry about it.

What is the difference between our McDonald's-Burger King example and our computer example? If lots of people switched to McDonald's from Burger King, then McDonald's would become less profitable. It would, in the end, become a smaller company: it would lay off workers, close restaurants, and so on. A company that is unable to compete at all will eventually go bankrupt. But if South Korea becomes better at making computers, the United States doesn't go bankrupt or even become a significantly smaller economy. It has the same resources (labor, capital, human capital, and technology) as before. Even if Dell closes factories and lays off workers, those workers will then be available for other firms in the economy to hire instead. Other areas of the economy will expand even as Dell contracts.

In that case, do countries compete at all? And if so, then how? The Dubai government's website that we showed at the beginning of this chapter provides a clue. The website sings the praises of the Emirate as a place for international firms to establish businesses. Dubai is trying to entice firms to set up operations there: in economic language, it wants to attract capital and skilled labor. Dubai is not alone. Many countries engage in similar advertising to attract business. And it is not only countries: regions, such as US states or even cities, deliberately enact policies to influence business location.

Dubai is trying to gain more resources to put into its aggregate production function. If Dubai can attract more capital and skilled labor, then it can produce more output. If it is successful, the extra physical and human capital will lead to Dubai becoming a more prosperous economy.

In the era of globalization, inputs can move from country to country. Labor can move from Poland to the United Kingdom or from Mexico to the United States, for example. Capital can also move. At the beginning of this chapter, we quoted from an article explaining that a Taiwanese manufacturer was planning to open a factory in Vietnam, drawn by low wages and preferential tax treatment. This, then, is the sense in which countries compete with each other—they compete to attract inputs, particularly capital. **Competitiveness** refers to the ability of an economy to attract physical capital.

We have more to say about this later. But we should clear up one common misconception from the beginning. Competing for capital does *not* mean "competing for jobs." People worried about globalization often think that if a Taiwanese factory opens a factory in Vietnam instead of at home, there will be higher unemployment in Taiwan. But the number of jobs—and, more generally, the level of employment and unemployment—in an economy does not depend on the amount of available capital. [***Chapter 8 "Jobs in the Macroeconomy" and Chapter 10 "Understanding the Fed" explain what determines these variables.***] This does not mean that factory closures are benign. They can be very bad news for the individual workers who are laid off and must seek other jobs. And movements of capital across borders can—as we explain later—have implications for the *quality* of available jobs and the wages that they pay. But they do not determine the number of jobs available.

KEY TAKEAWAY

The production capabilities of an economy are described by the aggregate production function, characterizing how the factors of production, such as capital, labor, and technology, are combined to produce real GDP.

In the aggregate production function, the marginal product is the extra amount of real GDP obtained by adding an extra unit of an input. • One measure of competitiveness is the ability of an economy to attract inputs for the production function, particularly capital.

***

Checking Your Understanding

Earlier, we observed that our news stories were about the following: •

Improved education in Niger •

A new factory opening in Vietnam •

A superior business environment in Dubai •

An influx of workers to the United Kingdom •

A better banking system in the United States

Which input to the production function is being increased in each case?

Building on part (b) of ***Figure 5.3 "A Graphical Illustration of the Aggregate Production Function", draw an aggregate production function that does not exhibit diminishing marginal product of labor.

5.2 Labor in the Aggregate Production Function

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What determines the amount of labor in the aggregate production function?

What determines the patterns of labor migration?

Why do real wages differ across countries?

The aggregate production function tells us how much output we get from the inputs that we have available. Our next task is to *explain* how much of each input goes into this production function. When we have done this, we will have explained the level of real gross domestic product (real GDP). We begin with labor because it is the most familiar—almost everyone has had the experience of selling labor services.

5.2.1 The Labor Market

***Figure 5.4 "Equilibrium in the Labor Market" shows a diagram for the **labor market**. In this picture, we draw the supply of labor by households and the demand for labor by firms. The price on the vertical axis is the **real wage**. The real wage is just the nominal wage (the wage in dollars) divided by the price level. It tells us the amount that you can consume (measured as the number of units of real GDP that you get) if you sell one hour of your time.

Toolkit: Section 16.1 "The Labor Market" and Section 16.5 "Correcting for Inflation"

When we adjust the nominal wage in this way, we are "correcting for inflation." The toolkit gives more information. You can also review the labor market in the toolkit.

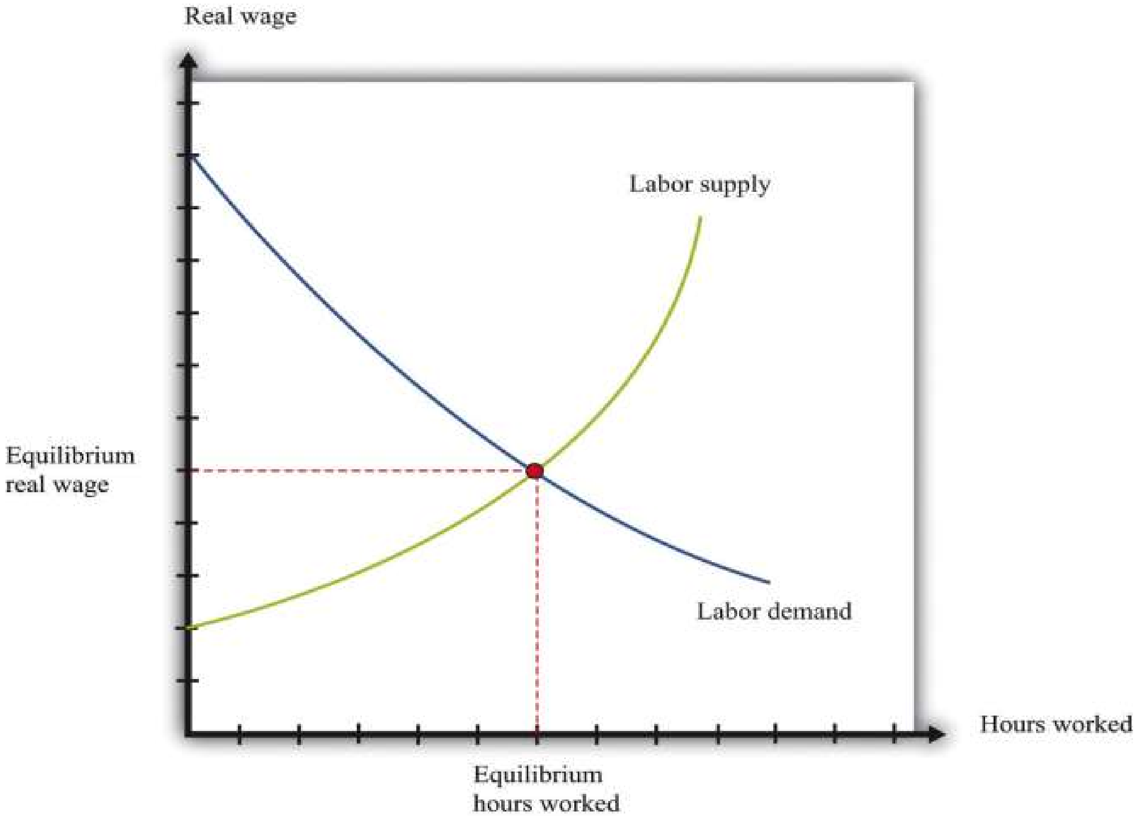

Fig. 5.4: Figure 5.4 Equilibrium in the Labor Market Equilibrium in the labor market occurs where the number of hours of labor supplied by households equals the number of hours of labor demanded by firms.

The upward-sloping **labor supply** curve comes from both an increase in hours worked by each employed worker and an increase in the number of employed workers. [***We discuss labor supply in more detail in Chapter 12 "Income Taxes".***] The downward-sloping **labor demand** curve comes from the decision rule of firms: each firm purchases additional hours of labor up to the point where *the extra output that it obtains from that labor equals the cost of that labor*. The extra output that can be produced from one more hour of work is—by definition—the marginal product of labor, and the cost of labor, measured in terms of output, is the real wage. Therefore firms hire labor up to the point where the marginal product of labor equals the real wage.

The marginal product of labor also depends on the other inputs available in an economy. An economy with more physical or human capital, for example, is one in which workers will be more productive. Increases in other inputs shift the labor demand curve rightward.

The point where the labor supply and labor demand curves meet is the point of equilibrium in the labor market. At the equilibrium real wage, the number of hours that workers want to work exactly matches the number of hours that firms wish to use. ***Figure 5.4 "Equilibrium in the Labor Market" shows that equilibrium in the labor market tells us two things: the real wage in the economy and how many hours of work go into the aggregate production function.

5.2.2 The Mobility of Labor

In November 2004, the median hourly wage in Florida was $12.50. In Washington State, it was $16.07. On average, in other words, wages were almost 30 percent higher in the Northwest compared to the Southeast. To take a more specific example, the median wage for health-care support occupations (dental assistants, pharmacy aides, hospital orderlies, etc.) was $8.14 in Mississippi and $12.81 in Massachusetts. Dental assistants who moved from Baton Rouge to Boston could expect to see about a 50 percent increase in their hourly wage. [***"Occupational Employment Statistics," Bureau of Labor Statistics, accessed June 29, 2011, http://www.bls.gov/oes/current/oessrcst.htm.***]

People in the United States are free to move from state to state, and many people do indeed move from one state to another every year. People move for many reasons: to go to college, join a girlfriend or boyfriend, or move to the place where they have always dreamed of living (such as New York; Los Angeles; or Burr Ridge, Illinois). People also move to take up new jobs, and one of the things that induces them to take one job rather than another is the wage that it pays. Different wages in different places therefore affect the patterns of migration across the United States.

***Figure 5.5 "Labor Markets in Florida and Washington State" shows the labor markets in Florida and Washington State for November 2004. The cost of living was different in those two states but, to keep our story simple, we ignore these differences. That is, we assume that there is no difference in the price level in the two states. If we set 2004 as the base year, the **price level** is 1. This means that the real wage is the same as the nominal wage. A more careful analysis would correct for differences in state taxes and the cost of living.

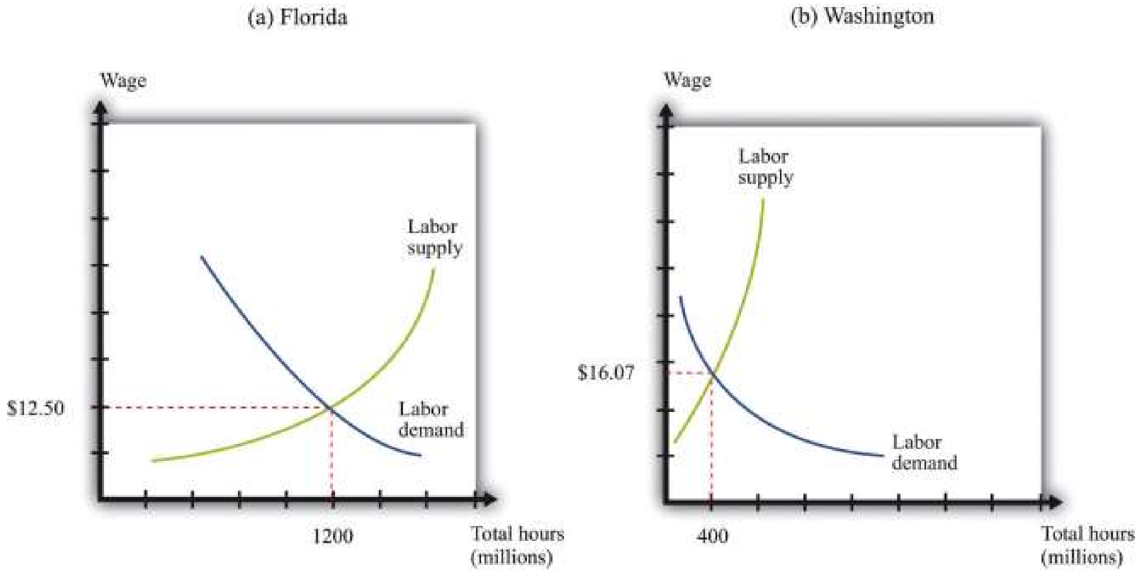

Fig. 5.5: Figure 5.5 Labor Markets in Florida and Washington State These diagrams show the labor markets in (a) Florida and (b) Washington State. Real wages are higher in Washington State than in Florida.

Part (a) of ***Figure 5.5 "Labor Markets in Florida and Washington State" shows the labor market in Florida. The equilibrium wage is $12.50, and the equilibrium level of employment is 1,200 million hours. This is roughly calibrated to the actual experience in Florida, where total employment in 2004 was just under 7.5 million individuals. Part (b) of ***Figure 5.5 "Labor Markets in Florida and Washington State" shows Washington State, where the equilibrium wage is $16.07, and employment is 400 million hours.

We expect that the higher wages in Washington State would attract people to move from Florida to Washington State. Workers would migrate from Florida to Washington State, causing the labor supply curve to shift leftward in Florida and rightward in Washington State. As a consequence, wages would increase in Florida and decrease in Washington State. ***Figure 5.6 "Migration from Florida to Washington State" shows what would happen if the only thing people cared about was wages: migration would stop only when wages were equal in both states. Employment would be lower in Florida and higher in Washington State. (The exact number of people who moved and the new equilibrium wage would depend on the slopes of the supply and demand curves in both labor markets.)

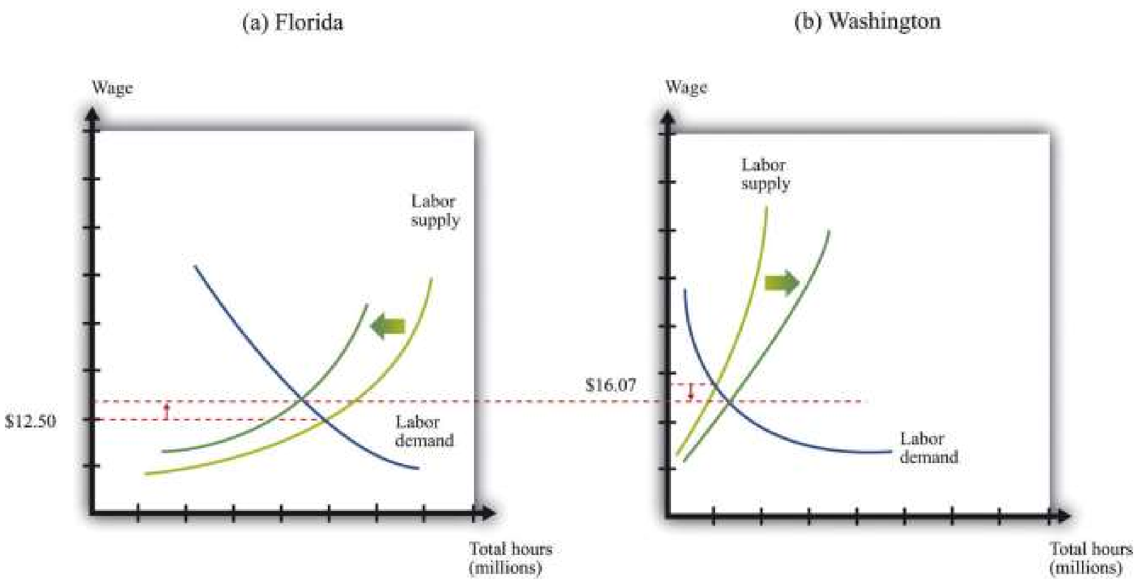

Fig. 5.6: Figure 5.6 Migration from Florida to Washington State Workers move from Florida to Washington State in search of higher wages. Labor supply decreases in Florida and increases in Washington State.

If wages were the only factor affecting people's decisions, migration would completely equalize real wages across the different state economies. In fact, we do not expect wages to become exactly equal in Florida, Washington State, and the other 48 states of the Union. Differences in both state taxes and the cost of living in different states and cities lead to persistent differences in wages. Some places are less attractive to live than others, so people will need to be paid more to induce them to live there. Our example nevertheless illustrates a key economic principle: people respond to incentives. Individual decisions about where to live respond to differences in real wages. *Labor tends to migrate to where it can earn the highest return*.

5.2.3 International Migration

People migrate between different US states because of wage differences. In China and other developing economies, many workers migrate from rural areas to urban areas, again in search of better wages. The same forces operate across international borders. Workers seek to emigrate from countries where their wages are low and move to countries that pay higher wages. Sometimes, this movement is actively encouraged. Some countries attract immigrant workers—particularly rich economies that want to attract relatively unskilled workers to perform low-paying and unattractive jobs.

However, there are many more barriers to movement among countries compared to movement within countries. Some are legal barriers. Most countries strictly limit the immigration that they permit. In the United States, a physical barrier has been constructed along some of the US-Mexican border to prevent illegal immigration from Mexico to the United States. Some countries also make emigration very difficult.

Even when legal impediments to migration are absent, there are cultural and language barriers. European Union citizens are legally free to live and work anywhere in the countries of the Union, and we saw at the beginning of this chapter that many young Polish workers take advantage of this by moving to the United Kingdom in search of work. But such examples notwithstanding, most European workers remain in the country of their birth. Migration from Portugal to Finland is very limited, for example, despite the higher wages paid in Finland. A Portuguese worker who wants to move to Finland must learn to cope with a completely different language and culture, not to mention a much colder climate.

To summarize, while we do see some movement of labor across national borders, people remain, for the most part, in the country in which they were born. When we are analyzing national economies, the main determinant of labor hours is, in the end, the number of people in the economy and the number of hours that they choose to work. International migration plays a limited role. We can also turn this argument on its head. We observe huge differences in real wages in different economies. If people were truly able and willing to migrate across economies, we would expect most of those differences to disappear. So we can conclude that there must be substantial barriers to migration.

5.2.4 Population Growth and Other Demographic Changes

Over long periods of time, the amount of labor in the production function is affected by changes in population and other demographic changes. As a country's population increases, it has more workers to "plug in" to the aggregate production function. Changes in the age structure of the population also have an effect. Much of the developed world has an aging population, meaning that the fraction of the population that is working is decreasing. [***We discuss some implications of this in Chapter 13 "Social Security".***]

Changes in social norms can also affect the amount of labor that goes into the production function. For example, child labor is now uncommon, whereas a century ago it was much more usual. Another example is the increase in women's participation in the labor force over the last half century, both in the United States and other countries. Public health matters as well. In some countries of the world, particularly in Africa, the HIV/AIDS crisis is having devastating effects. Quite apart from the human misery that the disease causes, the epidemic means that there is less labor available. The problem is particularly acute because working-age individuals are disproportionately affected.

In an introductory economics textbook such as this one, we do not seek to explain such social changes. To be sure, these changes are studied by economists, as well as by sociologists and other researchers. But here we investigate the effects rather than the causes of such social changes.

5.2.5 Explaining International Differences in the Real Wage

Real wages differ markedly across countries: the typical worker in Australia is paid much more than the typical worker in Bolivia, for example. Suppose that we compare two countries, and we find that real wages are higher in one country (country A) than in the other (country B). This tells us that the marginal product of labor is higher in country A than in country B. There are two basic reasons why this might be true:

1. Hours worked are fewer in country A than in country B.
2. Other inputs are larger in country A than in country B.

***Figure 5.7 "Why Real Wages May Be Different in Different Countries" illustrates these possibilities. Part (a) compares two countries that are identical except that less labor is supplied to the market in country A. In country A, the real wage is higher, and the equilibrium number of hours is lower. In part (b), the two countries have identical labor supplies, but one or more of the other inputs (physical capital, human capital, knowledge, social infrastructure, or natural resources) is higher in country A. This means that the labor demand curve in country A is further to the right, so the real wage is higher, and the equilibrium number of hours is also higher.

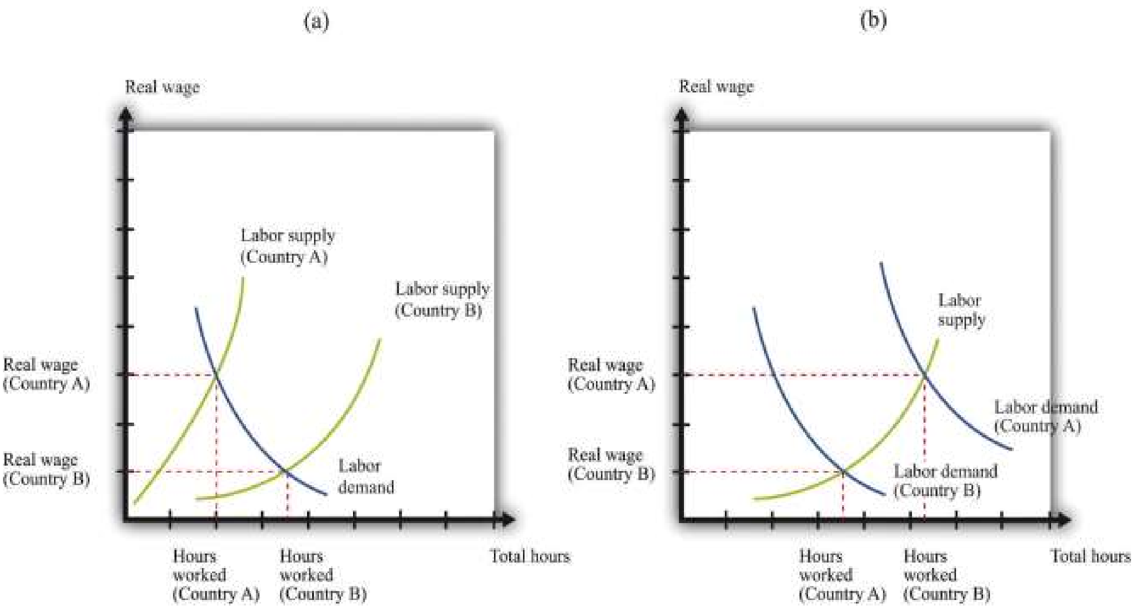

Fig. 5.7: Figure 5.7 Why Real Wages May Be Different in Different Countries Real wages are higher in country A than in country B either because of lower labor supply in country A (a) or greater labor demand in country A (b).

The real wage is an indicator of societal welfare because it tells us about the living standards of the typical worker. From the perspective of workers, increases in other inputs—such as capital stock or an economy's human capital—are desirable because they increase the marginal product of labor and hence the real wage.

Thus, when the World Bank helps to fund education in Niger, it is helping to increase GDP by increasing the amount of human capital in the production function. Furthermore, this increased GDP will appear in the form of higher wages and living standards in the economy. Conversely, if a food processing company decides to close a factory in England, capital stock in England decreases, and output and real wages decrease.

KEY TAKEAWAY

The quantity of labor in the aggregate production function is determined in the labor market. •

All else being the same, labor will migrate to the place with the highest real wage. •

Differences in real wages across economies reflect differences in the marginal product of labor due to differences in the number of hours worked, technology, and capital stocks.

***

Checking Your Understanding

To determine the patterns of labor migration, should we look at nominal or real wages? Should we look at wages before or after taxes?

Building on ***Figure 5.7 "Why Real Wages May Be Different in Different Countries", suppose that country A had fewer workers than country B but more capital. Would the real wage be higher or lower in country A than country B?

5.3 Physical Capital in the Aggregate Production Function

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What determines the movement of investment in a country?

How does the capital stock of a country change?

What determines the movement of capital across countries?

Many of the arguments that we have just made about labor have analogies when we think about capital. Just as the amount of labor in an economy depends on the size of the workforce, so the amount of capital depends on the capital stock. Just as the amount of labor depends on how many hours each individual works, so the amount of capital depends on the utilization rate of capital.

Capital utilization is the rate at which the existing capital stock is used. For example, if a manufacturing firm runs its production lines 24 hours per day, 7 days per week, then its capital utilization rate is very high.

Just as labor can migrate from country to country, so also capital may cross national borders. In the short run, the total amount of capital in an economy is more or less fixed. We cannot make a significant change to the capital stock in short periods of time. In the longer run, however, the capital stock changes because some of the real gross domestic product (real GDP) produced each year takes the form of new capital goods—new factories, machines, computers, and so on. Economists call these new capital goods **investment**.

Toolkit: Section 16.16 "The Circular Flow of Income"

Investment is one of the components of overall GDP.

5.3.1 The Circular Flow: The Financial Sector

We can use the circular flow to help us understand how much investment there is in an economy. ***Figure 5.8 "The Flows In and Out of the Financial Sector" reviews the four flows of dollars in and out of the financial sector. [***The circular flow is introduced in Chapter 3 "The State of the Economy". We elaborate on it in Chapter 4 "The Interconnected Economy", Chapter 7 "The Great Depression", Chapter 12 "Income Taxes", and Chapter 14 "Balancing the Budget".***]

1. Households put their savings into the financial sector. Any income that households receive today but wish to put aside for the future is sent to the financial markets. Although individual households both save and borrow, there is almost always more saving than borrowing, so, on net, there is a flow of dollars from the household sector into the financial markets (**private savings**).
2. There is a flow of dollars between the financial sector and the government sector. This flow can go in either direction. Figure 5.8 "The Flows In and Out of the Financial Sector" is drawn for the case where the government is borrowing (there is a **government deficit**), so the financial markets send money to the government sector. In the case of a government surplus, the flow goes in the other direction. The **national savings** of an economy are the savings carried out by the private and government sectors taken together:

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national savings = private savings + government surplus
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or

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national savings = private savings − government deficit.
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1. There is a flow of dollars between the financial sector and the foreign sector. This flow can also go in either direction. When our economy exports more than it

imports, we are sending more goods and services to other countries than they are sending to us. This means that there is a flow of dollars from the economy as foreigners buy dollars so that they can make these purchases. It also means that we are lending to other countries: we are sending more goods and services to other countries now in the understanding that we will receive goods and services from them at some point in the future. By contrast, when our economy imports more than it exports, we are receiving more goods and services from other countries than we are sending to them. We are then borrowing from other countries, and there is a flow of dollars into the economy. ***Figure 5.8 "The Flows In and Out of the Financial Sector" illustrates the case of borrowing from other countries.

2. There is a flow of dollars from the financial sector into the firm sector. These are the funds that are available to firms for investment purposes.

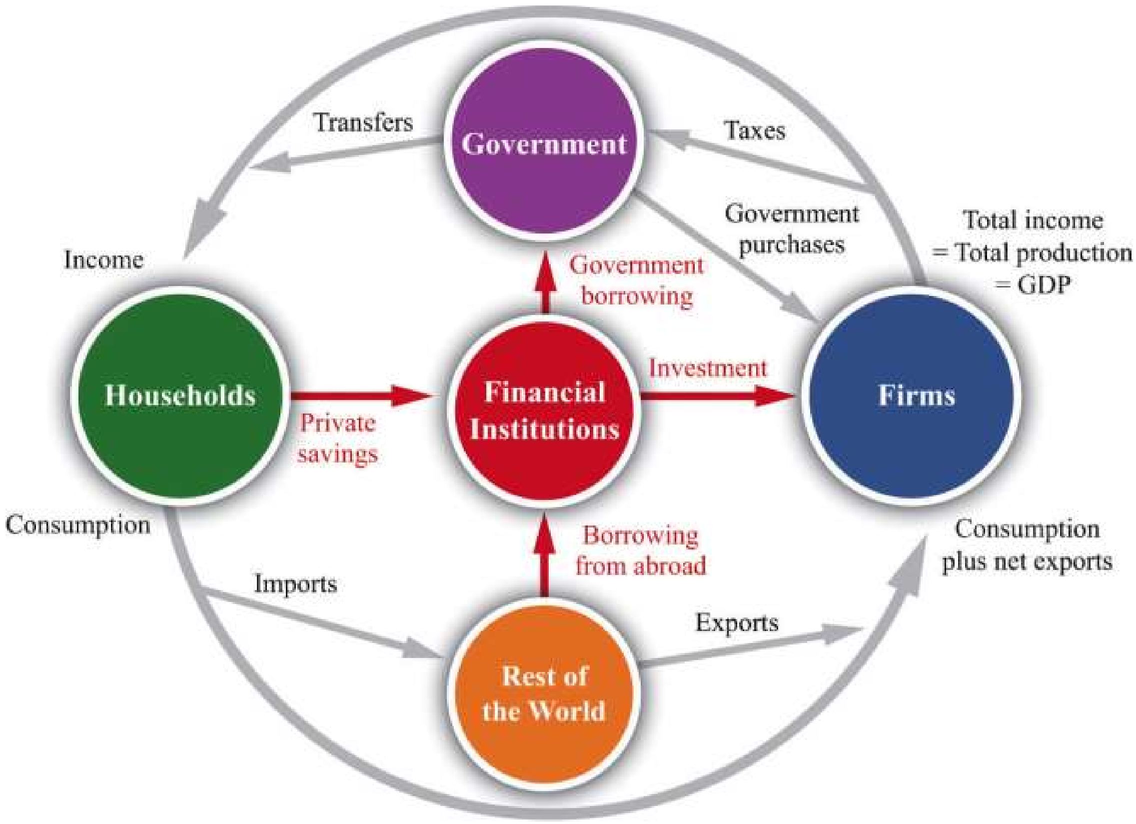

Fig. 5.8: Figure 5.8 The Flows In and Out of the Financial Sector The flows in and out of the financial sector must balance, which tells us that investment is financed by national savings plus borrowing from abroad.

The total flows in and out of the financial sector must balance. Because of this, as we see from ***Figure 5.8 "The Flows In and Out of the Financial Sector", there are two sources of funding for new physical capital: savings generated in the domestic economy and borrowing from abroad.

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investment = national savings + borrowing from other countries.
```

Or, in the case where we are lending to other countries,

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investment = national savings − lending to other countries.
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5.3.2 Changes in the Capital Stock

Capital goods don't last forever. Machines break down and wear out. Technologies become obsolete: a personal computer (PC) built in 1988 might still work today, but it won't be much use to you unless you are willing to use badly outdated software and have access to old- fashioned 5.25-inch floppy disks. Buildings fall down—or at least require maintenance and repair.

Depreciation is the term economists give to the amount of the capital stock that an economy loses each year due to wear and tear. Different types of capital goods depreciate at different rates. Buildings might stay standing for 50 or 100 years; machine tools on a production line might last for 20 years; an 18-wheel truck might last for 10 years; a PC might be usable for 5 years. In macroeconomics, we do not worry too much about these differences and often just suppose that all capital goods are the same. The overall capital stock increases if there is enough investment to replace the worn out capital and still contribute some extra. The overall change in the capital stock is equal to new investment minus depreciation:

```
change in capital stock = investment − depreciation of existing
capital stock.
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Investment and depreciation are the *flows* that lead to changes in the *stock* of physical capital over time. We show this schematically in ***Figure 5.9 "The Accumulation of Capital". Notice that capital stock could actually become smaller from one year to the next, if investment were insufficient to cover the depreciation of existing capital.

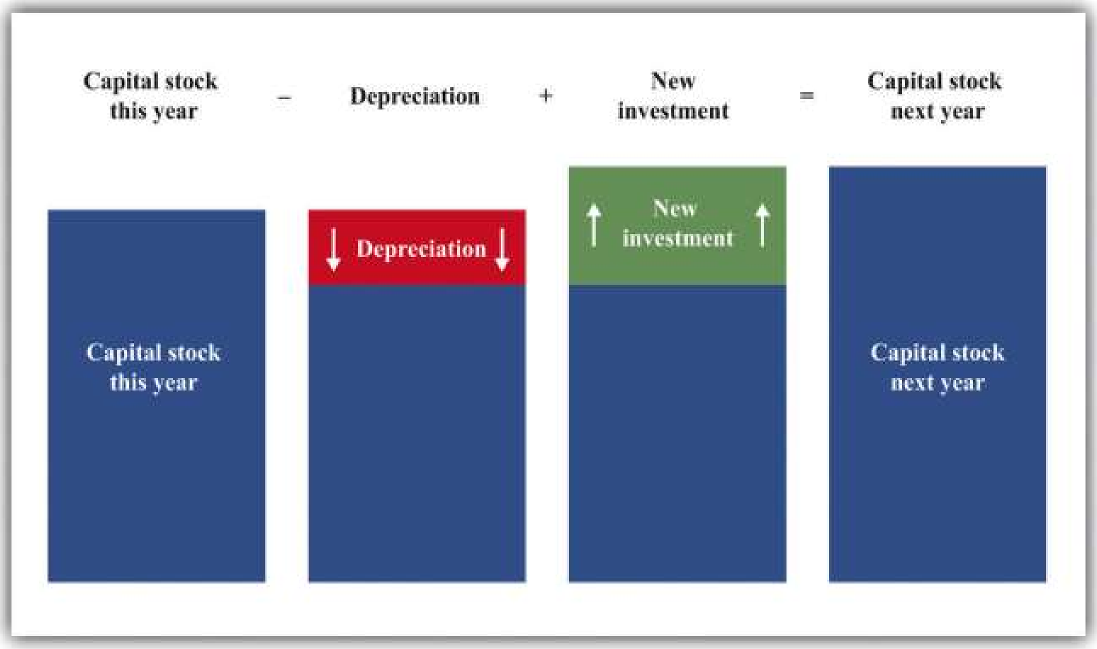

Fig. 5.9: Figure 5.9 The Accumulation of Capital Every year, some capital stock is lost to depreciation, as buildings fall down and machines break down. Each year there is also investment in new capital goods.

5.3.3 The Mobility of Capital

Can physical capital move from place to place? A first guess might be no. Although some capital goods, such as computers, can be transported, most capital goods are fixed in place. Factories are not easily moved from one place to another.

New capital, however, can be located anywhere. When Toyota decides to build a new factory, it could put it in Japan, the United States, Italy, Vietnam, or Brazil. Even if existing capital stocks are not very mobile, investment is. In the long run, firms can decide to close operations in one country and open in another. To understand how much capital a country has, therefore, we must recognize that investment in one country may come from elsewhere in the world.

Just as workers go in search of high wages, so the owners of capital seek to find the places where capital will have the highest return. We already know that the real wage is a measure of the marginal product of labor. Similarly, the real return on investment is the marginal product of capital (more precisely, the marginal product of capital adjusted for depreciation). Remember that the marginal product of capital is defined as the amount ofextra output generated by an extra unit of capital. The owners of capital look to put their capital in countries where its marginal product is high.

Earlier, we saw two reasons why the marginal product of labor (and thus the real wage) might be higher in one country rather than another. There are likewise two reasons why the marginal product of capital might be higher in one country (A) rather than in another country (B). Holding all else the same, the marginal product of capital will be higher in country A if

- • The capital stock is smaller in country A than in country B.
- • The stock of other inputs is larger in country A than in country B.

These two factors determine the return on investment in a country. The benefits of acquiring more capital are higher in a country that has relatively little capital than in a country that has a lot of capital. This is because new capital can be allocated to projects that yield a lot of extra output, but as the country acquires more and more capital, such projects become harder and harder to find. Conversely, a country that has more of the other inputs in the production function will have a higher marginal product of capital.

Countries with a lot of labor, other things being equal, will be able to get more out of a given piece of machinery—because each piece of machinery can be combined with more labor time. As a simple example, think about taxis. In a capital-rich country, there may be only one driver for every taxi. In a poorer country, two or three drivers often share a single vehicle, so that vehicle spends much more time on the road. The return on capital—other things being equal— is higher in countries with a lot of labor and not very much capital to share around. Such countries are typically relatively poor, suggesting that poor countries should attract investment funds from elsewhere. In other words, basic economics suggests that if the return on investment is indeed higher in poor countries, investment funds should flow to those countries.

We certainly do see individual examples of such flows. The story at the beginning of this chapter about a Taiwanese company establishing a factory in Vietnam is one example. The following quotation from a British trade publication describes another.

Less than two months into 2006 and the UK's grocery manufacturing industry is already notching up a growing list of casualties: Leaf UK is considering whether to close its factory in Stockport; Elizabeth Shaw is shutting a plant in Bristol; Arla Foods UK is pulling out of a site at Uckfield; Richmond Foods is ending production in Bude; and Hill Station is shutting a site in Cheadle.

[...]

The stories behind these closures are all very different. But two common trends emerge. First, suppliers are being forced to step up the pace of consolidation as retailer power grows and that means more facilities are being rationalised. Second, production is being shifted offshore as grocery suppliers take advantage of lower-cost facilities. [***"Shutting Up Shop," The Grocer, February 25, 2006, accessed June 28, 2011,http://www.coadc.com/grt_article_6.htm. The Grocer is a trade publication for the grocery industry in the United Kingdom.***]

This excerpt observes that food processing that used to be carried out in Britain is being shifted to poorer Eastern European countries, such as Poland. When factories close in Britain and open in Poland, it is as if physical capital—factories and machines—is moving from Britain to other countries.

If the amount of capital (relative to labor) were the only factor determining investment, we would expect to see massive amounts of lending going from rich countries to poor countries. Yet we do not see this. The rich United States, in fact, *borrows* substantially from other countries. The stock of other inputs—human capital, knowledge, social infrastructure, and natural resources—also matters. If workers are more skilled (possess more human capital) or if an economy has superior social infrastructure, it can obtain more output from a given amount of physical capital. The fact that the United States has more of these inputs helps to explain why investors perceive the marginal product of capital to be high in the United States.

Earlier we explained that even though migration could in principle even out wages in different economies, labor is, in fact, not very mobile across national boundaries. Capital *is* relatively mobile, however, and the *mobility of capital will also tend to equalize wages*. If young Polish workers move from Poland to England, real wages will tend to increase in Poland and decrease in England. If grocery manufacturers move production from England to Poland, then real wages will likewise tend to increase in Poland and decrease in England.

In fact, imagine that two countries have different amounts of physical capital and labor, but the same amount of all other inputs. If physical capital moves freely to where it earns the highest return, then both countries will end up with the same marginal product of capital *and the same marginal product of labor*. The movement of capital substitutes for labor migration and leads to the same result of equal real wages. This is a striking result.

The result is only this stark if the two countries have identical human capital, knowledge, social infrastructure, and natural resources. [***There are, not surprisingly, other, more technical, assumptions that matter as well. Perhaps the most important is that the production function should indeed display diminishing marginal product of capital, as we have assumed in this chapter.***] If other inputs differ, then the mobility of capital will still affect wages, but wages will remain higher in the economy with more of other inputs. If workers in one country have higher human capital, then they will earn higher wages even if capital can flow freely between countries. But the underlying message is the same: globalization, be it in the form of people migrating from one country to another or capital moving across national borders, should tend to make the world a more equal place.

KEY TAKEAWAY

As an accounting identity, the amount of investment is equal to the national savings of a country plus the amount it borrows from abroad. • The capital stock of a country changes over time due to investment and depreciation of the existing capital stock. • Differences in the marginal product of capital lead to movements of capital across countries.

***

Checking Your Understanding

Can investment ever be negative at a factory? In a country?

Explain why the movement of capital across two countries will have an effect on the real wages of workers in the two countries.

5.3.4 Other Inputs in the Aggregate Production Function

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How does the amount of human capital in a country change over time?

How is knowledge created?

How do property rights influence the aggregate production function?

We have less to say about the other inputs into the aggregate production function, so we group them together.

5.3.5 Human Capital

Education makes the most important contribution to human capital in an economy.

Kindergarteners learning to count are acquiring human capital, as are high-school students learning algebra, undergraduate students learning calculus, and experienced workers studying for an MBA. People also acquire human capital on the job—either as a result of explicit company training programs or simply because of practice and experience (sometimes called "learning by doing").

The education policy of national governments therefore plays a big part in determining how much human capital there is in a country. In the United States and Europe, education is typically compulsory up to age 15 or 16. In other countries, the school-leaving age is lower: 10 in Bangladesh, 11 in Iran, and 13 in Honduras, for example. In still other countries, education is not compulsory at all. [***"At What Age…? Comparative Table," Right to Education Project, accessed June 28, 2011,http://www.right-to-education.org/node/279.***] One of the aims of the American Competitiveness Initiative, mentioned at the beginning of this chapter, was to "provide American children with a strong foundation in math and science."

There are many similarities between human capital and physical capital. Human capital, like physical capital, is accumulated through a process of investment. Basic education is an investment made by parents and governments. University education is an investment made by individuals and households. When you go to college, you give up time that you could have spent working or having fun. This is one cost of education. The other cost is the expense of tuition. The gain from education—the return on your investment—is that sometime in the future you will be more productive and earn more income. An individual decision to go to college is based on an evaluation of the costs (such as tuition and foregone time) and the benefits (such as higher salary after graduation and the joy of studying fascinating subjects like economics).

Firms also invest in human capital. They seek to increase the productivity of their workers by in-house training or by sending workers to external training courses. Large firms typically devote substantial resources to the training and development of their employees. Some of the skills that workers acquire are transferable to other firms if the worker moves to another job. For example, workers who have attended a training course on accounting would be able to use the knowledge they acquired from that course at many different firms. Other skills are specific to a particular firm (such as knowing exactly where to hit a particular machine with a hammer when it jams).

Human capital, like physical capital, can depreciate. People forget things that they learned, or their knowledge becomes obsolete. VisiCalc was once a leading spreadsheet software, so people skilled in its use had valuable human capital; yet knowledge of this program is of little use today. Human capital that is specific to a particular firm is particularly prone to depreciation because it becomes worthless if the worker leaves or if the firm goes out of business. One reason why factory closures—such as those in the food retailing sector in the United Kingdom—arouse such concern is that laid-off workers may see their useful human capital decline and end up with lower paying jobs as a result.

While there are similarities between physical and human capital, there are also differences. Most importantly, human capital is trapped inside people. Economists say that such skills are “embodied” in the labor force. You cannot sell the human capital that you own without selling your own labor time as well. The implication for government policy is that importing human capital means importing people. Dubai is trying to attract human capital—so it advertises the things that make the country attractive to individuals who own that human capital. Thus their website speaks of the “cosmopolitan lifestyle” in Dubai, together with the quality of the hospitals, schools, shops, and so on.

5.3.6 Knowledge

Many large firms contain research and development (R&D) divisions. Employees in these divisions engage in product development and process development.**Product development** consists of developing new products and improving a firm’s existing products. **Process development** consists of finding improvements in a firm’s operations and methods of manufacture to reduce the costs of production.

An example of product development is the development and testing of a new pharmaceutical compound to treat cancer. An example of process development is the way in which transportation firms now use global positioning systems (GPSs) to better manage the movements of their trucks. In either case, firms invest today in the hope of gains in the future from lower production costs and better products.

Knowledge of this kind is also created by independent research laboratories, universities, think tanks, and other such institutions. In many cases, governments subsidize these institutions: policymakers actively intervene to encourage the production of new knowledge. Governments get involved because new knowledge can benefit lots of different firms in an economy. Think of how the invention of electric power, the internal combustion engine, the microchip, or the Internet benefits almost every firm in the economy today.

Economists say that basic knowledge is a **nonrival**. A good is nonrival if one person's consumption of that good does not prevent others from also consuming it. A good is rival if one person's consumption prevents others from also consuming it. The fact that one marketing manager is using economic theory to set a profit-maximizing price doesn't prevent another manager in a different firm from using the same piece of knowledge. (Contrast this with, say, a can of Coca-Cola: if one person drinks it, no one else can drink it.) Knowledge is also often nonexcludable. A **nonexcludable good** is one for which it is impossible to selectively deny access. In other words, it is not possible to let some people consume a good while preventing others from consuming it. An excludable good is one to which we can selectively allow or deny access. Once a piece of knowledge is out in the world, it is difficult to prevent others from obtaining access to it. Nobody has patents on basic economic principles of price setting.

Together, these two properties of knowledge mean that a discoverer or inventor of new knowledge may not get all, or even most, of the benefits of that knowledge. As a result, there is insufficient incentive for individuals and firms to try to create new knowledge.

5.3.7 Social Infrastructure

Social infrastructure is a catchall term for the general business environment within a country. Is the country relatively free of corruption? Does it possess a good legal system that protects property rights? In general, is the economy conducive to the establishment and operation of business?

Economists have found that social infrastructure is a critical input into the aggregate production function. Why does it matter so much? When a firm in the United States or another advanced country builds a factory, there is an expectation of revenues generated by this investment that will make the investment profitable. The owners of the firm expect to obtain the profits generated by the activities in that plant. They also expect that the firm has the right to sell the plant should it wish to do so. The firm's owners may confront uncertainty over the *profitability* of the plant—the product manufactured there might not sell, or the firm's managers might miscalculate the costs of production. But it is clear who owns the plant and has the rights to the profits that it generates.

If the owners of firms are unsure if they will obtain these profits, however, they have less incentive to ensure that firms are well managed, and indeed they have less incentive to establish firms in the first place. Output in an economy is then lower. Governments take many actions that influence whether owners will indeed receive the profits from their firms. First, in most countries, governments tax the profits of firms.

High tax rates reduce the return on investment. Uncertainty in tax rates also matters because it effectively lowers the return on investment activities. Economists have found that countries with high political turnover tend to be relatively slow growing. One key reason is that frequent changes in political power lead to uncertainty about tax rates.

Governments can also enact more drastic policies. The most extreme example of a policy that affects the return on investment is called *expropriation*—the taking of property by the government without adequate compensation. Although both domestically owned and foreign-owned firms could be subject to expropriation, expropriation is more often about the confiscation of the assets of foreign investors. The World Bank has an entire division dedicated to settling disputes over expropriation. [***It is called the International Centre for Settlement of Investment Disputes (http://icsid.worldbank.org/ICSID/Index.jsp). ***] For example, it is arbitrating on a $10 million dispute between a Cypriot investment firm and the government of Turkey: in 2003 the Turkish government seized without compensation the assets of two hydroelectric utilities that were majority owned by the Cypriot firm. Such settlements can take a long time; at the time of this writing (mid-2011), the dispute has not yet been settled.

There are also more subtle challenges to the rights of foreign investors. Governments may limit the amount of profits that foreign companies can distribute to their shareholders. Governments may limit currency exchanges so that profits cannot be converted from local currencies into dollars or euros. Or governments may establish regulations on foreign-owned firms that increase the cost of doing business. All such actions reduce the attractiveness of countries as places for foreign investors to put their funds. Economists group these examples under the heading of **property rights**. An individual (or institution) has **property rights** over a resource if, by law, that individual can make all decisions regarding the use of the resource. The return on investment is higher when property rights are protected. In economies without well-established property rights, the anticipated rate of return on investment must be higher to induce firms and households to absorb the investment risks they face.

As a consequence, countries with superior social infrastructure are places where firms will prefer to do business. Conversely, countries that have worse infrastructure are less attractive and will tend to have a lower output. On the website for Dubai at the beginning of the chapter, we see that Dubai touts its free enterprise system, for example. (Dubai's website reveals that physical infrastructure, which is part of the Emirate's capital stock, also plays a critical role: the website touts the superior transport, financial, and telecommunications infrastructure to be found in Dubai.) As another example, Singapore has a project known as Intelligent Nation 2015 that aims to "fuel creativity and innovation among businesses and individuals" [***"Singapore: An Intelligent Nation, A Global City, powered by Infocomm," iN2015, accessed June 29, 2011, http://www.ida.gov.sg/About%20us/20100611122436.aspx.***] through improved information technology, including making the entire country Wi-Fi enabled.

An illustration of the importance of social infrastructure comes from the vastly different economic performance of artificially divided economies. At the time that North Korea and South Korea were divided, the two countries were in very similar economic circumstances. Obviously, they did not differ markedly in terms of culture or language. Yet South Korea went on to be one of the big economic success stories of the past few decades, while North Korea is now one of the poorest countries in the world. The experience of East Germany and West Germany is similar: East Germany stagnated under communism, while West Germany prospered.

5.3.8 Natural Resources

There is less to say about what determines the amount of natural resources in the production function. The natural resources available to a country are largely accidents of geography. The United States is fortunate to have high-quality agricultural land, as well as valuable deposits of oil, coal, natural gas, and other minerals. South Africa has deposits of gold and diamonds. Saudi Arabia, Iraq, Kuwait, the United Arab Emirates, and other Middle Eastern countries have large reserves of oil. The United Kingdom and Norway have access to oil and natural gas from the North Sea. For every country, we can list its valuable natural resources. Natural resources are divided into those that are **renewable** and those that are **nonrenewable**. A **renewable resource** is a resource that regenerates over time. A **nonrenewable (exhaustible) resource** is one that does not regenerate over time. Forests are an example of a renewable resource: with proper management, forests can be maintained over time by judicious logging and replanting. Solar and wind energy are renewable resources. Coal, oil, and minerals are nonrenewable; diamonds taken from the ground can never be replaced.

It is difficult to measure the natural resources that are available to an economy. The availability of oil and mineral reserves is dependent on the technologies for extraction. These technologies have developed rapidly over time. The economic value of these resources, meanwhile, depends on their price in the marketplace. If the price of oil decreases, the value of untapped oil fields decreases as well.

Economists and others sometimes use real gross domestic product (real GDP) as an indicator of economic welfare. One problem with real GDP as an indicator of economic welfare is that it fails to take into account declines in the stock of natural resources. [***In Chapter 3 "The State of the Economy", we note several of these.***] If the stock of natural resources is viewed—as it should be—as part of the wealth of a country, then depreciation of that stock should be viewed as a loss in income. (The same argument, incidentally, applies to depreciation of a country's physical capital stock. Real GDP also does not take this into account. However, national accounts do report other statistics that adjust for the depreciation of physical capital, whereas they do not report any adjustment for natural resource depletion.)

KEY TAKEAWAY

The human capital of a country can be accumulated by education, the training of workers, and immigration of workers into that country. •

Knowledge about new products and new processes is created by R&D activities within firms, universities, and government agencies.

Property rights influence the amount of capital in the aggregate production function. In an economy where property rights are not well defined, there is a lower incentive to invest and hence less capital.

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Checking Your Understanding

How does on-the-job experience affect the human capital of an economy?

Why is it difficult to measure the natural resources available in an economy?

5.4 Accounting for Changes in GDP

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is growth accounting?

What are the different time horizons that we use in economics?

We have inventoried the factors that contribute to gross domestic product (GDP). The next step is to understand *how much* each factor contributes. If an economy wants to increase its GDP, is it better off trying to boost domestic savings, attract more capital from other countries, improve its infrastructure, or what? To answer such questions, we introduce a new tool that links the **growth rate** of output to the growth rate of the different inputs to the production function.

Toolkit: Section 16.11 "Growth Rates"

A growth rate is the percentage change in a variable from one year to the next. For example, the growth rate of real GDP is defined as

You can learn more about growth rates in the toolkit.

Some of the inputs to the production function—most notably knowledge, social infrastructure, and natural resources—are very difficult to measure individually.

Economists typically group these inputs together into **technology**, as shown in ***Figure 5.10 "The Aggregate Production Function". The term is something of a misnomer because it includes not only technological factors but also social infrastructure, natural resources, and indeed anything that affects real GDP but is not captured by other inputs.

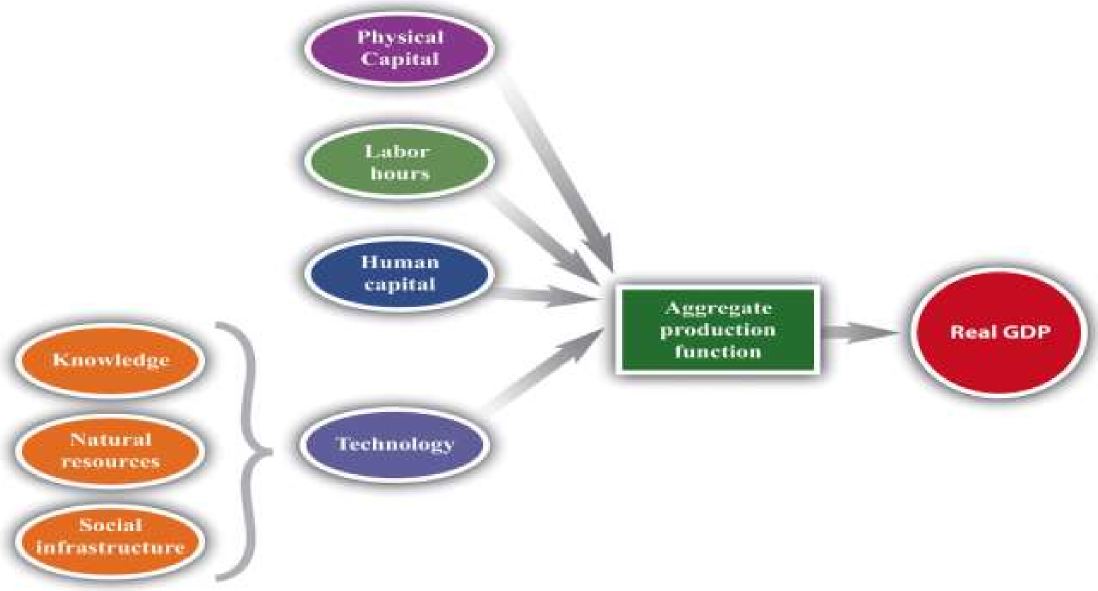

Fig. 5.10: Figure 5.10 The Aggregate Production Function The aggregate production function combines an economy's physical capital stock, labor hours, human capital, and technology (knowledge, natural resources, and social infrastructure) to produce output (real GDP).

The technique for explaining output growth in terms of the growth of inputs is called **growth accounting**.

Toolkit: Section 16.17 "Growth Accounting"

Growth accounting tells us how *changes* in real GDP in an economy are due to*changes*in available inputs. Under reasonably general circumstances, the change in output in an economy can be written as follows:

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output growth rate = a × capital stock growth rate
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[(1 − a) × labor hours growth rate]
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[(1 − a) × human capital growth rate]
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technology growth rate.
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In this equation, *a* is just a number. Growth rates can be positive or negative, so we can use the equation to analyze decreases and increases in GDP.

We can measure the growth in output, capital stock, and labor hours using easily available economic data. The growth rate of human capital is trickier to measure, although we can use information on schooling and literacy rates to estimate this number. We also have a way of measuring *a*. The technical details are not important here, but a good measure of (1 − *a*) is simply total payments to labor in the economy (that is, the total of wages and other compensation) as a fraction of overall GDP. For most economies, *a* is in the range of about 1/3 to 1/2.

For the United States, the number *a* is about 1/3. The growth rate of output is therefore given as follows:

Because we can measure everything in this equation except growth in technology, we can use the equation to determine what the growth rate of technology must be. If we rearrange, we get the following:

To emphasize again, the powerful part of this equation is that we can use observed growth in labor, capital, human capital, and output to infer the growth rate of technology—something that is impossible to measure directly.

5.4.1 Growth Accounting in Action

***Table 5.2 "Some Examples of Growth Accounting Calculations*" provides information on output growth, capital growth, labor growth, and technology growth. The calculations assume that *a* = 1/3. In the first row, for example, we see that

```
growth in technology = 5.5 − [(1/3) × 6.0] − [(2/3) × (2.0 + 1.0)] =
5.5 − 2.0 − 2.0= 1.5.
```

Table 5.2 Some Examples of Growth Accounting Calculations*

Year	Output Growth	Capital Growth	Labor Growth	Human Capital Growth	Technology Growth
2010	5.5	6.0	2.0	1.0	1.0
2011	2.0	3.0	1.5	0	0
2012	6.5	4.5	1.0	0.5	
2013	1.5	0	0	2.2	
2014	1.5	3.3		0	1.3
*The figures in each column are percentage growth rates.					

Growth accounting is an extremely useful tool because it helps us diagnose the causes of economic success and failure. We can look at successful growing economies and find out if they are growing because they have more capital, labor, or skills or because they have improved their technological know-how. Likewise, we can look at economies in which output has fallen and find out whether declines in capital, labor, or technology are responsible. [***We use this tool in Chapter 7 "The Great Depression" to study the behavior of the US economy in the 1920s and 1930s.***]

Researchers have found that different countries and regions of the world have vastly varying experiences when viewed through the lens of growth accounting. A World Bank study found that, in developing regions of the world, capital accumulation was a key contributor to output growth, accounting for almost two-thirds of total growth in Africa, Latin America, East Asia, and Southeast Asia. [***The study covered the period 1960–1987. See World Bank, World Development Report 1991: The Challenge of Development, vol. 1, p. 45, June 30, 1991, accessed August 22, 2011,http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=4780 60&pi PK=64165421&menuPK=64166093&entityID=000009265_3981005112648.***] Technology and human capital growth played a surprisingly small role in these regions, contributing nothing at all to economic growth in Africa and Latin America, for example.

5.4.2 The Short Run, the Long Run, and the Very Long Run

Growth accounting focuses on how inputs—and hence output—change over time. We use the tool both to look at changes in an economy over short time periods—say, from one month to the next—and also over very long time periods—say, over decades. We are limited only by the data that we have available to us. It is sometimes useful to distinguish three different time horizons.

1. The short run refers to a period of time that we would typically measure in months. If something has only a short-run effect on an economy, the effect will vanish within months or a few years at most.
2. The long run refers to periods of time that are better measured in years. If something will happen in the long run, we might have to wait for two, three, or more years before it happens.
3. The very long run refers to periods of time that are best measured in decades.

These definitions of the short, long, and very long runs are not and cannot be very exact. In the context of particular chapters, however, we give more precise definitions to these ideas. [***For example, Chapter 10 "Understanding the Fed" explains the adjustment of prices in an economy. In that chapter, we define the short run as the time horizon in which prices are “sticky”—not all prices have adjusted fully—whereas the long run refers to a period where all prices have fully adjusted. Meanwhile, Chapter 6 "Global Prosperity and Global Poverty" uses the very long run to refer to a situation where output and the physical capital stock grow at the same rate.***] ***Figure 5.11 "The Different Time Horizons in Economics" summarizes the main influences on the inputs to the production function in the short run, the long run, and the very long run.

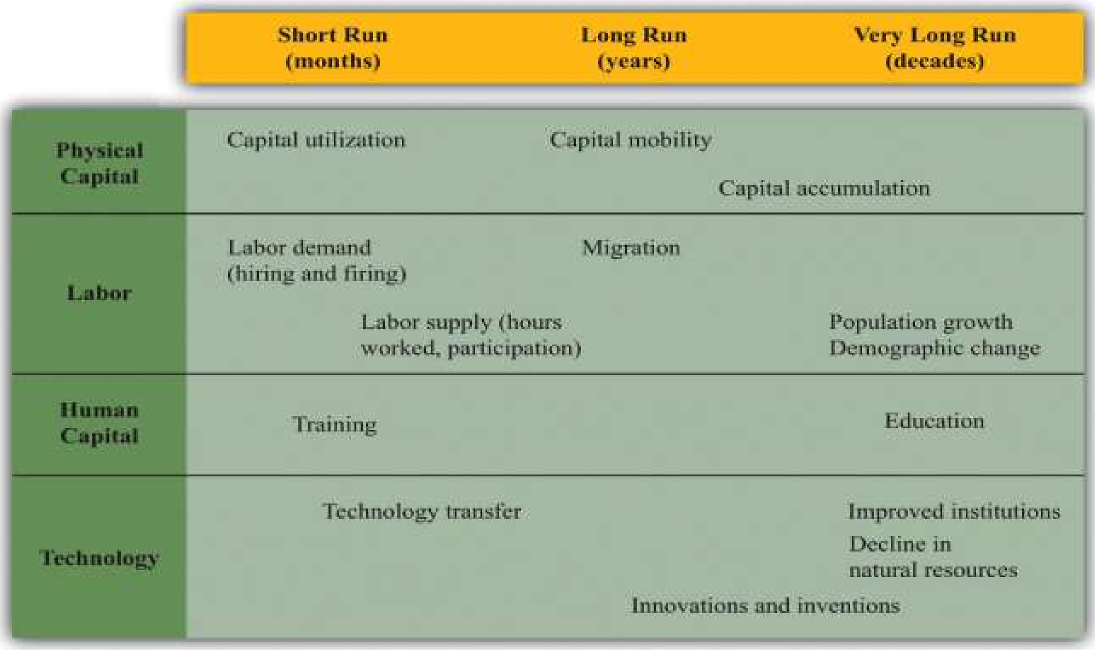

Fig. 5.11: Figure 5.11 The Different Time Horizons in Economics

Look first at physical capital—the first row in ***Figure 5.11 "The Different Time Horizons in Economics". In the short run, the amount of physical capital in the economy is more or less fixed. There are a certain number of machines, buildings, and so on, and we cannot make big changes in this capital stock. One thing that firms can do in the short run is to change capital utilization—shutting down a production line if they want to produce less output or running extra shifts if they want more output.

Once we move to the long run and very long run, capital mobility and capital accumulation become important.

Look next at labor. In the short run, the amount of labor in the production function depends primarily on how much labor firms want to hire (labor demand) and how much people want to work (labor supply). As we move to the long run, migration of labor becomes significant as well: workers sometimes move from one country to another in search of better jobs. And, in the very long run, population growth and other demographic changes (the aging of the population, the increased entry of women into the labor force, etc.) start to matter.

Human capital can be increased in the long run (and also in the short run to some extent) by training. The most important changes in human capital come in the very long run, however, through improved education.

There is not very much that can be done to change a country’s technology in the short run. In the long run, less technologically advanced countries can import better technologies from other countries. In practice, this often happens as a result of a multinational firm establishing operations in a developing country. For example, if Dell Inc. establishes a factory in Mexico, then it effectively transfers some know-how to the Mexican economy. This is known as **technology transfer**, the movement of knowledge and advanced production techniques across national borders.

In the long run and very long run, technology advances through innovation and the hard work of research and development (R&D) that—hopefully—gives us new inventions. In the very long run, countries may be able to improve their institutions and thus create better social infrastructure. In the very long run, declines in natural resources also become significant.

KEY TAKEAWAY

- Growth accounting is a tool to decompose economic growth into components of input growth and technological progress.
- In economics, we study changes in GDP over very different time horizons. We look at short-run changes due mainly to changes in hours worked and the utilization of capital stock. We look at long-run changes due to changes in the amount of available labor and capital in an economy. And we look at very-long-run changes due to the accumulation of physical and human capital and changes in social infrastructure and other aspects of technology.

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Checking Your Understanding

Rewrite the growth accounting equation for the case where a = 1/4.

Using the growth accounting equation, fill in the missing numbers in Table 5.2 "Some Examples of Growth Accounting Calculations*".

5.5 Globalization and Competitiveness Revisited

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How is competitiveness measured?

What are some of the policies governments use to influence their competitiveness?

At the beginning of this chapter, we noted that both President George W. Bush and President Obama have emphasized policies to improve the competitiveness of the United States. Such interest in national competitiveness is not restricted to the United States. [***It is perhaps more pronounced in the United States than in other countries. A Google

search on October 17, 2011 reveals that the string "Keep America Competitive" has almost twice as many hits as the string "Keep Canada Competitive" and more than three times as many hits as "Keep Britain Competitive."***]In their "Lisbon Agenda" of 2000, the heads of European countries stated an aim of making the European Union "the most competitive and dynamic knowledge-driven economy by 2010." [***See "Lisbon Agenda," EurActive, May 21, 2007, accessed July 27, 2011,http://www.euractiv.com/en/future-eu/lisbon-agenda/article-117510.***]

5.5.1 Competitiveness: Another Look

Various organizations produce rankings of the competitiveness of countries. For example, IMD, a business school in Switzerland, produces a World Competitiveness Yearbook (WCY) every year. [***See "World Competitiveness Center," IMD, accessed August 22, 2011,http://www.imd.org/research/centers/wcc/index.cfm.***] The World Economic Forum (WEF) produces an annual Global Competitiveness Report. [***See "Global Competitiveness Report," World Economic Forum, accessed June 29, 2011,http://www.weforum.org/s?s=global+competitiveness.***] In 2010, the WEF judged Switzerland to be the most competitive economy in the world, followed by the United States and Singapore. According to IMD, the top three were Hong Kong, the United States, and Singapore. These rankings are covered extensively in the business press, and there is also a market for them—WCY resources cost over $1,000. Business and governments purchase these reports each year. National competitiveness is big business.

In their bid to measure competitiveness, the WEF and the WCY look at a combination of "hard" economic data and surveys of businesspeople. Each looks at hundreds of measures in their respective attempts to measure national competitiveness. If these two institutions are to be believed, national competitiveness is a very complicated animal indeed. Although we do not want to go through their measures in detail, a few themes emerge.

- • Both the WEF and the WCY look at measures of human capital, such as the number of people enrolled in tertiary education.
- • Technology and technological infrastructure feature prominently in both lists of data. The WEF and the WCY look at measures such as the penetration of computers, the Internet, and mobile phones and the granting of patents.
- • The quality of public institutions and the prevalence of corruption feature prominently in both lists. Here, the WEF relies on survey data on corruption, bribes, and the extent to which the legal system is fair and transparent. The WCY includes survey information on management practices and "attitudes and values."

Thus the items that we have identified as components of social infrastructure and human capital are included as key determinants of competitiveness. (Technological infrastructure is difficult to classify and measure. In part, it is captured by measures of capital stock because knowledge can be embodied in the capital stock.)

Countries that do better in terms of these rankings will tend to have higher levels of output because these are all inputs into the aggregate production function. The competitiveness of a country is not a matter of how much output it produces, however; we already have a perfectly good measure of that, called real gross domestic product (real GDP). Instead, competitiveness is the ability to attract foreign capital. If countries do not have enough domestic savings to fund investment, then they need to obtain capital from other countries. The amount of capital in the world is limited, so countries compete for this capital by trying to make their economies attractive places to invest. More human capital, better knowledge, or superior social infrastructure all serve to increase the return on investment. If workers are more skilled, then extra capital will generate more output. If firms have better processes in place, then extra capital will generate more output. If a country is free of corruption, then extra capital will generate more output.

This suggests that one good yet simple indicator of national competitiveness is the marginal product of capital. Country A is more competitive than country B if capital investment in country A is more productive than in country B. More exactly, a country is more competitive if it has a higher marginal product of capital.

5.5.2 Globalization: Another Look

Whenever a good or service is produced and sold, economic value is created. The amount of value is given by the difference between the value to the buyer and the value to the seller. For example, suppose a toy car is produced in a factory in Kansas at a cost of $5. Imagine that a potential buyer in California values the car at $20—that is, she is willing to pay up to this amount for the toy. Then the value created if the buyer and seller trade is $20 − $5 = $15.

In a globalized world, toy cars can be transported around the world. This means two things. First, goods can go to where buyers value them the most. There might be a buyer in Germany who values the car at $25. If he buys the car, then the trade creates $20 worth of value (= $25 − $5). Second, goods can be manufactured where production costs are lowest. Perhaps the toy car can be manufactured in China for $2. If the toy is produced in China and sold in Germany, then the total value created by the trade increases to $23 (= $25 − $2). Globalization thus contributes to a more efficient global economy because goods—and many services—can be shipped around the world to create more value. They can be produced where it is most efficient to produce them and sold where they are valued the most.

We have also seen that capital (and to a lesser extent labor) moves around the world. Capital moves to competitive economies—that is, to the places where its marginal product is highest. This again contributes to economic efficiency because it means that we (that is, the world as a whole) get more output from a given amount of capital input.

This brief description paints a rosy picture of globalization as a force that makes the world a more productive place. Yet globalization has vehement critics. Protesters have taken to the streets around the world to complain about it. And the recent era of globalization has seen mixed results in terms of economic success. Some economies—particularly in East Asia—have exploited the opportunities of globalization to their advantage. But other countries—most notably in sub-Saharan Africa—remain stuck in poverty.

So what is our story missing? What is wrong with the idea that the free movement of goods and capital can encourage prosperity everywhere? There are some reasons why we should temper our optimism about the process of globalization, including the following:

- • **There are winners and losers.** There is a strong presumption from economic theory that globalization will increase overall economic efficiency, but there is no guarantee that everyone will gain. Investors are winners from globalization because they can send their funds to wherever capital earns the highest return. Workers in countries that attract capital will, in general, be winners because they will obtain higher real wages. However, workers in countries that lose capital lose from globalization: they see their real wages decrease. In our example, the buyers of toys in California and Germany benefit from the fact that toys are cheaper and available in greater variety. But the toy manufacturer in Kansas loses out because it cannot compete with the cheaper product from China. The factory may close, and its workers may be forced to look for other—perhaps less attractive—jobs.
- • **The playing field is not level.** In an introductory economics book, we do not have room to review the details of trade agreements throughout the world. But one trenchant criticism of globalization is that developed countries have maintained high tariffs and subsidies even as they have encouraged poorer countries to eliminate such measures. As a result, the benefits of globalization have been almost entirely absent for some of the poorest countries in the world. Moreover, rich countries have disproportionate control over some of the key international institutions: the managing director of the International Monetary

Fund (IMF) is traditionally a European; the president of the World Bank is appointed by the United States.

- • **One size may not fit all.** International institutions such as the IMF and the World Bank typically advocate similar policies for all countries. In fact, different policies might be appropriate for different countries. For example, these organizations argued that countries should allow free movement of capital across their borders. We have seen that there is a strong argument for allowing capital to go in search of the highest return. But not all capital flows take the form of building new factories. Sometimes, the movement of capital consists of only very fast transfers of money in and out of countries, based on guesses about movements in interest rates and exchange rates. These flows of money can be a source of instability in a country. There is increasing recognition that, sometimes at least, it is better to place some limits on such speculative capital movements.

Most economists are convinced that the benefits of globalization are enough to outweigh these concerns. Many—perhaps most—are also convinced that, if globalization is to live up to its promise for the world, it needs to be managed better than it has been in the past.

5.5.3 Policies to Increase Competitiveness and Real Wages

We know that if an economy increases its labor input, other things being equal, the marginal product of labor (and hence the real wage) decreases. If an economy increases its physical capital stock, meanwhile, then the marginal product of capital (and hence the economy's competitiveness) decreases.

There is a critical tension between competitiveness and real wages. Suppose for a moment that human capital and technology are unchanging. Then an economy in which real wages are increasing must also be an economy that is becoming less competitive. Conversely, the only way in which an economy can become more competitive is by seeing its real wages decrease.

High real wages make a country less attractive for businesses—after all, firms choose where to locate in an attempt to make as much profit as possible, so, other things being equal, they prefer to be in low-wage economies. Indeed, the WEF and the WCY both use labor costs as one of their indicators of competitiveness. Our article about Compal locating in Vietnam likewise cited low wages as an attraction of the country.

But we must not be misled by this. High real wages signal prosperity in a country. Low real wages, even if they make an economy competitive and help to attract capital, are not in themselves desirable. After all, the point of attracting capital in the first place is to increase economic well-being. As an example, China has been quite successful at attracting capital, in large part because of low real wages. As the country has become more prosperous, real wages have risen. A *BusinessWeek* article, commenting on the increasing wages in the country, observed the following: "The wage issue has started to affect how companies operate in China. U.S. corporations and their suppliers are starting to rethink where to locate facilities, whether deeper into the interior (where salaries and land values are smaller), or even farther afield, to lower-cost countries such as Vietnam or Indonesia. Already, higher labor costs are beginning to price some manufacturers out of more developed Chinese cities such as Shanghai and Suzhou." [***"How Rising Wages Are Changing the Game in China," Bloomberg BusinessWeek, March 27, 2006, accessed June 29, 2011,http://www.businessweek.com/magazine/content/06_13/b3977049.htm.***] In other words, increasing real wages are making China less competitive. But this tells us that China is getting richer, and workers in China are able to enjoy improvements in their standard of living. This is a good thing, not a problem.

What we really want are policies that will increase both competitiveness *and* real wages at the same time. The only way to do this is by increasing the stocks of human capital, knowledge, and social infrastructure (there is little a country can do to increase its stock of natural resources). There are no easy or quick ways to increase any of these. Still, important policy options include the following:

- • **Invest in education and training.** Overall economic performance depends to a great degree on the education and skills of the workforce. This is one reason why countries throughout the world recognize the need to provide basic education to their citizens. It is worthwhile for countries to build up their stock of human capital just as it is worthwhile for them to build up their stocks of physical capital.
- • **Invest in research and development (R&D).** The overall knowledge in an economy is advanced by new inventions and innovations. The romantic vision of invention is that some brilliant person comes up with a completely new idea. There are celebrated examples of this throughout human history, starting perhaps with the cave dweller who had the idea of cracking a nut with a stone and including the individual insights of scientists like Louis Pasteur, Marie Curie, and Albert Einstein. But the reality of invention in the modern economy is more mundane. Inventions and innovations today almost always originate from teams of researchers—sometimes in universities or think tanks or sometimes in the R&D departments of firms. Governments often judge it worthwhile to subsidize such research to help increase the stock of knowledge. R&D expenditures in the United States and other rich countries are substantial; in the United States they amount to about 2 percent of GDP.
- • **Encourage technology transfer.**Firms in developed countries tend to have access to state-of-the-art knowledge and techniques. To increase their stock of knowledge, such countries must advance the overall knowledge of the world. For poorer countries in the world, however, there is another possibility. Factories in poor countries typically do not use the most advanced production techniques or have the most modern machinery. These countries can improve their stock of knowledge by importing the latest techniques from other countries. In practice, governments often do this by encouraging multinational firms from rich countries to build factories in their countries. Technology transfer within a country is also important. Researchers have found that, even with a country, there can be big differences in the productivity of different factories within an industry. [***See Chang-Tai Hsieh and Peter Klenow, "Misallocation and Manufacturing TFP in China and India," The Quarterly Journal of Economics CXXIV, no. 4, November 2009, accessed June 28, 2011, http://klenow.com/MMTFP.pdf.***] So countries

may be able to increase real GDP by providing incentives for knowledge sharing across plants.

- • **Invest in social infrastructure.** Improvements in social infrastructure are hard to implement. A government, no matter how well intentioned, cannot eliminate corruption overnight. Nor can it instantly establish a reliable legal system that will uphold contracts and protect property rights. (Even if a country could do so, it would still take considerable time for international investors to gain confidence in the system.) Improving social infrastructure is, for most countries, a struggle for the long haul.

We should ask whether government needs to play a role in any of this. After all, individuals have an incentive to invest in their own education. Many people find it worthwhile to pay for undergraduate or graduate degrees because they know they will get better, higher paying jobs afterward. Similarly, firms have a lot of incentive to carry out R&D because a successful invention will allow them to earn higher profits.

There is no doubt that these private incentives play a big role in encouraging the advancement of knowledge. Still, most economists agree that private incentives are not sufficient. Particularly in poor countries, people may not be able to afford to pay for their own education or be able to borrow for that purpose, even if it would eventually pay off for them to do so.

Because knowledge is nonrival and frequently nonexcludable, not all the benefits from R&D flow to the firms that make the investment. For example, suppose a firm comes up with some new software. Other firms may be able to imitate the idea and capture some of the benefits of the invention. (Although the United States and other countries have patent and copyright laws to help ensure that people and firms can enjoy the benefits of their own inventions, such laws are imperfect, and firms sometimes find that their ideas are copied or stolen.) Private markets will do a poor job of providing nonrival and nonexcludable goods, so there is a potential role for the government.

Similar arguments apply to much social infrastructure. The provision of roads is a classic function of government because they are again (most of the time, at least) nonrival and nonexcludable. And the establishment of a reliable legal system is one of the most basic functions of government.

KEY TAKEAWAY

• In some leading studies, the items that we have identified as components of social infrastructure and human capital are included as key determinants of competitiveness. Overall, the marginal product of capital is a good indicator of the competitiveness of a country.

• Governments take actions to increase their competitiveness and the real wages of their workers by encouraging the accumulation of human capital, knowledge, and the transfer of technology.

***

Checking Your Understanding

Why is GDP not a good measure of competitiveness?

How could a policy to increase the inflow of capital lead to a decrease in competitiveness? What does this inflow of capital do to the real wage of workers?

5.6 End-of-Chapter Material

In Conclusion

We began the chapter with five stories from all around the world. Let us briefly review these stories, based on what we have learned in this chapter.

5.6.1 Niger

Niger is an extremely poor country. Life expectancy in Niger is 52, the infant mortality rate is over 10 percent, and less than 30 percent of the population can read and write. It is extremely poor because it lacks the key inputs to the production function. It is largely a subsistence agricultural economy: it has relatively little physical capital or human capital, little physical infrastructure, and poor social infrastructure as well. It is a natural target for World Bank help. The particular World Bank project that we cited is aimed at one particular input: its goal is to improve Niger's human capital.

5.6.2 Vietnam

In a globalized world, savings and investment do not have to be equal in any individual economy. Savers can send their funds almost anywhere in the world in search of a high return on capital. Countries that are competitive, in the sense that they have a high marginal product of capital, will tend to attract such funds. One manifestation of these flows of capital is that multinational companies establish factories where they can produce most cheaply. In the story, we see that Vietnam, a low-wage economy, is attracting capital investment from a Taiwanese company. Capital flows have a similar effect to the migration of labor: when capital flows into a country, it increases the real wage; when capital flows out of a country, real wages decrease. Globalization benefits the world as a whole, but many individual workers may lose out.

5.6.3 United Arab Emirates

The policies of Dubai are straightforward to understand in the framework of this chapter. Dubai is actively trying to import foreign physical capital and human capital. It is encouraging multinational firms to establish operations in the country. This makes sense because, as we now know, increased physical and human capital will both tend to increase the marginal product of labor in Dubai, leading to higher wages and higher prosperity. Dubai's claims of attractiveness rest largely on its social infrastructure.

5.6.4 The United Kingdom

Migrant workers are a global phenomenon, be they Poles traveling to England, Mexicans moving to the United States, or Filipinos moving to Saudi Arabia. Like the young Poles in this story, they move from country to country in search of higher wages. Worker migration across national boundaries tends to equalize wages in different countries. As workers leave Poland, for example, labor becomes scarcer there, so wages in Poland tend to increase. When they arrive in the United Kingdom, there is more labor supplied to the United Kingdom labor market, so wages there tend to decrease. However, labor migration is still quite limited because (1) countries restrict immigration and (2) most workers still do not want to suffer the upheaval of moving to a different country and culture.

5.6.5 United States

The competitiveness initiatives of President Obama and President George W. Bush are designed to increase both human capital and knowledge within the United States. They include measures to strengthen education (human capital), increase research and development (R&D; knowledge), and encourage entrepreneurship and innovation. We have seen that the idea of competitiveness is subtle: nations do not compete in the same way that countries do. Still, improvements in technology and human capital will tend to increase the marginal product of capital, making the United States a more attractive place for investment. In that sense, they do make the country more competitive.

5.6.6 Key Links

- • World Economic Forum: http://www.weforum.org

- • World Competitiveness Yearbook: http://www.imd.ch/wcc
- • World Bank: http://www.worldbank.org
- • Dubai government: http://www.dubaitourism.ae/node

EXERCISES

TABLE 5.3 AN EXAMPLE OF A PRODUCTION FUNCTION

Output	Capital	Labor	Human Capital	Technology
10	1	1	10	10
20	2	2	10	10
20	4	1	10	10
20	1	4	10	10
30	9	1	10	10
30	1	9	10	10
30	3	3	10	10
40	2	8	10	10
40	8	2	10	10
40	4	4	10	10
40	4	4	20	5
40	4	4	5	20
80	4	4	20	20

1. By comparing two different rows in the preceding table, show that the marginal product of labor is positive. Make sure you keep all other inputs the same. In other words, find two rows that show that an increase in labor, *keeping all other inputs the same*, leads to an increase in output.

2. By comparing two different rows in the preceding table, show that the marginal product of human capital is positive. Again, make sure you keep all other inputs the same.

3. By comparing two different rows in the preceding table, show that the marginal product of technology is positive.

4. Does the production function exhibit diminishing marginal product of physical capital? [Hint: if more and more extra capital is needed to generate the same increase in output, then there is diminishing marginal product.]

5. Does the production function exhibit diminishing marginal product of labor?

6. (Difficult) Can you guess what mathematical function we used for the production function?

7. Why are electricians not paid the same amount in Topeka, Kansas, and New York City? Why are electricians not paid the same amount in North Korea and South Korea? Is the explanation the same in both cases?

8. Think about the production function for the university or college where you are studying. What are some of the different inputs that go into it? Classify these inputs as physical capital, human capital, labor, knowledge, natural resources, and social infrastructure. Try to come up with at least one example of each.

9. Suppose government spending is 30, government income from taxes (including transfers) is 50, private saving is 30, and lending to foreign countries is 20. What is national savings? What is investment?

10. Explain how it is possible for investment to be positive yet for the capital stock to fall from one year to the next.

11. Is a fireworks display nonrival? Nonexcludable?

12. Suppose that a country's capital stock growth rate is 8 percent, the labor hours growth rate is 4 percent, the human capital growth rate is 2 percent, and the technology growth rate is 3 percent. The parameter a is 0.25. What is the output growth rate?

13. Suppose that a country's capital stock growth rate is 4 percent, the labor hours growth rate is 3 percent, the human capital growth

rate is 1 percent, and the output growth rate is 5 percent. The parameter *a* is 0.5. What is the technology growth rate?

14. Explain why a decrease in a country's competitiveness can be a sign that the country is becoming more prosperous.

15. Firms are sometimes willing to pay for training courses for their workers. Other things being equal, do you think a firm would prefer to pay for one of its employees to do a general management course or a course that trains the employee in the use of software designed specifically for the firm? Explain.

Economics Detective

1. Go to the website of the Bureau of Labor Statistics (http://www.bls.gov). Find the *median* hourly wage in the state in which you live. (If you do not live in the United States, pick a state at random.)

a) How does it compare to the median hourly wage for the country as a whole? b) Which is higher in your state—the median wage or the mean wage? Can you explain why?

2. Find an example of a competitiveness initiative in some country other than the United States. How will the proposed policies help to attract capital?

Chapter 6 Global Prosperity and Global Poverty

Life Around the World

[...]

I thought about my new friend Mariya, her life and daily routine. She was married before I had my driver's license. She pounded millet all day, sweating yet smiling. She hauled water from the well. She cooked. She birthed child after child. There was no end to the manual labor her life required. I liked to watch her. It was fascinating. But if hers was my life, I'd probably jump into that well.

I've always thought what life each soul is assigned to is a game of chance. I couldn't help but to wonder what would have become of me had the powers that be had shaken those dice one more time on March 16, 1982, before moving the game piece that sent me to DePaul Hospital in St. Louis, Missouri.

If I had been born into Mariya's life, would I have been able to hack it? If she had been born into my life, would she have been happier? [...] [***Alexis Wolff, "Village Life—Niger," February 27, 2005, accessed June 28, 2011,http://www.bootsnall.com/articles/05-02/village-life-niger.html. ***]

In Niger, where Mariya lives, about 1 in 9 children die before their first birthday. Life expectancy at birth is 53 years, and less than 30 percent of the population can read and write. About one-fifth of the population is nomadic. An Oxfam study in 2005 found that nomads had recently lost about 70 percent of their animals, and that "almost one in ten families is surviving on a diet of mainly wild plants, leaves, and grass." [***See "The World Factbook," Central Intelligence Agency, accessed June 28,

2011,https://www.cia.gov/library/publications/the-world-factbook/index.html; and

"Nomadic Way of Life in Niger Threatened by Food Crisis," Oxfam America, August 16, 2005,

accessed June 29, 2011, http://www.oxfamamerica.org/press/pressreleases/nomadic-way-oflife-in-niger-threatened-by-food-crisis.***]**Real gross domestic product (real GDP)** per person in Niger is the equivalent of about $700 per year.

Call centers are a phenomenon that has taken over the young crowd of metros in India by a storm. Its implications are social, cultural and economic. It is a new society of the young, rich and free, selling the new dream of an independent life to the regular desi.

[...]

[C]heap labor in India owes its origin to the high rate of unemployment here. Hundreds of thousands of graduates are jobless and desperate for work in India.

[...]

Most call center jobs require a basic understanding of computers and a good grasp over English. And the urban youth of India are computer literate graduates with a command over English language. This is the ideal unskilled labor that the call center industry is looking for.

[...]

With its operations mainly during the night, the call centers offer an opportunity for the young to live a perpetual nocturnal life, a saleable idea to the youth. The fascination of the dark and the forbidden, is tremendous for the Indian youth, recently unleashed from the chains of tradition and culture. Because of this fascination, the industry has developed an air of revolution about itself. Not only is it cool to work for call centers, it is radical and revolutionary.

Just like the bikers subculture of the 60s and the flower children of the 70s, these call centerites also have their own lingo and a unique style of existence. Most of them are happy in a well paying monotonous job, reaping the benefits of technology, enjoying a life away from rush hour traffic and local trains. The moolah is good, the work is easy and life is comfortable. [***“The Indo-American Dream—Coming of Age with Call Center Jobs,” Mumbai Travel & Living Guide, accessed June 28, 2011, http://www.mumbaisuburbs.com/articles/call-centersmumbai.html. ***]

Life expectancy in India is 67 years, and the infant mortality rate is about 1 in 20. Real GDP per person is about $3,500.

More Americans own pets than ever before, and they're spending more money to keep them healthy, according to a survey released today by the American Veterinary Medical Association. The number of U.S. households with pets climbed 7.6 million, to 59.5% of all homes, up from 58.3% in 2001. By comparison, about 35% of U.S. households have children, the Census Bureau says.

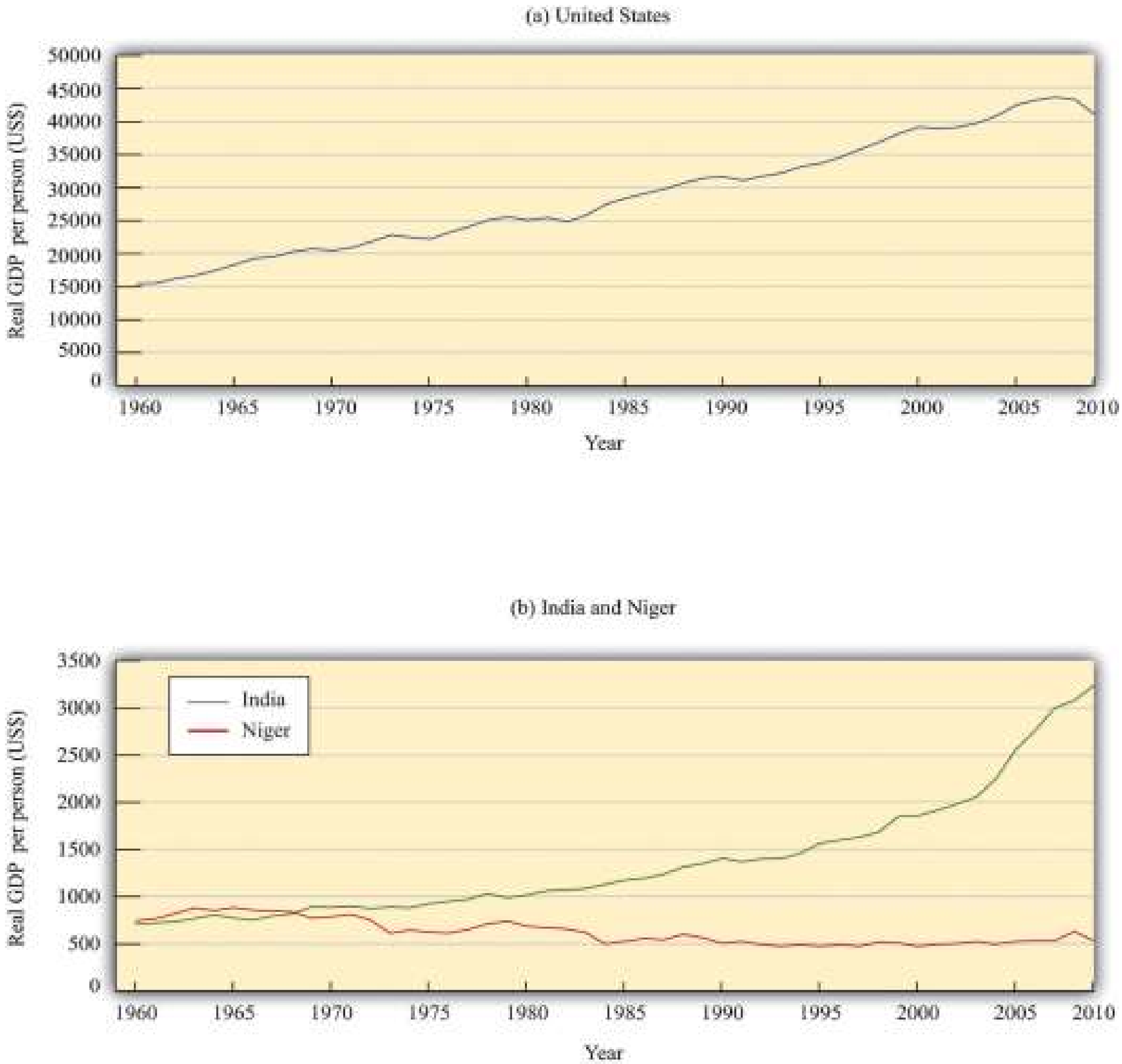

Fig. 6.1: Figure 6.1 Real GDP per Person in the United States, India, and Niger Real GDP per person in the United States (a) is substantially larger than (b) real GDP in India and Niger. The growth experiences of the three countries are also very different Source: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011.

[...]

Pet owners are spending more on medical care. Veterinary expenditures for all pets were estimated at $24.5 billion in 2006. In inflation-adjusted dollars, Americans spent $22.4 billion in 2001. This represents “the high-tech care that pet owners are demanding and willing to pay for,” DeHaven says. “Diseases that once would have been difficult to treat—diabetes, heart disease, cancer—today are very treatable. We’re even putting pacemakers in dogs.” [***Elizabeth Weiss, “We Really Love—and Spend on—Our Pets,” USA Today, December 11, 2007, accessed July 29, 2011, http://www.usatoday.com/life/lifestyle/2007-12-10-petsurvey_N.htm#.***]

In the United States, where spending on veterinary care for pets is considerably more than twice the entire GDP of Niger, the infant mortality rate is about 1 in 170, and life expectancy is about 78. Real GDP per person is more than 10 times greater than in India and almost 70 times greater than in Niger.

These stories are more than anecdotes. They are, in a real sense, representative of these three countries, as we can see by looking at economic data. ***Figure 6.1 "Real

GDP per Person in the United States, India, and Niger" shows real GDP per person in India, the United States, and Niger over the 1960–2009 period. [***Alan Heston, Robert Summers, and Bettina Aten, “Penn World Table Version 6.2,” Center

for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006, accessed June 29, 2011, http://pwt.econ.upenn.edu/php_site/pwt_index.php. The data in the Penn World Tables are constructed so that dollar figures for different countries can be legitimately compared. Specifically, the data are constructed on a purchasing power parity basis, meaning that they take into account the different prices of goods and services in different countries and are based on how much can actually be purchased. ***] From part (a) of ***Figure 6.1 "Real GDP per Person in the United States, India, and Niger", we can see that GDP per person in the United States has grown substantially. On average, real GDP per person grew at 2 percent per year. Perhaps this

doesn’t sound like a lot. Economic growth cumulates over time, however. An annual growth

rate of 2 percent means that real GDP per person is about 2.6 times higher than half a century ago. To put it another way, each generation is roughly twice as rich as the previous generation. Although there are periods of high and low (sometimes even negative) growth in GDP per person, these fluctuations are overwhelmed by the overall positive growth in our economy. With this growth come many benefits: higher consumption, more varieties of goods, higher quality goods, better medical care, more enjoyable leisure time, and so on.

Part (b) of ***Figure 6.1 "Real GDP per Person in the United States, India, and Niger" shows real GDP per person for India and Niger. Notice first that the scale on this graph is very different. In 1960, real GDP per person in the United States was about $15,000 (measured in year 2005 dollars). In Niger and India, it was about 5 percent of the US figure—about $700 per person. The second striking feature of this graph is the very different performance of India and Niger. India, like the United States, has grown: GDP per person is much higher at the end of the sample than at the beginning. Indeed, India has grown faster than the United States: the average growth rate over the period was 3.1 percent. Over the last two decades, the difference is even starker: India has grown at about 4.4 percent per year on average. Nevertheless, the United States is still a lot richer than India.

By world standards, India is a long way from being the poorest country. In 1960, Niger was richer than India on a per person basis. But in the following half century, Niger became poorer, not richer. GDP per person decreased by almost 30 percent. India in 2009 was six times richer than Niger. Statistics on GDP are just that—statistics—and it is easy to look at graphs like these and forget that they are telling us about the welfare of human beings. But imagine for a moment that Niger had managed to grow like India, instead of collapsing as it did. People would not be surviving by eating grass, infants would be more likely to grow up to be adults instead of dying of preventable diseases, and children would be learning to read and write.

This is why the study of economic growth matters. And this is why, in this chapter, we take on arguably the most important question in the entire book.

Why are some countries rich and other countries poor?

Along the way, we tackle two other closely related questions. We want to know if the differences in income that we see in the world are likely to persist over time. The experiences of the United States, India, and Niger suggest that this question may not have a simple answer: India has been tending to catch up with the United States, but Niger has been falling further behind. As we seek to answer that question, we will also investigate the ultimate sources of economic growth:

Will poorer countries catch up to richer countries?

Why do countries grow?

Road Map

The big mystery we investigate in this chapter is the vast variation in economic performance from country to country. We want to know why the experiences of the United States, India, and Niger are so different from one another.

We begin this chapter with an extended story. We think about how growth would work in a country with just a single inhabitant. Then we turn to a back-of-the-envelope calculation to understand why countries differ so much in terms of economic performance. To understand these differences, we focus attention on different inputs to the production function, first considering physical capital and then looking at human capital and technology. After that, we develop a complete framework for understanding how and why economies grow in the very long run. Finally, we look at policy and international institutions.

6.1 The Single-Person Economy

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How does the capital stock increase?

What are the factors that lead to output growth?

What are the differences between growth in a closed economy and growth in an open economy?

The macroeconomy is very complicated. Overall economic performance depends on billions of decisions made daily by millions of people. Economists have developed techniques to keep us from being overwhelmed by the sheer scale of the economy and the masses of data that are available to us. One of our favorite devices is to imagine what an economy would look like if it contained only one person. This fiction has two nice features: we do not have to worry about differences among individuals, and we can easily isolate the most important economic decisions. Thinking about the economy as if it were a single person is only a starting point, but it is an extremely useful trick for cutting through all the complexities of, say, a $12 trillion economy populated by 300 million individuals.

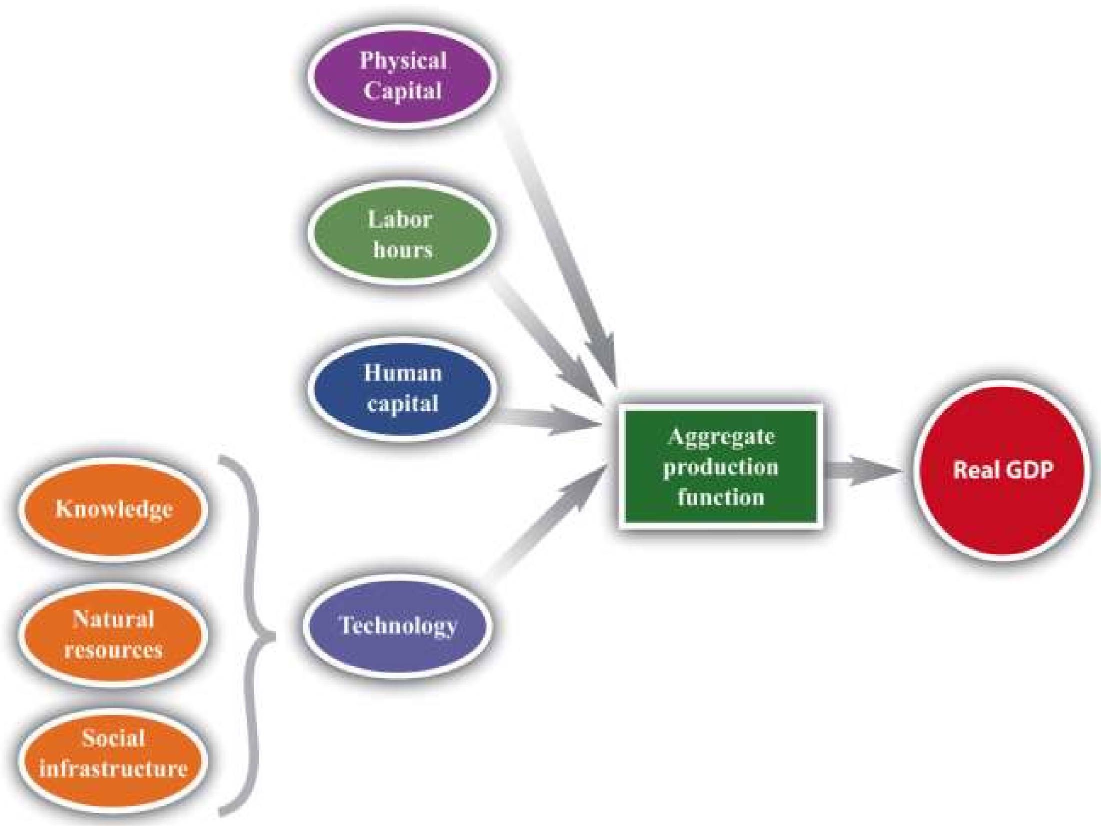

Fig. 6.2: Figure 6.2 The Aggregate Production Function The aggregate production function combines an economy's physical capital stock, labor hours, human capital, and technology to produce output (real gross domestic product [real GDP]).

Solovenia

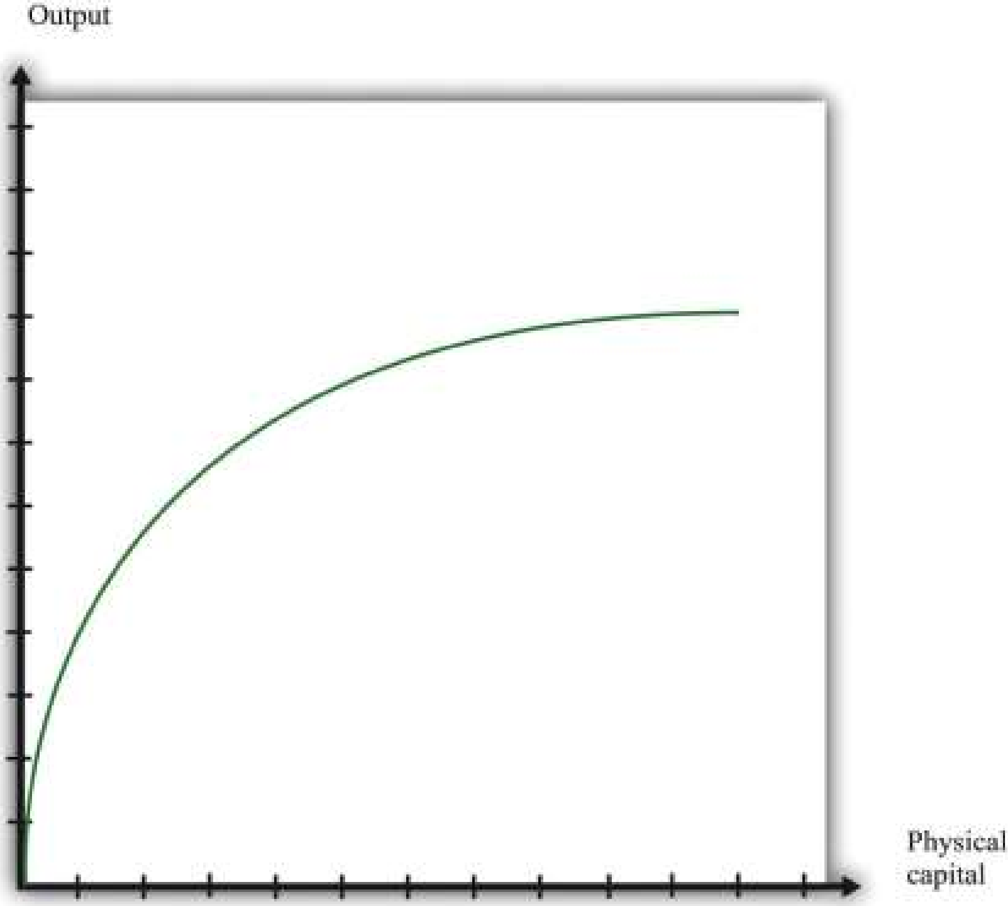

Fig. 6.3: Figure 6.3 The Aggregate Production Function: Output as a Function of the Physical Capital Stock / As the amount of physical capital increases, output increases, but at a decreasing rate because of the diminishing marginal product of capital.

Imagine, then, an economy called Solovenia. Solovenia is populated by one individual—we will call him Juan. Juan has access to an **aggregate production function**. The amount of output (real GDP) that he can produce depends on how large a physical**capital stock** he owns, how many hours he chooses to work, his human capital, and his technology (***Figure 6.2 "The Aggregate Production Function"). **Physical capital** is the stock of factories and machinery in the economy, while **human capital** refers to the skills and education of the workforce. **Technology** is a catchall term for everything else (other than capital, labor, or human capital) that affects output. [***Physical capital, human capital, and technology are discussed in more detail in Chapter 5 "Globalization and Competitiveness".***] It includes the following:

- • **Knowledge.**The technological know-how of the economy •
- **Social infrastructure.**The institutions and social structures that allow a country to produce its real GDP
- • **Natural resources.**The land and mineral resources in the country

Toolkit: Section 16.15 "The Aggregate Production Function"

You can review the aggregate production function, including its inputs, in the toolkit.

Much of our focus in this chapter is on how economies build up their stock of physical capital. ***Figure 6.3 "The Aggregate Production Function: Output as a Function of the Physical

Capital Stock" shows how output in the aggregate production function depends on the capital stock. Increases in the capital stock lead to more output. If Juan has more tools to work with, then he can produce more goods. However, we usually think that the production function will exhibit **diminishing marginal product of capital**, which means that a given increase in the capital stock contributes more to output when the capital stock is low than when the capital stock is high. In ***Figure 6.3 "The Aggregate Production Function: Output as a Function of the Physical Capital Stock", we can see this from the fact that the production function gets flatter as the amount of physical capital increases.

Each day Juan chooses how much time to work and how much time to spend in leisure. Other things being equal, we expect that Juan likes to have leisure time. This is not to say that Juan never gets any satisfaction from working. But like most people—even those who enjoy their jobs—he would prefer to work a little bit less and play a little bit more. He cannot spend all his time in leisure, however. He works because he likes to consume. The harder he works, the more real GDP he can produce and consume. Juan's decision about how many hours to work each day is determined in large part by how productive he can be—that is, how much real GDP he can produce for each hour of leisure time that he gives up.

Juan does not have to consume all the output that he produces; he might save some of it for the future. As well as deciding how much to work, he decides how much to consume and how much to save each day. You have probably made decisions like Juan's. At some time in your life, you may have worked at a job—perhaps in a fast-food restaurant, a grocery store, or a coffee shop. Perhaps you were paid weekly. Then each week you might have spent all the money you earned on movies, meals out, or clothes. Or—like Juan—you might have decided to spend only some of that money and save some for the future. When you save money instead of spending it, you are choosing to consume goods and services at some future date instead of right now. You may choose to forgo movies and clothes today to save for the purchase of a car or a vacation.

The choice we have just described—consuming versus saving—is one of the most fundamental decisions in macroeconomics. It comes up again and again when we study the macroeconomy. Just as you and Juan make this choice, so does the overall economy. Of course, the economy doesn't literally make its own decision about how much to save. Instead, the saving decisions of each individual household in the economy determine the overall amount of savings in the economy. And the economy as a whole doesn't save the way you do—by putting money in a bank. An economy saves by devoting some of its production to capital goods rather than consumer goods. If Juan chooses to produce capital goods, he will have a larger capital stock in the future, which will allow him to be more productive and enjoy higher consumption in the future.

6.1.1 Growth in a Closed Economy

At any given moment, Juan's ability to produce output is largely determined by his stock of physical capital, his human capital, and the state of technology in Solovenia. But, as time passes, the level of output in Solovenia can change through a variety of mechanisms. First, the capital stock in Solovenia can grow over time, as shown in Figure 6.4. Juan builds up his capital stock by saving. Since Juan is the only inhabitant, the amount he saves is equal to the **national savings** of Solovenia. It is the difference between his output (real GDP of Solovenia) and the amount he consumes. [***In a real economy, national savings also include the savings of government: we must add in the government surplus or subtract the government deficit, as appropriate.***]

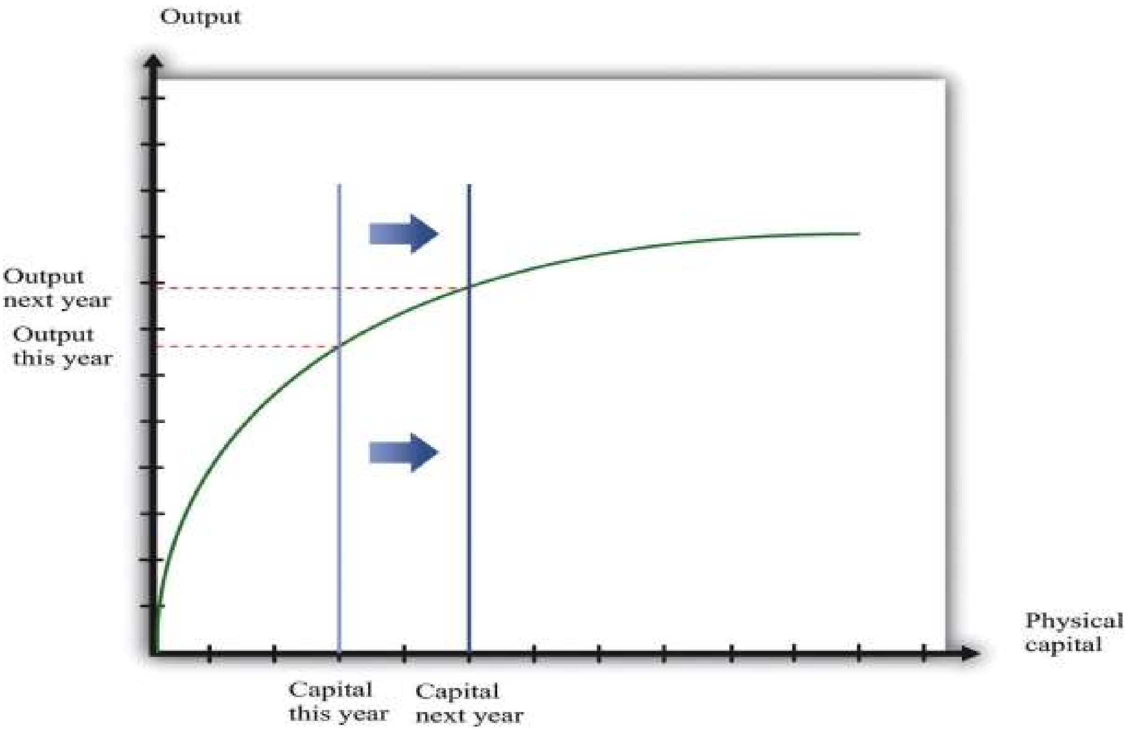

Fig. 6.4: Figure 6.4 Increases in the capital stock lead to increases in output. If the capital stock in Solovenia increases between this year and next year, output also increases. Increases in the capital stock are one source of growth.

The more that Juan saves today, the more he can build up his capital stock, and the higher his future standard of living will be. If Juan chooses to consume less today, he will have a higher living standard in the future. If Juan chooses to consume more today, he must accept that this means less consumption in the future. Economies, like individuals, can choose between eating their cake now or saving it for the future.

In making this decision, Juan weighs the cost of giving up a little bit of consumption today against the benefit of having a little bit more consumption in the future. The higher the marginal product of capital, the more future benefit he gets from sacrificing consumption today. Other things being equal, a higher marginal product of capital induces Juan to save more. Juan's choice also depends on how patient or impatient he is. The more patient he is, the more he is willing to give up consumption today to enjoy more consumption in the future.

Increases in the amount of physical capital are one way in which an economy can grow. Another is through increases in human capital and technology. These shift the production function upward, as shown in ***Figure 6.5. Perhaps Juan sometimes has better ideas about how to do things. Perhaps he gets better with practice. Perhaps Juan spends some time trying to come up with better ways of producing things.

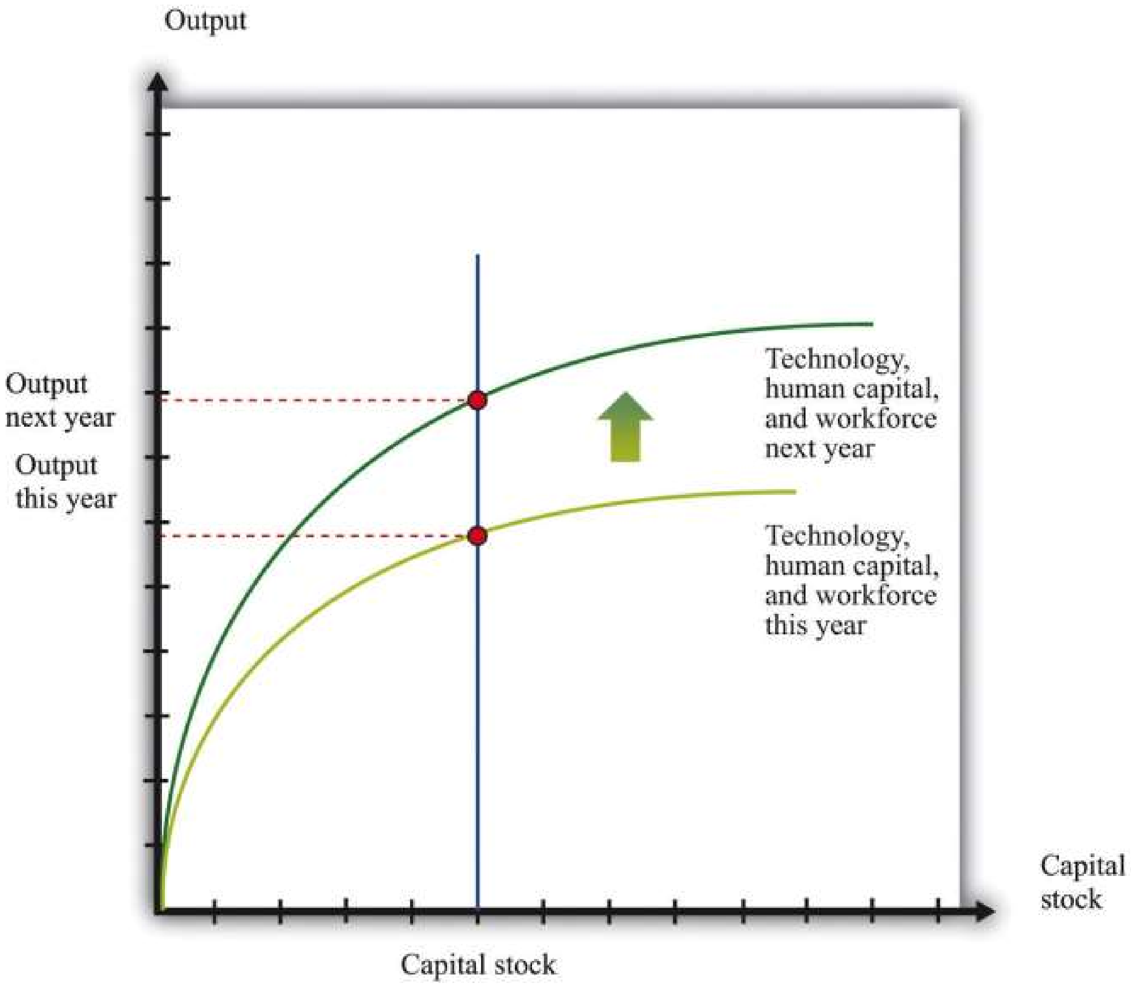

Fig. 6.5: Figure 6.5 Increases in human capital or technology lead to increases in output. Increases in technology, human capital, and the workforce, like increases in the capital stock, are a source of output growth.

Through the accumulation of physical and human capital, and by improving the components of technology such as knowledge and social infrastructure, the output in Solovenia will grow over time. The combined effect of physical capital growth and improvements in technology is shown in ***Figure 6.6.

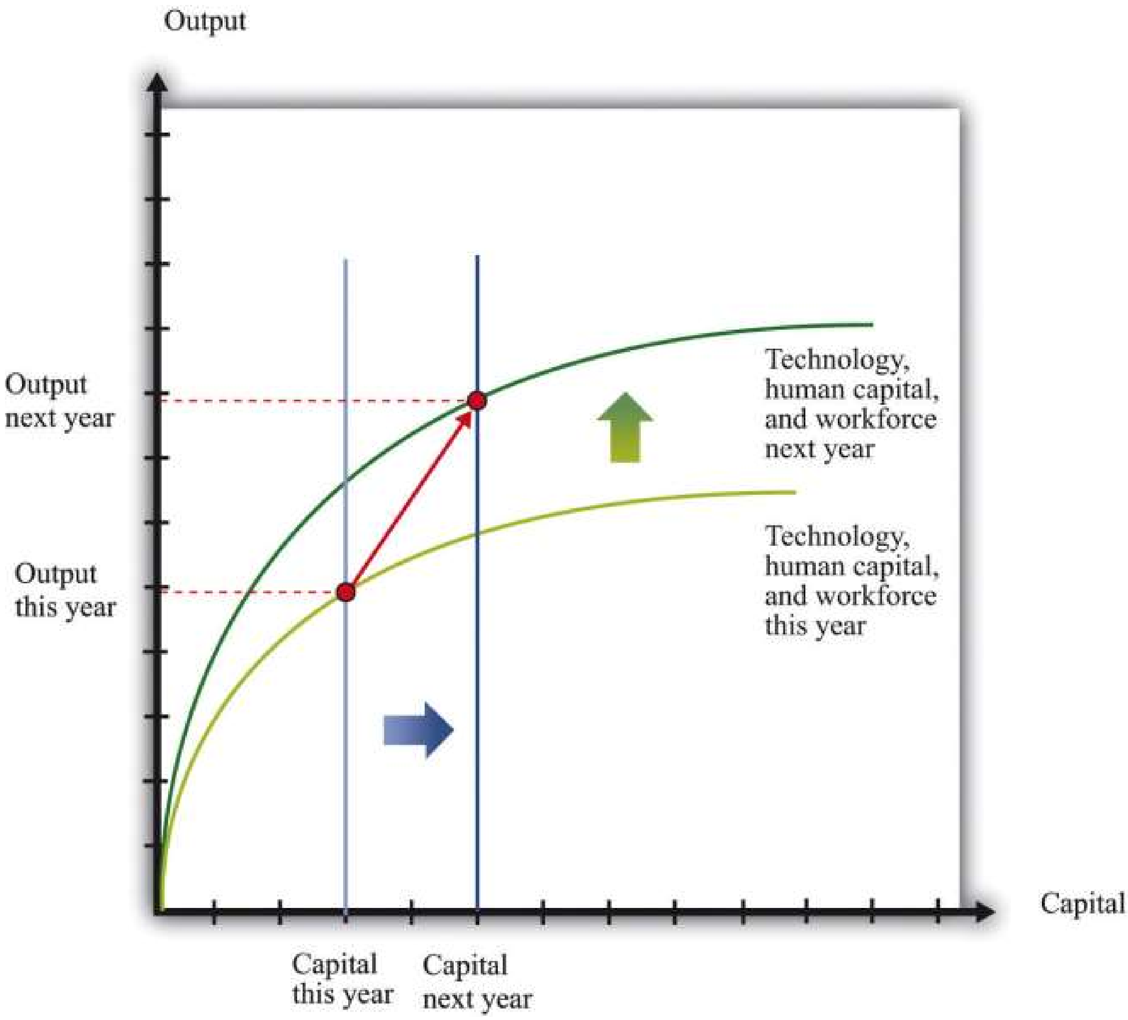

Fig. 6.6: Figure 6.6 Increases in capital, human capital, and technology all lead to increases in output. In general, economies grow because of increases in capital, technology, human capital, and the workforce.

6.1.2 Growth in an Open Economy

If Juan does not trade with the rest of the world, his only way to save for the future is by building up his capital stock. In this case, national savings equal **investment**. An economy that does not trade with other countries is called a **closed economy**. An economy that trades with other countries is called an **open economy**. In the modern world, no economy is completely closed, although some economies (such as Belgium) are much more open than others (such as North Korea). The world as a whole is a closed economy, of course.

If Solovenia is an open economy, Juan has other options. He might decide that he can get a better return on his savings by investing in foreign assets (such as Italian real estate, shares of Australian firms, or Korean government bonds). Domestic investment would then be less than national savings. Juan is lending to the rest of the world.

Alternatively, Juan might think that the benefits of investment in his home economy are sufficiently high that he borrows from the rest of the world to finance investment above and beyond the amount of his savings. Domestic investment is then greater than national savings. Of course, if Juan lends to the rest of the world, then he will have extra resources in the future when those loans are repaid. If he borrows from the rest of the world, he will need to pay off that loan at some point in the future.

There may be very good opportunities in an economy that justify a lot of investment. In this case, it is worthwhile for an economy to borrow from other countries to supplement its own savings and build up the capital stock faster. Even though the economy will have to pay off those loans in the future, the benefits from the higher capital stock are worth it.

The **circular flow of income** shows us how these flows show up in the national accounts. If we are borrowing on net from other countries, there is another source of funds in additional to national savings that can be used for domestic investment. If we are lending on net to other countries, domestic investment is reduced.

Toolkit: Section 16.16 "The Circular Flow of Income"

You can review the circular flow of income in the toolkit.

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investment = national savings + borrowing from other countries
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or

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investment = national savings − lending to other countries.
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Savings and investment in a country are linked, but they are not the same thing. The savings rate tells us how much an economy is setting aside for the future. But when studying the accumulation of capital in an economy, we look at the **investment rate** rather than the savings rate. Total investment as a fraction of GDP is called the investment rate:

Fig. 6.7: Figure 6.7 Investment Rates in the United States, India, and Niger / There are marked differences in investment rates in the United States, India, and Niger. Source: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011.

Figure 6.7 "Investment Rates in the United States, India, and Niger" shows investment rates in the United States, India, and Niger from 1960 to 2009. A number of features of this picture are striking: [International Monetary Fund, World

Economic Outlook Database, April 2011, accessed July 29, 2011, http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/index.aspx.***]

- • For most of the period, India had a higher investment rate than the other two countries. As we saw earlier, India was also the fastest growing of the three countries. These facts are connected: capital accumulation plays an important role in the growth process.
- • The investment rate in the United States has been relatively flat over time, though it has been noticeably lower in recent years.
- • Investment rates in Niger have been more volatile than in the other two countries. They were low in the mid 1980s but have increased substantially in recent years.

Low investment rates may be due to low savings rates. They may also reflect relatively low returns to increases in the capital stock in a country. The low investment rate that prevailed for many years in Niger not only reflected a low saving rate but also indicates that something is limiting investment from external sources. For the United States, in contrast, a significant part of the high investment rate is due not to domestic savings but to inflows from other countries.

We know that output per person is a useful indicator of living standards. Increases in output per person generally translate into increases in material standards of living. But to the extent that an economy trades with other countries, the two are not equivalent. If an economy borrows to finance its investment, output per person will exaggerate living standards in the country because it does not take into account outstanding obligations to other countries. If an economy places some of its savings elsewhere, then measures of output per person will understate living standards. [The national accounts deal with this issue by distinguishing between GDP, which measures the production that takes place within a country’s borders, and gross national product (GNP), which corrects for income received from or paid to other countries.]

6.1.3 Solovenia and Solovakia

Now add another country, Solovakia (with a single inhabitant named Una), and compare it to Solovenia. We can compare Solovenia and Solovakia by investigating which is producing more output per person and why. Imagine, for example, that Solovenia is a relatively poor country, and Solovakia is richer. Using our knowledge of the aggregate production function, we can understand how this difference might arise. It might be because Una has more human capital or knowledge than Juan, or because Una has a larger stock of physical capital.

Another basis for comparison is the rate at which the two economies are growing. If Solovakia is richer, and if it is also growing faster than Solovenia, then the gap between the two countries will become wider over time. We call such a process **divergence**. Conversely, if Solovenia is growing faster than Solovakia, then the gap between Juan’s and Una’s living standards will become smaller over time. Such a situation, where poorer countries catch up to richer ones, is called **convergence**.

Why might we see either convergence or divergence? Part of the answer has to do with the **marginal product of capital** in the two countries. Suppose that Solovakia is richer because it has a larger stock of physical capital than Solovenia. In that case, we expect the marginal product of capital to be larger in Solovenia. Solovenia is a more competitive economy than Solovakia. Juan will want to invest at home, while Una will take some of the output that she produces in Solovakia and invest it in Solovenia. Therefore we expect capital to migrate from Solovakia to Solovenia. As a consequence, it is likely that Solovenia will grow faster than Solovakia, leading to convergence.

KEY TAKEAWAY

- The capital stock increases through investment.
- Because physical capital is an input in the aggregate production function, growth in capital stock is one source of output growth. The other sources are the accumulation of human capital and increases in technology.
- In a closed economy, investment equals national savings. In an open economy, investment equals national savings plus inflows of funds from abroad. So in an open economy, growth in the capital stock and hence output growth can be financed both by domestic savings and borrowing from other countries.

***

Checking Your Understanding

Draw a version of ***Figure 6.3 "The Aggregate Production Function: Output as a Function of the Physical Capital Stock" with labor hours instead of physical capital on the horizontal axis. Explain how the figure illustrates the positive marginal product of labor and diminishing marginal product of labor. How would you illustrate a change in the capital stock using this figure?

Explain how an economy can have an investment rate of 10 percent but a savings rate of only 3 percent.

6.2 Four Reasons Why GDP Varies across Countries

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are the main possible explanations for real GDP differences across countries?

How important are differences in technology for explaining differences in real GDP across countries?

We started this chapter with the following question: "Why are some countries rich and other countries poor?" The aggregate production function and the story of Juan help us to understand what determines the amount of output that an economy can produce, taking us the first step toward explaining why some countries are richer than others.

The production function tells us that if we know four things—the size of the workforce, the amount of physical capital, the amount of human capital, and the level of technology—then we know how much output we are producing. When comparing two countries, if we find that one country has more physical capital, more labor, a better educated and trained workforce (that is, more human capital), and superior technology, then we know that country will have more output.

Differences in these inputs are often easy to observe. Large countries obviously have bigger workforces than small countries. Rich countries have more and better capital goods. In the farmlands of France, you see tractors and expensive farm machinery, while you see plows pulled by oxen in Vietnam; in Hong Kong, you see skyscrapers and fancy office buildings, while the tallest building in Burkina Faso is about 12 stories high; in the suburbs of the United States, you see large houses, while you see shacks made of cardboard and corrugated iron in the Philippines. Similarly, rich countries often have well-equipped schools, sophisticated training facilities, and fine universities, whereas poorer countries provide only basic education. We want to be able to say more, however. We would like to know *how much* these different inputs contribute to overall economic performance.

To get some sense of this, we look at some rough numbers for the United States, India, and Niger. We carried out this exercise using data from 2003, but the fundamental message does not depend on the year that we have chosen; we would get very similar conclusions with data from any recent year. To start, let us look at the different levels of output in these countries. Table 6.1 "Real GDP in the United States, India, and Niger"gives real gross domestic product (real GDP) in these countries. Note that we are now looking at the overall level of GDP, rather than GDP per person as we did at the beginning of this chapter. Real GDP in the United States was about $10.2 trillion. In India, real GDP was about one-third of US GDP: $3.1 trillion. In Niger, real

GDP was under $10 billion. In other words, the United States produces about 1,000 times as much output as Niger.

Table 6.1 Real GDP in the United States, India, and Niger

Country	Real GDP in 2003 (Billions of Year 2000 US Dollars)
United States	10,205
India	1,475
Niger	88

Source: Alan Heston, Robert Summers and Bettina Aten, Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, May 2011.

In the following subsections, we look at how the different inputs contribute to bring about these large differences in output. We go through a series of thought experiments in which we imagine putting the amount of each input available in the United States into the production functions for the Indian and Niger economies.

6.2.1 Differences in the Workforce across Countries

The United States, India, and Niger differ in many ways. One is simply the number of people in each country. The workforce in the United States is about 150 million people. The workforce in India is more than three times greater—about 478 million in 2010—while the workforce in Niger is only about 5 million people. Thus India has much more labor to put into its production function than does Niger.

In Table 6.2 "Real GDP in 2003 in the United States, India, and Niger if All Three Countries Had the Same Workforce" we look at what would happen to output in India and Niger if— counterfactually—each had a workforce the size of that in the United States while their other inputs were unchanged. Output in the United States is, of course, unchanged in this experiment. India's output would decrease to about $1.4 trillion because they would have a smaller workforce. Niger's output would increase about tenfold to $88 trillion. Differences in the workforce obviously matter but do not explain all or even most of the variation across the three countries. Niger's output would still be less than 1 percent of output in the United States.

Table 6.2 Real GDP in 2003 in the United States, India, and Niger if All Three Countries Had the Same Workforce

Country	Real GDP in 2003 (Billions of Year 2000 US Dollars)
United States	10,205
India	3,138
Niger	9

6.2.2 Differences in Physical Capital across Countries

Not surprisingly, the United States also has a much larger capital stock than does Niger. The capital stock in the United States is worth about $30 trillion. India's capital stock is about $3 trillion, and Niger's capital stock is much, much smaller—about $9 billion. So what would happen if we also gave India and Niger the same amount of physical capital as the United States? Table 6.3 "Real GDP in the United States, India, and Niger if All Three Countries Had the Same Workforce and Physical Capital Stock" shows the answer.

India's GDP, in this thought experiment, goes back to something close to its actual value of around $3 trillion. In other words, the extra capital compensates for the smaller workforce. Real GDP in the United States is still more than three times larger than that in India. The extra capital makes a big difference in Niger, increasing its output about ten-fold. Even if Niger had the same size workforce and the same amount of capital as the United States, however, it would still have only a tenth of the amount of output. The other two inputs— human capital and technology—evidently matter as well.

Table 6.3 Real GDP in the United States, India, and Niger if All Three Countries Had the Same Workforce and Physical Capital Stock

Country	Real GDP in 2003 (Billions of Year 2000 US Dollars)
United States	10,205
India	3,054
Niger	1,304

6.2.3 Differences in Human Capital across Countries

Differences in education and skills certainly help to explain some of the differences among countries. Researchers have found evidence that measures of educational performance are correlated with GDP per person. The causality almost certainly runs in both directions: education levels are low in Niger because the country is so poor, and the country is poor because education is low.

We can include measures of education and training in an attempt to measure the skills of the workforce. In fact, economists Robert Hall and Chad Jones have constructed a measure that allows us to compare the amount of human capital in different countries. [***To estimate relative human capital levels in different countries, we use the figures in Robert Hall and Chad Jones, "Why Do Some Countries Produce So Much More Output per Worker Than Others?" Quarterly Journal of Economics 114, no. 1 (1999): 83–116. ***]In ***Table 6.4 "Real GDP in 2003 in the United States, India, and Niger if All Three Countries Had the Same Workforce, Physical Capital Stock, and Human Capital Stock", we bring the human capital level in India and Niger up to the level in the United States and, as before, suppose that all three countries have the same amount of labor and physical capital. Real GDP in India would climb to about $5.2 trillion, or a little over half the level in United States. Niger's real GDP would equal about $2.8 trillion, meaning the increased human capital would more than double Niger's GDP. However, real GDP in the United States would still be more than three times greater than that of Niger.

Table 6.4 Real GDP in 2003 in the United States, India, and Niger if All Three Countries Had the Same Workforce, Physical Capital Stock, and Human Capital Stock

Country	**Real GDP in 2003 (Billions of Year 2000 US Dollars)**
United States	10,205
India	5,170
Niger	2,758

6.2.4 Differences in Technology across Countries

To summarize, even after we eliminate differences in labor, physical capital, and human capital, much is still left to be explained. According to our production function, the remaining variation is accounted for by differences in technology—our catchall term for everything apart from labor, physical capital, and human capital.

Just as firms accumulate physical capital, they also accumulate knowledge in various ways. Large firms in developed countries *develop* new knowledge through the activities of their research and development (R&D) divisions. [***Gains in productivity of this form sometimes end up embodied in capital stock—think of a computer operating system, such as Windows or Linux. Such knowledge increases the value of capital stock and is already captured by looking at the ratio of capital stock to GDP.***] In poorer countries, firms may access existing knowledge by importing technology from more developed countries.

Differences in knowledge help to explain differences in output per worker. The rich countries of the world tend to have access to state-of-the-art production techniques. We say that they are on the **technology frontier**; they use the most advanced production technologies available. Factories in poor countries often do not use these production techniques and lack modern machinery. They are *inside* the technology frontier.

As economists have researched the differences in economic performance in rich and poor countries, they have found that success depends on more than physical capital, human capital, and knowledge. Appropriate institutions—the social infrastructure—also need to be in place. These are institutions that allow people to hold property and write and enforce contracts that ensure they can enjoy the fruits of their investment. Key ingredients are a basic rule of law and a relative lack of corruption. An ability to contract and trade in relatively free markets is also important.

Particularly in more advanced countries, we need the right institutions to encourage technological progress. This is complicated because there is a trade-off between policies to encourage the *creation* of knowledge and policies to encourage the *dissemination* of knowledge. Knowledge is typically a **nonexcludable good**, so individuals and firms are not guaranteed the rights to new knowledge that they create. This reduces the incentive to produce knowledge. To counter this problem, governments establish certain property rights over new knowledge, in the form of patent and copyright laws. Knowledge is also typically a **nonrival good**, so everyone can, in principle, benefit from a given piece of knowledge. Once new knowledge exists, the best thing to do is to give it away for free. Patent and copyright laws are good for encouraging the development of knowledge but bad for encouraging the dissemination of knowledge. Current debates over intellectual property rights (file sharing, open source, downloading of music, etc.) reflect this trade-off.

Differences in **natural resources** can also play a role in explaining economic performance. Some countries are lucky enough to possess large amounts of valuable resources. Obvious examples are oil-producing states such as Saudi Arabia, Kuwait, Venezuela, the United States, and the United Kingdom. Yet there are many countries with considerable natural resources that have not enjoyed great prosperity. Niger's uranium deposits, for example, have not helped that country very much. At the same time, some places with very little in the way of natural resources have been very successful economically: examples include Luxembourg and Hong Kong. Natural resources help, but they are not necessary for economic success, nor do they guarantee it.

KEY TAKEAWAY

• Differences in real GDP across countries can come from differences in population, physical capital, human capital, and technology. •

After controlling for differences in labor, physical capital, and human capital, a significant difference in real GDP across countries remains.

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Checking Your Understanding

In ***Table 6.2 "Real GDP in 2003 in the United States, India, and Niger if All Three Countries Had the Same Workforce", Table 6.3 "Real GDP in the United States, India, and Niger if All Three Countries Had the Same Workforce and Physical Capital Stock", and Table 6.4 "Real GDP in 2003 in the United States, India, and Niger if All Three Countries Had the Same Workforce, Physical Capital Stock, and Human Capital Stock", the level of real GDP for the United States is the same as it is in Table 6.1 "Real GDP in the United States, India, and Niger". Why is this the case?

What kinds of information would help you measure differences in human capital?

How can human capital and knowledge flow from one country to another?

6.3 The Accumulation of Physical Capital

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What factors determine the growth rate of the capital stock?

Will poorer countries catch up to richer countries because of faster growth of capital stock?

What is the evidence on convergence?

Why might countries not converge?

Our first task in this chapter was to explain the vast differences in living standards that we observe in the world. We now know that this variation is due to differences in physical capital, human capital, and technology. The rough calculations in Section 6.2 "Four Reasons Why GDP Varies across Countries" tell us that variations in physical capital, human capital, and technology *all* play a role in explaining differences in economic performance.

Now we consider these inputs separately. In this section, we look at the accumulation of physical capital. In Section 6.4 "Balanced Growth", we look at the role of human capital and technology. Our main aim is to consider one of our two remaining questions:

Will poorer countries catch up to richer countries?

6.3.1 The Growth Rate of the Capital Stock

Capital goods are goods such as factories, machines, and trucks. They are used for the production of other goods and are not completely used up in the production process. Economies build up their capital stocks by devoting some of their gross domestic product (GDP) to new capital goods—that is, investment. As we saw in our discussion of Solovenia in Section 6.2 "Four Reasons Why GDP Varies across Countries", if a country does not interact much with other countries (that is, it is a closed economy) the amount of investment reflects savings within a country. In open economies, the amount of investment reflects the perceived benefits to investment in that country compared to other countries.

Capital goods wear out over time and have to be scrapped and replaced. A simple way to think about this depreciation is to imagine that a fraction of the capital stock wears out every year. A reasonable average **depreciation rate** for the US economy is 4 or 5 percent. To understand what this means, think about an economy where the capital stock consists of a large number of identical machines. A depreciation rate of 5 percent means that for every 100 machines in the economy, 5 machines must be replaced every year. [***The depreciation rate can be understood in terms of the average lifetime of a typical machine. For example, a depreciation rate of 5 percent is the same as saying that, on average, machines last for 20 years. To see this, imagine that capital stock is kept constant at 100 machines, and each machine lasts for 20 years. Imagine also that 5 machines are 1 year old, 5 machines are 2 years old, and so forth, with the oldest 5 machines being 20 years old. Each year, these 5 oldest machines would wear out (5 percent depreciation) and have to be replaced by 5 new machines. After a year has passed, the situation will be exactly the same as the previous year: there will be 5 machines that are 1 year old, 5 machines that are 2 years, and so forth. Mathematically, we are saying that the lifetime of a machine = 1/depreciation rate: 20 = 1/0.05. ***]

The depreciation of capital goods reduces the capital stock. The total amount of capital lost to depreciation each year is calculated by multiplying the depreciation rate and the capital stock together. If the capital stock is $30 trillion, for example, and the depreciation rate is 5 percent, then $1.5 trillion (= $30 trillion × 0.05) worth of capital is lost each year.

The capital stock increases as long as there is enough new investment to replace the worn out capital and still contribute some extra. The overall change in the capital stock is equal to new investment minus depreciation:

```
change in capital stock = new investment − depreciation rate ×
capital stock.
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For example, suppose that the current capital stock (measured in trillions of dollars) is 40, and the depreciation rate is 10 percent per year. Then the capital stock after depreciation is 40 − (.1 × 40) = 40 − 4 = 36. Suppose that new investment is $4.8 trillion. Then the new capital stock is 36 + 4.8 = 40.8. In this case, capital stock has increased by $0.8 trillion, or 2 percent.

The equation for the change in the capital stock is one of the fundamental ingredients of economic growth. It tells us that economies build up their capital stock—and therefore their real GDP—by devoting enough output to new investment to both replace worn out capital and then add some more. If we divide both sides of the previous equation by the capital stock, we can obtain the **growth rate** of the capital stock. (Remember that the growth rate of a variable is the change in the variable divided by its initial level.)

The growth rate of the capital stock depends on three things:

1. **The amount of investment.**The more investment the economy carries out, the more quickly the capital stock grows.
2. **The current capital stock.**The larger the capital stock, other things being equal, the lower its growth rate.
3. **The depreciation rate.**If existing capital wears out faster, the capital stock grows more slowly.

It is intuitive that a higher investment rate increases the growth rate of the capital stock, and a higher depreciation rate decreases the growth rate of the capital stock. It is less obvious why the growth rate of the capital stock is lower when the capital stock is higher. The growth rate measures the change in the capital stock *as a percentage of the existing capital stock*. A given change in the capital stock results in a smaller growth rate if the existing capital stock is larger. For example, suppose that the current capital stock is 100, and the change in the capital stock is 10. Then the growth rate is 10 percent. But if the current capital stock is 1,000, then the same change of 10 in the capital stock represents only a 1 percent growth rate.

Toolkit: Section 16.11 "Growth Rates"

The toolkit contains more information on how growth rates are calculated.

6.3.2 Convergence through Capital Accumulation

Why are we so interested in the accumulation of capital? One reason is that poverty of the kind we observe in Niger and elsewhere is a massive problem for the world. About 40 percent of the world's population—close to 2.5 billion people—live in conditions of poverty. (The World Bank defines poverty as living on less than US$2 per day.) We are not going to solve the problem of mass poverty overnight, so we would like to know whether this gap between the rich and the poor is a permanent feature of the world. It might be that economies will diverge, meaning that the disparities in living standards will get worse and worse, or it might be that they will converge, with poorer countries catching up to richer countries.

When comparing two countries, if we find that the poorer economy is growing faster than the richer one, then the two are converging. If we find that the richer country is growing faster than the poorer one, they are diverging. Moreover, if a country has a small capital stock, we know that—other things being equal—it will tend to be a poorer country. If a country has a large capital stock, then—again, other things being equal—it is likely to be a richer country. The question of convergence then becomes: other things being equal, do we expect a country with a small capital stock to grow faster than an economy with a large capital stock?

The answer is yes, and the reason is the marginal product of capital. From the production function, the marginal product of capital is large when the capital stock is small. Think again about Juan in Solovenia. A large marginal product of capital means that he can obtain a lot of extra output if he acquires some extra capital. This gives him an incentive to save rather than consume. A large marginal product of capital also means that Juan can attract investment from other countries.

A country where the marginal product of capital is high is a competitive economy—one where both domestic savers and foreign savers want to build up the capital stock. The capital stock will grow quickly in such an economy. This is precisely what we saw in the equation for the growth rate of the capital stock: higher investment and a lower capital stock both lead to a larger capital stock growth rate. Both of these imply that a country with a large marginal product of capital will tend to grow fast.

We illustrate this idea in ***Figure 6.8 "Convergence through the Accumulation of Capital". Country A has a small capital stock. The aggregate production function tells us that this translates into a large marginal product of capital—the production function is steep. In turn, a large marginal product of capital means that country A will grow quickly. Country B has an identical production function but a larger capital stock, so the marginal product of capital is lower in country B than in country A. There is less incentive to invest, implying that country B, while richer than country A, grows more slowly.

***Figure 6.8 "Convergence through the Accumulation of Capital" also shows that it is possible for a country to have such a large capital stock that it shrinks rather than grows. Country C has so much capital that its marginal product is very low. There is little incentive to build up the capital stock, so the capital stock depreciates faster than it is replaced by new investment. In such an economy, the capital stock and output would decrease over time.

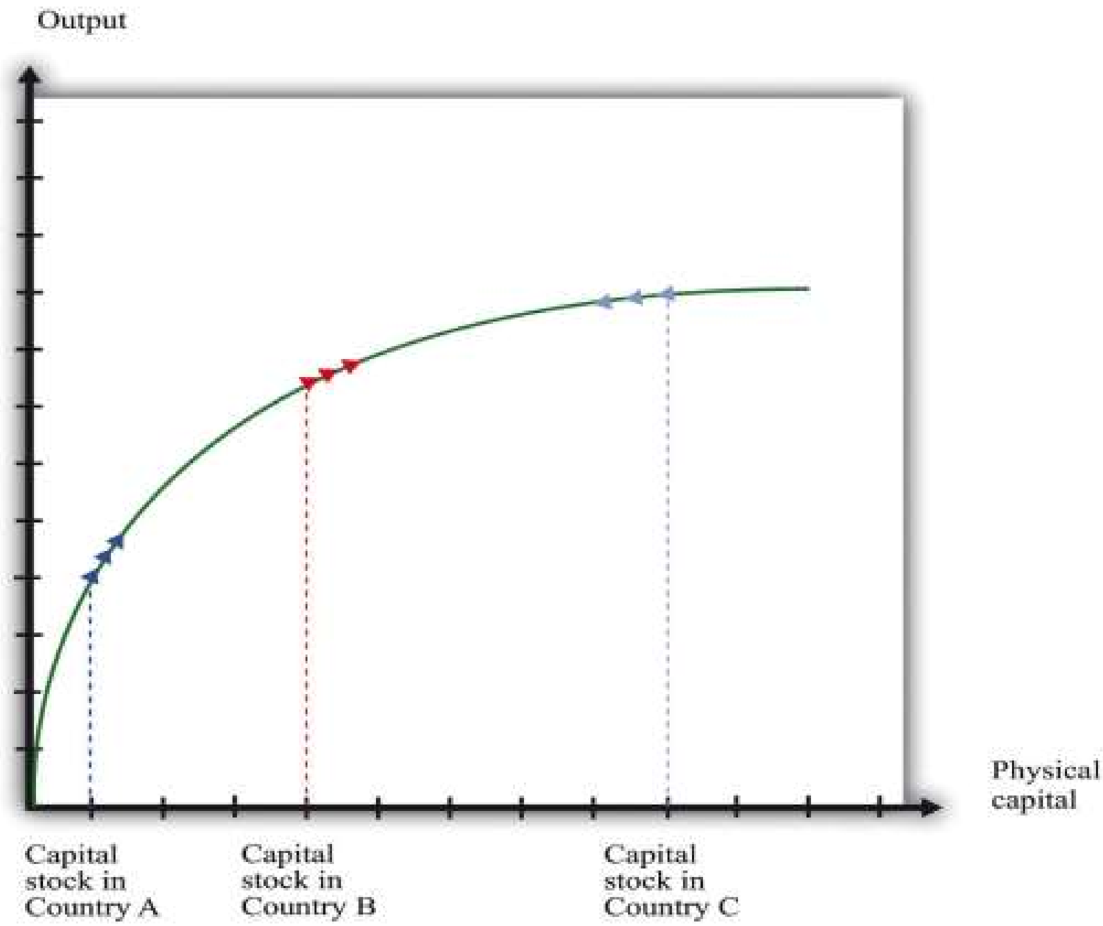

Fig. 6.8: Figure 6.8 Convergence through the Accumulation of Capital The growth rate of the capital stock depends on the marginal product of capital. Country A has little capital, so the marginal product of capital is large, and the capital stock will grow rapidly. Country B has more capital, so the capital stock grows more slowly. Country C has so much capital that the capital stock decreases.

***Figure 6.8 "Convergence through the Accumulation of Capital" suggests an even stronger conclusion: all three economies will ultimately end up at the same capital stock and the same level of output—complete convergence. This conclusion is half right. If the three economies were identical except for their capital stocks and if there were no growth in human capital and technology, they would indeed converge to exactly the same level of capital stock and output. In Section 6.4 "Balanced Growth", we look at this argument more carefully. First, though, we examine the evidence on convergence.

6.3.3 Convergence or Divergence? Two Contrasting Pictures

Convergence is a very pretty theory but is it borne out by the evidence? ***Figure 6.9 "Some Evidence of Convergence" shows the growth experience of several countries in the second half of the 20th century. These countries are all members of the Organisation for Economic Cooperation and Development (OECD) and are, relatively speaking, rich. [***The countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Switzerland, and the United States. The median real GDP per capita in 1950 for these countries was about $6,000, in year 1996 dollars. Data for Figure 6.9 "Some Evidence of Convergence" and Figure 6.10 "Some Evidence of Divergence" come from Alan Heston, Robert Summers, and Bettina Aten, "Penn World Table Version 6.2," Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, September 2006, accessed June 29, 2011,http://pwt.econ.upenn.edu/php_site/pwt_index.php.***]Figure 6.9 "Some Evidence of Convergence" shows real GDP per person in these countries*relative to the United States* (the United States itself is the horizontal line near the top of the figure.) ***Figure 6.9 "Some Evidence of Convergence" does show some evidence of convergence. Countries with higher levels of real GDP person in 1950 tended to grow more slowly than countries with lower levels of real GDP per person. Poorer countries in this group tended to catch up with richer countries.

Fig. 6.9:

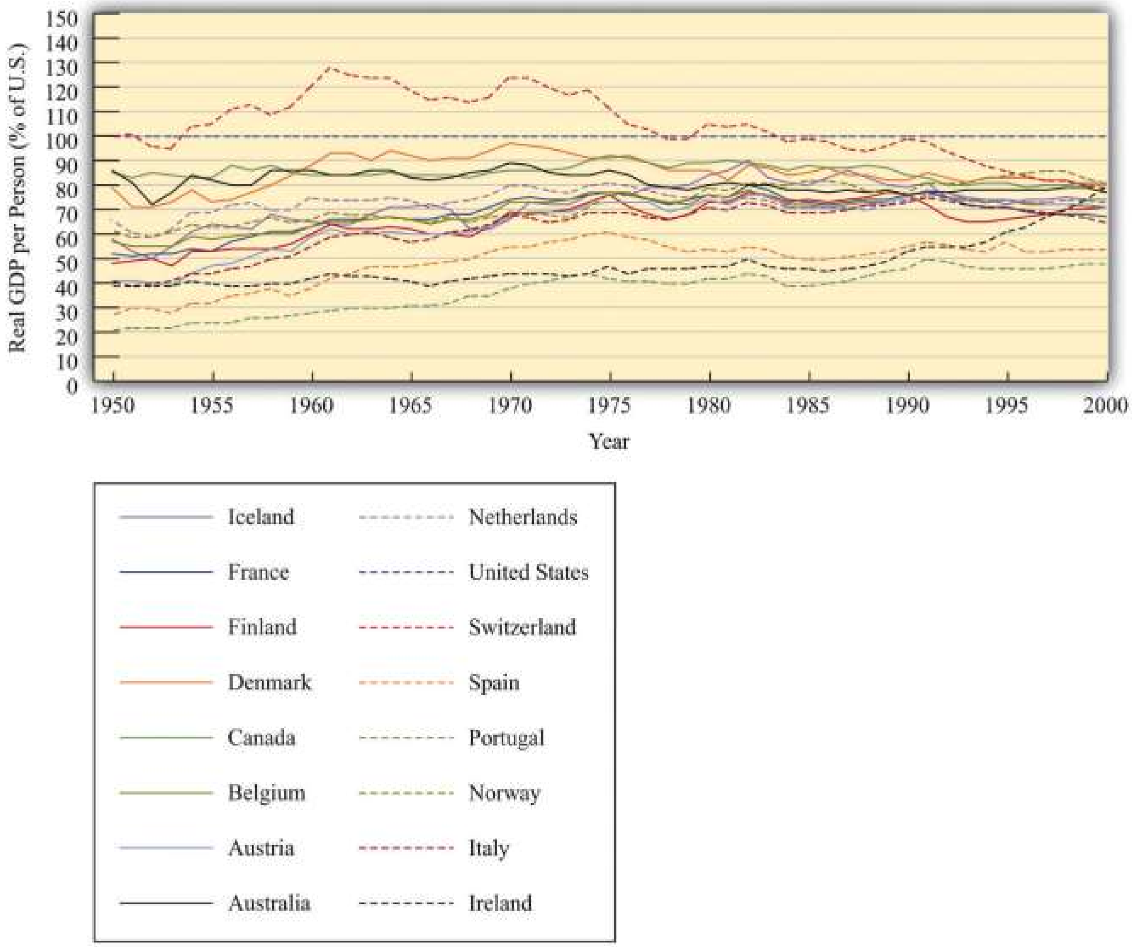

Fig. 6.10: Figure 6.9 Some Evidence of Convergence The growth experience of 16 relatively developed countries, measured as real GDP per person relative to the level in the United States, shows considerable evidence of convergence.

So far so good. But ***Figure 6.10 "Some Evidence of Divergence" shows the growth experience over the same period for a more diverse group of countries. This group is largely composed of poorer countries. The picture here is very different: we do not see convergence. There is no evidence that the poorer countries are growing faster than the richer countries. In some cases, there even appears to be divergence: poor countries growing more slowly than rich countries so that output levels in rich and poor countries move further apart.

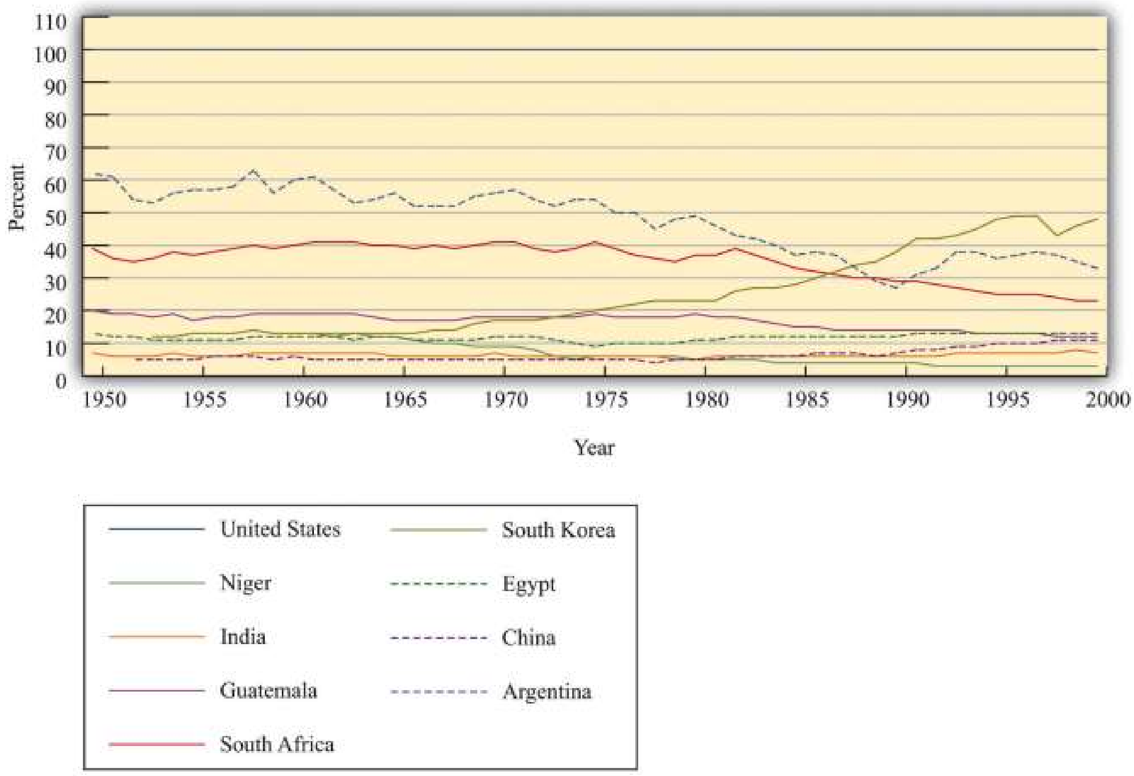

Fig. 6.11: Figure 6.10 Some Evidence of Divergence In contrast to Figure 6.9 "Some Evidence of Convergence", the countries in this sample do not appear to be converging. Many countries that were poor in 1950 were just as poor, relatively speaking, in 2000.

Table 6.5 "Evidence from Select Countries" shows more data for some of these countries. It lists the level of initial GDP per person and the average growth rate in GDP per person between the early 1950s and the end of the century. For example, Argentina had real GDP per person of $6,430 in 1950 (in year 1996 dollars) and grew at an average rate of 1.25 percent over the 50-year period. Egypt and South Korea had very close levels of GDP per person in the early 1950s, but growth in South Korea was much higher than that in Egypt: by the year 2000, GDP per person was $15,876 in South Korea but only $4,184 in Egypt. These two countries very clearly diverged rather than converged. Looking at China, the level of GDP per person in the early 1950s was less than 10 percent that of Argentina. By 2000, GDP per person in China was about 33 percent of that in Argentina.

Table 6.5 Evidence from Select Countries

Country (Starting Year)	Real GDP per Capita (Year 1996 US Dollars)	Percentage Average Growth Rate to 2000
Argentina (1950)	6,430	1.25
Egypt (1950)	1,371	2.33
China (1952)	584	4.0
South Korea (1953)	1,328	5.5

Source: Penn World Tables

Overall, this evidence suggests that our theory can explain the behavior over time of some but not all countries. If we look at relatively rich countries, then we do see evidence of convergence. Across broader groups of countries, we do not see convergence, and we see some evidence of divergence.

6.3.4 Explaining Divergence

Why is it that, contrary to what ***Figure 6.8 "Convergence through the Accumulation of Capital" seems to suggest, not all countries converge? The logic of that picture rests on the diminishing marginal product of capital. If rich countries have lower marginal product of capital than poor countries, then we expect poor countries to catch up. If, for some reason, richer countries sometimes also have a higher marginal product of capital than poorer countries, then the argument for convergence disappears.

***Figure 6.11 "Divergence Arising from Increasing Marginal Product of Capital" shows an example where the aggregate production function looks a bit different. This production function has a range where increases in capital stock lead to a higher rather than a lower marginal product of capital. That is, for some amounts of capital, we see increasing marginal product of capital rather than diminishing marginal product of capital. In the figure, country A and country B converge, just as in our previous diagram. But country C is rich enough to lie on the other side of the range where there is an increasing marginal product of capital. Country C therefore has a higher marginal product of capital than country B, even though country C is richer. Countries B and C will diverge, rather than converge.

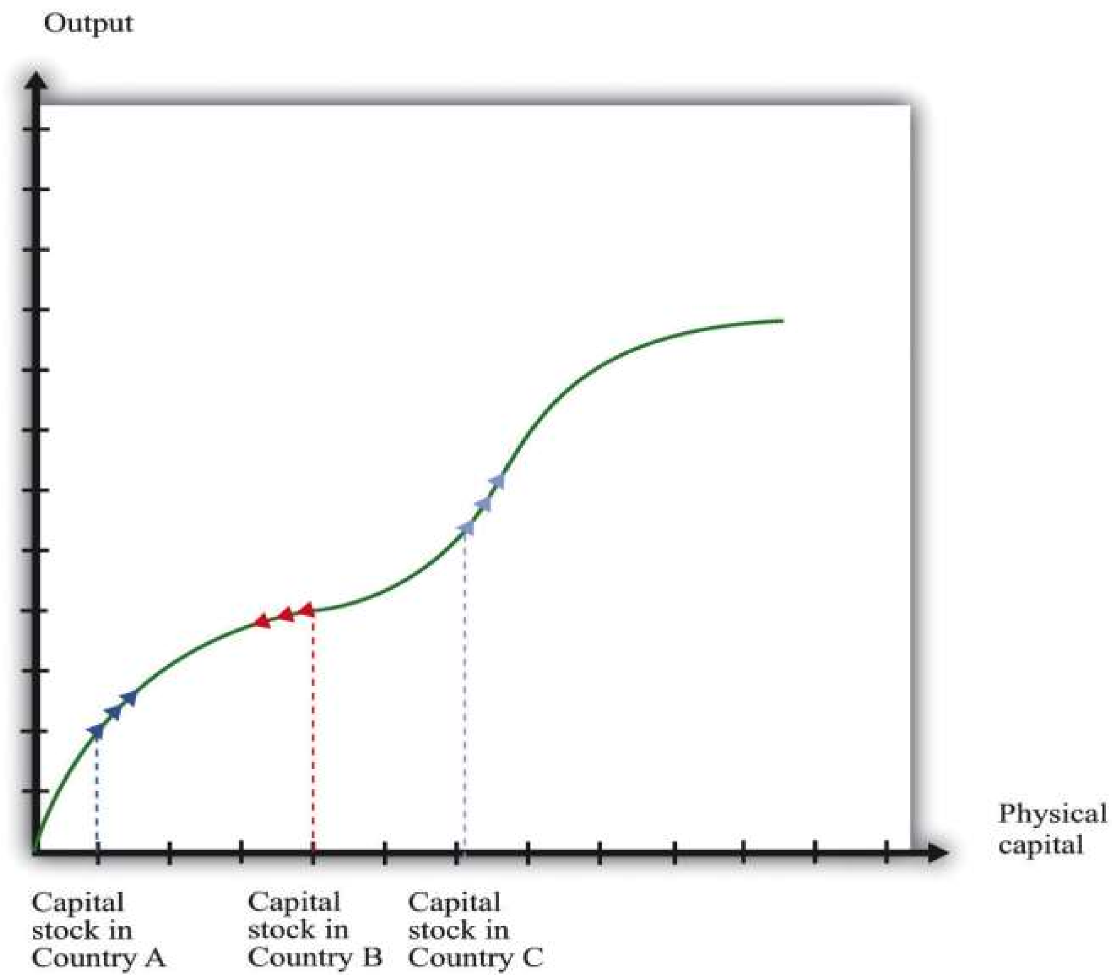

Fig. 6.12: Figure 6.11 Divergence Arising from Increasing Marginal Product of Capital In this diagram, three countries have an aggregate production function that does not always exhibit diminishing marginal product of capital. As a result, the economies need not converge.

Figure 6.12 "Divergence Arising from Differences in Technology" shows another reason why a richer country might have a higher marginal product of capital than a smaller country. In ***Figure 6.8 "Convergence through the Accumulation of Capital" we supposed that the three countries had the same production function and differed only in terms of their capital stock. In ***Figure 6.12 "Divergence Arising from Differences in Technology", country B is richer than country A for two reasons: it has more capital *and* has a superior technology (or more labor or human capital). The higher capital stock, other things being equal, means a lower marginal product of capital in country B. But the superior technology, other things being equal, means a higher marginal product of capital in country B. In the picture we have drawn, the technology effect dominates. Country B has the higher marginal product of capital, so it is the more attractive location for capital—it is more competitive. Because of this, the capital stock increases in country B. Indeed, if the only factor driving investment is the marginal product of capital, then we would expect capital to flow among countries until the marginal product of capital is equal everywhere. [We discuss capital migration across countries in more detail in Chapter 5 "Globalization and Competitiveness".***]

One reason why a richer economy might have better technology is because it has better social infrastructure. In particular, developed economies often have the legal and cultural institutions that preserve **property rights**. The return on investment is higher, other things being equal, when property rights are protected. In economies with less well-developed institutions, investors need a higher rate of return to compensate them for the additional risk of placing their capital in those countries.

Measuring these aspects of social infrastructure is a challenge. The World Bank has attempted to do so in its 2005 *World Development Report*. [***World Bank, World Development Report 2005: A Better Investment Climate for Everyone(New York: World Bank and Oxford University Press, 2004), 8, accessed August 22, 2011,http://siteresources.worldbank.org/INTWDR2005/Resources/complete_report.pdf.

Saylor URL: http://www.saylor.org/books Saylor.org ***] The study looks at various aspects of doing business in 48 countries. The top constraints on investment reported by firms were policy uncertainty, macroeconomic instability, and taxes. Many of the risks of doing business are directly associated with government action in the present and in the future. This is nicely stated in the World Bank report: "Because investment decisions are forward looking, firms' judgments about the future are critical. Many risks for firms, including uncertain responses by customers and competitors, are a normal part of investment, and firms should bear them. But governments have an important role to play in maintaining a stable and secure environment, including by protecting property rights. Policy uncertainty, macroeconomic instability, and arbitrary regulation can also cloud opportunities and chill incentives to invest. Indeed, policy-related risks are the main concern of firms in developing countries." [***World Bank, World Development Report 2005: A Better Investment Climate for Everyone(New York: World Bank and Oxford University Press, 2004), 5, accessed August 22, 2011,http://siteresources.worldbank.org/INTWDR2005/Resources/complete_report.pdf.***]

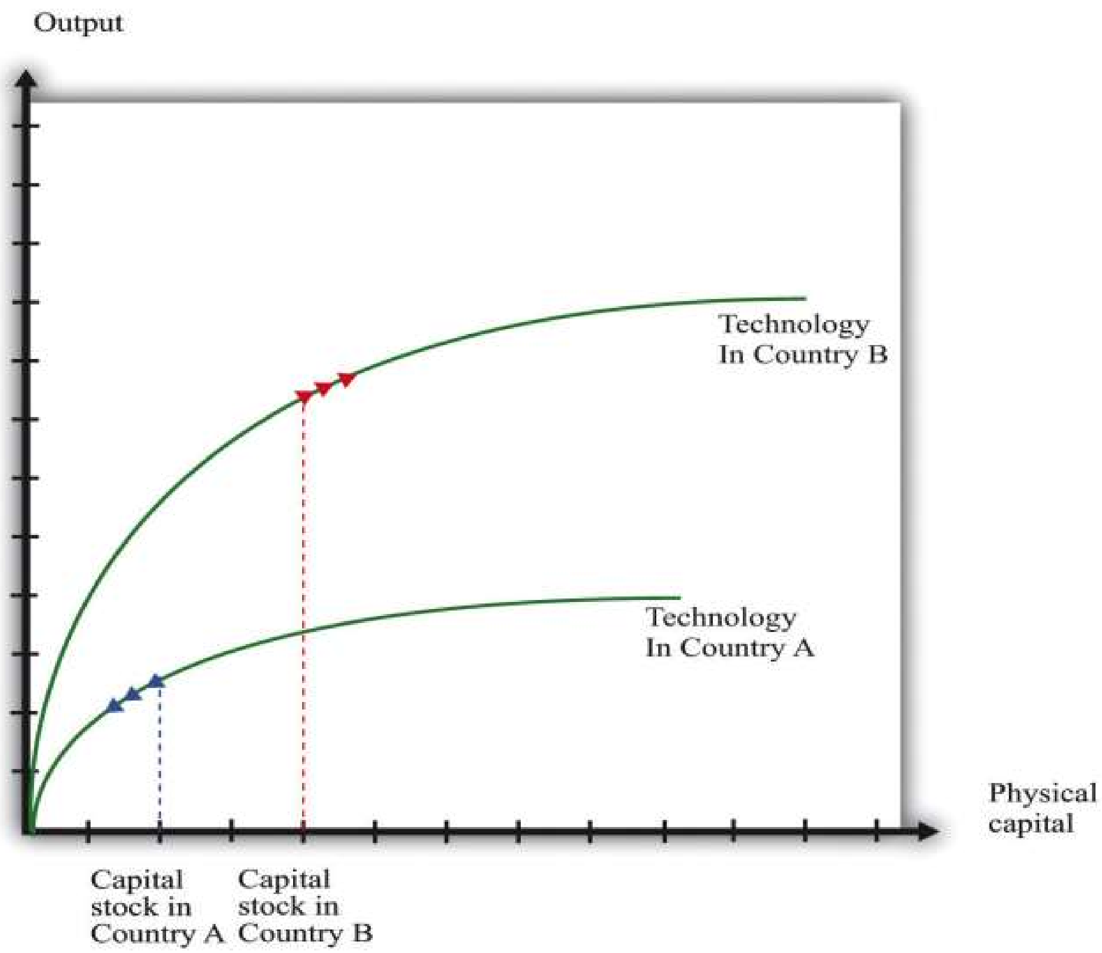

Fig. 6.13: Figure 6.12 Divergence Arising from Differences in Technology In this diagram, country B has a better technology or more human capital than country A. Even though country B has a larger capital stock, it also has a larger marginal product of capital.

KEY TAKEAWAY

- Capital stock increases from investment and decreases due to the depreciation of capital stock.
- All else being the same, poorer countries have a lower capital stock and therefore a higher marginal product of capital compared to rich countries. Thus capital accumulation should be faster in poor countries, which will lead to convergence with richer countries.
- The evidence suggests convergence between some but not all economies.
- Divergence of output across countries might come from the presence of an increasing marginal product of capital or from one country having a superior technology to another.

***

Checking Your Understanding

Suppose we have 100 units of capital stock at the beginning of 2012 and the following table gives the investment for the next 5 years. Suppose the depreciation rate is 5 percent. Fill in the blanks in the table for the years 2012–2017.

Year	Capital Stock (Start of Year)	Investment	Depreciation
2012	100	80	
2013		20	
2014		50	
2015		120	
2016		10	

If one country has a higher level of real GDP than another, does that mean it must have a higher growth rate as well?

If citizens of a relatively poor country are educated in a richer country, does this help or hinder convergence?

6.4 Balanced Growth

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is balanced growth?

Why does balanced growth matter?

When will economies converge to a balanced-growth path?

We have seen that the accumulation of capital—other things being equal—leads economies to converge over time. However, we saw that the evidence for such convergence in the data is highly mixed. To understand more about when economies will and will not converge, we need a more complete theory of the sources of economic growth. In this section, we develop such a theory and then use it to look again at the question of convergence. We initially take as given— that is, as **exogenous**—the growth rates of human capital, the workforce, and the technology.

6.4.1 Growth Accounting

We begin with the tool of **growth accounting**. The growth accounting equation for our aggregate production function is as follows: [***Growth accounting is discussed in more detail in Chapter 5 "Globalization and Competitiveness".***]

```
output growth rate = [a × (capital growth rate)]
```

*

```
+[(1 − a) × (workforce growth rate + human capital growth rate)]
```

*

```
+technology growth rate.
```

Toolkit: Section 16.17 "Growth Accounting"

You can review growth accounting in the toolkit.

In this equation, *a* is just a number. For the US economy, *a* is approximately equal to 1/3. Remember that output is just another term for real gross domestic product (real GDP).

It turns out that, in the very long run, we expect the capital stock and the level of output to grow at exactly the same rate. We see why later in this section. Such a situation is called **balanced growth**. When this is true, the growth accounting equation then becomes [***You don’t need to worry about the mathematical details, but if you are interested, we obtain this equation by setting the capital growth rate equal to the output growth rate:output growth rate ^{BG} = [a × (output growth rate ^{BG})] + [(1 − a) × (workforce growth rate + human capital growth rate)] + technology growth rate, which implies (1 − a) × output growth rate ^{BG} = [(1 − a) × (workforce growth rate + human capital growth rate)] + technology growth rate.****]

For example, suppose that *a* = 1/3, the human capital growth rate = 0.01, the technology growth rate = 0.02, and the workforce growth rate = 0.03. Then

6.4.2 The Growth Rate of Output per Worker in a Balanced-Growth Economy

When we are comparing living standards across countries, it is better to adjust for differences in the size of the workforce to obtain output per worker. This is a measure of the overall **productivity** of an economy—that is, the effectiveness of an economy for producing output. (Of course, output per worker and output per person are very closely related. For the US economy, the workforce is roughly half the total population, so output per person is therefore approximately half as much as output per worker.) The growth rate of output per worker equals the growth rate of output minus the growth rate of the workforce:

This equation tells us that, in the end, the secret to economic growth is the development of knowledge and skills. Invention, innovation, education, training, and improvements in social infrastructure are the drivers of economic growth in the very long run. Perhaps surprisingly, the growth rate of the capital stock is not a fundamental determinant of the growth rate. When we have balanced growth, the capital stock grows, which contributes to the overall growth of output. But if we ask what determines the overall growth rate in an economy, it is the growth of technology and human capital. The capital stock then adjusts to keep the economy on its balanced-growth path. By the definition of balanced growth, the growth rate of the capital stock is equal to the output growth rate.

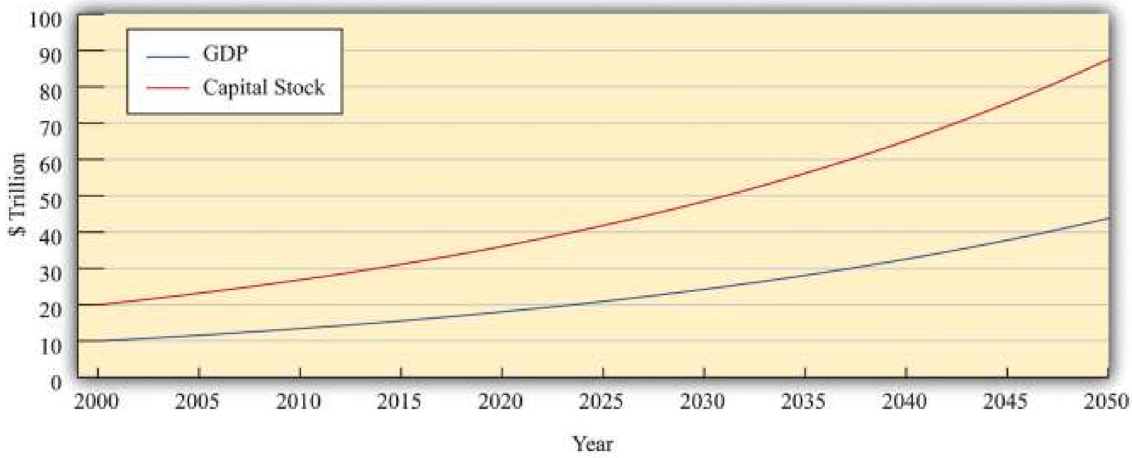

Fig. 6.14: Figure 6.13 Output and Capital Stock in a Balanced-Growth Economy This picture shows an example of an economy on a balanced-growth path. Both variables grow at 3 percent per year and the capital stock is always equal to exactly twice the level of GDP.

***Figure 6.13 "Output and Capital Stock in a Balanced-Growth Economy" illustrates balanced growth. Look first at output. Notice that even though the *growth rate* of output is constant, the graph is not a straight line. Instead, it curves upward: the change in the *level* of output increases over time. This is because a growth rate is a percentage change. In our example, output in 2000 is $10 trillion, and the growth rate is 3 percent. From 2000 to 2001, output increases by $300 billion (= $10 trillion × 0.03).

By 2050, output is equal to $44 trillion. Between that year and the next, output increases by $1.3 trillion (= $44 trillion × 0.03). Even though the growth rate is the same, the change in the level of output is more than four times as large.

When output and the capital stock grow at the same rate, the *ratio* of the capital stock to GDP does not change. In ***Figure 6.13 "Output and Capital Stock in a Balanced-Growth Economy", the value of the capital stock is always twice the value of output. The capital stock and real GDP both grow at the same rate (3 percent per year), so the ratio of the capital stock to GDP does not change over time.

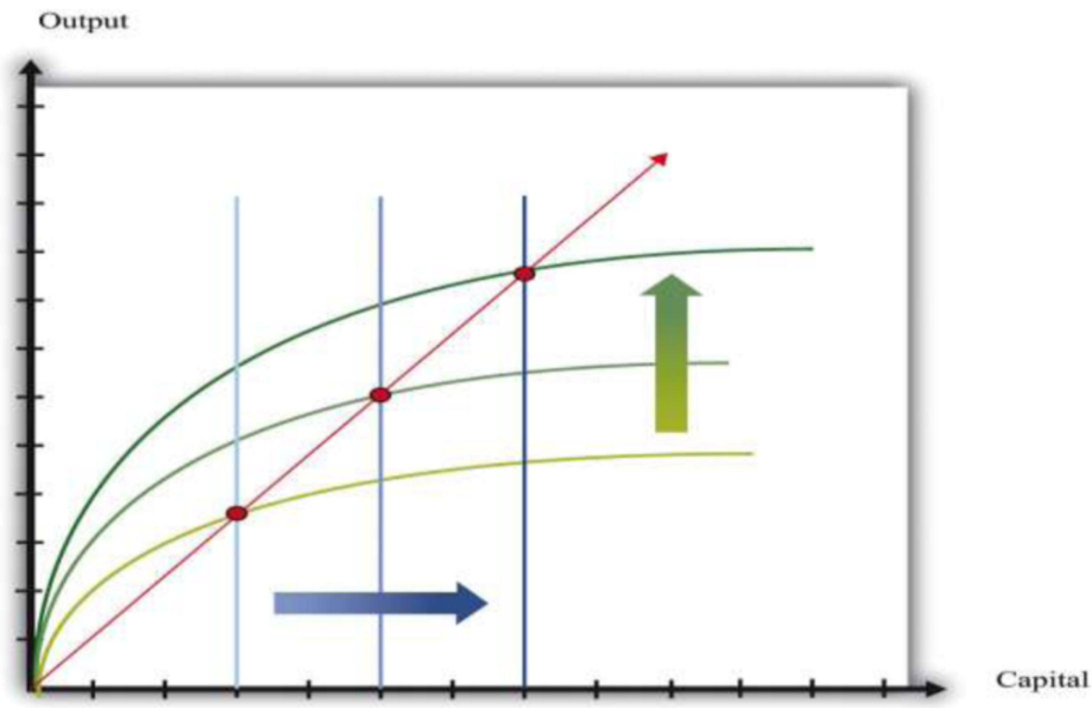

Fig. 6.15: ***Figure 6.14*** *Balanced growth means that the ratio of the capital stock to output does not change. On a balanced-growth path, output and the capital stock grow at the same rate, so the ratio of the capital stock to output is always the same: the growth path of the economy is a straight line from the origin.*

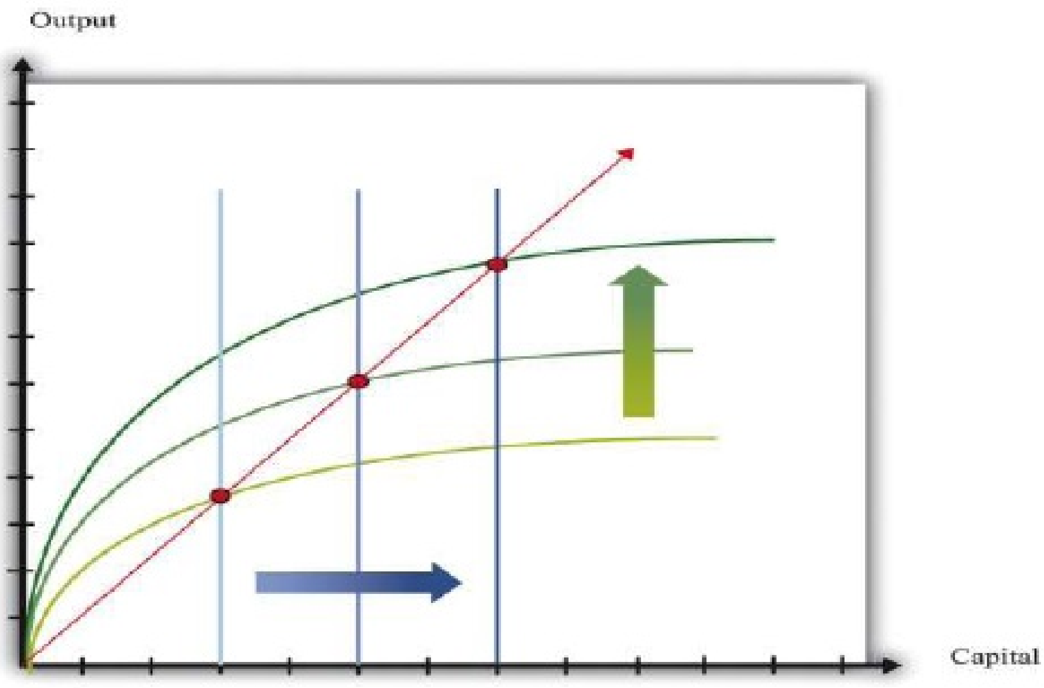

Fig. 6.16:

***Figure 6.14 shows what a constant ratio of the capital stock to GDP looks like in our production function diagrams. Along any straight line from the origin, the ratio of the capital stock to output does not change. As a simple example, suppose that (as in ***Figure 6.13 "Output and Capital Stock in a Balanced-Growth Economy") the capital stock is always twice the level of output. This means that output is always half of the capital stock:

```
output = 0.5 × capital stock.
```

This is just the equation of a straight line that passes through the origin. In ***Figure 6.14, increases in human capital or technology shift the production function upward. On the balanced-growth path, capital stock grows at exactly the right rate so that the economy grows along a straight line from the origin.

6.4.3 The Transition to Balanced Growth

If an economy is not yet on its balanced-growth path, it will tend to go toward that path. If a country has a small capital stock relative to GDP, then its capital stock will grow faster than real GDP. Countries that are still developing may well be in this position. Countries that are further along in the development process are likely to be (approximately) on their balanced-growth paths. For such countries, the ratio of capital stock to output is unchanging.

Economies that have not yet accumulated enough capital to be on their balanced-growth paths will have a growth rate that equals the balanced-growth rate *plus* an additional factor due to the growth rate of capital relative to GDP. [***If you are interested in the mathematical derivation of this equation, you can find it in the toolkit.***]

The first term is the growth rate along the balanced-growth path. The second term is the *additional* component to growth that comes about whenever the capital stock is growing faster than output.

***Table 6.6 "Approaching the Balanced-Growth Path" gives an example of an economy that is approaching a balanced-growth path. Like the economy in ***Figure 6.13 "Output and Capital Stock in a Balanced-Growth Economy", the balanced-growth output growth rate is 3 percent. The workforce grows at 1 percent, so output per worker grows at 2 percent along the balanced-growth path. However, this economy starts off (in the year 2000) with a smaller capital stock than is needed for balanced growth. Looking at the first row of the table, you can see that the capital stock grows at 14.4 percent, while output grows at 6.8 percent. Because capital grows faster than output, there is an additional component to growth, as we have just explained. This contributes an extra 3.8 percentage points to the growth rate, so output per worker grows at 5.8 percent.

As time goes on, the capital stock grows relative to output, and the economy gets closer to the balanced-growth path. As this happens, the additional component of growth becomes smaller. For example, in 2010, the capital stock grows at 6.8 percent, and output grows at 4.3 percent. The growth rate of output per worker is 3.3 percent—2 percentage points being the balanced-growth contribution and 1.3 percent due to the faster growth rate of capital stock compared to output. By 2050, the economy is close to balanced growth: output per worker grows at 2.3 percent, with capital stock growing only a little bit faster than output.

Table 6.6 Approaching the Balanced-Growth Path

Year	Balanced-Growth Output Growth Rate (%)	Balanced-Growth Output per Worker Growth Rate (%)	Capital Growth Rate (%)	Output Growth Rate (%)	Output per Worker Growth Rate (%)
2000	3.0	2.0	14.4	6.8	5.8
2005	3.0	2.0	9.3	5.1	4.1
2010	3.0	2.0	6.8	4.3	3.3
2015	3.0	2.0	5.5	3.8	2.8
2020	3.0	2.0	4.7	3.6	2.6
2025	3.0	2.0	4.1	3.4	2.4
…	…	…	…	…	…
2050	3.0	2.0	3.8	2.3	

Countries that are well below their growth path will see their capital stock grow rapidly relative to GDP. They will experience relatively rapid GDP growth. Countries that are close to their balanced-growth path will see their capital stock grow more slowly relative to GDP and have a GDP growth rate that is only slightly bigger than the balanced-growth rate. Although the economy will eventually reach its balanced-growth value, this adjustment may take decades. For this reason, we say that the economy will achieve balanced growth only in the very long run. [***To be mathematically precise, the economy gets closer and closer to its balanced-growth path but never quite gets there. Over a period of decades, it gets close enough that it makes no practical difference.****]

6.4.4 Convergence Revisited

We can now use our theory of balanced growth to make our earlier argument for convergence more precise. Then we consider whether we might also see convergence from changes in human capital and technology.

6.4.5 Convergence in Physical Capital

Imagine that we are comparing two countries that are identical in almost every respect. They both have the same levels of technology and human capital and the same balanced-growth ratio of capital stock to GDP. However, they have different amounts of physical capital. Suppose that one of the countries has a large capital stock (call it the rich country) and the other country has a much smaller capital stock (call it the poor country).

These two economies will initially have different levels of output and living standards. Our model predicts, however, that these differences will be temporary. Both economies will approach the balanced-growth path. The poor country will grow more rapidly because its ratio of capital stock to GDP will be increasing more quickly as it moves toward the balanced-growth path. Over time, we expect to see the poor country catch up to the rich one. We illustrate this in ***Figure 6.15 "Convergence of a Rich Country and a Poor Country".

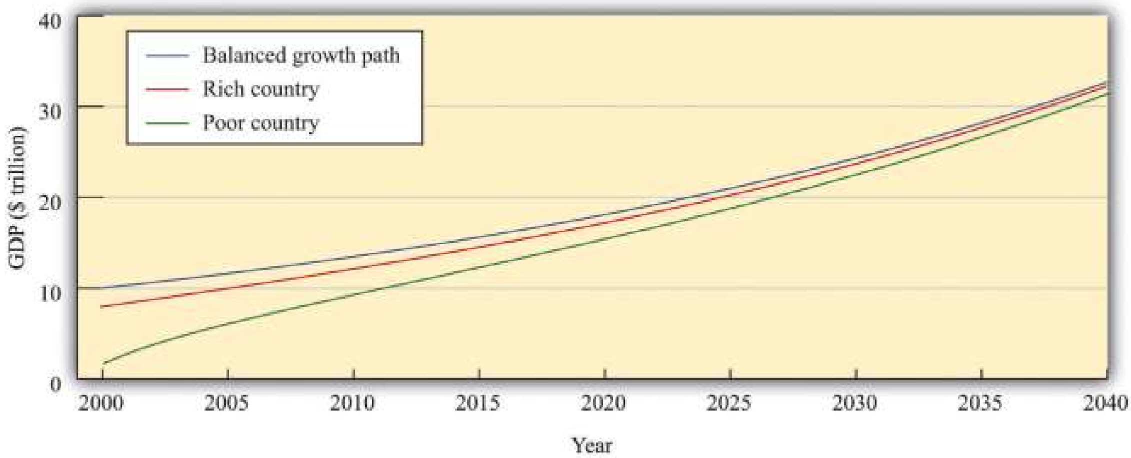

Fig. 6.17: Figure 6.15 Convergence of a Rich Country and a Poor Country Consider two economies, identical in all respects except that one has a smaller capital stock than the other. The poorer country accumulates capital faster than the richer country and grows faster.

This is exactly the same mechanism for convergence that we saw before. The country with a smaller capital stock will have a higher marginal product of capital and will grow faster because the country is a more attractive place for investment. Because the poor country accumulates capital more rapidly than the richer country, it will grow faster. The two countries will converge to the same balanced-growth path and to the same level of output per person.

6.4.6 Convergence in Human Capital

So far we have not considered why human capital might change over time. If there are reasons to think that this variable might grow more quickly in poor countries than in rich countries, we have another force that might drive convergence.

In some ways, human capital resembles physical capital. As with the physical capital stock, some accumulation is the result of decisions by governments, and some comes from decisions by private agents. From the government side, it is likely that economies with low levels of human capital might also be economies in which there is a high return to basic education. If literacy rates are low and most children do not receive much education, even straightforward investments in schooling might yield big gains in terms of the ultimate capabilities of the workforce. Governments in poor countries might see big potential gains from investment in education. Private individuals and firms may also perceive that the returns on education are larger in poorer economies. If very few people in the economy have college degrees, an individual might find that a college education yields a very large payoff. By contrast, if the population as a whole is highly educated, it might take a much larger investment to stand out from others.

This discussion is somewhat speculative. Human capital is difficult to measure, and the marginal product of human capital is even harder to quantify. Nevertheless, there are some good reasons to believe that the incentives to invest in human capital are greater in poorer economies. If so, we have another reason to expect convergence.

6.4.7 Convergence in Technology

What about technology? Will it grow faster in poorer economies? The answer depends on which aspect of technology we are talking about.

Differences in knowledge between rich and poor countries are likely to diminish over time. Rich economies are typically close to the technology frontier, meaning that they are using state-of-the-art production techniques. For countries on the technology frontier, growth in knowledge can only come the hard way, through investment in research and development (R&D). Countries inside the technology frontier are typically poorer developing countries. These economies can grow their stock of knowledge simply by importing knowledge from countries at the frontier. Technological advance is much cheaper and easier if you can use others' inventions and innovations rather than coming up with your own. We therefore expect such countries to have faster growth rates of knowledge. As they become more developed, the growth of knowledge in these economies will slow down to the rate experienced by other countries near the technology frontier. But in the meantime, they will grow faster than rich countries. Technology transfer to developing economies is surely a force leading to convergence of economies.

There is less to say about social infrastructure and natural resources. The amount of natural resources available in an economy is largely due to accidents of history and geography: there is no obvious reason to expect the growth rate of natural resources to be linked to the level of development. Social infrastructure, meanwhile, is a complicated mix of institutions, customs, and other factors. Again, there is no obvious reason to expect social infrastructure to grow more quickly in poorer economies.

6.4.8 Divergence Revisited

Now that we have incorporated human capital and technology into our framework, we can identify some further possible explanations of divergence. Our theory says that economies will converge if they differ only in terms of their initial capital stock. But it is possible that different economies will also have different balanced-growth paths. ***Figure 6.16 "Balanced Growth in Two Countries with Different Ratios of Capital to Output" shows what this looks like. The ratio of capital stock to output in the very long run depends on a number of different factors, including the growth rate of technology and the growth rate of the workforce. If these differ across countries, then their balanced-growth paths will differ as well, and we will not observe convergence. [***The toolkit presents a complete model of balanced growth, including a formula for the balanced-growth ratio of capital stock to output.***]

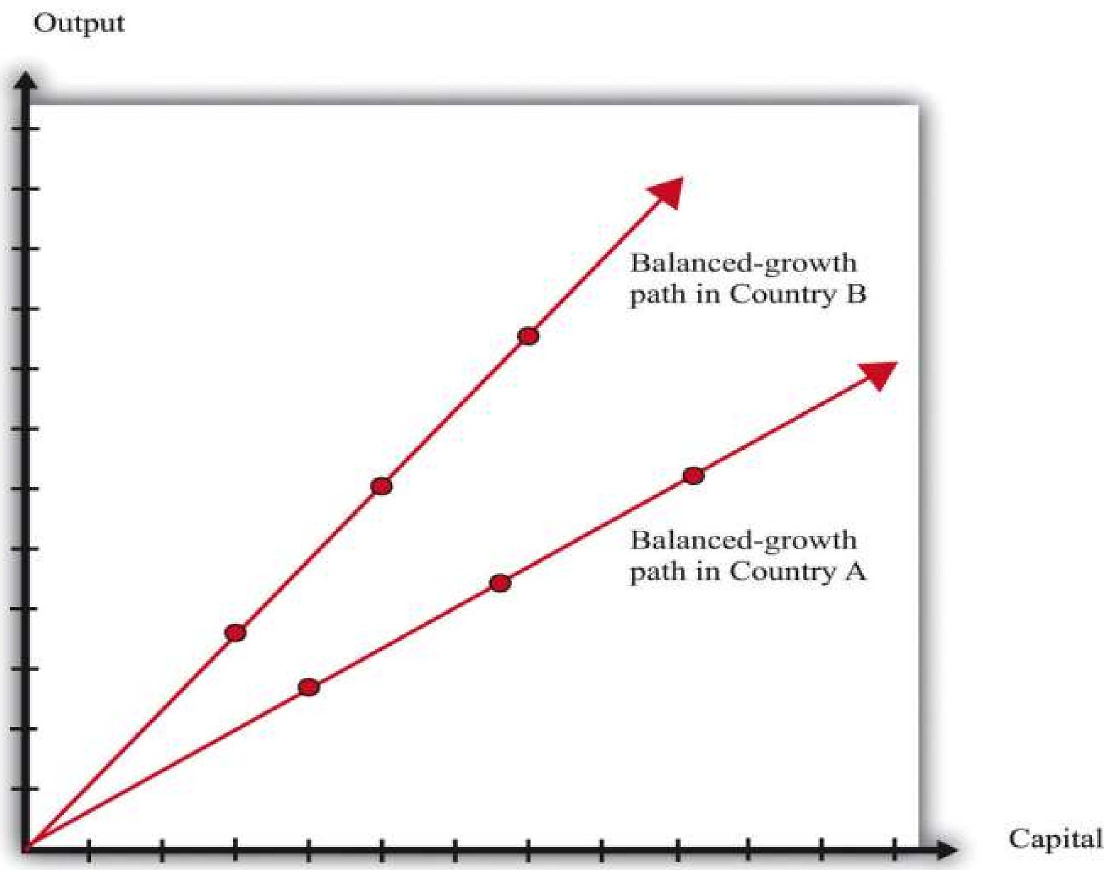

Fig. 6.18: Figure 6.16 Balanced Growth in Two Countries with Different Ratios of Capital to Output
Economies may have different balanced-growth paths. In this example, the ratio of capital stock to output is higher in country A than in country B.

This explanation—and our previous stories of divergence—tells us why different economies will not necessarily end up at exactly the same level of output per worker. But the problem of divergence is in some ways worse than that. Some countries are not only failing to converge but also moving further and further apart. In other words, in some cases, richer economies are growing faster than poorer economies. Indeed, as we saw with Niger, some of the poorest economies in the world have been shrinking rather than growing.

Remember that the growth rate of output per worker on a balanced-growth path is as follows:

We can explain divergence in our framework if human capital or technology is growing more slowly in poor countries than in rich ones. Are there reasons to expect this to be the case? Earlier, we said that countries with low levels of human capital might also be countries where the return to human capital investment was large, which is a force for convergence. We also pointed out, however, that the marginal product of physical capital might be larger in an economy with a superior technology, even if that economy had more capital. The same is true of human capital. Countries can build up their human capital through schooling and training. They can also build up their human capital by attracting skilled workers from other countries. If richer countries are able to attract skilled workers, then we will see divergence rather than convergence. [***In Chapter 5 "Globalization and Competitiveness", we discuss how economies actively seek to attract human capital.***]

Turning to technology, divergence in social infrastructure is certainly a possibility. Social infrastructure includes the rule of law, the general business climate, social attitudes toward corruption, the protection of property rights, and many other intangible factors. These influences on economic growth are difficult to define and almost impossible to measure accurately. Yet economists are convinced that successful economies must have a good set of such social institutions. It is likely that it is easier to build and improve such institutions in countries that are relatively prosperous, which would again lead richer countries to grow more rapidly than poorer countries.

Economists have built some of these ideas into the theoretical framework of economic growth. Unfortunately, the models are too complicated for an introductory economics textbook, so we will not go into them in any detail here. We can, however, provide a simple example that conveys the flavor of these more complex ideas. The story goes as follows. We know that workers acquire human capital through education and on-the-job training. Suppose that, when there is more *physical* capital in the economy (relative to the number of workers), it is easier to acquire *human* capital. You can study in modern facilities with up-to-date computers. You work with state-of-the-art machinery and become more skilled. In this story, human capital is **endogenous**: it depends on the amount of physical capital.

To be concrete, imagine that technology is constant, and the amount of human capital is proportional to the amount of physical capital per worker. When we incorporate this assumption into the production function, we end up with a very straightforward relationship:

```
output = B × physical capital,
```

where *B* is just a number. [***The derivation of this equation is not very difficult; it is explained in the toolkit.***]

In this economy, the ratio of capital stock to GDP is constant at all times (capital/output = 1/*B*). This economy is *always* on a balanced-growth path. Because of this, the growth rate of output equals the growth rate of capital stock:

```
output growth rate = physical capital growth rate.
```

The more important point, though, is that this technology *does not exhibit diminishing marginal product of capital*. The marginal product of capital is constant: it equals *B*. If this number were different in different economies, then we would expect to see capital stock flowing from economies where *B* is small toward economies where *B* is large. We would see divergence rather than convergence.

The model that we have described in this subsection is simplistic. Its point is simply to show that, if we make human capital endogenous, it is much easier to explain divergence. Economists have built more complicated and realistic models with endogenous human capital and technology that give similar results.

KEY TAKEAWAY

Balanced growth occurs when capital stock grows at the same rate as output. Along a balanced-growth path, the ratio of output to capital stock does not change. •

Balanced growth is important to understand because over long periods of time, we expect economies to reach their balanced-growth path.

There are reasons to expect at least some convergence in physical capital, human capital, and knowledge. However, there is no strong argument for why we would see convergence in social infrastructure.

***

Checking Your Understanding

Suppose that an economy has a balanced-growth path where the physical capital stock is three times the level of GDP. If the current capital stock is four times the level of GDP, do you expect capital stock to grow faster or slower than GDP?

Suppose we have two economies that are currently identical, except in the first economy a is 0.3 and in the second economy a is 0.5. Will the balanced-growth path be the same in both countries? Which economy will converge more quickly to the balanced-growth path?

6.5 The Role of International Institutions in Promoting Growth

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are the main international organizations that help to promote growth?

What do these institutions do to achieve their stated goals?

Governments acting alone can do a lot to promote economic growth. We have discussed the importance of protecting property rights and establishing a climate of political stability. These efforts by individual governments are complemented by international actions to promote growth and development in poorer countries. In this section, we describe three powerful and controversial international economic organizations: the World Bank, the International Monetary Fund (IMF), and the World

Trade Organization (WTO). We briefly explain what these institutions do and how they go about reaching their goals. [***The websites of the World Bank, the IMF, and the WTO are, respectively, as follows:http://www.worldbank.org, http://www.imf.org/external/index.htm, and http://www.wto.org. ***]

6.5.1 The World Bank

The World Bank is an international intermediary funded by 184 member countries. Its goal is to provide loans and grants to developing countries with the aim of eliminating poverty by promoting economic growth. Economists working at the World Bank rely on variants of the growth model used in this chapter to understand the growth experiences of different countries and determine the effects of policies in those countries.

The World Bank borrows money on international capital markets and also receives funds directly from member countries. The World Bank is similar to a bank that a household or a firm would approach for a loan to build a factory or a house, except that its borrowers are national governments. It often funds projects that would otherwise not be undertaken. In many cases, these are projects that promote infrastructure, education, health, and so forth. Projects like these may have social benefits yet not be profitable enough for private firms to undertake. Building a road in a rural part of a developing country is not the type of investment project one normally associates with a profit-seeking firm, for example, even though the road may have spurred rural development.

In 2010 the World Bank made about $45 billion in loan commitments and $29 billion in loan disbursements. [***“Annual Report 2010: Financial Information,” World Bank, accessed August 22, 2011,http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/EXTANNREP/ EXTANNREP2010/ 0,,contentMDK:22626599~menuPK:7115719~pagePK:64168445~piPK:6 4168309 ~theSitePK:7074179,00.html.***] At one level, this is evidently substantial—a project worth $100 million or more can certainly have a large impact on a poor country. At another level, it is not a huge sum of money in the global economy. For comparative purposes, BP set aside over $40 billion to pay for the cleanup of its 2010 oil spill in the Gulf of Mexico.

World Bank projects range broadly. They include funding for infrastructure construction, promoting health care (such as HIV/AIDS programs), promoting education, and so forth. Many of these projects involve the provision of public goods, so they create benefits for society as a whole that exceed the direct return on investment. That is, many of the projects that are funded by national governments in richer countries are funded through the World Bank in developing countries. At the beginning of this chapter, we saw an example of a World Bank project in Niger, which was aimed at increasing human capital in that country. As another example, here is a description of a recent World Bank loan to Guyana to provide water access to the poor.

6.5.2 Guyana: Water Sector Consolidation Project

GRANT AMOUNT: $12.3 million

PROJECT DESCRIPTION: This project's main objective is to increase access to safe water among the poor. The project seeks to support the achievement of sustainable universal access to safe and affordable water for the population of Guyana, especially the poor. The project will also help to consolidate the water sector modernization and reform process undertaken by the government with support of the International Development Association (IDA) and other donors in recent years. [***"Water Sector Consolidation Project," World Bank, July 12, 2005, accessed June 30, 2011,http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P088030&cid=3001_72.***]

The project described here would not likely be a profitable private sector project, but it is important for the development of Guyana. Notice, too, that this loan, like many other World Bank loans, is for the development of infrastructure (roads, bridges, schools, communication systems, etc.). In more developed countries, such projects are usually performed by governments, but in developing countries, these investments are frequently undertaken through the World Bank.

Investment in infrastructure is typically complementary to the accumulation of other physical capital, such as machines and plants. Even though developing countries have relatively low capital stocks, investment in plants and equipment may not be very profitable if basic infrastructure is lacking. There is no point in building a factory if there are no roads to take your goods to market. Investment in infrastructure can increase the marginal product of capital and make other investment more attractive.

6.5.3 The International Monetary Fund

The IMF was established to (among other things) provide short-term support for countries facing financial difficulties. This is explicitly stated in the IMF's Articles of Agreement: "To give confidence to members by making the general resources of the Fund temporarily available to them under adequate safeguards, thus providing them with opportunity to correct maladjustments in their balance of payments without resorting to measures destructive of national or international prosperity." [***"Articles of Agreement of the International Monetary Fund," International Monetary Fund, February 22, 2010, accessed June 30, 2011, http://www.imf.org/external/pubs/ft/aa/aa01.htm.***]

A country's balance of payments has two main components. The first is the trade balance. A balance of payment maladjustment may mean that a country is running persistent trade deficits—that is, its imports are greater than its exports. This means the country is borrowing from other countries and is building up its external debt. The second component of the balance of payments is the interest that a country must pay on its *existing* external debt. This means that imbalances in the past lead to worse imbalances in the present. Imagine, for example, that Juan in Solovenia borrowed extensively in the past. It is then difficult for him to get out of debt because he has to pay so much interest. Moreover, the amount of external debt in a country cannot grow forever. When countries get into trouble by accumulating large amounts of debt, there is a temptation to default on outstanding debt. A key role of the IMF is to help countries through these difficult episodes.

IMF help has strings attached. A controversial aspect of the IMF's mode of operation is in the phrase…*under adequate safeguards*. As part of a deal to provide resources to countries in need of funds, the IMF often makes explicit demands about government fiscal and monetary policies. This is termed IMF "conditionality" and is described by the IMF as follows: "When a country borrows from the IMF, its government agrees to adjust its economic policies to overcome the problems that led it to seek financial aid from the international community. These loan conditions also serve to ensure that the country will be able to repay the Fund so that the resources can be made available to other members in need. In recent years, the IMF has streamlined conditionality in order to promote national ownership of strong and effective policies." [***"IMF Conditionality," International Monetary Fund, March 18, 2011, accessed August 22, 2011, http://www.imf.org/external/np/exr/facts/conditio.htm.

Saylor URL: http://www.saylor.org/books Saylor.org***]

A quick tour of the IMF website (http://www.imf.org/external/index.htm) provides a lot of information about past and ongoing loans. One example is the ongoing relationship between the IMF and Argentina. [***The IMF formulates country reports on an annual basis, and these are available on the IMF website. These reports summarize the dealings between individual countries and the IMF. Argentina had reached an agreement with the IMF in September 2003 providing Argentina with access to SDR 8,981 million. SDR means "special drawing right." It is a unit of account used by the IMF whose value is an average of four key currencies. Its actual value on any given date can be found at http://www.imf.org/external/np/fin/data/rms_sdrv.aspx. In May 2011, 1 SDR was worth US$1.59.***] This agreement with Argentina came after Argentina was unable to meet demands for payment on some of its external debt and after real gross domestic product (real GDP) had fallen by nearly 11 percent in 2002. Agreement with the IMF was not immediate, partly due to the conditionality of a prospective loan. Though agreement was ultimately reached, there were lengthy negotiations regarding the conduct of fiscal and monetary policy in Argentina as a condition for IMF assistance.

6.5.4 The World Trade Organization

The WTO "makes the rules" for international trade. It is a relatively new organization—having been founded in 1995—and has 150 member countries. It arose from earlier trade agreements between countries, most notable the *General Agreement on Tariffs and Trade*. The WTO website describes the role of the organization as follows:

[...]

Essentially, the WTO is a place where member governments go, to try to sort out the trade problems they face with each other. The first step is to talk. The WTO was born out of negotiations, and everything the WTO does is the result of negotiations. The bulk of the WTO's current work comes from the 1986–94 negotiations called the Uruguay Round and earlier negotiations under the General Agreement on Tariffs and Trade (GATT). The WTO is currently the host to new negotiations, under the "Doha Development Agenda" launched in 2001. Where countries have faced trade barriers and wanted them lowered, the negotiations have helped to liberalize trade. But the WTO is not just about liberalizing trade, and in some circumstances its rules support maintaining trade barriers—for example to protect consumers or prevent the spread of disease.

[...] [***"What Is the World Trade Organization?" World Trade Organization, accessed June 30, 2011,http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact1_e.htm.***]

The negotiations at the WTO set the ground rules for international trade. Using the mechanisms of the WTO, countries agree on trade policies, such as the levels of tariffs. This is also a forum for designing policies on the protection of intellectual property rights. The WTO also provides a forum for dispute resolution.

Many critics of globalization have focused their attention on the WTO. For example, the nongovernmental organization Global Exchange (http://www.globalexchange.org) lists 12 "top reasons to oppose the WTO," including the claims that the WTO is increasing hunger, increasing inequality, trampling human rights, destroying the environment, and killing people through its policies. Critics such as this group argue that the WTO is fundamentally undemocratic, writing the rules so as to favor powerful corporations and rich countries. Defenders of the WTO argue that it gives poorer countries a much greater voice in international economic decision making. They point out, for example, WTO decisions are based on consensus, meaning that all 150 member countries must agree to them.

KEY TAKEAWAY

• The World Bank, the IMF, and the WTO are three leading international organizations that help countries in the development process. •

The World Bank funds projects in recipient countries, the IMF provides balance of payments support, and the WTO works to reduce trade barriers.

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Checking Your Understanding

In what way does the IMF work to promote convergence across countries?

The WTO helps to govern intellectual property rights. What is the impact of those rights on development?

6.6 End-of-Chapter Material

In Conclusion

We live in a world today that would be unrecognizable and unimaginable to those born two centuries ago. Things we take for granted—jet travel, antibiotics, electricity, the Internet, dentistry—are all products of the extraordinary growth of the last 200 years. Yet despite all our technological advances, billions of people in the world still live in poverty. Although some countries continue to grow rapidly, others stagnate or even go backward. If we could unlock the secrets of economic growth, we would have the means to help people to permanently better lives.

Even as economists emphasize economic growth as a way to combat poverty, noneconomists are often critical of economic growth, pointing out that it comes with costs as well as benefits. For example, as countries become richer, they use more energy and more of the world's natural resources. Oil reserves are being depleted, and rainforests are disappearing. Growth may lead to increased pollution, such as greenhouse gas emissions that in turn contribute to climate change. These are serious and legitimate concerns. In brief, economists have four main responses.

1. The framework we presented in this chapter does, in fact, capture the effect of declining natural resources. They lead to a slower rate of growth in technology. Indeed, it is possible that declining natural resources could more than offset growth in knowledge and social infrastructure so that the technology growth rate becomes negative. As yet, there is no evidence that this is a significant concern, but—at least until we have a better understanding of the drivers of knowledge and social infrastructure growth—it certainly might become relevant in the future.
2. There are indeed uncompensated side effects of economic growth, such as increased pollution. Economists agree that such effects can be very important. However, they can and should be corrected directly. Curtailing growth is an extremely indirect and inefficient response to its adverse side effects. As Nobel Prize–winner Robert Solow put it, "What no-growth would accomplish, it would do by cutting off your face to spite your nose." [***Robert M. Solow, "Is the End of the World at Hand?" Challenge 16, no. 1 (March/April 1973): 39–50. Also available at http://www.jstor.org/stable/40719094.***]
3. The evidence reveals that *some* environmental problems are solved rather than exacerbated by growth. Air pollution is a much more serious problem in the

developing countries of the world than in the rich countries of the world. In part this is because a clean environment is a luxury good; people only worry about the state of the environment once their basic needs of food and shelter are addressed.

4. The most serious problems are those where we cannot rely on market mechanisms. If oil becomes scarce, then increases in the price of oil will provide incentives for people to economize on their use of fuel and look for alternative sources of energy. These incentives will at least ease the adjustment of the world economy. But there are no functioning market mechanisms to deal with climate change, for example.

Decades of research by economists have told us that there is no magic bullet, no simple and painless way to encourage economic growth. At the same time, we have learned a great deal about how and why countries grow. We have learned that growth depends on the accumulation of both physical and human capital. We have learned that growth ultimately hinges on the growth of knowledge, highlighting the importance of education, training, and research and development (R&D). And we have learned that good institutions are critical for countries that want to promote economic growth.

We have made progress, but the study of economic growth remains one of the most fascinating and challenging problems in all economics. There is no doubt that economists will continue their search for the elusive secrets of prosperity. As the Nobel Prize–winning economist Robert Lucas observed, “Once one starts to think about [economic growth], it is hard to think about anything else.”

Key Links

- Penn World Tables: http://pwt.econ.upenn.edu •
- International Monetary Fund (IMF): http://www.imf.org/external/index.htm •
- World Bank: http://www.worldbank.org •
- World Bank Development Report:http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EX TWDRS/0,,contentMDK:20227703~pagePK:478093~piPK:477627~theSitePK:477624,00.html
- World Bank Development Indicators:http://www.google.com/publicdata/overview?ds=d5bncppjof8f9_&ctype=l&st rail=false&nselm=h&hl=en&dl=en
- World Trade Organization: http://www.wto.org •
- CIA World Factbook: https://www.cia.gov/library/publications/the-world-factbook
- Angus Maddison’s home page: http://www.ggdc.net/maddison •
- Excel file of long-run data:http://www.ggdc.net/maddison/Historical_Statistics/horizontal-file_03-2007.xls

EXERCISES

Think about your last visit to a shopping center or a large food store in the United States or other developed economy. Which of these goods and services do you think are available in a typical market in Niger? Which were available in the United States 50 years ago? 100 years ago?

(Advanced) In the late 1990s, the US government was running a surplus of about 1 percent of gross domestic product (GDP). Current projections show that the government is going to run deficits in excess of 5 percent of GDP in the future. Let us imagine that there are no changes in private saving or in foreign borrowing/lending. [***The condition that private savings do not change is important. For example, if the government cuts taxes, it is possible that people will predict that taxes will be higher in the future and will increase their savings in anticipation. We will say more about this in Chapter 14 "Balancing the Budget".***] In this case, the increased deficit translates directly into a decrease in the investment rate. To investigate the implications of such a decrease,

suppose that, in the year 2000 investment rate = 0.24, depreciation rate = 0.085, and output growth rate = 0.035.

a) On a balanced-growth path, the ratio of capital stock to output is given by the following formula:

Suppose that the economy was on a balanced-growth path in 2000. Calculate the balanced-growth ratio of the capital stock to GDP.

b) Suppose the production function for this economy is output per worker = 15,000 × capital/output. What is output per worker in 2000?

c) Now suppose that the increase in the government deficit means that the investment rate decreases to 0.18. What is the new balanced-growth ratio of the capital stock to GDP?

d) Suppose that by 2040, improvements in technology and human capital mean that the production function is given by output per worker = 30,000 × capital/output. Suppose also that the economy has reached its new balanced-growth path. What is output per worker in 2040?

e) What would output per worker equal in 2040 if there had been no change in the investment rate?

Try to estimate approximately how much you spend every day. Be sure to include an amount for rent, utilities, and food. Do you think it would be possible for you to live on $2 per day?

Suppose there are two economies. The first has a current level of real GDP of 100, and the second has a current level of real GDP of 200. The poorer country is forecasted to grow at 10 percent in the coming year, while the richer country is forecasted to grow at 15 percent. If these forecasts are true, what will their levels of real GDP be next year? Is this a case of divergence or convergence?

When capital's share of output (a) is larger, does an economy move to its balanced-growth path more quickly or more slowly? Explain.

6. Suppose that capital's share of output is 0.5, the human capital growth rate is 2 percent, the technology growth rate is 1 percent, and the workforce is not growing. What is the balanced-growth growth rate of output?

Look at Table 6.6 "Approaching the Balanced-Growth Path". Explain why the output growth rate decreases over time.

(Advanced) Think about Juan in Solovenia. Consider two cases. In the first case, he experiences an increase in his productivity that he knows will last for only one month. In the second, he experiences a permanent increase in his productivity. How do you think his decisions about how hard to work will be different in the two cases?

On a balanced-growth path, the ratio of capital stock to output is given by the following formula:

Use the formula for the balanced-growth rate of output to determine how the ratio of capital stock to output depends on the growth rate of the workforce. Does an increase in the growth rate of the workforce lead to an increase or a decrease in the ratio of capital stock to output?

Economics Detective

Find savings rates for the United States, India, and Niger and compare these to the investment rates for these countries. What can you say about capital inflows from other countries?

Go to the Penn World Tables (http://datacentre2.chass.utoronto.ca/pwt61). Click on "Alphabetical List of Countries." Select the United States and two other countries of your choice. Look at the data for real GDP per capita and real GDP per worker. Briefly describe in words what has happened to these two variables over the period for which data are available.

Spreadsheet Exercises

Using a spreadsheet, reproduce ***Figure 6.13 "Output and Capital Stock in a Balanced-Growth Economy". Specifically, suppose that GDP starts with the value 10 in the year 2000, and capital stock in the same year has the value 20. Now set the growth rate of each series equal to 3 percent (0.03). What is the capital stock in 2050? What is GDP? Has the ratio of capital stock to GDP stayed constant?

Using the same spreadsheet and keeping the growth rate of GDP equal to 3 percent, examine what happens if the growth rate of capital is (a) 1 percent; (b) 5 percent.

Suppose that an economy has the following production function: Suppose that the workforce is growing at 1 percent per year, and human capital is growing at 2 percent per year. (We are assuming technology is constant in this example.) Suppose that we find that the ratio of capital stock to GDP is 4 on all dates and, initially, human capital is 15,000. What are the values for the growth rate of output per worker, the growth rate of output, and the growth rate of capital?

By experimenting with a spreadsheet, find out how long it will take for output per worker to double in this example.

Chapter 7 The Great Depression

Lessons from History

Newspaper headlines around the world in 2008 asked whether the world's economies were heading for another "Great Depression." Long-past economic history suddenly captured the attention of economists, journalists, and others. But what was this event and why—even though it occurred the best part of a century ago—does it still hold such a prominent place in our economic memories?

In the early 1930s, instead of benefiting from economic growth and improved standards of living, people witnessed a huge decline in the level of economic activity. There was great economic hardship: large numbers of families struggled to obtain even basic food and shelter. Some sense of the desperation during these times can be found in oral histories. Here, for example, is one person's story of what it was like trying to find a job:

I'd get up at five in the morning and head for the waterfront. Outside the Spreckles Sugar Refinery, outside the gates, there would be a thousand men. You know dang well there's only three or four jobs. The guy would come out with two little Pinkerton cops: 'I need two guys for the bull gang. Two guys to go into the hole.' A thousand men would fight like a pack of Alaskan dogs to get through there. Only four of us would get through. I was too young a punk. [***See Studs Terkel, *Hard Times: An Oral History of the Great Depression* (New York: Pantheon Books, 1970), 30.***]

The personal suffering is less apparent in the figure below, but this picture does reveal the extraordinary nature of those times. It shows real gross domestic product (real GDP) in the United States from 1890 to 1939. Three things stand out. First, the level of economic activity grew substantially during this half century. This is normal: economies typically grow over the long haul, becoming more productive and producing more output. Second, although the level of US economic activity grew substantially over this half century, there were many ups and downs in the economy during the late 19th century and early 20th century. Third—and most important for our purposes—the period from 1929 to 1937 stands out from the rest. This was not a minor blip in economic activity; the US economy suffered a collapse that persisted for many years. At the same time, unemployment climbed to a staggering 25 percent in 1933—one out of four people was unemployed—compared to a rate of only 3.2 percent in 1929.

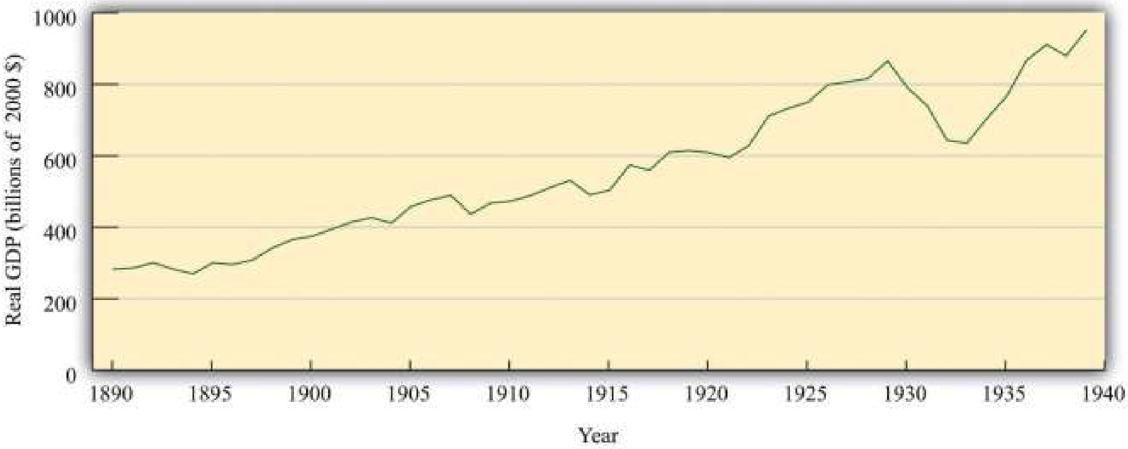

Fig. 7.1: Figure 7.1 US Real GDP, 1890–1939 Real GDP increased considerably between 1890 and 1939, but the Great Depression of the early 1930s is a striking exception. Source: Data from "What Was the U.S. GDP Then?," Measuring Worth, accessed August 22, 2011, http://www.measuringworth.org/datasets/usgdp/result.php.

The United States was not the only country to experience such hard economic times in this period. Many other countries, such as the United Kingdom, Canada, France, Germany, and Italy also saw their economic progress reversed for a period of years. The Great Depression, as this economic cataclysm came to be called, was a shock to the economists of the day. Prior to that time, most economists thought that, though economies might grow fast in some years and decline slightly in others, prolonged unemployment and underutilization of resources was impossible. The Great Depression proved this view to be erroneous and eventually led to a fundamental change in the way in which economists thought about the aggregate economy. The idea that the economy was naturally stable was replaced with a view that severe economic downturns could recur at any time.

Along with this change in thinking about the economy came a change in attitudes toward macroeconomic policy: economists began to believe that the government could play an active role to help stabilize the economy, perhaps by increasing government spending in bad times. Prior to the Great Depression, nobody even thought that the government should try to keep the economy stable. Both Democrats and Republicans in the 1932 election advocated *less* government spending because government revenues had fallen. Yet, by the end of the 1930s, the United States and other countries had adopted the view that active policy measures were useful or even essential for the proper functioning of economies.

Three-fourths of a century later, these events are part of economic history. Few people still alive experienced those terrible years directly, yet the time remains part of our collective memory. Above all, we need to know what went wrong if we hope to ensure that such punishing times do not come again. Indeed, the world economy recently suffered the most severe recession since the 1930s, and it is unclear at the time of this writing how long or how bad the current crisis will be. The insights of the economists who explained the Great Depression are still at the heart of today's discussions of economic policy. Understanding what happened to the economy in the 1930s is more than an exercise in economic history; it is essential for understanding modern macroeconomics. We want to know— What caused the Great Depression?

Road Map

We begin by looking at some facts about the Great Depression and the boom that preceded it. Our goal is to see if we can develop a good explanation of these facts. The most fundamental defining feature of the Great Depression was the large and sustained decrease in real GDP. In the figure below, which shows the circular flow of income, reminds us that real GDP measures both production and spending.

Figure 7.2 The Circular Flow of Income

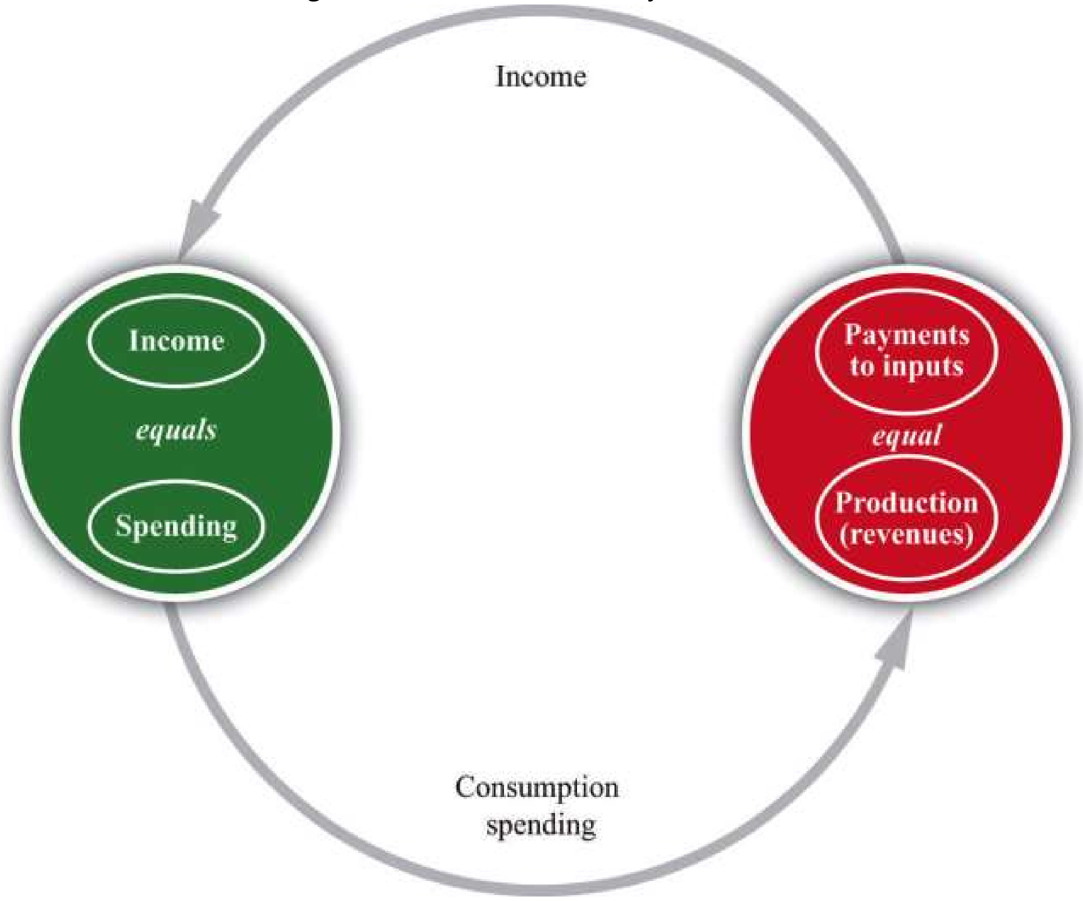

Fig. 7.2: GDP measures the production of an economy and total income in an economy. We can use the terms production, income, spending, and GDP interchangeably.

It follows that during the Great Depression, both output and spending decreased. Perhaps it is the case that production in the economy declined for some reason, and spending decreased as a consequence. Or perhaps spending declined for some reason, and production decreased as a consequence. We examine two approaches to the Great Depression, based on these ideas. One sees the root cause of the Great Depression as a decline in the productive capabilities of the economy, meaning that firms—for some reason—were unable to produce as much as they had before. This then led to decreased spending. The other approach sees the root cause of the Great Depression as a decline in spending, meaning that households and firms—for some reason—decided that they wanted to purchase fewer goods and services. This then led to decreased production.

We look at each explanation in turn. We investigate which inputs contributed the most to the decrease in output and also look at what happened to the different components of spending. This more careful look at the data helps us to evaluate the two competing theories of the Great Depression. We conclude by examining the implications for economic policy and considering what policies were actually conducted at the time of the Great Depression.

7.1 What Happened during the Great Depression?

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are the main facts about the Great Depression?

What is puzzling about the Great Depression?

What are the two leading strands of thought about the cause of the Great Depression?

We begin with some facts. ***Table 7.1 "Major Macroeconomic Variables, 1920–39*" shows **real gross domestic product (real GDP)**, the **unemployment rate**, the**price level**, and the **inflation rate** from 1920 to 1939 in the United States. Real GDP measures the overall production of the economy, the unemployment rate measures the fraction of the labor force unable to find a job, the price level measures the overall cost of GDP, and the inflation rate is the growth rate of the price level.

Table 7.1 Major Macroeconomic Variables, 1920–39*

Year	Real GDP	Unemployment	Price Level	Inflation Rate
1920	606.6	5.2	11.6	
1921	585.7	11.7	10.4	-10.3
1922	625.9	6.7	9.8	-5.8
1923	713.0	2.4	9.9	1.0
1924	732.8	5.0	9.9	0.0
1925	748.6	3.2	10.2	3.0
1926	793.9	1.8	10.3	1.0
1927	798.4	3.3	10.4	1.0
1928	812.6	4.2	9.9	-4.8
1929	865.2	3.2	9.9	0.0
1930	790.7	8.9	9.7	-2.0
1931	739.9	16.3	8.8	-9.3
1932	643.7	24.1	8.0	-9.1
1933	635.5	25.2	7.5	-6.3
1934	704.2	22.0	7.8	4.0
1935	766.9	20.3	8.0	2.6
1936	866.6	17.0	8.1	1.3
1937	911.1	14.3	8.4	3.7

1938	879.7	19.1	8.2	−2.4
1939	950.7	17.2	8.1	−1.2
***GDP is in billions of year 2000 dollars (Bureau of Economic Analysis [BEA]). The unemployment rate is from the US Census Bureau, *The Statistical History of the United States: From Colonial Times to the Present* (New York: Basic Books, 1976; see also** http://www.census.gov/prod/www/abs/statab.html**). The base year for the price index is 2000 (that is, the index equals 100 in that year) and comes from the Bureau of Labor Statistics (BLS;** http://www.bls.gov**), 2004.**				

Looking at these data, we see first that the 1920s were a period of sustained growth, sometimes known as the "roaring twenties." Real GDP increased each year between 1921 and 1929, with an average growth rate of 4.9 percent per year). Meanwhile the unemployment rate decreased from 6.7 percent in 1922 to 1.8 percent in 1926. Real GDP reached a peak of $865 billion in 1929. This number is expressed in year 2000 dollars, so we can compare that number easily with current economic data. In particular, if we divide by the population at that time, we find that GDP per person was the equivalent of about $7,000, in year 2000 terms. Real GDP per person has increased about fivefold since that time.

Toolkit: Section 16.11 "Growth Rates" You can review growth rates in the toolkit.

The Great Depression began in late 1929 as a recession not unlike those experienced previously—a decrease in GDP from one year to the next was common—but it rapidly blossomed into a four-year reduction in economic activity. By 1933, real GDP had fallen by over 25 percent and was only $636 billion. At the same time, unemployment increased from around 3 percent to 25 percent. In 1929, jobs were easy to come by. By 1933, they were almost impossible to find. More than a quarter of the people wishing to work were unable to find a job. Countless others, no doubt, had given up even looking for a job and were out of the labor force.

The experience of the 1920s and 1930s tells us that when real GDP increases, unemployment tends to decline and vice versa. We say that unemployment is **countercyclical**, meaning that it typically moves in the direction opposite to the movement of real GDP. An economic variable is **procyclical**if it typically moves in the same direction as real GDP, increasing when GDP increases and decreasing when GDP decreases. The countercyclical behavior of unemployment is not something that is peculiar to the Great Depression; it is a relatively robust fact about most economies. It is also quite intuitive: if fewer people are employed, less labor goes into the production function, so we expect output to be lower.

An event occurred in September 1929 that, at least with hindsight, marks a turning point. The stock market, as measured by the Dow Jones Industrial Average, had been increasing until that time but then decreased by 48 percent in less than 2.5 months. The value of the stock market is a measure of the value, in the minds of investors, of all the firms in the economy. Investors suddenly decided that the US economy was worth only half what they had believed three months earlier. It is unlikely that two such dramatic economic events occurred at almost the same time and yet are unconnected. We should not make the claim that the stock market crash *caused* the Great Depression. But the stock market decrease was *correlated* with declining output in the early days of the Great Depression. **Correlation** is distinct from causation. It is possible, for example, that the stock market crash and the Great Depression were both caused by some other event.

Toolkit: Section 16.13 "Correlation and Causality"

Correlation is a statistical measure of how closely two variables are related. If the two variables tend to increase together, we say that they are "positively correlated"; if one increases when the other decreases, then they are "negatively correlated." If the relationship between the two variables is an exact straight line, we say that they are "perfectly correlated." The fact that two variables are correlated does not necessarily mean that changes in one variable *cause* changes in the other. The toolkit contains more information.

Table 7.1 "Major Macroeconomic Variables, 1920–39*" also contains information on the price level and the inflation rate. The most striking fact from this table is that the price level declined over this period—on average, goods were considerably cheaper in dollar terms in 1940 than they were in 1920. We see this both from the decrease in the price level and from the fact that the inflation rate was *negative* in several years (remember that the inflation rate is the growth rate of the price level). If we look at the more recent history of the United States and at most other countries, we rarely observe negative inflation. Decreasing prices are an unusual phenomenon.

Other countries had similar experiences during this time period. Figure 7.3 "The Great Depression in Other Countries" shows that France, Germany, and Britain all experienced very poor economic performance in the early 1930s. Output was lower in each country in 1933 compared to four years earlier, and each country also saw a decline in the price level. Many other countries around the world had similar experiences. The Great Depression was a worldwide event.

Figure 7.3 The Great Depression in Other Countries

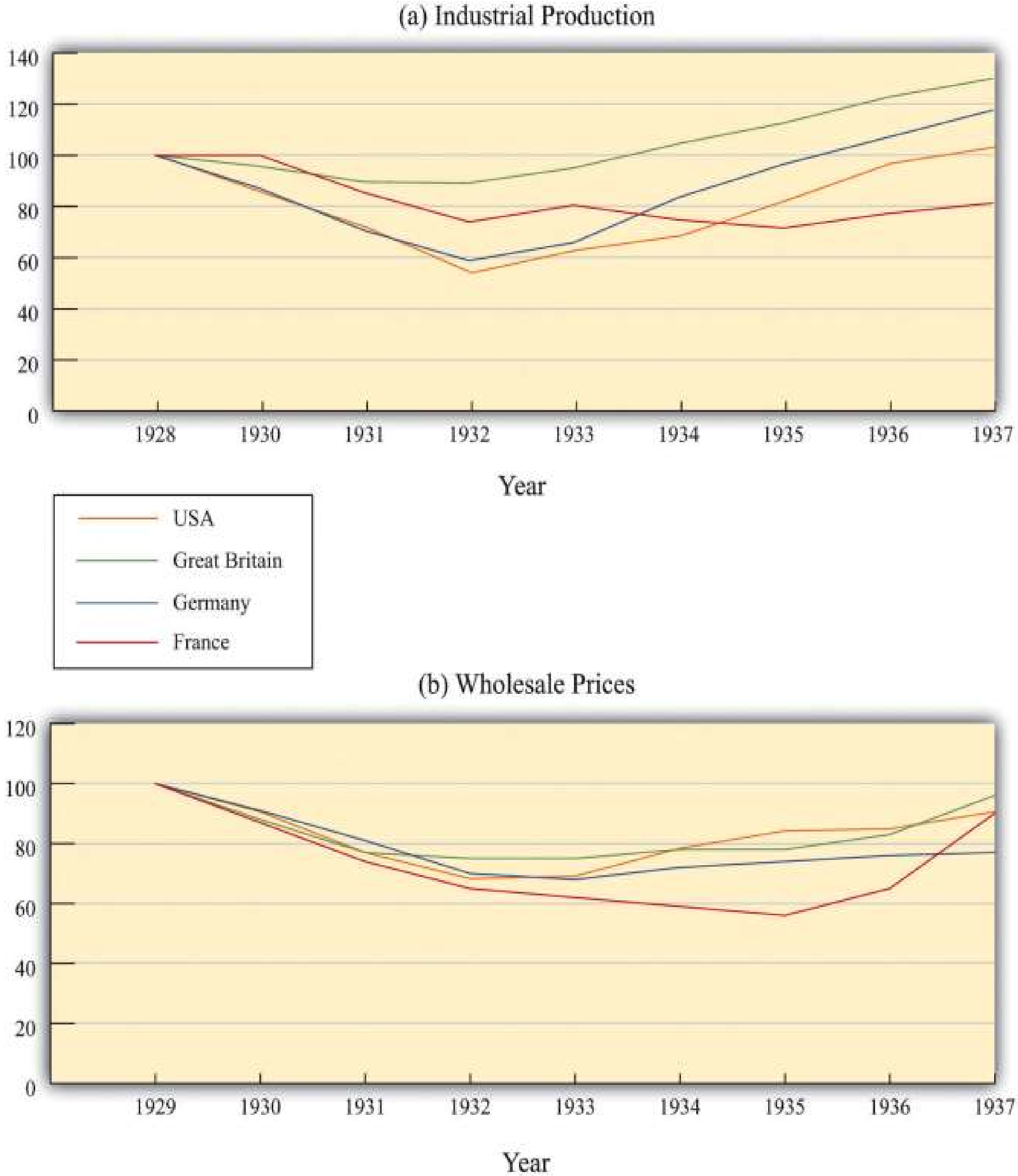

Fig. 7.3: France, Germany, and Britain also experienced declines in output (a) and prices (b) during the Great Depression. The output data are data for industrial production (manufacturing in the case of the United States), and the price data are wholesale prices. Source: International Monetary Fund, "World Economic Outlook: Crisis and Recovery," April 2009, Box 3.1.1,http://www.imf.org/external/pubs/ft/weo/2009/01/c3/Box3_1_1.pdf.

Why this was the case remains one of the puzzles of the period. There were events at the time that had international dimensions, such as concerns about the future of the "gold standard" (which determined the **exchange rates** between countries) and various policies that disrupted international trade. Still, economists are unconvinced that such factors can explain why the Great Depression occurred in so many countries. Three-fourths of a century later, we still do not have a complete understanding of the Great Depression and are still unsure exactly why it happened. From one perspective this is frustrating, but from another it is exciting: the Great Depression maintains an air of mystery.

Toolkit: Section 16.10 "Foreign Exchange Market"

You can review the meaning and definition of the exchange rate in the toolkit.

7.1.1 The Puzzle of the Great Depression

Try to imagine yourself in the United States or Europe in the early 1930s. You are witnessing immense human misery amid a near meltdown of the economy. Friends and family are losing their jobs and have bleak prospects for new employment. Stores that you had shopped in all your life suddenly go out of business. The bank holding your money has disappeared, taking your savings with it. The government provides no insurance for unemployment, and there is no system of social security to provide support for your elderly relatives.

Economists and government officials at that time were bewildered. The experience in the United States and other countries was difficult to understand. According to the economic theories of the day, it simply was not possible. Policymakers had no idea how to bring about economic recovery. Yet, as you might imagine, there was considerable pressure for the government to do something about the problem. The questions that vexed the policymakers of the day—questions such as "What is happening?" and "What can the government do to help?"—are at the heart of this chapter.

Economists make sense of events like the Great Depression by first accumulating facts and then using frameworks to interpret those facts. We have a considerable advantage relative to economists and politicians at the time. We have the benefit of hindsight: the data we looked at in the previous subsection were not known to the economists of that era. And economic theory has evolved over the last seven decades, giving us better frameworks for analyzing these data.

Earlier, we said there are two possible reasons why output decreased.

1. There was a decrease in production due to a decrease in the available inputs into the **aggregate production function**. Since there was no massive decrease in the amount of **physical capital** or the size of the workforce, and people presumably did not suddenly lose all their **human capital**, this means that the culprit must have been a decrease in **technology**.
2. There was a decrease in aggregate spending. Households chose to reduce their consumption, firms chose to reduce their investment, and governments chose to reduce their spending. As a consequence, firms scaled back their production.

We look at each of these candidate explanations in turn.

Toolkit: Section 16.15 "The Aggregate Production Function" You can review the aggregate production function and the inputs that go into it in the toolkit.

KEY TAKEAWAYS

- During the Great Depression in the United States from 1929 to 1933, real GDP decreased by over 25 percent, the unemployment rate reached 25 percent, and prices decreased by over 9 percent in both 1931 and 1932 and by nearly 25 percent over the entire period.
- The Great Depression remains a puzzle today. Both the source of this large economic downturn and why it lasted for so long remain active areas of research and debate within economics.
- One explanation of the Great Depression rests on a reduction in the ability of the economy to produce goods and services. The second leading explanation focuses on a reduction in the overall demand for goods and services in the economy.

***

Checking Your Understanding

The notes in ***Table 7.1 "Major Macroeconomic Variables, 1920–39*" state that the base year for the price level is 2000, so the price index has a value of 100 in that year. Approximately how much would you expect to have paid in the year 2000 for something that cost $2 in the late 1920s?

Using ***Table 7.1 "Major Macroeconomic Variables, 1920–39*", how can you see that the unemployment rate is countercyclical?

7.2 The Great Depression: A Decrease in Potential Output?

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is potential output?

How could a decrease in potential output create the Great Depression?

How does the theory that the Great Depression was caused by a decrease in potential output match the facts?

Our first approach to interpreting the Great Depression focuses on **potential output**, which is the amount of real gross domestic product (real GDP) an economy produces when the labor market is in equilibrium and capital goods are not lying idle. We start here because this approach corresponds reasonably closely to the economic wisdom of the time.

A Decrease in Technology: The Multiple-Markets Perspective

Comparative statics is a technique that allows us to understand the effects of a decrease in technology in a particular market, such as the market for new homes. In a comparative statics exercise, we look at what happens to **endogenous variables** (in this case, production and prices of new homes) when we change an **exogenous variable** (in this case, technology). A decline in technology shifts the market supply curve leftward: at any given price, the decrease in technology means that the firm can produce less output with its available inputs. The result is shown in part (a) of ***Figure 7.4 "An Inward Shift in the Market Supply of Houses" for the housing market: output of new homes decreases and the price of new homes increases.

Toolkit: Section 16.8 "Comparative Statics"

You can review the technique of comparative statics and the definition of endogenous and exogenous variables in the toolkit.

(a) A decrease in technology leads to an inward shift of the market supply curve for houses. (b) The labor and other resources that are not being used to produce houses can now be used to produce other goods, such as cars.

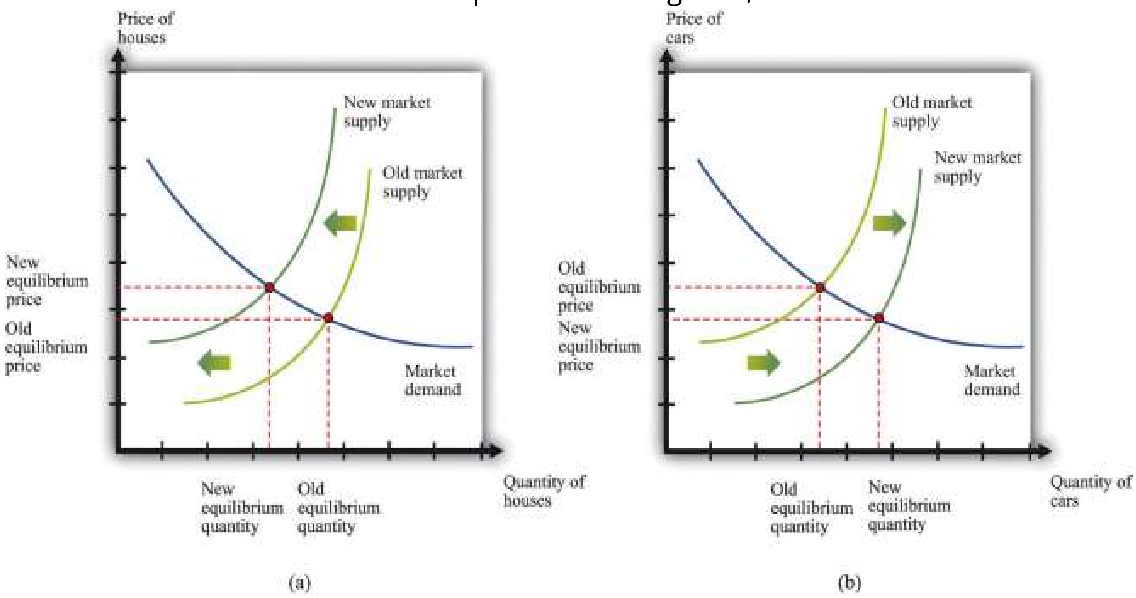

Fig. 7.4: Figure 7.4 An Inward Shift in the Market Supply of Houses

If this decline in technology in the housing market were the only change in the economy, what would happen? Construction firms would fire workers because these firms were building fewer new homes. Over time, however, the fired construction workers would find new jobs in other sectors of the economy. The same logic applies to other inputs: capital and other inputs that were being used in the construction industry would be redeployed to other markets. For example, there would be additional labor and other inputs available for automobile production. Part (b) of ***Figure 7.4 "An Inward Shift in the Market Supply of Houses" shows the resulting outward shift in the supply curve for cars. It is difficult to explain the big decrease in output and the high rate of unemployment in the Great Depression through a change in technology in a single market.

Suppose, however, that this change in technology does not happen in just one market but occurs across the entire economy. Then a version of part (a) in ***Figure 7.4 "An Inward Shift in the Market Supply of Houses" would hold for each market in the economy. We would see declines in economic activity across a wide range of markets. Moreover, with declines in so many industries, we would expect to see lower real wages and less employment. The idea that workers could easily move from one industry to another is not as persuasive if the entire economy is hit by an adverse technology shock.

7.2.1 Using Growth Accounting to Understand the Great Depression

We use **growth accounting** to show how changes in output are driven by changes in the underlying inputs—capital, labor, and technology. Equivalently, we use the technique to give us a measure of the growth rate of technology, given data on the growth rates of output, capital, and labor:

technology growth rate = output growth rate − [*a* × capital stock growth rate]− [(1 − *a*) × labor growth rate].

We have omitted human capital from this growth accounting equation. We do so because, unfortunately, we do not have very good human capital measures for the period of the Great Depression. Human capital typically changes very slowly, so this is not too much of a problem: over a period of a decade, we do not expect big changes in human capital. Any changes in human capital that do occur are included in the catchall “technology” term.

Toolkit: Section 16.17 "Growth Accounting"

You can review the technique of growth accounting in the toolkit.

The key ingredient needed for the growth accounting equation is the number *a*. It turns out that a good measure of *a* is the fraction of real GDP that is paid to owners of capital. Roughly speaking, it is the amount of GDP that goes to the profits of firms. Equivalently, (1 − *a*) is the fraction of GDP that is paid to labor. The circular flow of income reminds us that all income ultimately finds its way back to households in the economy, which is why these two numbers sum to one.

7.2.2 Can Technology Changes Explain the Roaring Twenties?

The economist John Kendrick applied such growth accounting to data from the Great Depression. [***See John W. Kendrick, Productivity Trends in the United States (Princeton, NJ: Princeton University Press, 1961), particularly Table A-XXII, p. 335, and the discussion of these calculations.***] ***Table 7.2 "Growth Rates of Real GDP, Labor, Capital, and Technology, 1920– 39*" summarizes his findings. Each row in ***Table 7.2 "Growth Rates of Real GDP, Labor, Capital, and Technology, 1920–39*" decomposes output growth into three components. In 1923, for example, output grew at a very high rate of 14.2 percent. This growth in output came from labor growth of 9.9 percent and capital stock growth of 2.0 percent. The remainder, which we interpret as growth in technology, grew at 9.5 percent. By all accounts, 1923 was a good year. The other entries in the table can be read in the same way.

Table 7.2 Growth Rates of Real GDP, Labor, Capital, and Technology, 1920–39*

Year	Real GDP	Unemployment	Price Level	Inflation Rate
1920	0.4	1.4	2.1	−1.2
1921	−3.6	−11.5	1.5	4.0
1922	6.4	8.7	0.7	0.1
1923	14.2	9.9	2.0	9.5
1924	2.0	−3.2	2.6	4.9
1925	3.6	4.0	2.4	0.1
1926	6.2	4.2	3.2	3.4
1927	1.1	−0.2	2.9	0.5
1928	1.0	0.6	2.4	−0.3
1929	6.5	2.2	2.4	5.7
1930	−9.2	−8.1	2.0	−4.8
1931	−7.5	−10.5	0.1	0.4
1932	−14.5	−13.5	−2.2	−5.2
1933	−2.5	−1.0	−3.4	−1.2
1934	9.9	0.4	−2.8	13.7
1935	9.0	5.8	−1.4	6.6
1936	12.8	10.3	0.0	6.8
1937	6.9	5.8	1.4	2.9

1938	−5.5	−9.3	0.9	1.2
1939	9.1	6.2	−0.3	4.6
***All entries are annual growth rates calculated using data from John W. Kendrick,*Productivity Trends in the United States* (Princeton, NJ: Princeton University Press, 1961), Table A-XXII, 335. Following the discussion in Kendrick, the capital share (a) was 0.30 until 1928 and 0.25 thereafter.**				

Real GDP and technology were both growing in most years in the 1920s. In the early 1930s both variables decreased, and both grew again as the economy recovered from the Great Depression. In other words, technology growth and output growth are positively correlated over this period. This suggests the possibility that changes in technology *caused* the changes in output—always remembering that, as we observed earlier, correlation need not imply a causal relationship. An improvement in technology causes firms to want to produce more. They demand more workers, so employment and real wages increase. The increased output, through the circular flow, means that there is increased income. Households increase both consumption and savings. Higher savings means higher investment, so, over time, the economy accumulates more capital. Exactly the opposite holds if there is a decrease in technology: in this case, employment, consumption, and investment all decrease.

Does this theory fit the facts? For the roaring twenties, we see growth in output, labor, and capital. In addition, there was a positive technology growth rate in almost all the years of the decade. These movements are indeed consistent with the behavior of an economy driven by improvements in technology. Jumping back for a moment to individual markets, improvements in technology shift supply curves rightward. Increased output is therefore accompanied by decreased prices. The aggregate price level is nothing more than a weighted average of individual prices, so price decreases in individual markets translate into a decrease in the overall price level. From ***Table 7.1 "Major Macroeconomic Variables, 1920–39*", the price level actually moved very little between 1922 and 1929, so this fits less well.

Overall, the view that technological progress fueled the growth from 1922 to 1929 seems broadly consistent with the facts. Given the simplicity of the framework that we are using, "broadly consistent" is probably the best it is reasonable to hope for.

7.2.3 Can Technology Changes Explain the Great Depression?

Now let us apply the same logic to the period of the Great Depression. Negative growth in output from 1930 to 1933 was matched by negative growth in labor and technology (except for 1931). The capital stock decreased from 1932 to 1935, reflecting meager investment during this period. When the economy turned around in 1934, technology growth turned up as well.

Imagine that the economy experienced negative technology growth from 1929 to 1933. The reduced productivity of firms leads to a decrease in demand for labor, so real wages and employment decrease. Lower productivity also means that firms did not think it was worthwhile to invest in building new factories and buying new machinery. Both labor and capital inputs into the production function declined. Once technology growth resumed in 1934, the story was reversed: labor and capital inputs increased, and the economy began to grow again. In this view, there was a substantial decline in the production capabilities of the economy, leading to negative growth in output, consumption, and investment. The Great Depression, in this account, was driven by technological regress.

Many economists are skeptical of such an explanation of the Great Depression. They have three criticisms. First, large-scale technological regress is difficult to believe on its face. Did people know an efficient way to manufacture something in 1929 but then forget it in 1930? Even remembering that technology includes social infrastructure, it is hard to imagine any event that would cause a decrease of 3 percent or more in technology—and if such an event did occur, surely we would be able to point to it and identify it. Second, this explanation claims that labor input decreased because households saw lower real wages and voluntarily chose to consume leisure rather than work. By most measures, though, real wages *increased*. Moreover, it is difficult to equate a 25 percent unemployment rate, not to mention all the stories of how people could not find work, with a labor market in which households are simply moving along a labor supply curve.

Third, a prominent feature of the Great Depression is the decrease in the price level that occurred from 1929 to 1933. ***Table 7.1 "Major Macroeconomic Variables, 1920–39*" tells us that prices decreased by over 9 percent in both 1931 and 1932. However, a reduction in the level of potential GDP would cause an inward shift of market supply curves and thus an *increase*, rather than a decrease, in prices. For most economists, the view of the Great Depression as a shift in technology is not convincing. Something else must have been going on. In particular, the very high unemployment rate strongly suggests that labor markets were malfunctioning. Thus, rather than viewing the large decreases in output in economies around the world as part of the normal functioning of supply and demand in an economy, we should perhaps consider it as evidence that sometimes things can go badly wrong with the economy’s self-correction mechanisms. If we want to explain the Great Depression, we are then obliged—as were the economists at the time—to find a new way of thinking about the economy. It was an economist named John Maynard Keynes who provided such a new approach; in so doing, he gave his name to an entire branch of macroeconomic theory.

KEY TAKEAWAY

Potential output is the amount of real GDP an economy could produce if the labor market is in equilibrium and capital goods are fully utilized. •

A large enough decrease in potential output, say through technological regress, could cause the large decrease in real GDP that occurred during the Great Depression.

A reduction in potential output would lead to a decrease in real wages and an increase in the price level. Those implications are inconsistent with the facts of the Great Depression years. Further, it is hard to understand how potential output could decrease by the extent needed to match the decrease in real GDP during the Great Depression. Finally, a 25 percent unemployment rate is not consistent with labor market equilibrium.

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Checking Your Understanding

Draw the comparative statics picture for the labor market for the situation in which the Great Depression is a consequence of technological regress—that is, negative technology growth. Which curve shifts? Does it shift leftward or rightward?

Suppose the supply curve in a market shifts rightward. What must happen to the demand curve if the price in the market does not change?

7.3 The Components of GDP during the Great Depression

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are the main components of aggregate spending?

What is the national income identity?

What happened to consumption and investment spending during the Great Depression?

What is consumption smoothing?

In his analysis of the Great Depression, John Maynard Keynes contrasted his new approach with the prevailing “classical” theory: [***John Maynard Keynes, The General

Theory of Employment, Interest and Money (Orlando: First Harvest/Harcourt, 1964[1936]), 3.***] “I shall argue that the postulates of the classical theory are applicable to a special case only and not to the general case….Moreover, the characteristics of the special case assumed by the classical theory happen not to be those of the economic society in which we actually live, with the result that its teaching is misleading and disastrous if we attempt to apply it to the facts of experience.” Keynes claimed that there was a fundamental failure in the economic system that prevented markets from fully coordinating activities in the economy. He argued that, as a consequence, the actual output of the economy was not determined by the productive capacity of the economy, and that it was “misleading and disastrous” to think otherwise. In more modern terms, he said that actual output need not always equal potential output but was instead determined by the overall level of spending or demand in the economy.

Keynes provided a competing story of the Great Depression that did not rely on technological regress and in which unemployment truly reflected an inability of households to find work. Keynes gave life to **aggregate spending—**the total spending by households, firms, and governments—as a determinant of aggregate gross domestic product (GDP). With this new perspective, Keynes also uncovered a way in which government intervention might help the functioning of the economy.

To understand how Keynes approached the puzzle of the Great Depression, we must first look more closely at the components of GDP. ***Figure 7.5 "The Firm Sector in the Circular Flow" shows the circular flow, emphasizing the flows in and out of the firm sector of the economy. Accounting rules tell us that in every sector of the circular flow, the flow of dollars in must equal the flow of dollars out. We know that the total flow of dollars from the firm sector measures the total value of production in the economy. The total flow of dollars into the firm sector equals total expenditures on GDP. The figure therefore illustrates a fundamental relationship in the national accounts.

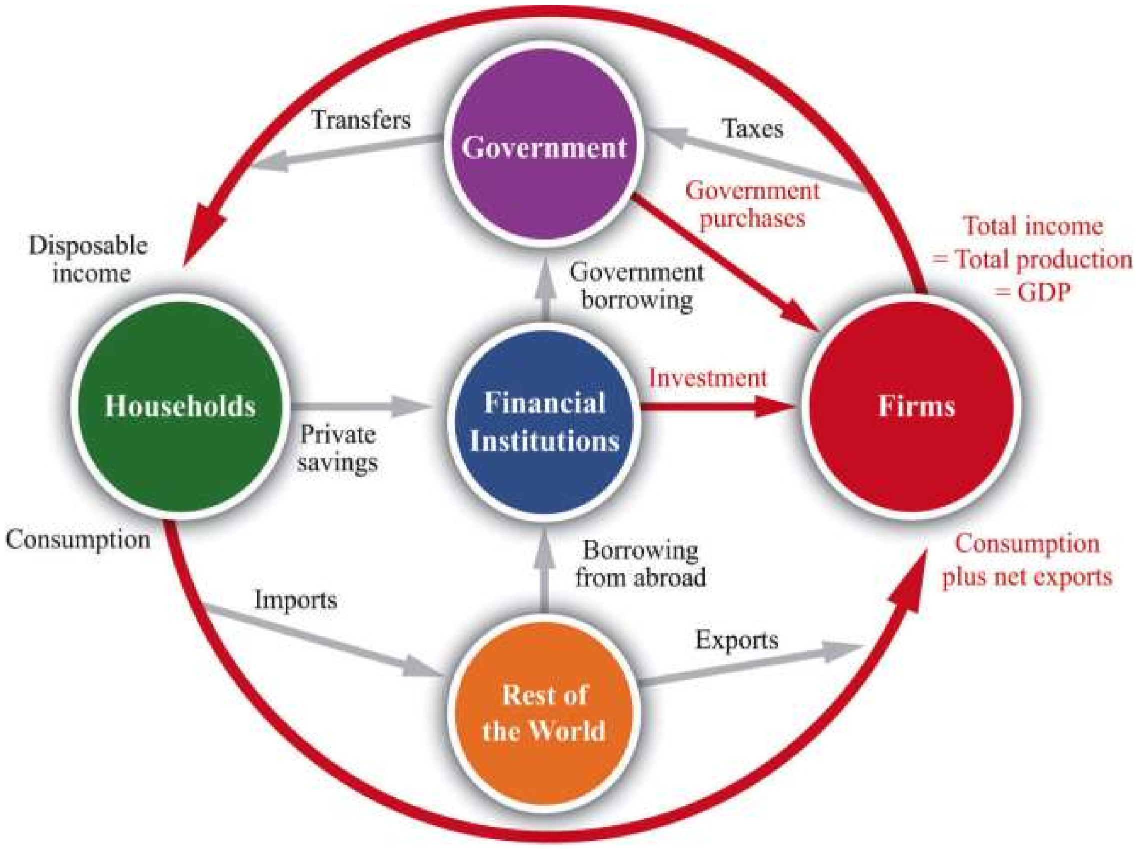

Fig. 7.5: Figure 7.5 The Firm Sector in the Circular Flow The flow of dollars into the firm sector equals consumption plus net exports plus investment plus government purchases. The flow of dollars from the firm sector equals total GDP in the economy.

7.3.1 The National Income Identity

The national income identity states that

```
production = consumption + investment + government purchases + net
exports.
```

Toolkit: Section 16.16 "The Circular Flow of Income" The toolkit describes the circular flow of income in more detail.

Consumption refers to total consumption spending by households on final goods and services. Consumption is divided into three categories.

1. **Services**. These are items such as haircuts, restaurant meals, hotel nights, legal services, and movies. There is often no tangible product; the consumer purchases the time and skills of individuals (such as barbers, chefs, and lawyers). Production and consumption of services usually occur together.
2. **Nondurable goods**. Examples include groceries, clothing, and DVDs—tangible products that (usually) have a fairly limited lifespan (typically less than three years).

3. **Durable goods**. These are items such as automobiles, “white goods” (washing machines, refrigerators, and other appliances), and computers. They are tangible products that usually have a lifespan of several years.

The distinctions among these categories are not always as clear-cut as the definitions suggest. A good pair of blue jeans might outlast a shoddy dishwasher, even though the jeans are classified as a nondurable good and the dishwasher as a durable good. **Investment** is the purchase of new goods that increase the capital stock, allowing us to produce more output in the future. Investment is divided into three categories.

1. **Business fixed investment**. Purchases of physical capital (plants, machines) for the production of goods and services
2. **New residential construction**. The building of new homes
3. **Inventory investment**. Change in inventories of final goods

The economist’s definition of investment is precise and differs from the way we often use the word in everyday speech. Specifically, economists do *not* use the term to mean the purchase of financial assets, such as stocks and bonds. Most of the time when we talk about investment in this book, we are referring to business fixed investment—the production of new physical capital goods. Inventory investment is a special category of investment that we explain in Section 7.3.2 "Inventory Investment".

As a rough rule of thumb, consumption spending is carried out by households, and investment spending is carried out by firms. But there is one important exception: new residential construction is included in investment. A new house purchased by a household is treated as investment, not consumption.

Government purchases include all purchases of goods and services by the government. We include in our definition of “government” local as well as national government activity. In the United States, this means that we collapse together federal, state, and local governments for the purpose of our analysis.

This component of spending refers only to *purchases* of goods and services, not to **transfers**. So, if the federal government buys aircraft from Boeing or the local police department buys a fleet of Volvos, these are included in government purchases. However, a transfer you receive from the government—say, because you are unemployed and are being paid unemployment insurance—is not counted in GDP. (Of course, if you then use this income to purchase goods and services, that consumption is part of GDP.)

Net exports simply equal exports minus imports. They are included because we must correct for the expenditure flows associated with the rest of the world. Some spending in the economy goes to imported goods, which is not associated with domestic production. We must subtract these imports from total expenditures. Against that, some demand for domestically produced goods comes from other countries. We add these exports to total expenditure.

7.3.2 Inventory Investment

Inventory investment is a relatively minor component of GDP, but we need to understand it in some detail because it plays a key role in the Keynesian approach. When a firm produces output, it does one of two things with it: it either sells it or adds it to inventory. Thus an accounting relationship within a firm is that

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production = sales + changes in inventory.
```

If a firm produces more than it sells, its stocks of inventories increase. If a firm sells more than it produces, its stocks of inventories decrease. The inventories that a firm holds are counted as part of its capital stock, so any change in firms' inventories is counted as a component of investment.

Suppose General Motors (GM) produces 10 million cars, anticipating that it will sell them all. Then imagine that demand is lower than expected, so it only sells 9.9 million. The result is that 100,000 cars pile up on GM's lots, and the GM accountants record this as an addition to inventory. We want GDP to measure both production and spending, but we have 100,000 cars that have been produced but not purchased. The national income accounts get around this problem by effectively pretending that GM bought the cars from itself.

If the cars are then sold in the following year, they will not contribute to GDP in that year— quite properly, since they were not produced that year. The national accounts in the next year will show that 100,000 cars were sold to households, but they will also show that inventories decreased by 100,000 cars. Thus the accounts record expenditures on these cars as part of durable goods consumption, but the accounts also contain an offsetting reduction in inventory investment.

In some cases, firms change their stocks of inventory as a part of their business strategy. More often, changes in inventories occur because a firm did not correctly forecast its sales. **Unplanned inventory investment** is an increase in inventories that comes about because a firm sells less than it anticipated. Because GM *expected* to sell all 10 million cars but sold only 9.9 million, GM had 100,000 cars of unplanned inventory investment.

Moreover, GM is likely to react swiftly to this imbalance between its production plans and its sales. When it sees its sales decrease and its inventory increase, it will respond by cutting its production back until it is in line with sales again. Thus, when an individual firm sees inventories increase and sales decrease, it typically scales down production to match the decrease in demand. Now let us think about how this works at the level of an economy as a whole. Suppose we divide total spending in the economy into unplanned inventory investment and everything else, which we call **planned spending**.

Toolkit: Section 16.19 "The Aggregate Expenditure Model"

Planned spending is all expenditure in the economy except for unplanned inventory investment:

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GDP = planned spending + unplanned inventory investment.
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This equation must always hold true because of the rules of national income accounting.

Begin with the situation where there is no unplanned inventory investment—so GDP equals planned spending—and then suppose that planned spending decreases. Firms find that their production is in excess of their sales, so their inventory builds up. As we just argued, they respond by decreasing production so that GDP is again equal to planned spending, and unplanned inventory investment is once again zero. Thus, even though unplanned inventory investment *can* be nonzero for very short periods of time, we do not expect such a situation to persist. We expect instead that actual output will, in fact, almost always equal planned spending.

7.3.3 What Happened to the Components of GDP during the Great Depression?

Now let us look at how these components of GDP behaved during the 1930s. Table 7.3 "Growth Rates of Key Macroeconomic Variables, 1930–39*" presents these data in the form of growth rates. Remember that a positive growth rate means the variable in question increased from one year to the next, while a negative growth rate means it decreased.

Table 7.3 Growth Rates of Key Macroeconomic Variables, 1930–39*

Growth Rates	1930	1931	1932	1933	1934	1935	1936	19
Real GDP	−8.6	−6.4	−13.0	−1.3	10.8	8.9	13.0	5.
Consumption	−5.3	−3.1	−8.9	−2.2	7.1	6.1	10.1	3.
Investment	−33.3	−37.2	−69.8	47.5	80.5	85.1	28.2	2
Government Purchases	10.2	4.2	−3.3	−3.5	12.8	2.7	16.7	−

***This table shows growth rates in real GDP, consumption, investment, and government pur from the National Income and Product Accounts web page, Bureau of Economic Analysis, De Commerce (**http://www.bea.gov/national/nipaweb/index.asp**).**

We see again that real GDP decreased for four years in succession (the growth rates are negative from 1930 to 1933). The decrease in real GDP was accompanied by a decline in consumption and investment: consumption likewise decreased for four successive years, and investment decreased for three successive years. The decline in consumption was not as steep as the decline in real GDP, while the decline in investment was much larger. Were we to drill deeper and look at the components of consumption, we would discover that expenditures on durable goods decreased by 17.6 percent in 1930 and 25.1 percent in 1932, while expenditures on services decreased by only 2.5 percent in 1930 and 6.3 percent in 1932.

Whatever was happening during this period evidently had a much larger influence on firms' purchases of investment goods, and on households' spending on cars and other durable goods, than it did on purchases of nondurable goods (such as food) and services (such as haircuts). A similar pattern can be observed in modern economies: consumption is smoother than output, and spending on services is smoother than spending on durables. The reason for this is a phenomenon that economists call **consumption smoothing**.

Toolkit: Section 16.23 "The Life-Cycle Model of Consumption"

Consumption smoothing is the idea that households like to keep their flow of consumption relatively steady over time. When income is unusually high, the household saves (or pays off existing loans); when income is unusually low, the household borrows (or draws down existing savings). Consumption smoothing is a key ingredient of the life-cycle model of consumption, which is discussed in more detail in the toolkit.

If your company has a good year and you get a big bonus, you will increase consumption spending not only this year but also in future years. To do so, you must *save* a portion of your bonus to pay for this higher consumption in the future. By the same logic, if your income decreases, your consumption will not decrease as much. People who became unemployed during the Great Depression did not reduce their consumption of services and nondurable goods to zero. Instead, as far as was possible, they drew on their existing savings, borrowed, and postponed purchases of durable goods.

Consumption of durable goods, in other words, resembles investment rather than consumption of nondurable goods and services. This makes sense because durable goods resemble investment goods that are purchased by households. Like investment goods, they yield benefits over some prolonged period of time. As an example, consider automobile purchases during the Great Depression. Although 5.4 million cars were produced in 1929, only 3.4 million were produced in 1930—a reduction of more than 37 percent in a single year. Instead of buying new cars, households simply held onto their existing cars longer. As a consequence of the boom of the 1920s, there were a lot of relatively new cars on the road in 1929: the number of cars less than 3 years old was about 9.5 million. Two years later, this number had fallen to 7.9 million. [*** These figures are from Michael Bernstein, The Great Depression: Delayed Recovery and Economic Change in America, 1929–39 (Cambridge, MA: Cambridge University Press, 1987).]

This reduction in activity in the automobile industry was matched by a reduction of inputs into the production process. By early 1933, there were only 4 workers for every 10 who had been employed 4 years previously. Equipment purchases for the transportation sector were so low that capital stock for this sector decreased between 1931 and 1935. In the turmoil of the Great Depression, many small car producers went out of business, leaving a few relatively large companies—such as Ford Motor Company and GM—still in business. Similar patterns arose as the economy recovered. Investment, in particular, was astonishingly volatile. It decreased by about one-third in 1930 and again in 1931, and by over two-thirds in 1932, but rebounded at an astoundingly high rate after 1933. Consumption, meanwhile, grew at a slower rate than GDP as the economy recovered.

KEY TAKEAWAY

The components of aggregate spending are consumption, investment, government purchases of goods and services, and net exports.

The national income identity states that real GDP is equal to the sum of the components of aggregate spending. •

During the Great Depression, both consumption spending and investment spending experienced negative growth. •

Households use savings to retain relatively smooth consumption despite fluctuations in their income.

***

Checking Your Understanding

Explain the difference between investment spending in the national income and product accounts and a decision to buy shares of a company.

If someone is unemployed and receives unemployment benefits from a state government, are those funds counted in aggregate expenditure?

7.4 The Great Depression: A Decrease in Aggregate Spending?

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How did the perspective of Keynes differ from the "classical theory" of the macroeconomy?

How does a decrease in aggregate spending lead to a reduction in real gross domestic product (real GDP)?

Can a decrease in consumption explain the Great Depression?

Can a decrease in investment explain the Great Depression?

Now that we understand the components of aggregate spending, we can consider whether a decrease in one or more of these components can explain the Great Depression.

7.4.1 A Decrease in Aggregate Spending: The Multiple-Markets Perspective

Consider, as before, the market for new houses and suppose there is a reduction in spending on houses. Market demand shifts inward, causing a decrease in the price of houses, as shown in ***Figure 7.6 "An Inward Shift in Market Demand for Houses". The lower price means that construction firms choose to build fewer houses; there is a movement along the supply curve.

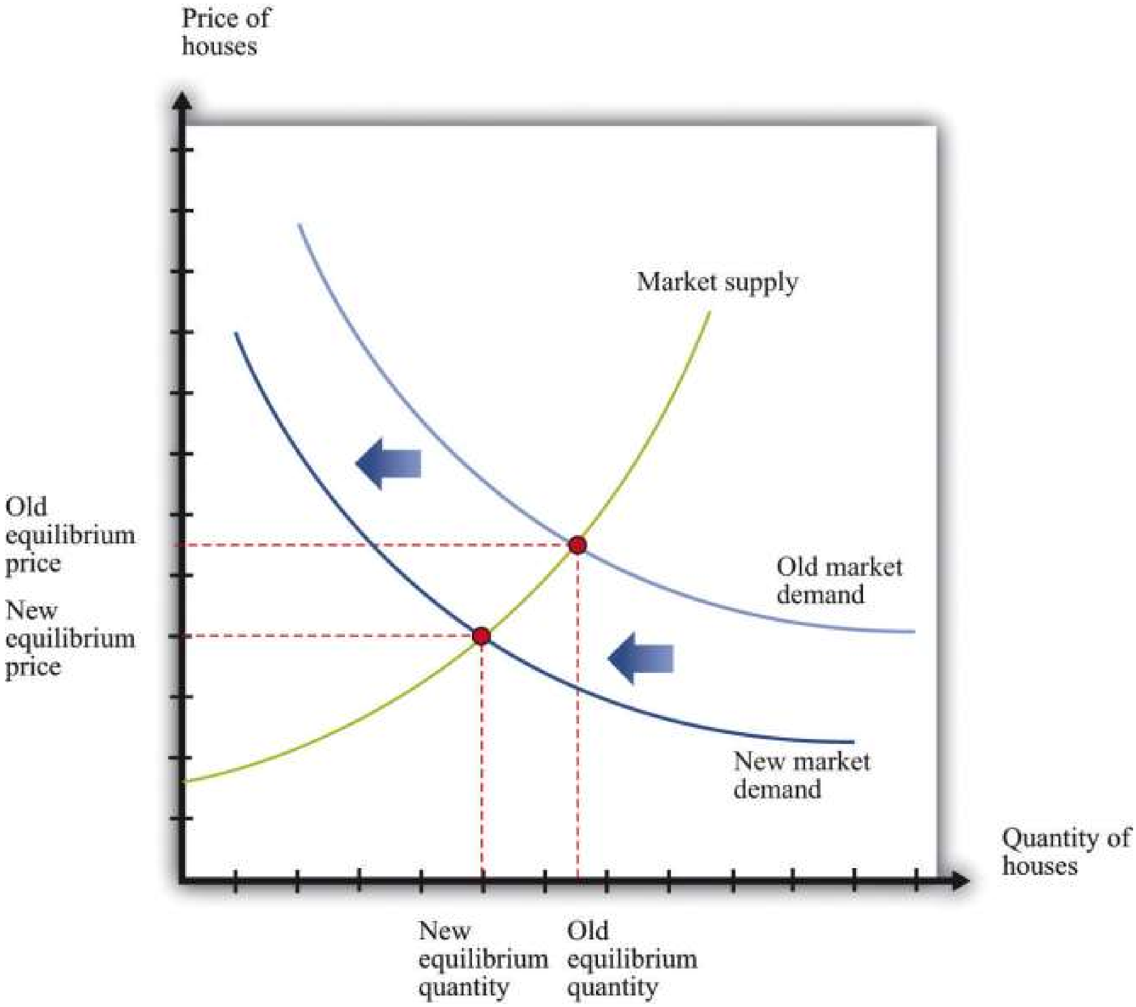

Fig. 7.6: Figure 7.6 An Inward Shift in Market Demand for Houses A decrease in demand for houses leads to a decrease in the price of houses and a lower quantity of houses being produced and sold.

As before, the effects are not confined to the housing market. Construction firms demand less labor, so the wages of these workers decrease. Employment in the construction industry declines, but these workers now seek jobs in other sectors of the economy. The increased supply of labor in these sectors reduces wages and thus makes it more attractive for firms to increase their hiring. Supply curves in other sectors shift rightward. Moreover, the income that was being spent on housing will instead be spent somewhere else in the economy, so we expect to see rightward shifts in demand curves in other sectors as well. In summary, if we are looking at the whole economy, a decrease in spending in one market is not that different from a decrease in technology in one market: we expect a reduction in one sector to lead to expansions in other sectors. The economy still appears to be self-stabilizing.

In this story, as is usual when we use supply and demand, we presumed that prices and wages adjust quickly to bring supply and demand into line. This is critical for the effective functioning of markets: for markets to do a good job of matching up demand and supply, wages and prices must respond rapidly to differences between supply and demand.**Flexible prices** adjust immediately to shifts in supply and demand curves so that price is always at the point where supply equals demand. If, for example, the quantity of labor supplied exceeds the quantity of labor demanded, flexible wages decrease quickly to bring the labor market back into equilibrium.

Suppose we instead entertain the possibility that wages and prices do not immediately adjust. **Sticky prices** do not react immediately to shifts in supply and demand curves, and the adjustment to equilibrium can take some time. We defer for the moment the discussion of *why* prices might be sticky and concentrate instead on the implications of this new idea about how markets work. The easiest way to see the effects of price stickiness is to suppose that prices do not change at all. ***Figure 7.7 "A Shift in Demand for Houses When Prices Are Sticky" shows the impact of a decrease in demand for houses when the price of houses is completely sticky. If you compare ***Figure 7.7 "A Shift in Demand for Houses When Prices Are Sticky" to ***Figure 7.6 "An Inward Shift in Market Demand for Houses", you see that a given shift in demand leads to a larger change in the quantity produced.

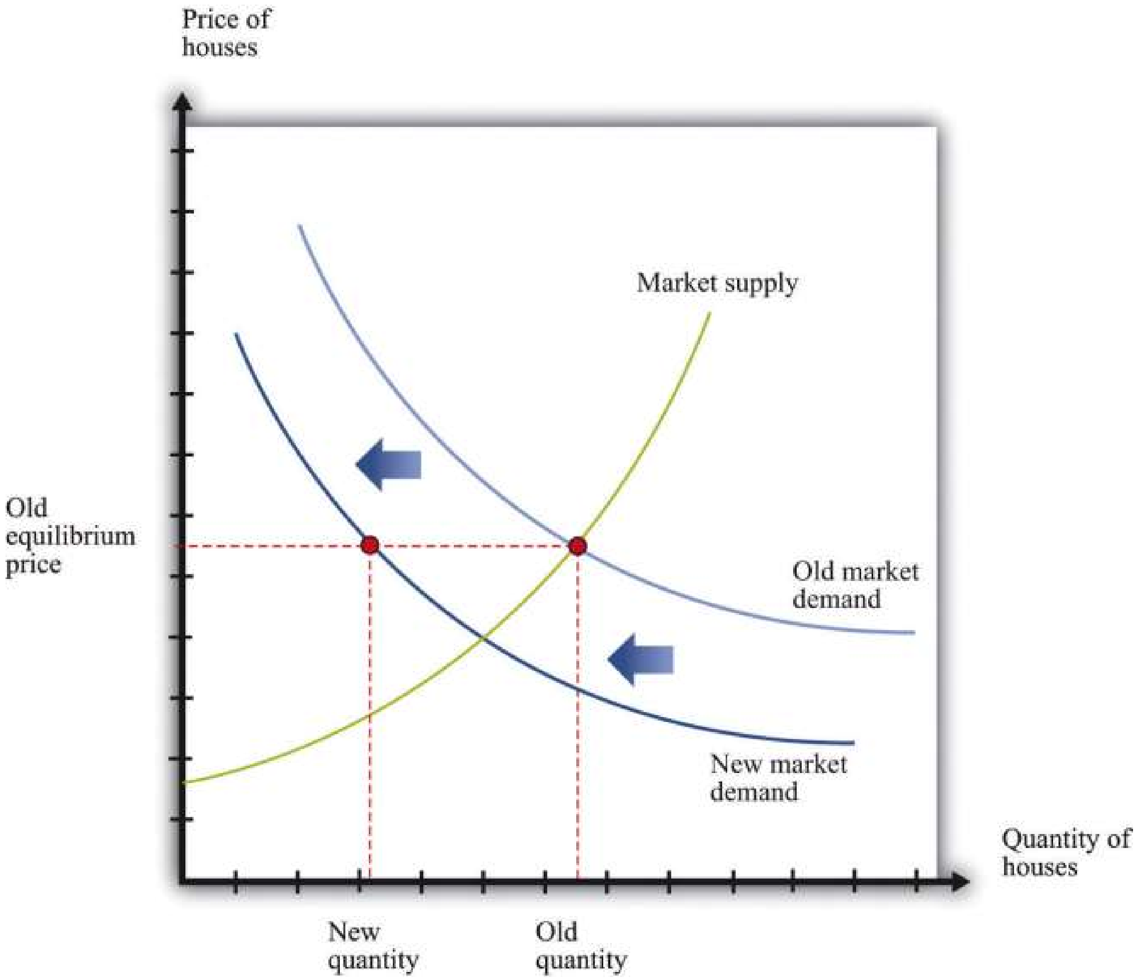

Fig. 7.7: Figure 7.7 A Shift in Demand for Houses When Prices Are Sticky If the price in the market is "sticky," it may not adjust immediately to the change in demand, resulting in a large decrease in the quantity of houses that are produced and sold.

What about the effects on other markets? As before, a decrease in demand for housing will cause construction workers to lose their jobs. If wages are sticky, these workers may become unemployed for a significant period of time. Their income decreases, and they consume fewer goods and services. So, for example, the demand for beef in the economy might decrease because unemployed construction workers buy cheaper meat. This means that the demand for beef shifts inward. The reduction in activity in the construction sector leads to a reduction in activity in the beef sector. And the process does not stop there—the reduced income of cattle farmers and slaughterhouse workers will, in turn, spill over to other sectors.

What has happened to the self-stabilizing economy described earlier? First, sticky wages and prices impede the incentives for workers to flow from one sector to another. If wages are sticky, then the reduction in labor demand in the construction sector does not translate into lower wages. Thus there is no incentive for other sectors to expand. Instead, these other sectors, such as food, see a decrease in demand for their product, which leads them to contract as well. Second, the decrease in income means that it is possible to see decreases in demand across the entire economy. It no longer need be the case that reductions in spending in one area lead to increased spending in other sectors.

7.4.2 The Circular Flow of Income during the Great Depression

So far, we have told this story in terms of individual markets. The circular flow helps us see how these markets come together in the aggregate economy. When we looked at the markets for housing and beef, we saw that a decrease in demand for housing led to a decrease in demand for labor and, hence, to lower labor income. We also saw that as income earned in the housing market decreased, spending decreased in the beef market. Such linkages are at the heart of the circular flow of income. Household spending on goods and services is made possible by a flow of income from firms. Firms' hiring of labor is made possible by a flow of revenue from households. Keynes argued that this was a delicate process that might be prone to malfunction in a variety of ways.

Households are willing to buy goods and services if they have a reasonable expectation that they can earn income by selling labor. During the Great Depression, however, household expectations were surely quite pessimistic. Individuals without jobs believed that their chances of finding new employment were low. Those lucky enough to be employed knew that they might soon be out of work. Thus households believed it was possible, even likely, that they would receive low levels of income in the future. In response, they cut back their spending.

Meanwhile, the willingness of firms to hire labor depends on their expectation that they can sell the goods they manufacture. When firms anticipate a low level of demand for their products, they do not want to produce much, so they do not need many workers. Current employees are laid off, and there are few new hires.

Through the circular flow, the pessimism of households and the pessimism of firms interact. Firms do not hire workers, so household income is low, and households are right not to spend much. Households do not spend, so demand for goods and services is low, and firms are right not to hire many workers. The pessimistic beliefs of firms and workers become self-fulfilling prophecies.

7.4.3 The Aggregate Expenditure Model

In the remainder of this section, we build a framework around the ideas that we have just put forward. The framework focuses on the determinants of aggregate spending because, in this approach, the output of the economy is determined not by the level of potential output but by the level of total spending. This model is based around the idea of sticky prices—or, more precisely, it tells us what the output of the economy will be, *at a given value of the overall price level*. Once we understand this, we can add in the effects of changing prices.

Earlier, we introduced the national income identity:

```
production = consumption + investment + government purchases + net
exports.
```

This equation must be true by the way the national income accounts are constructed. That is, it is an accounting *identity*. We also explained that

```
GDP = planned spending + unplanned inventory investment.
```

It is possible for firms to accumulate or decumulate inventories unintentionally, but such a situation will not persist for long. Firms quickly respond to such imbalances by adjusting their production. The aggregate expenditure model takes the national income identity and adds to it the condition that unplanned inventory investment equals zero—equivalently, gross domestic product (GDP) equals planned spending:

```
planned spending = consumption + investment + government purchases +
net exports.
```

Another way of saying this is that as long as we interpret investment to include only planned investment, the national income equation is no longer an identity but instead a condition for equilibrium.

7.4.4 The Relationship between Planned Spending and Output

We could now examine all four components of planned spending separately. [***Different chapters of this book delve deeper into these types of spending.***] For the moment, however, we group them all together. We focus on the fact that total planned spending depends positively on the level of income and output in an economy, for two main reasons:

1. If households have higher income, they are likely to increase their spending on many goods and services. The relationship between income and consumption is one of the cornerstones of macroeconomics.
2. Firms are likely to decide that higher levels of output—particularly if expected to persist— mean that they should build up their capital stock and thus increase their investment.

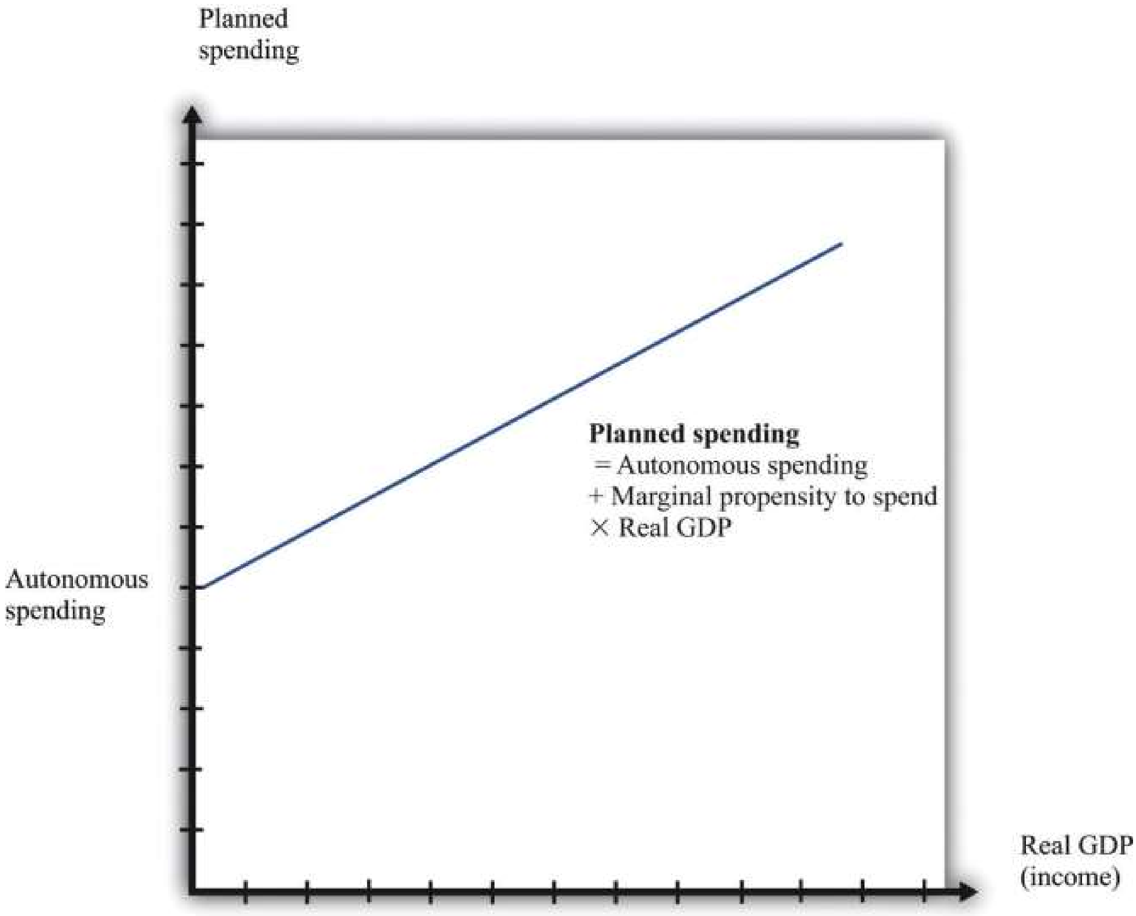

Fig. 7.8: Figure 7.8 The Planned Spending Line Planned spending is composed of autonomous spending (the amount of spending when real GDP equals zero) and induced spending (spending resulting from real GDP).

In summary, we conclude that when income increases, planned expenditure also increases. We illustrate this in ****Figure 7.8 "The Planned Spending Line", where we suppose for simplicity that the relationship between planned spending and GDP is a straight line: planned spending = autonomous spending + marginal propensity to spend × GDP.

Autonomous spending is the *intercept* of the planned spending line. It is the amount of spending that there would be in an economy if income were zero. It is positive, for two reasons: (1) A household with no income still wants to consume something, so it will either draw on its existing savings or borrow against future income. (2) The government purchases goods and services even if income is zero.

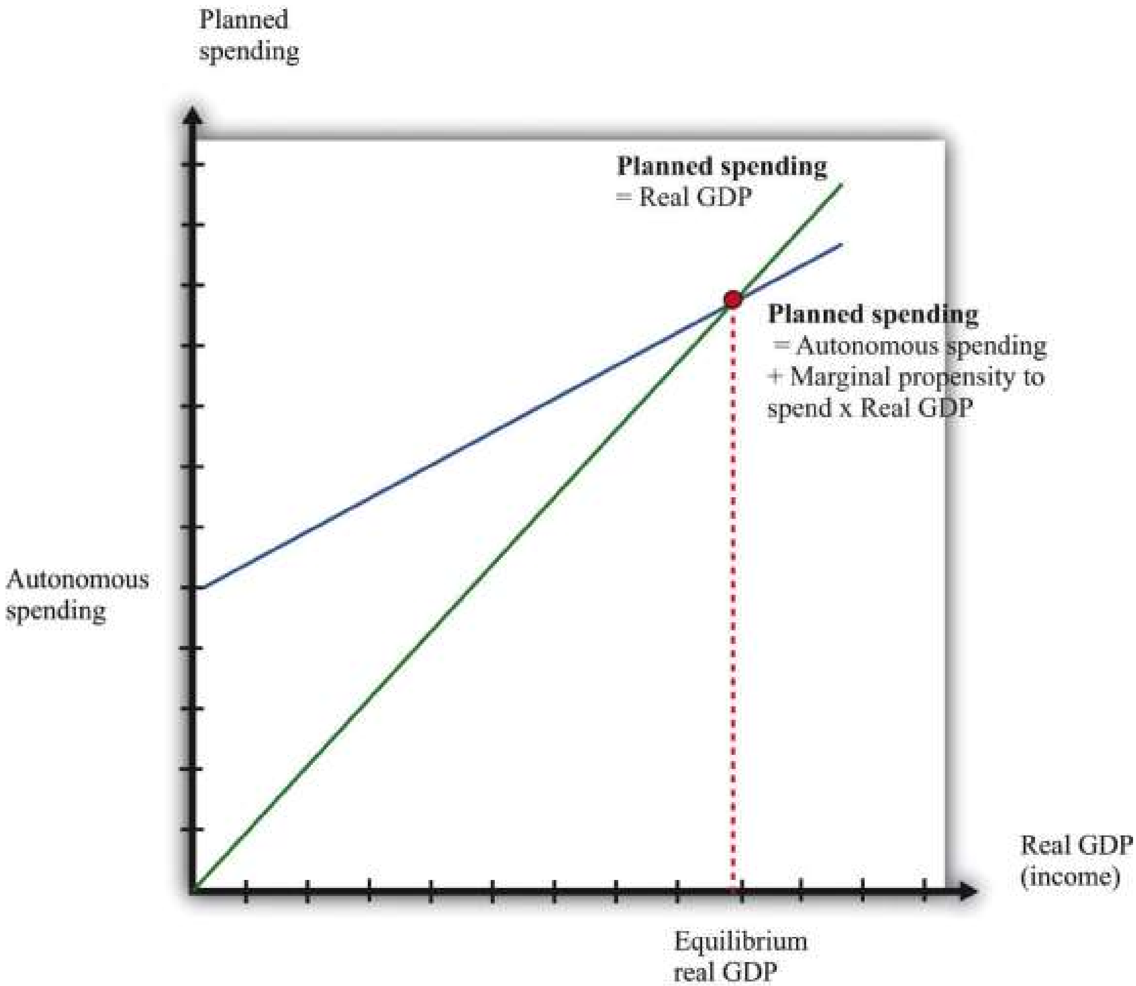

Fig. 7.9: ***

The **marginal propensity to spend** is the *slope* of the planned spending line. It tells us how much planned spending increases if there is a $1 increase in income. The marginal propensity to spend is positive: Increases in income lead to increased spending by households and firms. The marginal propensity to spend is less than one, largely because of consumption smoothing by households. If household income increases by $1, households typically consume only a fraction of the increase, saving the remainder to finance future consumption. This equation, together with the condition that GDP equals planned spending, gives us the **aggregate expenditure model**.

Toolkit: Section 16.19 "The Aggregate Expenditure Model"

The aggregate expenditure model takes as its starting point the fact that GDP measures both total spending and total production. The model focuses on the relationships between output and spending, which we write as follows:

```
planned spending = GDP
```

and

```
planned spending = autonomous spending + marginal propensity to spend × GDP.
```

The model finds the value of output for *a given value of the price level*. It is then combined with a model of price adjustment to give a complete picture of the economy.

Figure 7.9 Equilibrium in the Aggregate Expenditure Model

The aggregate expenditure framework tells us that the economy is in equilibrium when planned spending equals real GDP.

We can solve the two equations to find the values of GDP and planned spending that are consistent with both equations:

We can also take a graphical approach, as shown in ***Figure 7.9 "Equilibrium in the Aggregate Expenditure Model". On the horizontal axis is the level of real GDP, while on the vertical axis is the overall level of (planned) spending in the economy. We graph the two relationships of the aggregate expenditure model. The first line is a 45° line—that is, it is a line with a slope equal to one and passing through the origin. The second is the planned spending line. The point that solves the two equations is the point where the two lines intersect. This diagram is the essence of the aggregate expenditure model of the macroeconomy.

The aggregate expenditure model makes no reference to potential output or the supply side of the economy. The model assumes that the total amount of output produced will always equal the quantity demanded at the given price. You might think that this neglect of the supply side is a weakness of the model, and you would be right. In Section 7.4.6 "Price Adjustment", when we introduce the adjustment of prices, the significance of potential output becomes clear.

7.4.5 Can a Decrease in Consumption Spending Explain the Great Depression?

We now apply this framework to the Great Depression. The aggregate expenditure approach suggests that output decreased in the Great Depression because aggregate spending decreased. Part (a) of Figure 7.10 "A Decrease in Aggregate Expenditures"shows how this process begins: a decrease in autonomous spending shifts the spending line down. The interpretation of such a shift is that, *at every level of income*, spending is lower. Such a decrease in spending is due to a decrease in (the autonomous component of) consumption, investment, government spending, or net exports (or some combination of these). Part (b) of ***Figure 7.10 "A Decrease in Aggregate Expenditures" shows what happens when the planned spending line shifts downward. The equilibrium level of real GDP decreases. So far, therefore, the aggregate expenditure model seems to work: a decrease in autonomous spending leads to a decrease in real GDP at the given price level. But we need to know *why* planned spending decreased.

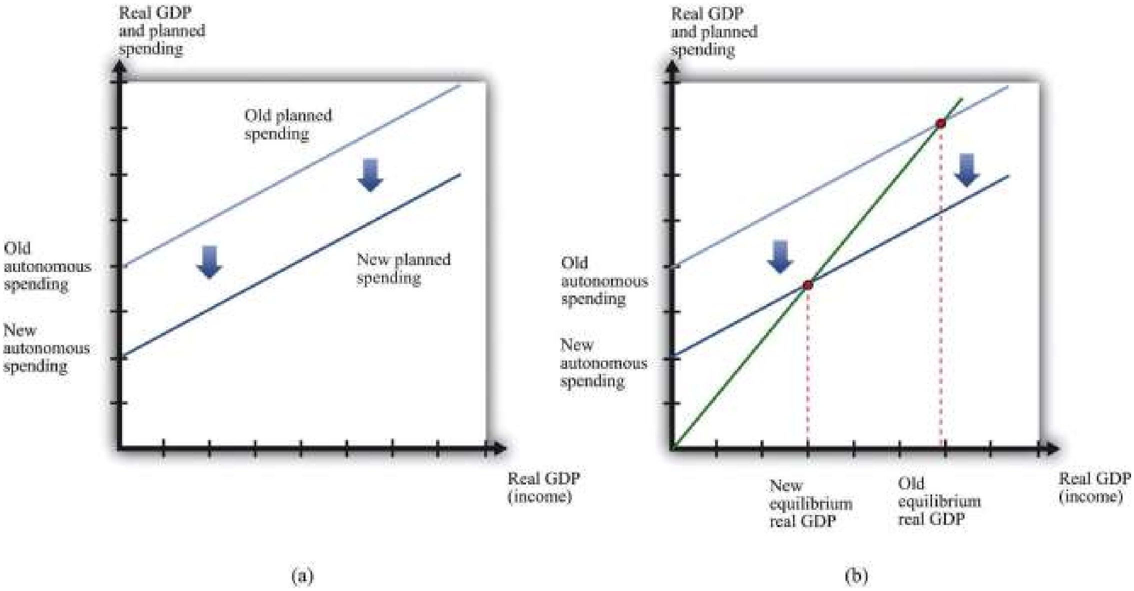

Fig. 7.10: Figure 7.10 A Decrease in Aggregate Expenditures The Keynesian explanation of the Great Depression is that a decrease in autonomous spending caused the planned spending line to shift downward (a) leading to a decrease in the equilibrium level of real GDP (b).

Let us first consider the possibility that a reduction in consumption triggered the Great Depression. Recall that, between September and November 1929, the stock market in the United States crashed. This collapse meant that many households were suddenly less wealthy than they had been previously. A natural response to a decrease in wealth is to decrease consumption; this is known as a **wealth effect**.

Wealth is distinct from income. Income is a flow: a household's income is the amount that it receives over a period of time, such as a year. Wealth is a stock: it is the cumulated amount of the household's savings. Is it plausible that wealth effects could explain a collapse of the magnitude of the Great Depression? To answer this, we need to determine how much real GDP decreases for a given change in autonomous spending.

7.4.6 The Multiplier

Toolkit: Section 16.19 "The Aggregate Expenditure Model"

The solution for output in the aggregate expenditure model can be written in terms of changes as follows:

```
change in GDP = multiplier × change in autonomous spending,
```

where the **multiplier** is given by

Suppose that the marginal propensity to spend is 0.8. Then

A given change in autonomous spending will lead to a fivefold change in real GDP. Economists refer to this as a multiplier process. Because (1 − marginal propensity to spend) is less than one, the multiplier is a number greater than one. This means that any change in autonomous spending is multiplied up to result in a larger change in GDP. Even relatively small decreases in spending can end up being damaging to an economy.

The economics behind the multiplier comes from the circular flow of income. Begin with a decrease in autonomous spending. The reduction in spending means less demand for firms' goods and services. Firms respond by cutting output. (As a reminder, the signal to firms that they should cut their output comes from the fact that they see a buildup of their inventory.) When firms cut their output, they require less labor and pay out less in wages, so household income decreases. This causes households to again cut back on consumption, so spending decreases further. Thus we go round and round the circular flow diagram: decreased spending leads to decreased output, which leads to decreased income, which leads to decreased spending, which leads to decreased output, and so on and so on. The process continues until the reductions in income, output, and consumption in each round are tiny enough to be ignored.

We use the multiplier to carry out comparative static exercises in the aggregate expenditure model. In this case, the endogenous variable is real GDP, and the exogenous variable is autonomous spending. Given a change in autonomous spending, we simply multiply by the multiplier to get the change in real GDP when the price level is fixed. Let us do some back-ofthe-envelope comparative static calculations, based on the assumption that the marginal propensity to spend is 0.8, so the multiplier is 5.

***Table 7.1 "Major Macroeconomic Variables, 1920–39*" tells us that real GDP decreased by approximately $75 billion between 1929 and 1930. With a multiplier of 5, we would need a drop in autonomous spending of $75 billion divided by 5, or $15 billion, to get this large a decrease in GDP. The population of the United States in 1930 was approximately 123 million, so a $15 billion decrease in spending corresponds to about $122 per person. Remember that the figures in Table 7.1 "Major Macroeconomic Variables, 1920–39*" are in terms of year 2000 dollars. It certainly seems plausible that households, who had been made significantly poorer by the collapse in the stock market, would have responded by cutting back spending by the equivalent today of a few hundred dollars per year.

Our goal, you will remember, is to explain the events of the Great Depression. How are we doing so far? The good news is that we do have a story that explains how output could decrease as precipitously as it did in the Great Depression years: there was a major stock market crash, which made people feel less wealthy, so they decided to consume less and save more.

If we look more closely, though, this story still falls short. When we examined the data for the Great Depression, we saw that—while output and consumption both decreased—consumption decreased much less than did output. For example, from 1929 to 1933, real GDP decreased by 26.5 percent, while consumption decreased by 18.2 percent. By contrast, investment (that is, purchases of capital by firms, new home construction, and changes in business inventories) decreased much more than output. In 1932, purchases of new capital were $11 billion (year 2000 dollars), compared to a level of $91 billion in 1929. This is a reduction in real investment of about 82 percent. We must look more closely at investment to see if our theory can also explain the different behavior of consumption and investment.

7.4.7 Can a Decrease in Investment Spending Explain the Great Depression?

When GDP decreases, there can be an *induced* decrease in investment: declines in income lead firms to anticipate lower production in the future, meaning they see less of a need to build up their capital stock. But the changes in investment during the Great Depression were very large. Because it is implausible that such large variation was the result of changes in output alone, economists look for additional explanations of why investment decreased so much during the Great Depression.

During the Great Depression, the link between savings and investment was disrupted by bank failures. Between 1929 and 1933, a number of US banks went out of business, often taking the savings of households with them. People began to trust banks less, and many households stopped putting their savings into the financial sector. The financial sector is an intermediary between households and firms, matching up the supply of savings from households with the demand for savings by firms. ***Figure 7.11 "The Financial Sector in the Circular Flow of Income" shows the flows in and out of the financial sector. (Our focus here is on the role of this sector in matching savers and investors. As ***Figure 7.11 "The Financial Sector in the Circular Flow of Income" shows, however, funds also flow into (or from) the financial sector from the rest of the world and the government sector.)

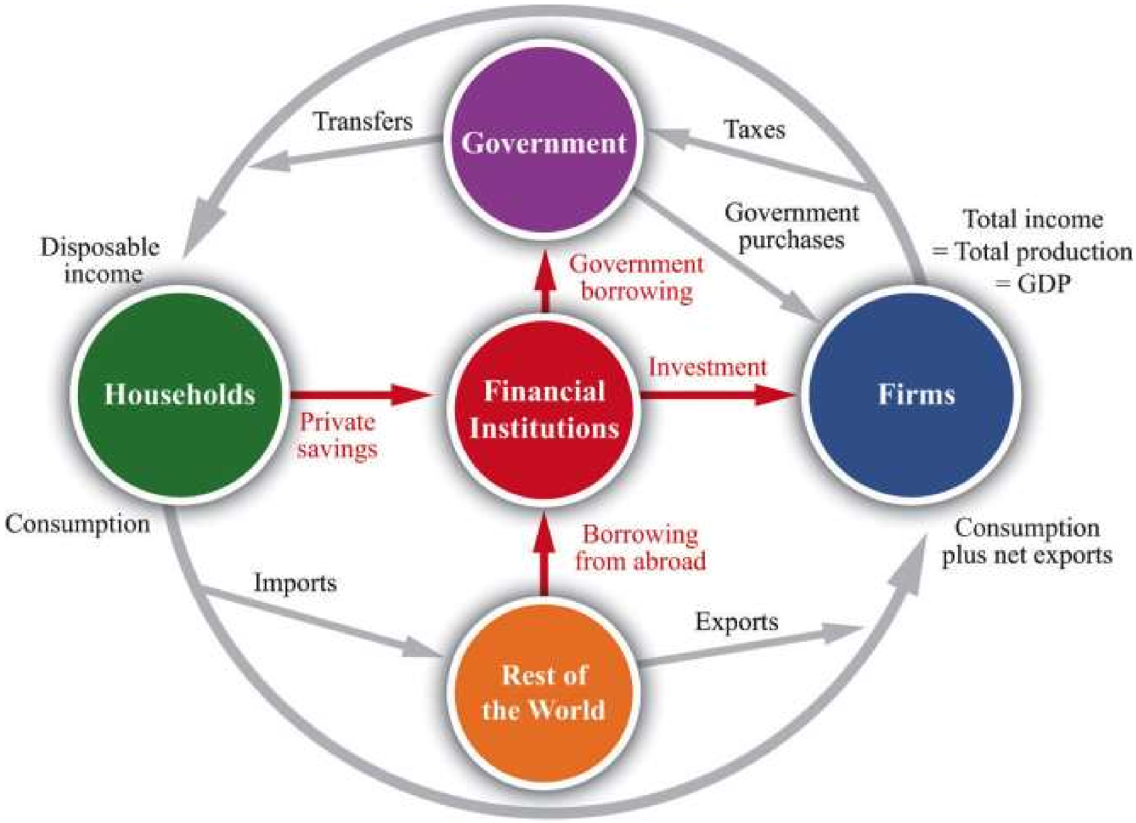

Fig. 7.11: Figure 7.11 The Financial Sector in the Circular Flow of Income Financial institutions such as banks act as intermediaries in the circular flow of income. During the Great Depression, many banks failed, disrupting the matching of savings and investment.

To understand bank failures in the Great Depression, we need to take a moment to review what banks do. A bank is an institution that accepts money ("bank deposits") from individuals. It then takes some of that money and puts it into longer-term projects—the construction of an apartment building, for example. The bank in this case issues a long-term loan to the company that plans to construct the new building.

At any time, a bank has a portfolio of assets. Some are **liquid**; they are easily and quickly exchanged for cash. Some are **illiquid**; they cannot easily be converted into cash. Banks keep some assets in a highly liquid form, such as cash or very short-term loans, and also hold assets that are relatively illiquid, such as a two-year loan to a construction company.

At any time, depositors at a bank can choose to withdraw their money. Under normal circumstances, people are happy to leave most of their money in the bank, so only a small fraction of depositors want to withdraw money on any given day. The bank keeps some cash in its vaults to accommodate this demand. But suppose that times are not normal. Suppose that, as was the case during the Great Depression, depositors start to see that other banks are going out of business. Then they may worry that their own bank is also at risk of failing, in which case they will lose their savings. The natural response is to rush to the bank to withdraw money before the bank fails.

If a large number of depositors all try to withdraw money at once, the bank will run out of cash and other liquid assets. It will not be able to meet the needs of its depositors. The consequence is a **bank run**. And if the bank is unable to meet its depositors’ demands, it may be forced out of business altogether. This is known as a **bank failure**.

A striking feature of a bank failure caused by a bank run is that it is a self-fulfilling prophecy:

- If everybody believes that the bank is safe, then no one will withdraw money, and the bank will indeed be safe.
- If everybody believes that the bank is going to fail, then everyone will try to withdraw money, and the bank will indeed fail.

Notice that every individual’s decision about what to do is based on what that individual expects everyone else will do.

***Figure 7.12 "Payoffs in a Bank-Run Game" presents the decisions underlying a bank run in a stylized way. Imagine that you deposit $100 in the bank. The table in the figure shows how much you obtain, depending on your own actions and those of other depositors. You and the other depositors must decide whether to leave your money in the bank (“don’t run”) or try to take your money out of the bank (“run”). If everyone else leaves money in the bank, then you can withdraw your money and get $100 or leave it in the bank and get the $100 plus $10 interest. If others do not run, then it is also best for you not to run. But if everyone else runs on the bank, then you get nothing if you leave your money in the bank, and you can (in this example) recover $20 if you run to the bank along with everyone else. Thus, if you expect others to run on the bank, you should do the same.

	Others leave their money in the bank	Others take their money out of the bank
You leave your money in the bank (don't run)	110	0
You leave your money in the bank (don't run)	100	20

Fig. 7.12: Figure 7.12 Payoffs in a Bank-Run Game This table shows the payoffs in a bank-run game. That is, it shows you what you get back depending on your choice and everybody else's choice about whether to run on the bank. If everyone else leaves money in the bank, then you should do the same, but if everyone else runs on the bank, you are better running as well.

Economists call this situation a **coordination game**. In a coordination game, there are *multiple equilibria*. In this example, there is one equilibrium where there is no run on the bank, and there is another equilibrium where everyone runs to the bank to withdraw funds.

Toolkit: Section 16.9 "Nash Equilibrium"

You can find more details on coordination games in the toolkit.

During the Great Depression, a story such as this played out not only at one bank but at many. Figure 7.13 shows what happened in terms of the aggregate expenditure framework. Prior to the Great Depression, the economy was in a "high confidence" equilibrium, in which the banking system was healthy and confidence was high. Then—for some reason—people became nervous about leaving money in banks, and it became much harder for firms to obtain loans. The cost of borrowing—the **real interest rate**—increased, and investment decreased substantially. The planned spending line shifted downward, and the economy moved to the bad "low confidence" equilibrium. The downward shift in planned spending leads to a decrease in real GDP, given the existing level of prices.

***Figure 7.13 should look familiar; it is the same as part (b) of ***Figure 7.10 "A Decrease in Aggregate Expenditures". This is because a decrease in autonomous consumption and a decrease in autonomous investment both look the same in the aggregate expenditure model, even though the underlying story is different. Of course, it is also possible that both autonomous consumption and autonomous investment decreased.

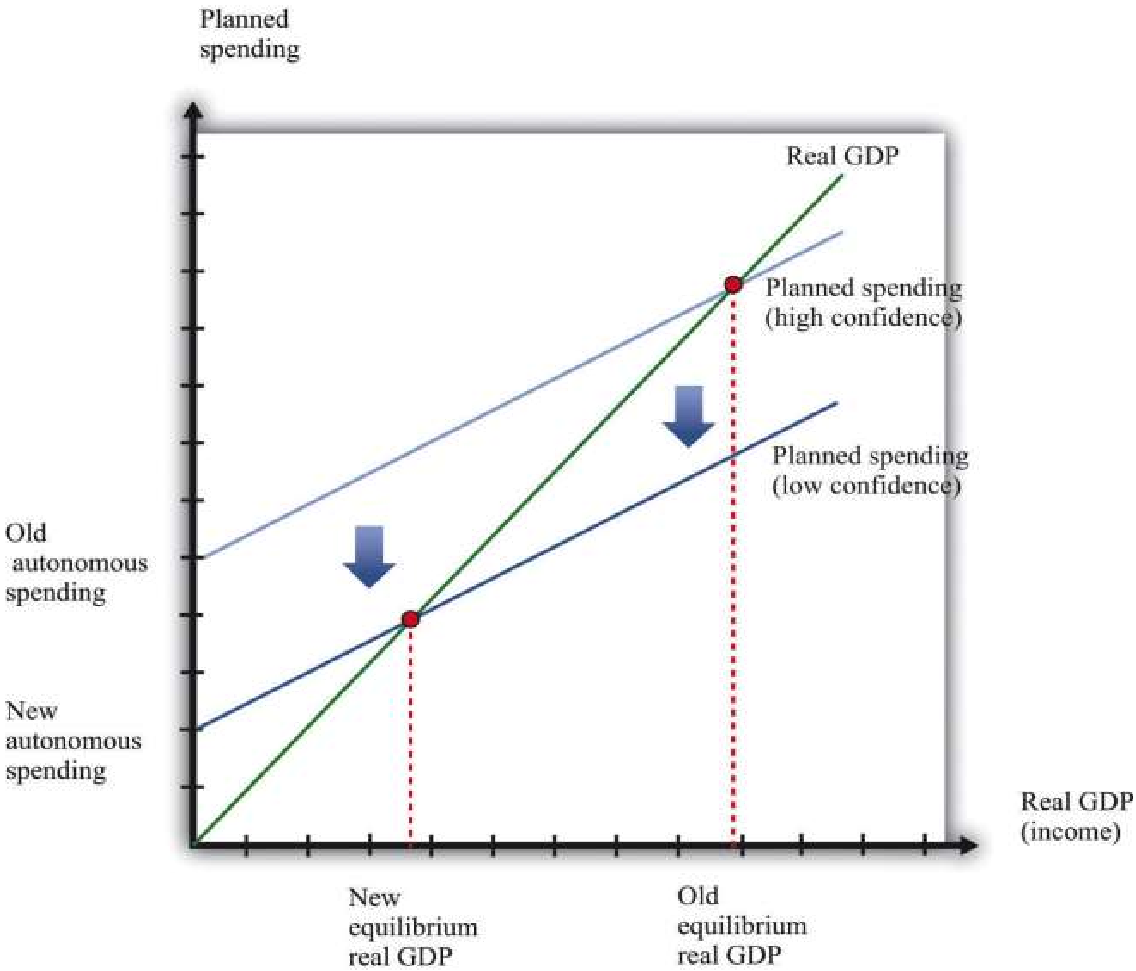

Fig. 7.13: Figure 7.13 Failures in the financial sector lead to a drop in investment spending. During the Great Depression, a decrease in confidence in the banking system meant that many banks failed, and it became more difficult and expensive for firms to borrow. The planned spending line shifted downward, and real GDP decreased.

To summarize, the banking crisis made households reluctant to put money in the banks, and banks were reluctant to make loans. Two banking measures help us see what was happening. The **currency-deposit ratio** is the total amount of currency (that is, either banknotes or coins) divided by the total amount of deposits in banks. The **loan-deposit ratio** is the total amount of loans made by banks divided by the total amount of deposits in banks.

If the currency-deposit ratio is low, households are not holding very much cash but are instead keeping wealth in the form of bank deposits and other assets. The currency-deposit ratio increased from 0.09 in October 1929 to 0.23 in March 1933. [***See Milton Friedman and Anna Schwartz, A Monetary History of the United States, 1867– 1960 (Princeton, NJ: Princeton University Press, 1963), Table B3.***] This means that households in the economy started holding onto cash rather than depositing it in banks. You can think of the loan-deposit ratio as a measure of the productivity of banks: banks take deposits and convert them into loans for investment. During the Great Depression, the loan-deposit ratio decreased from 0.86 to 0.73. [***See Ben Bernanke, “Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression,” American Economic Review 73 (1983): 257–76, Table 1.***]

7.4.8 Price Adjustment

The story we have told explains why the economy departs from potential output but says nothing about how (if at all) the economy gets back to potential output. The answer is that prices have a tendency to adjust back toward their equilibrium levels, even if they do not always get there immediately. This is most easily understood by remembering that prices in the economy are, in the end, usually set by firms. When a firm sees a decrease in demand for its product, it does not necessarily decrease its prices immediately. Its decision about what price to choose depends on the prices of its inputs and the prices being set by its competitors. In addition, it depends on not only what those prices are right now but also what the firm expects to happen in the future. Deciding exactly what to do about prices can be a difficult decision for the managers of a firm.

Without analyzing this decision in detail, we can certainly observe that firms often keep prices fixed when demand decreases—at least to begin with. The result looks like that in ***Figure 7.6 "An Inward Shift in Market Demand for Houses". In the face of a prolonged decrease in demand, however, firms *will* lower prices. Some firms do this relatively quickly; others keep prices unchanged for longer periods. We conclude that prices are sticky; they do not decrease instantly, but they decrease eventually. [***Chapter 10 "Understanding the Fed" provides more detail about the price-adjustment decisions of firms.***] For the economy as a whole, this adjustment of prices is represented by a **price-adjustment equation**.

Toolkit: Section 16.20 "Price Adjustment"

The difference between potential output and actual output is called the **output gap**:

```
output gap = potential real GDP − actual real GDP.
```

If an economy is in recession, the output gap is positive. If an economy is in a boom, then the output gap is negative. The inflation rate when an economy is at potential output (that is, when the output gap is zero) is called **autonomous inflation**. The overall inflation rate depends on both autonomous inflation and the output gap, as shown in the price-adjustment equation:

```
inflation rate = autonomous inflation − inflation sensitivity × 
output gap.
```

This equation tells us that there are two reasons for increasing prices.

1. Prices increase because autonomous inflation is positive. Even when the economy is at potential output, firms may anticipate that their suppliers or their competitors are likely to increase prices in the future. A natural response is to increase prices, so autonomous inflation is positive.
2. Prices increase because the output gap is negative. The output gap matters because, as GDP increases relative to potential, labor and other inputs become scarcer. Firms see increasing costs and choose to set higher prices as a consequence. The “inflation sensitivity” tells us how responsive the inflation rate is to the output gap.

When real GDP is above potential output, there is upward pressure on prices in the economy. The inflation rate exceeds autonomous inflation. By contrast, when real GDP is below potential, there is downward pressure on prices. The inflation rate is below the autonomous inflation rate. The price-adjustment equation is shown in ***Figure 7.14 "Price Adjustment".

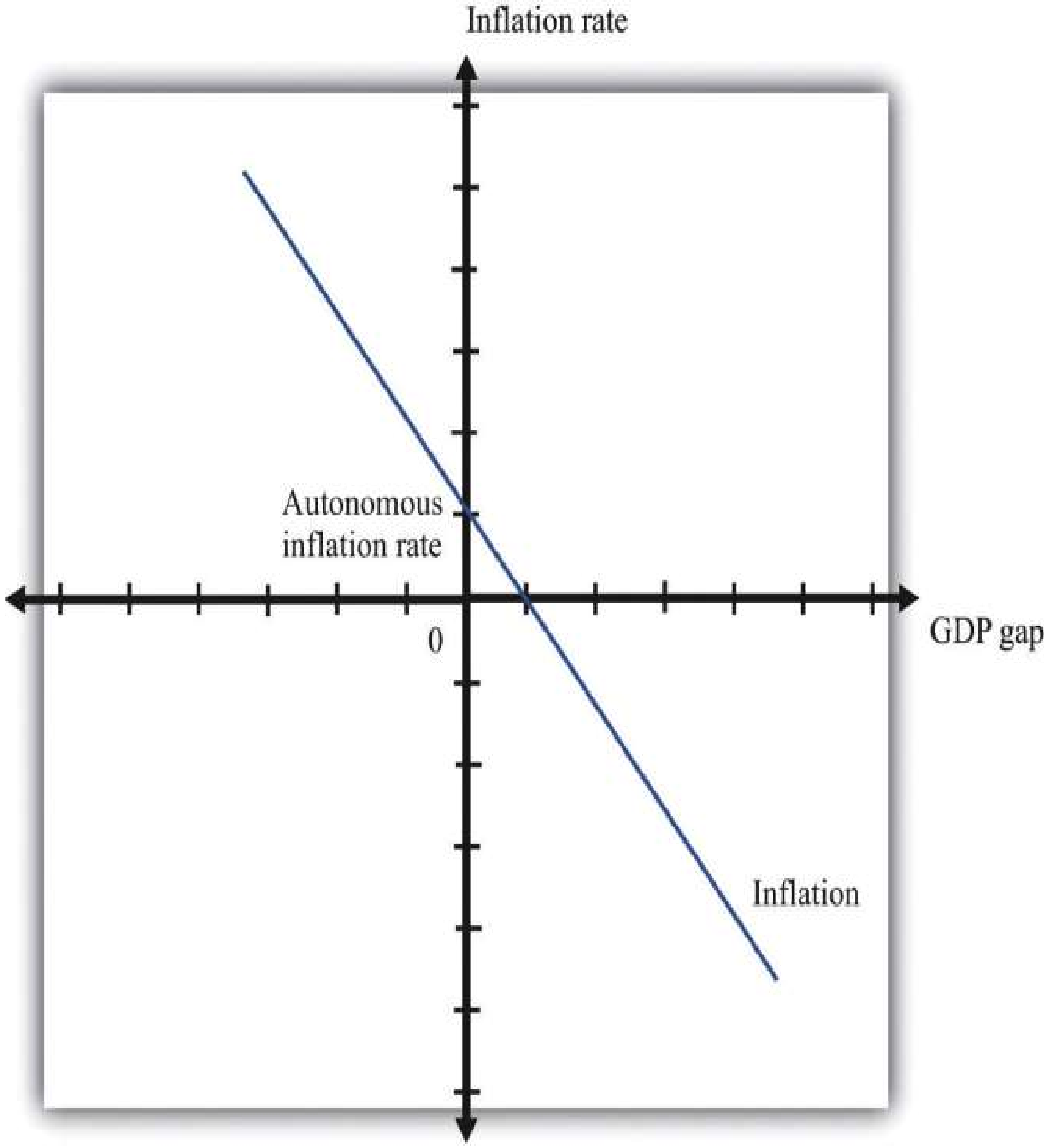

Fig. 7.14: Figure 7.14 Price Adjustment When an economy is in a recession, actual inflation is lower than autonomous inflation. In a boom, inflation is higher than its autonomous level.

We can apply this pricing equation to the Great Depression. Imagine first that autonomous inflation is zero. In this case, prices decrease when output is below potential. From 1929 to 1933, output was surely below potential and, as the equation suggests, this was a period of decreasing prices. After 1933, as the economy rebounded, the increase in the level of economic activity was matched with positive inflation—that is, increasing prices. This turnaround in inflation occurred even though the economy was still operating at a level below potential output. To match this movement in prices, we need to assume that—for some reason that we have not explained—autonomous inflation became positive in this period.

KEY TAKEAWAY

Keynes argued that, at least in the short run, markets were not able to fully coordinate economic activity. His theory gave a prominent role to aggregate spending as a determinant of real GDP.

•Given prices, a reduction in spending will lead to a reduction in the income of workers and owners of capital, which will lead to further reductions in spending. This link between income and spending is highlighted by the circular flow of income and underlies the aggregate expenditure model.

The stock market crash in 1929 reduced the wealth of many households, and this could have led them to cut consumption. This reduction in aggregate spending, through the multiplier process, could have led to a large reduction in real GDP.

The reductions in investment in the early 1930s, perhaps coming from instability in the financial system, could lead to a reduction in aggregate spending and, through the multiplier process, a large reduction in real GDP.

***

Checking Your Understanding

Some researchers have suggested that a reduction in US net exports is another possible cause of the Great Depression. Use the aggregate expenditure model to consider the effects of a reduction in net exports. What happens to real GDP?

Suppose autonomous inflation is constant, but real GDP moves around. Would you expect inflation to be procyclical or countercyclical?

7.5 Policy Interventions and the Great Depression

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is stabilization policy?

What is monetary policy, and how was it used during the Great Depression?

What is fiscal policy, and how was it used during the Great Depression?

Understanding why the Great Depression occurred is certainly progress. But policymakers also wanted to know if there was anything that could be done in the face of this economic catastrophe. One of Keynes' most lasting contributions to economics is that he showed how different kinds of economic policy could be used to assist economies that were stuck in recessions.

When markets are doing a good job of allocating resources, standard economic reasoning suggests that it is better for the government to stay out of the way. But when markets fail to allocate resources well, the government might be able to improve the overall functioning of the economy. The idea that markets left alone would coordinate aggregate economic activity is difficult to defend in the face of 25 percent unemployment of the labor force and a decline in economic activity of nearly 30 percent over a 4-year period. Thus the rationale for government intervention in the aggregate economy is that markets are failing to allocate resources properly, perhaps because prices and wages are sticky.

7.5.1 Policy Remedies

In the wake of the Great Depression, economists started advocating the use of government policy to improve the functioning of the macroeconomy. There are two kinds of government policy. **Monetary policy** refers to changes in interest rates and other tools that are under the control of the monetary authority of a country (the central bank).**Fiscal policy** refers to changes in taxation and the level of government purchases; such policies are typically under the control of a country's lawmakers. **Stabilization policy** is the general term for the use of monetary and fiscal policies to prevent large fluctuations in real gross domestic product (real GDP).

In the United States, the Federal Reserve Bank controls monetary policy, and fiscal policy is controlled by the president, the Congress, and state governments. In the countries of the European Union, monetary policy is controlled by the European Central Bank, and fiscal policies are controlled by the individual governments of the member countries.

Keynes suggested that the cause of the Great Depression was an unusually low level of aggregate spending. This diagnosis suggests an immediate remedy: use government policies to increase aggregate spending. Because

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change in GDP = multiplier × change in autonomous spending,
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any government policy that increases autonomous spending will, through this equation, also increase GDP. There are many different policies at the disposal of the government, but they are similar at heart. The idea is to stimulate one of the components of aggregate spending— consumption, investment, government purchases, or net exports.

One fiscal policy measure is an increase in government purchases. Suppose the government increases its expenditure—perhaps by hiring more teachers, buying more tanks, or building more roads. This increases autonomous spending and works its way through the economy, just as in our earlier discussion of a decrease in autonomous consumption—except now we are talking about an increase rather than a decrease. If the government spends an extra dollar, this immediately expands income by that dollar. Extra income leads to extra spending, which leads to further increases in output and income. The process continues around and around the circular flow.

Imagine that, as before, the marginal propensity to spend is 0.8, so that the multiplier is 5. If the government increases expenditure on goods and services by $1 billion, overall GDP in the economy will increase by $5 billion. Thus to offset the decrease in real GDP of about $90 billion between 1929 and 1933, assuming a marginal propensity to spend of 0.8, the federal government should have increased government spending by $18 billion. The multiplier is a double-edged sword. It has the bad effect that it can turn small decreases in spending into big decreases in output. But it also means that relatively small changes in government spending can have a big effect on output.

Tax cuts are another way to stimulate the economy. If households have to pay fewer taxes to the government, they are likely to spend more on consumption goods. This form of policy intervention has been used over and over again by governments in the United States and elsewhere. Tax cuts, like government spending, must be paid for. If the government spends more and taxes less, then the government deficit increases. The government must borrow to finance such fiscal policy measures. [***Chapter 12 "Income Taxes" and Chapter 14 "Balancing the Budget" have more to say about fiscal policy.***]

The central bank can use monetary policy to affect aggregate spending. Monetary policy operates through changes in interest rates, which are—in the short run at least—under the influence of the central bank. Lower interest rates make it cheaper for firms to borrow, which encourages them to increase investment spending. Lower interest rates likewise mean lower mortgage rates, so households are more likely to buy new homes. Lower interest rates may encourage households to borrow and spend more on other goods. And lower interest rates can even encourage net exports. [***The link from interest rates to net exports is complicated because it involves changes in exchange rates. You do not need to worry here about how it works. We explain it, together with other details of monetary policy, in Chapter 10 "Understanding the Fed".***]

7.5.2 Monetary and Fiscal Policies during the Great Depression

We have argued that monetary and fiscal policies *could* have been used to help the economy out of the Great Depression. But what did policymakers actually do at the time? The answer comes in two parts: at the start of the Great Depression, they did not do much; after 1932, they did rather more.

Both presidential candidates campaigned in favor of conservative fiscal policy in 1932. Here are some excerpts from the party platforms. [***See John Woolley and Gerhard

Peters, The American Presidency Project, accessed June 30, 2011, http://www.presidency.ucsb.edu.***]

From the Democratic Party platform:

We advocate an immediate and drastic reduction of governmental expenditures by abolishing useless commissions and offices, consolidating departments and bureaus, and eliminating extravagance to accomplish a saving of not less than twenty-five per cent in the cost of the Federal Government. And we call upon the Democratic Party in the states to make a zealous effort to achieve a proportionate result.

We favor maintenance of the national credit by a federal budget annually balanced on the basis of accurate executive estimates within revenues, raised by a system of taxation levied on the principle of ability to pay. [***"Democratic Party Platform of 1932," The American Presidency Project, accessed June 30, 2011, http://www.presidency.ucsb.edu/ws/index.php?pid=29595#ax zz1N9yDnpSR.***]

From the Republican Party platform:

The President's program contemplates an attack on a broad front, with far-reaching objectives, but entailing no danger to the budget. [...]

Constructive plans for financial stabilization cannot be completely organized until our national, State and municipal governments not only balance their budgets but curtail their current expenses as well to a level which can be steadily and economically maintained for some years to come. [***"Republican Party Platform of 1932," The American Presidency Project, accessed June 30, 2011, http://www.presidency.ucsb.edu/ws/index.php?pid=29638#axz z1N9yDnpSR.***]

Both parties were arguing for *cuts* in government expenditures, not the increases that (with the benefit of hindsight and better theory) we have suggested were needed. Monetary policy was likewise not used to stimulate the economy at this time. It seems unlikely that the fiscal and monetary authorities knew what to do but did nothing. Instead, the tools of economic thought needed to guide policy were simply not sufficiently well developed at the time. In keeping with the prevailing view that the economy was self-correcting, the incumbent Republican president, Herbert Hoover, had insisted that "prosperity is just around the corner."

The election of Franklin Roosevelt in 1932 was a turning point. After his election, President Roosevelt and his advisors created a series of measures—called the New Deal—that were intended to stabilize the economy. In terms of fiscal policy, the US government moved away from budget balance and adopted a much more aggressive spending policy. Government spending increased from 3.2 percent of real GDP in 1932 to 9.3 percent of GDP by 1936. These spending increases were financed by budget deficits.

Roosevelt also took action to stabilize the banking system, most notably by creating a system of deposit insurance. This policy remains with us today: if you have deposits in a US bank, the federal government insures them. According to the Federal Deposit Insurance Corporation (http://www.fdic.gov), not a single depositor has lost a cent since the introduction of deposit insurance. [***The FDIC site (http://www.fdic.gov) provides a discussion the history of this fund and current activities. The discussion of

“Who is the FDIC?” (http://www.fdic.gov/about/learn/symbol/index.html) is a good place to start.***] Finally, the 1930s was also the time of the introduction of Social Security and other measures to protect workers. The Social Security Administration (http://www.ssa.gov) originated in 1935. [***General information on social security is available at http://www.ssa.gov. The history of the legislation, including various House and Senate Bills, is also available athttp://www.ssa.gov/history/history.html. The original act included old-age benefits and the provision of unemployment insurance. The disability part of the program was created in 1956.***]

The New Deal brought about changes not only in policy but also in attitudes toward policymaking. Gardiner Means, who was an economic adviser to the Roosevelt administration in 1933, said of policymaking at the time:

It was this which produced the yeastiness of experimentation that made the New Deal what it was. A hundred years from now, when historians look back on this, they will say a big corner was turned. People agreed old things didn’t work. What ran through the whole New Deal was finding a way to make things work.

Before that, Hoover would loan money to farmers to keep their mules alive, but wouldn’t loan money to keep their children alive. This was perfectly right within the framework of classical thinking. If an individual couldn’t get enough to eat, it was because he wasn’t on the ball. It was his responsibility. The New Deal said: “Anybody who is unemployed isn’t necessarily unemployed because he is shiftless.” [***See Studs Terkel, Hard Times: An Oral History of the Great Depression (New York: Pantheon Books, 1970), 247.***]

KEY TAKEAWAY

Stabilization policy entails the use the monetary and fiscal policy to keep the level of output at potential output. •

Monetary policy is the use of interest rates and other tools, under the control of a country’s central bank, to stabilize the economy. During the Great Depression, monetary policy was not actively used to stabilize the economy. A major component of stabilization after 1932 was restoring confidence in the banking system.

Fiscal policy is the use of taxes and government spending to stabilize the economy. During the first part of the 1930s, contractionary fiscal policy may have deepened the Great Depression. After 1932, fiscal policy became more expansionary and may have helped to end the Great Depression.

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Checking Your Understanding

Suppose the government wants to increase real GDP by $1,000. Explain why a smaller multiplier implies that the government must increase its spending by more to increase real GDP by this amount.

Did the government miss a chance to carry out stabilization policy before 1932?

7.6 End-of-Chapter Material

In Conclusion

We started this chapter by describing the experience of the economy of the United States and other countries in the 1930s. The catastrophic economic performance of that period was difficult to reconcile with the view of classical economists that markets always worked to coordinate aggregate economic activity. Although technological progress provides a plausible explanation of the roaring twenties, technological regress is much less convincing as a story of the Great Depression. Technological regress also cannot explain the behavior of the price level and real wages during the Great Depression.

The Keynesian view explains the Great Depression as being driven by a decrease in aggregate spending, caused primarily by two factors: household consumption decreased because the stock market crash reduced household wealth, and investment decreased because of disruption of the financial intermediation process and pessimism over the future of the economy. These reductions in spending, through the multiplier, led to large reductions in real output. This story is consistent with the observed reductions in consumption, investment, and real GDP. With sticky prices, these reductions in spending translate into lower real GDP. The simple Keynesian story also has two problems: it can explain increasing prices only by assuming an exogenous increase in autonomous inflation and it provides no explanation of why observed technology decreased in the Great Depression period.

Along with the Keynesian explanation of the Great Depression comes a solution: use government policies to manage aggregate spending. If the aggregate expenditure model were literally true, policymaking would become an exact science: the policymaker would start with a target level of output and then determine the level of, say, government purchases needed to reach that target. As you might imagine, life as an economic policymaker is more complicated. The economists and politicians designing fiscal and monetary policy do not have a perfect picture of the current state of the economy. Moreover, control over policy tools is often inexact, and policy decisions take time.

The Great Depression remains something of a puzzle to macroeconomists. This became very apparent again recently during the so-called Great Recession—the major economic downturn that began in 2008. There are some resemblances between the two episodes, and the experience of the Great Depression certainly influenced some of the monetary policy decisions that were made in recent years. In this chapter, we did not yet consider monetary policy in detail. Chapter 10 "Understanding the Fed", which discusses the conduct of monetary policy, also addresses monetary policy during the Great Depression.

The aggregate expenditure framework is not a very sophisticated theory of the economy. Much work in macroeconomics in the decades since the Great Depression has involved refining the various pieces of the aggregate expenditure model. Economists have developed more rigorous theories of consumption, investment, and price adjustment, for example, in which they emphasize how households and firms base their decisions on expectations about the future. But Keynes' fundamental insight—that the level of output may sometimes be determined not by the productive capacity of the economy but by the overall level of spending—remains at the heart of macroeconomic research and policymaking today.

Key Links

- • The history of deposit insurance: http://www.fdic.gov/about/history
- • Social Security, including details on its history: http://www.ssa.gov and
- http://www.ssa.gov/history/history.html
- • Bureau of Labor Statistics: http://www.bls.gov
- • US Census Bureau, Statistical
- Abstracts:http://www.census.gov/prod/www/abs/statab.html
- • Photo exhibits about the Great Depression:
- • Photo essay:http://www.english.uiuc.edu/maps/depression/photoessay.htm
- • Library of Congress: http://memory.loc.gov/ammem/fsowhome.html
- • President Hoover's library: http://hoover.archives.gov

EXERCISES

Consider the bank-run game presented in Section 7.4.5 "Can a Decrease in Investment Spending Explain the Great Depression?". Discuss in words how you think the introduction of deposit insurance would change the incentives of an individual to run on a bank.

If the marginal propensity to spend is 0.6 and autonomous spending decreases by $500, what is the change in output predicted by the aggregate expenditures model?

During the early 1930s, the government was intent on balancing its budget. If this required a reduction in government spending, what do you predict would happen to real GDP?

Do you think that labor force participation (that is, the percentage of the population that is actively in the labor force, either working or looking for a job) is procyclical or countercyclical? Why?

What is the effect of consumption smoothing on the value of the multiplier?

Explain why an increase in the value of the stock market might lead to higher real GDP. [Hint: think about what happens to consumption.]

Suppose you plan to meet a friend at a restaurant at 7 p.m. You are worried that she might be late and not show up until 8 p.m. You would prefer to eat at 7 p.m. rather than 8 p.m., but you also would prefer not to have to stand around waiting for your friend for an hour. She has the same tastes as you do. Explain carefully how you and your friend are in a coordination game. Is it an equilibrium for you both to show up at 7 p.m.? Is it an equilibrium for you both to show up at 8 p.m.?

Suppose that the inflation rate is very sensitive to the output gap in the economy. What does this imply about how quickly the economy will get back to equilibrium following a shock?

Spreadsheet Exercises

1. Using the data presented in ***Table 7.1 "Major Macroeconomic Variables, 1920–39*", create a spreadsheet to look graphically at the relationship between real GDP, unemployment, and the price level from 1929 to 1933.
2. Redo Table 7.2 "Growth Rates of Real GDP, Labor, Capital, and Technology, 1920–39*" assuming that a = 0.3 throughout the period of study. How do the results change?

Economics Detective

1. Consider the town in which you were born. Try to find out what happened there during the Great Depression. Did local businesses close? Were jobs available?

2. Can you find a recent example of a bank run in some country? What happened?
3. Following the financial crisis of 2008, the United States adopted a large fiscal stimulus. Try to find some details of this stimulus. How big was it? What form did it take? How big did policymakers think the multiplier was?

Chapter 8 Jobs in the Macroeconomy

Taking to the Streets

In March 2006, students demonstrated on the streets of France.

Violent French Protests: 300 Held

Police detained some 300 people around France after nationwide student marches against a new labor law turned violent, as street cleaners cleared away torched cars Friday and the government braced for more protests. A quarter of a million people took to the streets in some 200 demonstrations around the country Thursday, in a test of strength between youth and the conservative government of 73year-old President Jacques Chirac. Most of the violence—and the arrests—were around the Sorbonne University in Paris, where police fired rubber pellets and tear gas at youths who pelted them with stones and set cars on fire.

[...]

Many trade unionists and students oppose the new youth employment law because it allows new workers under the age of 26 to be dismissed within a two-year trial period. [***"Violent French Protests: 300 Held," VOV News, March 18, 2006, accessed August 22, 2011,http://english.vov.vn/Home/Violent-French-protests-300-held/20063/36835.vov.***]

If, like most readers of this book, you are a student in the United States, it is unlikely that you have taken part in violent demonstrations about labor policy. It is not that such demonstrations are unheard of. In Madison, Wisconsin, in 2011, there were extended protests concerning proposed changes in public sector contracts. Still, in the United States, it is accepted that the government has a limited influence on contracts between workers and firms. It is part of economic life in the United States that employment is not protected by the government. In Europe, however, many countries have extensive laws on their books that are designed to protect workers. For example, in much of Europe, unemployment insurance is more generous than in the United States. Unemployed people obtain larger benefits and are eligible for these benefits for longer periods of time.

In many European countries, it is also much more difficult to fire workers than it is in the United States. The proposed new job contract that led to the demonstrations in France was intended to reduce the nearly 25 percent unemployment rate of the French youth. Perhaps paradoxically, the contract was designed to make it easier to make young people unemployed. The logic was that firms would be willing to hire more workers if the costs of firing them were lower.

The different systems in the United States and Europe each have their defenders. Supporters of European labor laws point to the greater job security enjoyed by workers in Europe. Supporters of the US system argue that the United States enjoys greater flexibility in the labor market, leading to a more efficient economy with less unemployment. Some feel that the

United States should adopt European-style labor protection measures; others feel that Europe would benefit from becoming more like the United States. In this chapter, we look at the different experiences of Europe and the United States in order to evaluate these different approaches to the labor market. In the end, we want to be able to answer—or at least form intelligent opinions about—the following question:

What are the results of the different labor market policies in the United States and Europe?

This is not just an academic question for discussion in a textbook. In both the United States and Europe, labor market policy is frequently debated. The US Congress has considered various labor policies, such as restrictions on plant closing to protect jobs, requirements that firms offer workers health insurance, requirements that firms include paid sick days in employment contracts, and so on. At the same time, there is considerable discussion in Germany, France, and elsewhere in Europe about the possible benefits of increased labor market flexibility.

Road Map

Employment and unemployment are ideas that most of us are familiar with. You may well have already been employed, at least in a part-time capacity, at some point in your life. It is also possible that you have been unemployed, meaning that you were without a job, but were actively seeking work. Our personal experiences, and those of our parents and friends, help us understand the basics of employment and unemployment.

Even if you have not yet been employed, you will begin searching for a job once you graduate with a college degree. As you surely know, finding a good job is not always easy. You want to find a job that you enjoy, fits your skills, and pays well. It is also not easy for prospective employers: they want to find someone who is suitably skilled, will work well within the firm, and is not too expensive. The challenge is to match workers and jobs: the worker needs to be suited to the job, and the job needs to be suited to the worker.

The process of matching does not happen just once. As time passes, your skills, ambitions, and choice of occupation may change. As time passes, your employer’s needs change. You may wish to move to another city. Your employer may want to move your job to another city. Most people do not spend their entire lives in one job.

A schematic representation of this process is shown in ***Figure 8.1 "Employment Transitions over Your Lifetime". Here you leave college and look for a job. Finding that job is likely to be time-consuming. You will have to contact lots of prospective employers, read newspaper ads, use search engines on the Internet, and, of course, show up for interviews. In the end, you will find your first job and begin your career.

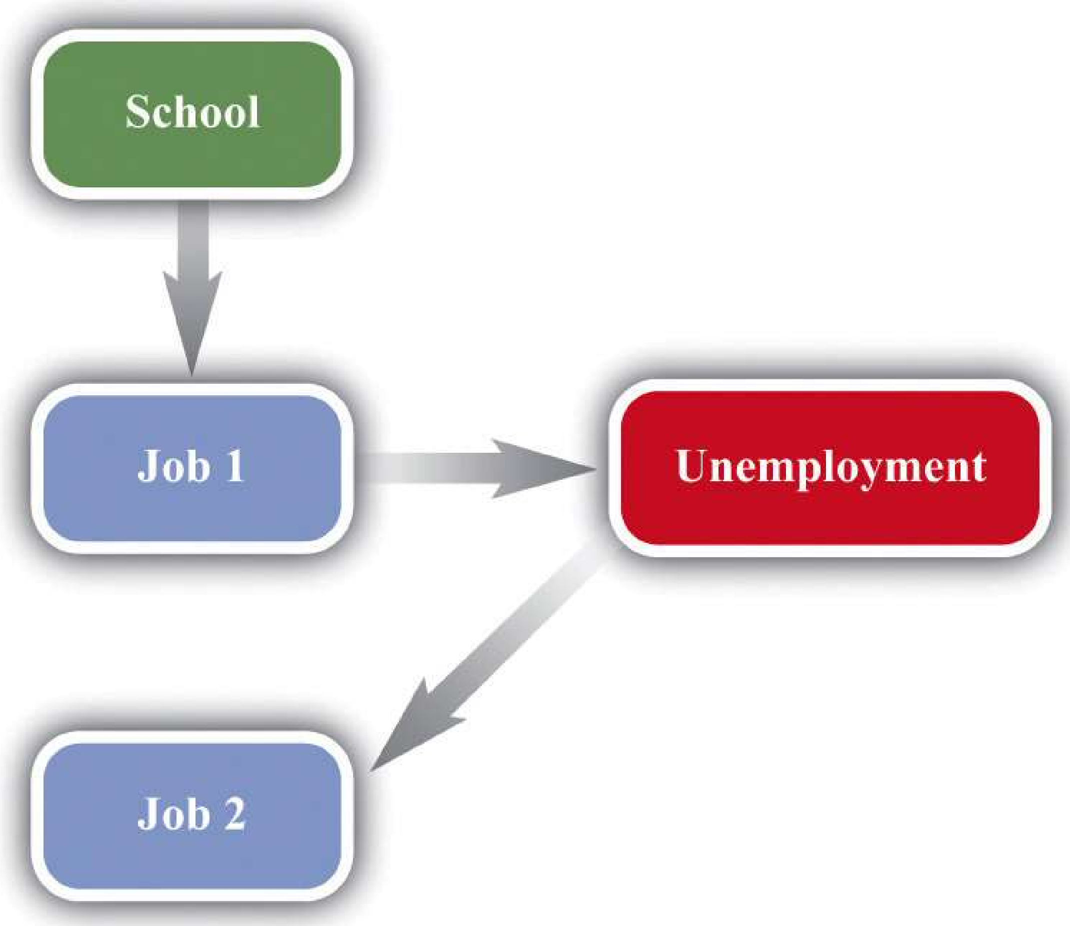

Fig. 8.1: Figure 8.1Employment Transitions over Your Lifetime

You might stick with this job for a while, but in all likelihood the match between you and your employer will come to an end sooner or later. You may leave the job through your own choice because you are no longer happy with it. Alternatively, you may be forced to leave because your employer no longer has need of you. You then search for another job. When you succeed in finding a new position where your needs and desires align with those of another employer, a new match is formed.

Fifty years or so ago, people often joined companies and stayed with them for life, but this is very unusual today. You are likely to move between jobs several times during your lifetime before your eventual retirement. Sometimes you may be able to move from one job to another without interruption. At other times you will be unemployed between jobs. Throughout your life, you are likely to face periods of anxiety and stress because of the employment uncertainties that you confront:

- • How likely is it that you will be able to retain your current job?
- • If you lose your job, will you be able to find another job that you like?
- • How long will it take to find another job?
- • What should you do if you do not like your job?
- • How will you support yourself while you are unemployed?

This discussion makes it clear that we cannot analyze labor market policies without understanding the movements in and out of employment and unemployment. But before we can do so, we need to make sure we understand exactly what unemployment is, and what causes it. Thus we begin by carefully defining unemployment. [***In part, this is a review of material in Chapter 3 "The State of the Economy". There, we explained that the unemployment rate is one possible indicator of the overall health of the economy.***] We look at the data for Europe and the United States and make sense of this data using economic reasoning. We then turn to an analysis of the matching between workers and jobs and the decisions of individual workers in this process. All this analysis gives us a better understanding of unemployment and, more generally, the operation of labor markets. We conclude by evaluating labor market policies in the United States and Europe.

8.1 Unemployment

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is the unemployment rate, and how is it measured?

What are the differences and the similarities in unemployment rates in the United States and Europe?

If the labor market functions perfectly, what is the rate of unemployment?

How does unemployment arise?

We begin by discussing the most commonly watched indicator of the state of the labor market: the unemployment rate. In the United States, the unemployment rate is measured by the Bureau of Labor Statistics (BLS; http://www.bls.gov/cps/home.htm). The BLS looks at the population of individuals of working age who are not in the military. It sorts such people into three separate categories:

1. **Employed.**Individuals with a job, either full time or part time
2. **Unemployed.**Individuals who do not currently have a job but are searching for employment
3. **Out of the labor force.**Individuals who are not employed and not looking for work

Thus

civilian working age population = number employed + number unemployed+ number out of the labor force.

Those out of the labor force include students, stay-at-home parents, those who are prevented from working by disability, and people who have taken early retirement. The category also

includes **discouraged workers**, those who are deemed to have dropped out of the labor force because they have stopped looking for a job.

The **civilian labor force** comprises the employed and the unemployed. The **unemployment rate** is calculated as follows:

and the **employment rate** is calculated as follows:

In the United States, the definition of "employed" is fairly liberal. To be classified as employed, it is sufficient to have done *any* work for pay or profit in the previous week. People may even be counted as employed if they did not work during the week—for example, if they were on vacation, out sick, on maternity/paternity leave, or unable to work because of bad weather.

In this chapter, we explore differences in unemployment in the United States and Europe. To do this properly, we need to take care that unemployment is measured in a similar way within the sample of countries. The European Commission defines as unemployed those aged 15 to 74

- • who were without work during the reference week, but currently available for work,
- • who were either actively seeking work in the past four weeks or who had already found a job to start within the next three months. [***"Employment and Unemployment (LFS): Definitions," European Commission, accessed July 31, 2011,http://epp.eurostat.ec.europa.eu/portal/page/portal/ employment_unemployment_lfs/ methodology/definitions.***]

As in the United States, the unemployment rate is the number of people unemployed as a percentage of the labor force, and the labor force is the total number of people employed and unemployed.

The European Commission defines as employed those aged 15 to 74

- who during the reference week performed work, even for just one hour a week, for pay, profit or family gain,
- were not at work but had a job or business from which they were temporarily absent because of, e.g., illness, holidays, industrial dispute or education and training. [***"Employment and Unemployment (LFS): Definitions," European Commission, accessed July 31, 2011,http://epp.eurostat.ec.europa.eu/portal/ page/portal/employment_unemployment_lfs/ methodology/definitions.***]

These descriptions reveal that the definitions used in Europe are broadly similar to those in the United States, meaning that we can legitimately compare employment and unemployment rates in the two regions.

National and local governments help people cope with the risk that they might lose their jobs. In the United States and many other countries, unemployed people are typically eligible to receive payments from the government, called **unemployment insurance**, for some period of time after losing their jobs. Some governments help the unemployed find jobs and may even provide financial support to help people retrain and obtain marketable skills.

8.1.1 Unemployment in the United States and Europe

***Figure 8.2 "Unemployment Rates in France, the United States, and the Euro Area, 19852011" shows quarterly unemployment rates for the United States, France, and Europe as a whole. In the late 1980s, unemployment fell in both the United States and France, although the US unemployment rate was about two percentage points lower than the French rate. The 1990s were a different story. Unemployment rates increased in both countries at the beginning of the decade. Thereafter, the unemployment rate decreased in the United States, but it continued to increase in France for about half of the decade and decreased only near the end of century. From the early 1990s up to about 2008, the unemployment rate in Europe was substantially higher than that in the United States. The pattern for Europe as a whole closely matches the pattern for France, although unemployment in France is typically a little higher than the European average.

The crisis of 2008, however, led to a dramatic rise in the unemployment rate in the United States. At the end of 2007, the US unemployment rate was just under 5 percent. Two years later, at the start of 2010, the rate was over 10 percent. Unemployment also rose in Europe, but to nothing like the same degree. In early 2011, US and European unemployment rates were almost identical.

One other feature of the data is noticeable: there is a regular seasonal pattern in the data. For example, in the United States, unemployment is almost always higher in the first quarter of the year than it is in the preceding or following quarter. This is because some sectors of the economy are heavily affected by seasonal patterns. For example, stores may hire extra people during the Christmas holiday period, while construction firms may employ fewer people during the winter months. Sometimes, data such as these are “seasonally adjusted” to remove these effects.

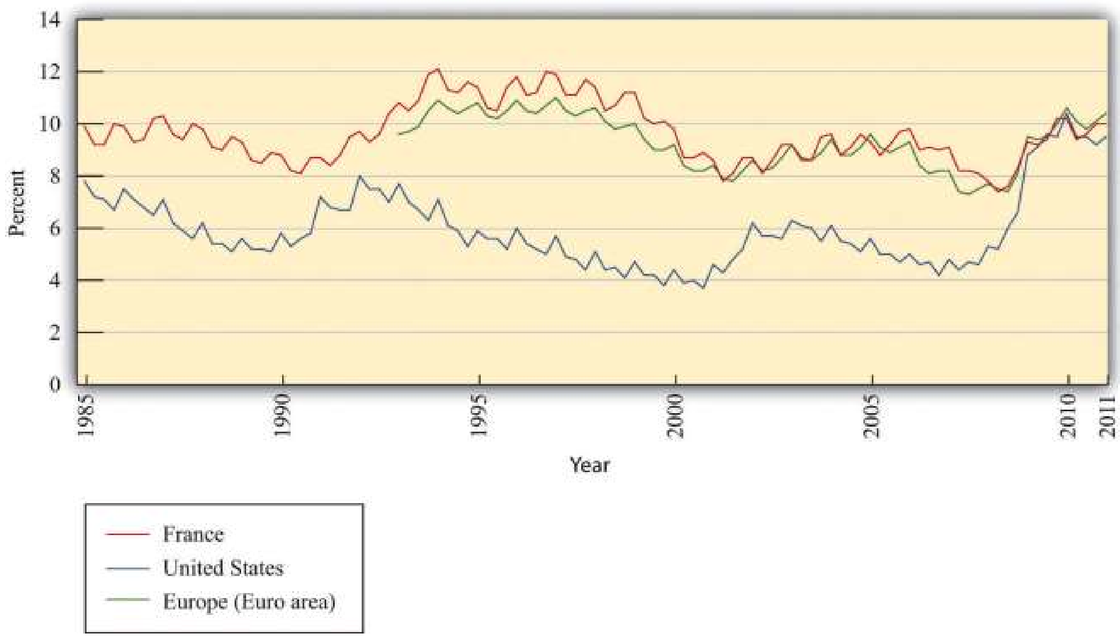

Fig. 8.2: Figure 8.2 Unemployment Rates in France, the United States, and the Euro Area, 1985-2011

Source: OECD, "Statistics Portal: Labour,"http://www.oecd.org/topicstatsportal/0,2647,en_2825_495670_1_1_1_1_1,00.htm l#499797.

The French labor law reforms with which we began the chapter were aimed at young workers, so let us also look specifically at the unemployment experience of this group. Between 2000 and 2010, the unemployment rate in France for the age group 20–24 ranged between 17 and 21 percent, with an average of 18.6 percent. In the United States, in contrast, for the same period and the same group of workers, the unemployment rate averaged 10 percent. [***The figures on youth unemployment come from "Statistics Portal: Labour," OECD,http://www.oecd.org/topicstatsportal/0,2647,en_2825_495670_1_1_1_1_1,00.html# 499797.***] In both countries, the unemployment rate is higher for younger workers than the overall unemployment rate.

Although there are some similarities between France and the United States, there is also a clear puzzle: unemployment, for both the overall population and young workers, was, until very recently, much higher in France. We need to understand the source of this difference before we can evaluate different policy remedies.

8.1.2 The Labor Market

Unemployment suggests a mismatch between supply and demand. People who are unemployed want to have a job but are unable to find one. In economic language, they are willing to supply labor but cannot find a firm that demands their labor. The most natural starting point for an economic analysis of unemployment is therefore the **labor market**.

Toolkit: Section 16.1 "The Labor Market"

The labor market brings together the supply of labor by households and the demand for labor by firms. You can review the labor market in the toolkit.

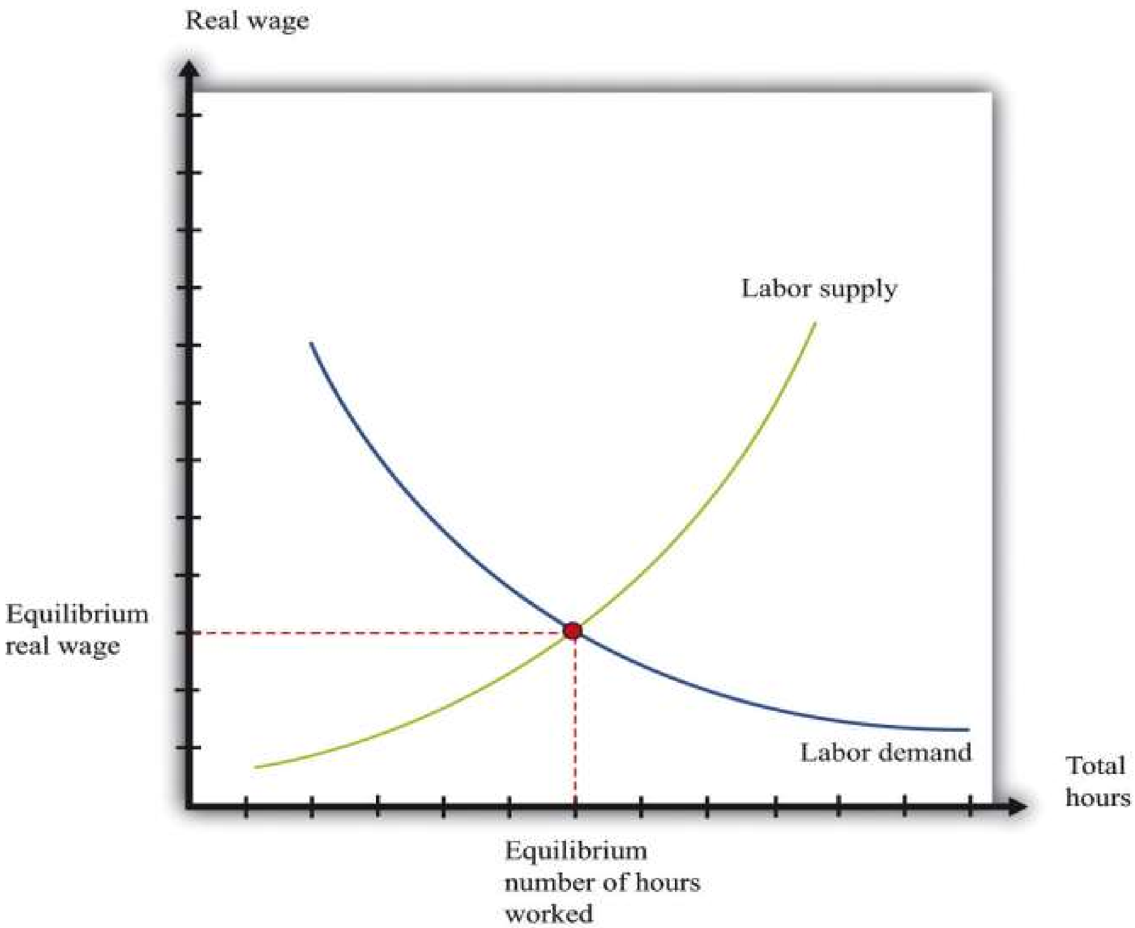

Fig. 8.3: Figure 8.3 Labor Market

The labor market is depicted in ***Figure 8.3 "Labor Market". “Price” on the vertical axis is the **real wage**, which is the nominal wage divided by the price level. It tells us how much you can obtain in terms of real goods and services if you sell an hour of your time. Recalling that the price level can be thought of as the price of a unit of the real gross domestic product (real GDP), you can equivalently think of the real wage as the value of your time measured in units of real GDP.

At a higher real wage, households supply more labor. There are two reasons for this. First, a higher real wage means that, for the sacrifice of an hour of time, households can obtain more goods and services than before. Households are therefore induced to substitute away from leisure to work and ultimately consume more. Second, as the wage increases, more individuals join the labor force and find a job. Embedded in the upward-sloping labor supply curve is both an increase in hours worked by each employed worker and an increase in the number of employed workers.

At a higher real wage, firms demand fewer labor hours. A higher real wage means that labor time is more expensive than before, so each individual firm demands less labor and produces less output. The point where the labor supply and demand curves meet is the equilibrium in the labor market. At the equilibrium real wage, the number of hours that workers choose to work exactly matches the number of hours that firms choose to hire.

Supply and demand in the labor market determine the real wage and the level of employment. Variations in either labor supply or labor demand show up as shifts in the curves. If we want to talk about unemployment, however, the labor market diagram presents us with a problem. The idea of a market is that the price adjusts to reach **equilibrium**—the point where supply equals demand. In the labor market, this means the real wage should adjust to its equilibrium value so that there is no mismatch of supply and demand. Everyone who wants to supply labor at the equilibrium wage finds that their labor is demanded—in other words, everyone who is looking for a job is able to find one.

Remember the definition of unemployment: it is people who are not working *but who are looking for a job*. The supply-and-demand framework has the implication that there should be no unemployment at all. Everyone who wants to work is employed; the only people without jobs are those who do not want to work.

8.1.3 Theories of Unemployment

So where do we go from here? One natural approach is to start from Figure 8.3 "Labor Market" but look for circumstances in which we would see unemployment. Figure 8.4 "Unemployment in the Labor Market" shows us that there will be unemployment if the real wage in the market is too high—that is, above the equilibrium real wage. In this case, the amount of labor that workers want to sell is greater than the amount that firms want to buy. Some workers will want a job at this wage but be unable to find one. They will be unemployed.

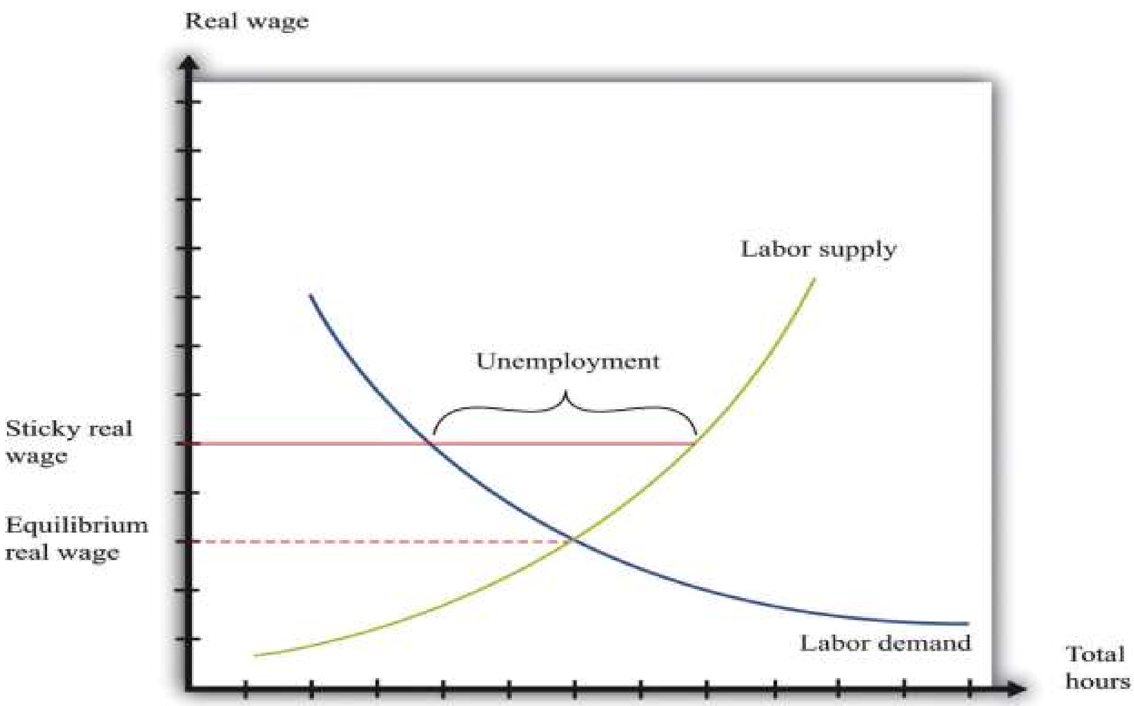

Fig. 8.4: Figure 8.4 Unemployment in the Labor Market If the real wage is sticky, it may be higher than the equilibrium real wage, meaning that some workers who want to work are unable to find a job.

***Figure 8.4 "Unemployment in the Labor Market" shows us what the labor market must look like for there to be unemployment, but it is hardly an explanation of unemployment. Economists typically expect markets to look like ***Figure 8.3 "Labor Market", not ***Figure 8.4 "Unemployment in the Labor Market". That is, they think that the price in a market—in this case, the real wage—adjusts quickly to ensure that supply equals demand. If we want to explain unemployment with a picture like ***Figure 8.4 "Unemployment in the Labor Market", we also need some story of why real wages might be sticky, so they remain above the equilibrium wage.

8.1.4 Inflexible Real Wages

Over the years, economists have offered several stories about why wages might be inflexible.

- One story is that the wage is not allowed to decrease by law. Many economies have minimum wage laws on their books. This could explain some unemployment. A difficulty with this explanation is that the minimum wage affects only low-income workers. Most workers in the economy actually earn a wage above the legal minimum and are unaffected by minimum-wage legislation.
- Another possibility is that firms find it difficult to adjust wages downward. The market for people's time is not like the market for bread. Pay cuts are very visible to workers and are likely to meet a great deal of resistance. If a firm tries to cut wages, it is likely to find that its workers become demotivated and that its best workers start looking for jobs at other firms.

Both of these stories are really explanations of why **nominal wages** may be unable to adjust. ***Figure 8.4 "Unemployment in the Labor Market" has the real wage on the axis. Remember that the real wage is calculated as follows:

Minimum wage laws specify a fixed minimum nominal wage. Even if the nominal wage is fixed, the real wage decreases when the **price level** increases. It follows that rigidities in the nominal wage translate into rigidities in the real wage only if the price level is also sticky.

Prices in an economy may indeed be sticky in the short run, so sticky wages and prices do provide one explanation for short periods of unemployment. Such unemployment is sometimes called **cyclical unemployment**. In the long run, however, we would expect the labor market to return to an equilibrium with zero unemployment. Cyclical unemployment is the component of unemployment that depends on the business cycle. During a recession, cyclical unemployment is relatively high. In periods of economic expansion, cyclical unemployment is low or nonexistent. But we *always* observe some unemployment, which tells us that sticky nominal wages and prices cannot be the whole story.

Figure 8.4 "Unemployment in the Labor Market" tells us that the only way to get persistent unemployment in this framework is for the *real* wage to be permanently above the equilibrium wage. We need to find some reason why market forces will not cause the real wage to adjust to the point where demand equals supply.

One possible story introduces labor unions into the picture. Unions give some market power to workers. Just as we sometimes think about firms having market power, meaning that they have some control over the prices that they set, so we can think about a union having some control over the wage that workers are paid. If there were just a single union representing all workers, then it could choose the real wage, much as monopoly firms choose their price. Firms would then hire as many hours as they wanted at that wage. Generally, unionized workers are paid more than the wage at which supply equals demand, just as in ***Figure 8.4 "Unemployment in the Labor Market". The union accepts some unemployment but believes that the higher wage more than compensates. A problem with this story is that, like the minimum wage, it is relevant only for a relatively small number of workers. In the United States in particular, only a small fraction of the workforce is unionized.

Another story goes by the name of **efficiency wages**. The idea here is that firms have an incentive to pay a wage above the equilibrium. Workers who are paid higher wages may feel better about their jobs and be more motivated to work hard. Firms may also find it easier to recruit good workers when they pay well and find it easier to keep the workers that they already have. The extra productivity and lower hiring and firing costs may more than compensate the firm for the higher wage that it is paying.

8.1.5 Inside the Labor Market

So far, we have come up with four possible stories about unemployment. Can these theories help to explain differences between Europe and the United States?

First, it is generally the case that minimum wages are more generous in Europe than in the United States, so it is certainly possible that higher minimum wages in Europe contribute to higher levels of unemployment there. Second, there is some evidence that nominal wages are in some sense “stickier” in Europe than in the United States. Third, we can observe that unions are generally more prevalent and more powerful in Europe than in the United States. Thus some of the stories that we have told are potentially helpful in explaining differences between the United States and Europe.

However, all these theories are silent about the underlying movement of workers from employment to unemployment and back again. ***Figure 8.4 "Unemployment in the Labor Market" paints a static picture of a world that is in fact dynamic and fluid. There is no means in the framework to explore the role of unemployment insurance and other policies that differ across Europe and the United States. In addition, market forces may work differently in the labor market. In ***Figure 8.4 "Unemployment in the Labor Market", there are more workers wanting to work than there are jobs offered by firms. The standard story of market adjustment is that workers willing to work for a lower wage would approach a firm, offer to undercut the wage of an existing worker, and be immediately hired as a replacement. This is not how hiring and firing usually works in the labor market. Firms have a relationship with their existing workers; they know if their workers are competent, hardworking, and reliable. Firms will not readily replace them with unknown quantities, even for a lower wage.

For these reasons, researchers in labor economics think that Figure 8.4 "Unemployment in the Labor Market" is too simple a framework to explain the realities of modern labor markets. Instead, they frequently turn to a different framework more suited to thinking about labor market flows.

KEY TAKEAWAY

The unemployment rate is the fraction of the civilian labor force looking for a job but currently not employed. The BLS in the United States produces this number on a monthly basis.

During the early part of the 1980s, the unemployment experiences in the United States and Europe were similar. Up until 2008, the unemployment rate in Europe had been significantly higher than the unemployment rate in the United States. Very recently, however, the US unemployment rate climbed to European levels.

In a perfectly functioning labor market, the unemployment rate would be zero. • Possible explanations of unemployment include rigidities in wages, the market power of unions, and incentive effects.

***

Checking Your Understanding

Explain in your own words why the standard supply-and-demand framework predicts zero unemployment when it is applied to the labor market.

What wage is determined in labor market equilibrium—the real wage or the nominal wage?

8.2 Job and Worker Flows

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What key features of labor markets does the static model of labor supply and labor demand fail to capture?

What are some of the key facts about worker labor market flows?

What is search theory, and how is it useful for understanding labor market outcomes?

What are the efficiency gains from flexible labor markets?

The labor market is a highly dynamic place. Workers are constantly moving from job to job, in and out of the workforce, or from employment to unemployment and vice versa. Large firms devote substantial resources to human resource management in general and hiring and firing in particular. By contrast, is *static* because it shows the labor market at a moment in time. Our understanding of the labor market—and, by extension, employment and unemployment—is badly incomplete unless we look more carefully at the movement of workers. Further, when workers and firms meet, they do not take as given a market wage but instead typically engage in some form of bargaining over the terms of employment.

This vision of a dynamic labor market with bargaining is much closer to the reality of labor relations than is the model of labor supply and demand. To better understand the determinants of employment and unemployment, we therefore turn to labor market flows. We begin with some more facts, again contrasting the experience of Europe with that of the United States, and then develop a framework that allows us to think explicitly about the dynamic labor market.

8.2.1 Facts

Our starting point is the classification of individuals in the civilian working age population. Recall that economic statistics place them as one of the following: employed, unemployed, or not in the labor force. Imagine taking a snapshot of the US economy each month. For a given month, you would be able to count the number of people employed, unemployed, and out of the labor force. We could call these the *stocks* of each kind of individual.

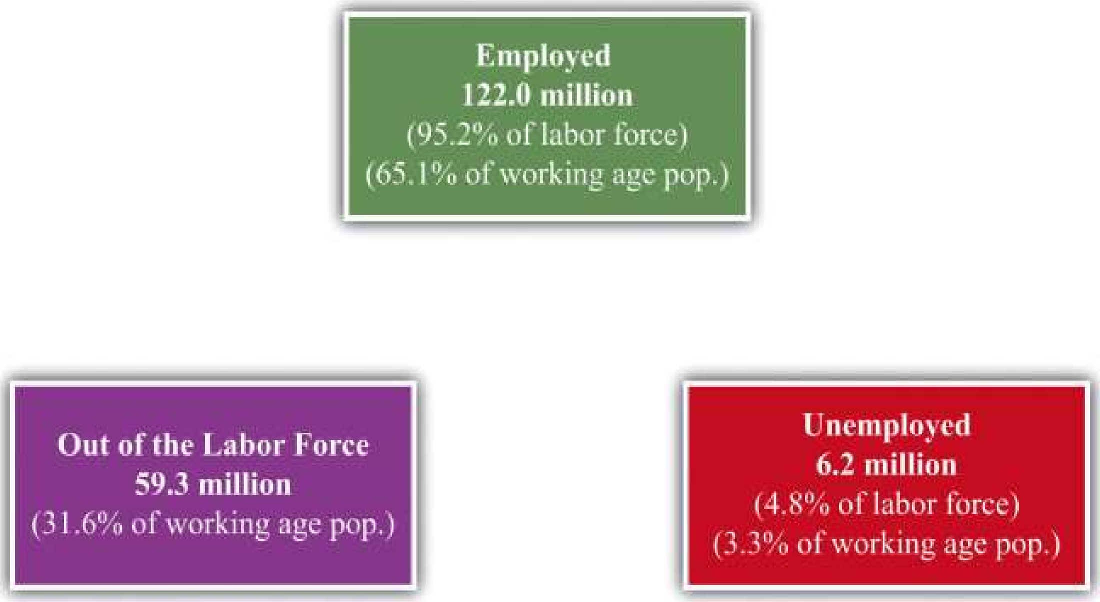

Fig. 8.5: Figure 8.5 Worker Stocks in the United States

shows the number of people between 16 and 64 years old in the United States in three different “states”—employment, unemployment, and out of the labor force—over the period 1996–2003. [***These data come from a study using a monthly survey conducted by the Bureau of Labor Statistics (BLS) called the Current Population Survey and were compiled by Stephen J. Davis, Jason Faberman, and John Haltiwanger. The numbers here come from S. Davis, R. J. Faberman, and J. Haltiwanger, “The Flow Approach to Labor Market: New Data Sources and Micro-Macro Links” NBER Working Paper #12167, April 2006, accessed June 30, 2011,http://www.nber.org/papers/w12167.***] On average, there were 122 million people employed, 6.2 million unemployed, and 59.3 million considered out of the labor force. Adding these numbers together, there were 187.5 million working-age individuals, of whom 128.2 million were in the labor force. The average unemployment rate was 4.8 percent over this period, and the employment rate was 95.2 percent. Notice, though, that many individuals are out of the labor force: only 65 percent of the population is employed.

shows an average over many months, but you could also look at how these numbers change from month to month. Even more informatively, you could count the number of people who were employed in two consecutive months. This would tell you the likelihood of being employed two months in a row. These calculations for the US economy are summarized in. Look, for example, at the arrows associated with the box labeled *unemployed*. There are two arrows coming in: one from the employed box and one from the out-of-the-labor-force box. There are two arrows going out: one to the employed box and one to the out-of-the-laborforce box. Each of these four arrows has a percentage attached, indicating the fraction of people going from one box to another. Thus, on average, 28.3 percent of the unemployed people in one month are employed in the next and 23.3 percent leave the labor force. The remaining 48.4 percent stay in the group of unemployed.

The numbers in the figure are averages over a long period. Such flows change over the course of the year due to seasonal effects. Around Christmas, for example, it may be easier for an unemployed worker to find a job selling merchandise in a retail shop. These flows also change depending on the ups and downs of the aggregate economy.

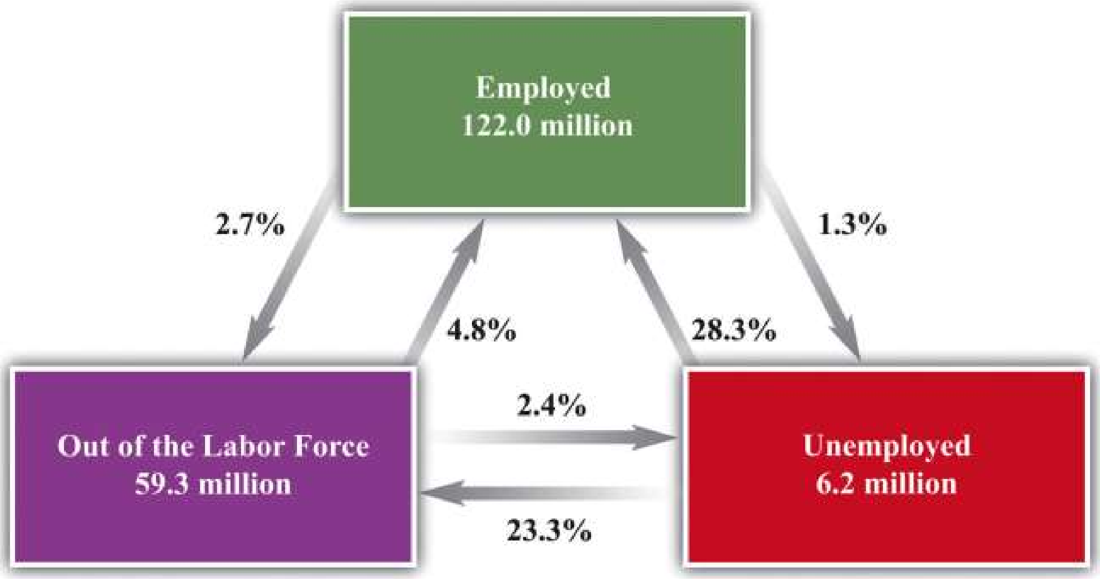

Fig. 8.6: Figure 8.6 Worker Flows in the United States

Do European countries exhibit similar patterns? Portugal makes for a good comparison with the United States because the unemployment rates in the two countries were broadly similar over most of the last two decades. Yet Portugal has very strong employment protection laws, to the point where they are enshrined in the Portuguese Constitution: [***"Article 53," Portugal-Constitution, adopted April 2, 1976, accessed June 30, 2011,http://www.servat.unibe.ch/icl/po00000_.html#A053_.***]

8.2.2 Article 53 Job Security

The right of workers to job security is safeguarded. Dismissals without just cause or for political or ideological reasons are forbidden.

A study that compared the labor markets in Portugal and the United States uncovered the following facts: [***See Olivier Blanchard and Pedro Portugal, "What Hides Behind an Unemployment Rate: Comparing Portuguese and U.S. Labor Markets," American Economic Review 91, no. 1, (2001), 187–207.***]

- The flows into unemployment from employment and the flows from employment to unemployment are much lower in Portugal compared to the United States.
- Average unemployment duration in Portugal is about three times that of the United States.
- Job protection is very high in Portugal relative to the United States.

Even though Portugal and the United States have similar overall unemployment rates, the underlying flows are quite different in the two countries. Flows between employment and unemployment—and vice versa—are much smaller in Portugal. This means that if you lose your job, it is likely to take a long time to find a new one. If you have a job, you are likely to keep it for a long time. As we would expect from this, people typically spend much longer periods of time in unemployment in Portugal than they do in the United States. If we compare the United States with Europe more generally, we see similar patterns. In 2010, the average **unemployment duration** for workers ages 15–24 was about 10.6 months in Europe but only 5.9 months for the United States. For workers in the 25–54 age group, the duration was higher in both Europe (13.7 months) and the United States (8.2 months) than for younger workers. [***See “Unemployment Duration,” Online OECD Employment database, accessed June 30, 2011,http://www.oecd.org/document/34/0,3746,en_2649_33927_40917154_1_1_1_1,00.ht ml#uduration.

Saylor URL: http://www.saylor.org/books Saylor.org***] Recall that in 2010, Europe and the United States had similar rates of unemployment. Employment duration, however, is still much higher in Europe than the United States. In both places, older workers tend to be unemployed for longer periods than younger workers. But European workers are typically unemployed for much longer periods of time than US workers. [***These figures come from “Average Duration of Unemployment,” OECD, accessed June 30, 2011, http://stats.oecd.org/Index.aspx?DataSetCode=AVD_DUR.***]

The Organisation for Economic Co-operation and Development (OECD) conducted a large study on the employment protection legislation in a variety of developed countries. The main study (OECD Employment Outlook for 2004,http://www.oecd.org/document/62/0,3746,en_2649_33927_31935102 _1_1_1_1,00.html) created a measure of employment protection and then attempted to relate it to labor market outcomes in different countries. The reasoning we have just presented suggests that in countries with relatively high levels of employment protection, labor markets would be much more sluggish.

Formulating a comprehensive measure of employment protection is not easy. In principle, the idea is to measure the costs of firing workers and various regulations of employment. Examples would include requirements on advance notice of layoffs and the size of severance payments that firms are obliged to pay. In some countries, a firm must go to court to lay off workers. For temporary workers, there are specific restrictions placed on this form of contract, as in the discussion of France that opened this chapter. In reality, these costs are difficult to detect and convert to a single measure. The OECD findings should be interpreted with these challenges in mind.

Another OECD publication (http://www.oecd.org/dataoecd/40/56/36014946.pdf) examines employment protection legislation across OECD countries in 1998 and 2003.[*** This discussion is based on Figure A.6 of OECD, “Annex A: Structural Policy Indicators,”Economic Policy Reforms: Going for Growth, accessed June 30, 2011,http://www.oecd.org/dataoecd/40/56/36014946.pdf.****] Portugal was the country with the highest level of employment protection legislation, while the United States was the lowest. France was above average, while the United Kingdom and Canada were below average. The OECD analysis highlighted two effects of such legislation on labor market flows:

1. It limits flows from employment into unemployment because it is costly to fire workers.
2. It limits flows from unemployment to employment because firms, when deciding to hire a worker, will realize that they may wish to fire that worker sometime in the future.

The first effect is the more obvious one; indeed, it provides the rationale for employment protection. If it is hard to fire workers, then firms are less likely to do so. The second effect is less obvious and more pernicious. If it is hard to *fire* workers, then firms become more reluctant to *hire* workers. Put yourself in the place of a manager wondering whether to make a hire. One concern is that the person you are considering will turn out to be unsuitable, or a bad worker. Another is that conditions in your industry will worsen, so you may not need as many employees. In those circumstances, you want to be able to let the worker go. If you will not be able to do so, you may decide it is safer simply to make do with the workers you already have.

The OECD analysis particularly stressed the effects on the labor market experience of relatively young workers. The report emphasized that stronger legislation is linked to lower employment of young workers. If it is costly to sever a relationship, then a firm will not give a young worker a chance in a new job. The OECD also noted an important *benefit* of employment protection legislation: it enhances the willingness of young workers to invest in skills that are productive at their firms. Without a strong attachment to the firm, workers have little incentive to build up skills that are not transferable to other jobs.

8.2.3 Job Creation and Job Destruction

In place of the supply-and-demand diagram, we can think about the decisions that workers and firms make when they are trying to form or break an employment relationship. Individual workers search for available jobs, which are called vacancies. On the other side, vacancies are searching for workers. When a vacancy and a worker are successfully matched, a job is created. When we say that a vacancy is searching for a worker, we, of course, really mean that a firm with a vacancy is seeking to hire a worker. You can think of a firm as being a collection of jobs and vacancies.

Whereas the standard supply-and-demand picture downplays differences among workers and jobs, this "search-and-matching" approach places these differences at the center of the analysis. Workers differ in terms of their abilities and preferences. Jobs differ in terms of their characteristics and requirements. For an economy to function well, we need to somehow do a good job of matching vacancies with workers. When a successful match occurs, we call this "job creation."

Search theory is a framework for understanding this matching process. Let us think about how this process looks, first from the perspective of the worker and then from the perspective of the firm. Workers care about the various characteristics of their jobs. These characteristics might include how much the job pays, whether it is in a good location, whether it offers good opportunities for advancement, whether it is interesting, whether it is dangerous, and other attributes.

Vacancies are likewise "looking" for certain characteristics of workers, such as how much they cost, what skills they possess, whether they have relevant experience, whether they are hardworking and motivated, whether they are trustworthy, and so on. The firm cares about these characteristics because it cares about profitability: its goal is to make as much profit as possible.

Over time, the quality of the match between a worker and a vacancy may change. A job may become less profitable to the firm and/or less attractive to the worker. To put it another way, the amount of *value* created by the job may change. The worker may come to dislike particular aspects of the job or may wish to change location for family reasons. The worker may feel that he or she would be better matched with some other firm, perhaps because of changes in his or her skills and experience. From the firm's side, demand for the firm's product may decrease, or the firm might shift to a new production technique that requires different skills. If the value created by a job decreases too much, then the firm or the worker may choose to end the relationship, either by the worker's choice (quitting the job) or the firm's (firing the worker). This is "job destruction."

Jobs are created and destroyed all the time in the economy. The flows of workers among jobs and employment states are a key characteristic of the labor market. As these flows occur, workers often spend time unemployed. After a job is destroyed, the worker may spend some time unemployed until he or she finds a job with a different firm.

8.2.4 Labor Flows and Productivity

In a rapidly changing economy, the value of different jobs (worker-firm matches) changes over time. To function efficiently, the labor market needs to be able to accommodate such changes. For this discussion, we will think about efficiency as simply being measured by the productivity of the match between workers and firms. In an efficient match, the worker is productive at the chosen job. For the overall economy, if all matches are efficient, then it is not possible to change the assignment of workers to jobs and produce more output.

8.2.5 Comparative and Absolute Advantage

Let us see how this works in a simple example. gives an example of an economy with two workers and two jobs. Each entry in the table is the amount of output that a particular worker can produce in each job in one day. For example, worker B can produce 4 units of output in job 2 and 8 units of output in job 1.

Table 8.1 Output Level per Day in Different Jobs

Worker	Job 1	Job 2
A	9	6
B	8	4

Before we begin, let us pause for a moment to think about this kind of example. This chapter is motivated by the desire to explain the employment and unemployment experiences of hundreds of millions of workers in the United States and Europe. It may seem ridiculous to think that a story like this—with two workers, two jobs, and some made-up numbers—can tell us anything about employment and unemployment across two continents. Economists often refer to such stories as "toy" models, in explicit recognition of their simplicity. This kind of model is not designed to tell us anything specific about US or European unemployment. The point of this kind of model is to keep our thinking clear. If we cannot understand the workings of a story like this, then we cannot hope to understand the infinitely more complicated real world. At the same time, if we do understand this story, then we begin to get a feel for the forces that operate in the real world.

If we were in charge of this economy, how would we allocate the workers across the jobs? In this case, the answer is easy to determine. If we assign worker A to job 1 and worker B to job 2, then the economy will produce 13 units of output per day. If we assign worker A to job 2 and worker B to job 1, then the economy will produce 14 units of output per day. This is the better option because—in the interest of efficiency—we would like the workers to be assigned to the jobs they do best.

Notice, by the way, that worker A is better than worker B at both jobs. However, worker A is a lot better at job 2 (50 percent more productive) and only a little better at job 1 (12.5 percent more productive). The best assignment of workers is an application of the idea called comparative advantage: each worker does the job at which he or she does best*when compared to the other person*.

Comparative advantage and **absolute advantage** are used to compare the productivity of people (countries) in the production of a good or a service. We introduce this tool here assuming there are two people and two goods that they can each produce.

Toolkit:

A person has an absolute advantage in the production of a good if that person can produce more of that good in a unit of time than another person can. A person has a comparative advantage in the production of one good if the opportunity cost, measured by the lost output of the other good, is lower for that person than for another.

In our example, worker A has a comparative advantage in job 2, and worker B has a comparative advantage in job 1. We have defined comparative advantage in terms of opportunity cost, so let us go through this carefully and make sure it is clear. The opportunity cost of assigning a worker to one job is the amount of output the worker could have produced in the other job.

We can measure opportunity cost in terms of the output lost from assigning a worker to job 2 instead of job 1. The opportunity cost of assigning worker A to job 2 rather than job 1 is 3 units (9 − 6). The opportunity cost of assigning worker B to job 2 rather than job 1 is 4 units of output (8 − 4). The opportunity cost is higher for worker B, which is another way of saying that worker B has a comparative advantage in job 1. Worker B should be assigned to job 1, and worker A should take on job 2.

We could equally have measured opportunity cost the other way around: as the output lost from assigning a worker to job 1 rather than job 2. The opportunity cost of assigning worker A to job 1 rather than job 2 is −3 units (6 − 9). The opportunity cost of assigning worker A to job 1 rather than job 2 is less, it is −4 units of output (4 − 8). Worker A has the higher opportunity cost (−3 is greater than −4), so we again conclude that worker A should be assigned to job 2.

8.2.6 Changes in Productivity

Suppose that this simple economy is indeed operating efficiently, with worker A in job 2 and worker B in job 1. Then imagine that the productivity of one of these matches changes. For example, suppose that at some point worker B goes on a training course for job 2, so becomes .

Table 8.2 Revised Output Level per Hour from Assigning Jobs

Worker	Job 1	Job 2
A	9	6
B	8	7

If you compare these two tables, you can see that worker B is now more productive than worker A in job 2. Worker A is still better at job 1, as before.

If we want to produce the maximum amount of output in this economy, we now want to switch the workers around: if worker A does job 1 and worker B does job 2, then the economy can produce 16 units of output per day instead of 14.

How might this change happen in practice? Here are three scenarios.

1. **Instantaneous reallocation.**In this case, the labor market is very fluid. Workers A and B trade places as soon as B becomes more productive. No one is unemployed, and real gross domestic product (real GDP) increases immediately.
2. **Stagnant labor market.**This scenario is the opposite of the first. Here, there is no reallocation at all. People are stuck in their jobs forever. In this case, worker B remains assigned to job 1, and worker A remains assigned to job 2. Although this

was the best assignment of jobs when described the economy, it is not the best assignment for . Relative to the better assignment, the economy loses 2 units of GDP every day.

3. **Frictional unemployment.**This scenario lies between these two extremes: workers and firms adjust but not instantaneously. How might workers A and B exchange jobs? One possibility is that worker A is fired from job 2 because the firm wants to attract worker B to the job instead. At the same time, worker B might quit in the hope of getting job 1 when it is vacant. Both workers move from employment into unemployment, as in the arrow from employment to unemployment in . During the time when workers A and B are unemployed, their production is reduced to zero. So, during the period of adjustment, the economy in the third scenario undergoes a recession. But once adjustments are made, the economy is much more productive than before. Economists refer to the unemployment that occurs when workers are moving between jobs as **frictional unemployment**.

How do these three scenarios compare? It is evident that fluid labor markets are the ideal scenario. In this situation, there is no lost output due to unemployment, and the economy is always operating in the most efficient manner. The choice between the second and third scenarios is not so clear-cut. In the second scenario, there is no loss of output from unemployment, but the assignment of workers to jobs is not efficient. In the third scenario, the economy eventually gets back to the most efficient assignment of jobs, but at the cost of some lost output and unemployment (and, in the real world, various other costs of transition incurred by workers and firms).

You can think of the time spent in unemployment in the second scenario as a type of investment. The economy forgoes some output in the short run to enjoy a more efficient match of workers and firms in the long run. As with any investment decision, we decide if it is worthwhile by comparing the immediate cost (the first four weeks of lost output) with the discounted present value of the future flow of benefits. Discounted present value is a technique that allows us to add together the value of dollars received at different times.

Toolkit:

Discounted present value is a technique for adding together flows at different times. If you are interested in more detail, review the toolkit.

Suppose, for example, that it takes four weeks for the economy to reallocate the jobs in the third scenario. Assuming the workweek has 5 working days, the economy produces 0 output instead of 14 units of output for a total of 20 days. The total amount of lost output is 20 × 14 = 280. Once the workers have found their new jobs, the economy produces 10 more units per week than previously. After 28 weeks, this extra output equals the 280 lost units. If we could just add together output this month and output next month, we could conclude that this investment pays off for the economy after 28 weeks. Because output produced in the future is worth less than output today, it will actually take a bit longer than 28 weeks for the investment to be worthwhile.

Provided that changes to the relative productivity of workers do not occur too frequently, the costs of adjusting the assignment of workers to jobs (the spells of unemployment) will be more than offset by the extra output obtained by putting workers into the right jobs. This is the gain from a fluid labor market, even though the process entails spells of unemployment.

8.2.7 Youth Unemployment

We observed earlier that the unemployment rate for young workers is higher than for older workers, in both France and the United States. We can understand why by thinking about the search and matching process.

When lawyers, doctors, professors, and other professionals change jobs, they typically do so with little or no intervening unemployment. Search and matching is easy because they have visible records, meaning their productivity at a particular job is relatively easy to figure out. In general, the longer someone has been in the workforce, the more information is available to potential new employers. Also, experienced workers have a good understanding of the kinds of job that they like.

Just the opposite is more likely in the labor market for young workers. Firms know relatively little about the young workers they hire. Likewise, young workers, with little employment experience, are likely to be very uncertain about whether or not they will like a new job. The result, at least in the United States, is a lot of turnover for young workers. Young workers sample different jobs in the labor market until they find one suited to their tastes and talents. They take advantage of the fluid nature of the US labor market to search for a good match. The gain is a better fit once they find a job they like. The cost is occasional spells of unemployment.

In Europe, search and matching is much harder. Some young workers are even effectively guaranteed jobs for life by the government from the moment they finish college. By contrast, young workers without jobs find it difficult to obtain employment. Given the lack of fluidity in European labor markets, it is surprising neither that more young workers are unemployed, nor that they stay unemployed for longer periods of time.

8.2.8 The Natural Rate of Unemployment

We expect there to be some frictional unemployment, even in a well-functioning economy. We also know that there is cyclical employment associated with the ups and downs of the business cycle. When cyclical unemployment is zero, we say that the economy is operating at *full employment*. The **natural rate of unemployment** is defined as the amount of unemployment we expect in an economy that is operating at full employment—that is, it is the level of unemployment that we expect once we have removed cyclical considerations.

The natural rate of unemployment can seem like an odd concept because it says that it is normal to have unemployment even when the economy is booming. But it makes sense because all economies experience some frictional unemployment as a result of the ongoing process of matching workers with jobs. Government policies that affect the flows in and out of employment lead to changes in the natural rate of unemployment.

KEY TAKEAWAY

•The static model of labor supply and labor demand fails to capture the dynamic nature of the labor market and does not account for job creation and destruction.

In the United States, labor markets are very fluid. Each month, a significant fraction of workers lose their jobs, and each month a significant fraction of unemployed workers find jobs.

Search theory provides a framework for understanding the matching of workers and jobs and wage determination through a bargaining process.

The economy is operating efficiently when workers are assigned to jobs based on comparative advantage. Inflexible labor markets lead to inefficient allocations of workers to jobs.

***

Checking Your Understanding

Is it best to assign workers to jobs based on absolute advantage or comparative advantage?

Why is frictional unemployment not always zero?

8.3 Hours Worked

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are the facts about hours worked across countries?

What are the explanations for these differences in hours worked?

The total number of hours worked in an economy depends on both the number of people who are employed and the number of hours worked by each employed person. So far, we have said little or nothing about this second issue. But another significant difference between Europe and the United States is that people work less in Europe than in the United States. If you hear such a statement, perhaps on the radio, you might have some questions about this comparison.

- Does this difference stem from differences in productivity? That is, is it the case that workers in Europe are less productive than workers in the United States, so it is less worthwhile for them to work as much?
- How is the difference measured? For example, suppose we simply divided the number of hours worked in an economy by the total population and found that this number was higher in the United States than in Europe. There are many possible reasons why this might be true. It could be because labor force participation is higher in the United States. Or it could be because the unemployment rate is lower in the United States. Or it could be because the average employed person in Europe works fewer hours than the average employed person in the United States.

Such questions simply mean that we had better be sure that we get our facts straight. We do this in the next part of this chapter. After that, we again turn to some theory to understand what is going on. [***Discussions of this topic by academics have been prompted by the work of Nobel Prize– winning economist Edward C. Prescott. The following article provides an overview and analysis of the key issues: Edward S. Prescott, “Why Do Americans Work So Much More Than Europeans?”Federal Reserve Bank of Minneapolis Quarterly Review 28, no. 1 (July): 2–13, accessed August 22, 2010, http://www.minneapolisfed.org/publications_papers/pub_display.cfm?id=905.***]

8.3.1 Hours Worked in Europe and the United States

and show some basic facts about hours worked in the United States and Europe. [***Richard Rogerson, “Understanding Differences in Hours Worked,” Review of Economic Dynamics 9 (2006): 365–409.***]shows how hours worked in a number of different European countries compare to hours worked in the United States. More precisely, it shows the total hours worked by individuals between 15 and 64 years old divided by the number of people in that age group. The table does not distinguish by employment status: all working age people are counted, not just employed people.

Three of the largest European countries—France, Germany, and Italy—average less than 75 percent of the hours worked in the United States. Part of this difference is due to longer holidays in Europe, and part is due to the fact that the workweek in Europe is typically shorter. Because the table counts all working age people, the higher unemployment rate in Europe also contributes to the difference.

H < .75	.75 < H < .85	.85 < H < .95	H > .95
Belgium	Austria	Denmark	Australia
France	Finland	Greece	Canada
Germany	Ireland	Portugal	Japan
Italy	Netherlands	Sweden	New Zealand
	Norway	UK	Switzerland
	Spain		

H = Hours in Europe/Hours in US

Fig. 8.7: Figure 8.7 Hours in Europe Relative to the United States

looks at the hours worked in various countries over the 40 years from 1970 to 2009. The measure of hours is calculated in the same manner as . Average hours worked have declined significantly in most of these countries. Meanwhile average hours worked in the United States have been more or less flat over these four decades. As a result, hours worked are now significantly higher in the United States than in any of these countries.[*** The data come from OECD (2010), "Hours Worked: Average annual hours actually worked",OECD Employment and Labour Market Statistics (database). doi: 10.1787/data00303-en (Accessed on 18 October 2011)http://scholar.harvard.edu/alesina/files/work_and_leisure_in_the_u.s._and_europe.p df. Figure 1 shows a similar pattern of divergence in hours worked for employed people, though the hours worked per employed person has declined in all countries over this period.***]

Research by the Nobel Prize–winning economist Edward Prescott paints a similar picture. He reports that from 1993 to 1996, the hours worked per person in France were about 68 percent of the level in the United States. In addition, US output per person was much higher than in Europe. Prescott explains this difference based on the number of hours worked, not by differences in output per hour worked. In other words, the United States is richer, not because it is more productive but simply because people work more.

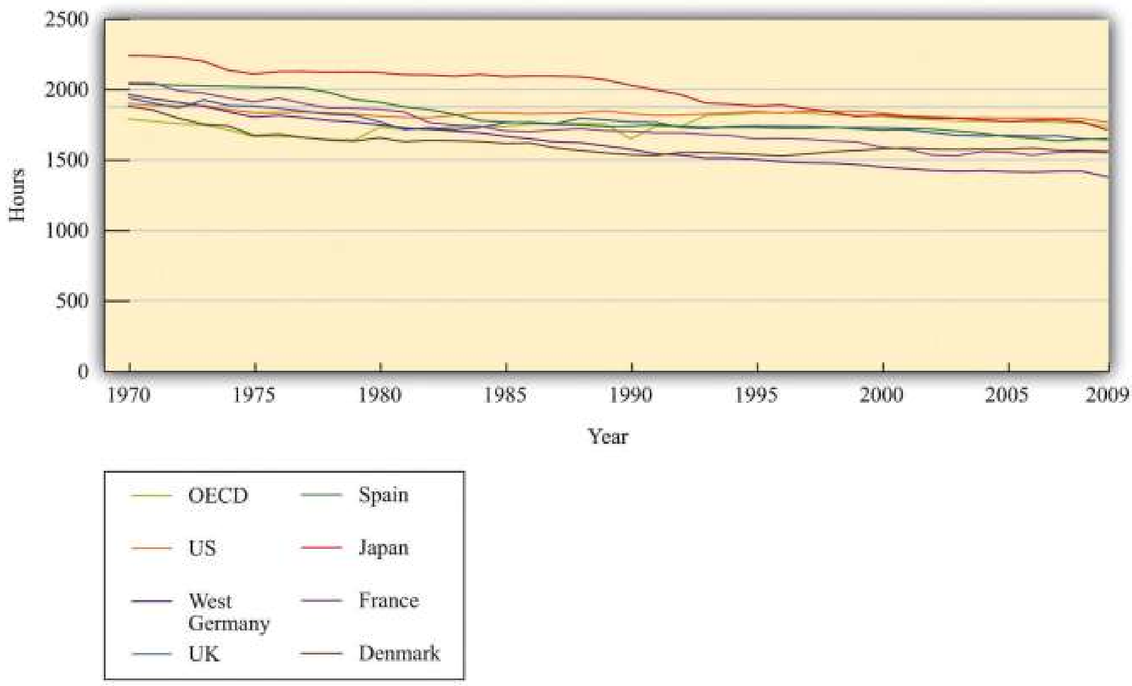

Fig. 8.8: Figure 8.8 Annual Hours in Various Countries

8.3.2 Where Do Differences in Hours Worked Come From?

The immediate question is, why do people work more in the United States? A natural place to look for explanations is the labor supply decisions of households. One possibility is simply that the tastes of US and European households are different. Perhaps Europeans prefer having fewer goods and more leisure. Although this is possible, economists prefer to start from the presumption that people have broadly similar tastes and look first to see if there are other plausible explanations.

The differences in hours worked are not explained by Europeans having poorer technology. Both the United States and European countries are highly developed, so technologies used in one country are used in the others as well. Supporting this is the fact that, as we already noted, productivity does not appear to be lower in Europe.

Another candidate explanation is that there are differences in the tax system. shows an **individual labor supply curve**—in either Europe or the United States. Notice in the wage on the vertical axis is the real wage *after taxes*. This is defined as follows:

```
real wage after taxes = real wage × (1 − tax rate).
```

In this equation, the tax rate is a *marginal* tax rate. This means that it is the tax paid on the *extra amount you earn*if you work a little bit more. Suppose the tax rate is 0.40 and your real wage per hour is $10. Then, if you work an extra hour, you pay $4 to the government, and you retain $6.

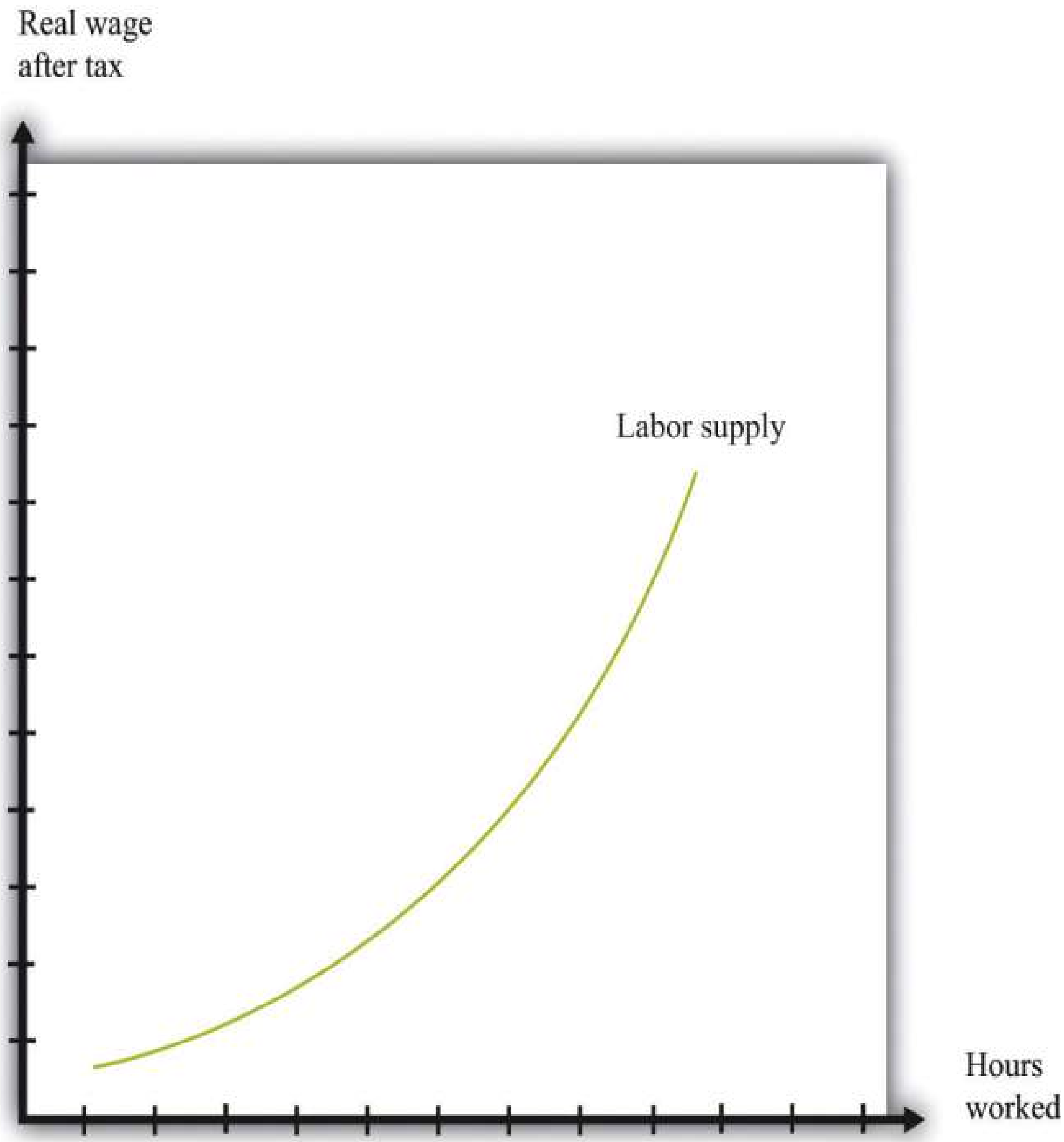

Fig. 8.9: Figure 8.9 Labor Supply

Toolkit: If you want to see the underpinnings of the labor supply curve, you can look in the toolkit. shows that an increase in the after-tax real wage will cause an individual to supply more time to the market and thus consume less time as leisure. The increase in the wage creates an incentive for the individual to substitute away from leisure because it has become more costly.

Suppose that we compare two identical individuals in Europe and the United States. If the marginal tax rate in Europe is higher than it is in the United States, then the after-tax wage in Europe will be smaller. Since labor supply is upward sloping, individuals in Europe will work less than individuals in the United States. For this to be a convincing explanation, two things must be true:

1. Marginal tax rates must be higher in Europe.
2. Labor supply must slope upward enough to match the differences in hours.

Marginal tax rates are indeed lower in the United States than in Europe. Recent research finds that the marginal tax rate on labor income is about 34.5 percent in the United States compared to 57.7 percent in Europe (Germany, France, Italy, and the

United Kingdom).[*** Alberto F. Alesina, Edward L. Glaeser, and Bruce Sacerdote, "Work and Leisure in the U.S. and Europe: Why So Different?" (Harvard Institute for Economic Research, Working Paper #2068, April 2005), accessed June 30, 2011,http://www.colorado.edu/Economics/morey/4999Ethics/AlesinaGlaeserSacerdote2005 .pdf. ***] So, if you work an extra hour and earn a pretax wage of $10, then you would keep $6.55 in the United States and $4.23 in Europe.

The evidence is also consistent with the view that labor supply increases as the after-tax real wage increases. shows the implication of this. On the vertical axis are two different levels of the after-tax real wage: a low one for Europe and a higher one for the United States. These differences in the after-tax real wage translate into differences in hours, using the labor supply curve of an individual. Thus, as in , individuals in the United States work more hours than in Europe. As this is true for everyone in the labor force, this argument immediately translates into a statement about hours worked for the aggregate economy.

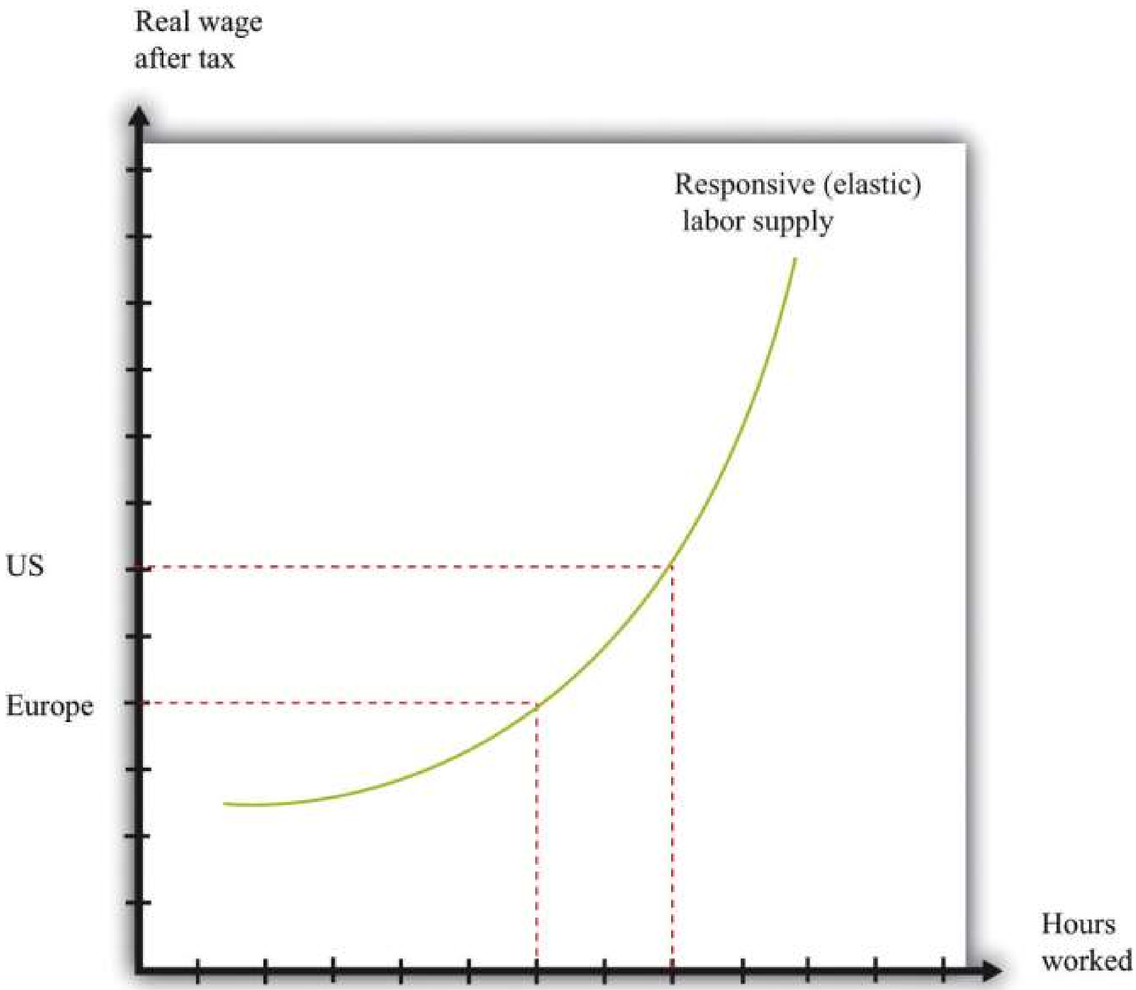

Fig. 8.10: Figure 8.10 Differences in Hours Supplied There are two real wages after taxes shown: one for Europe and one for the United States. These differences in real wages translate into differences in hours worked.

There are two real wages after taxes shown: one for Europe and one for the United States. These differences in real wages translate into differences in hours worked.

Can the difference in the after-tax real wage explain the observed difference in hours worked? This depends on how responsive labor supply is to changes in the real wage.shows two labor supply curves. In one case (the solid curve), labor supply is very responsive to changes in the wage. Relatively small differences in taxes then have substantial effects on hours worked. In the other case (the dashed curve), labor supply is not very responsive to the wage. Differences in tax rates are then unlikely to be able to explain the differences in hours worked.

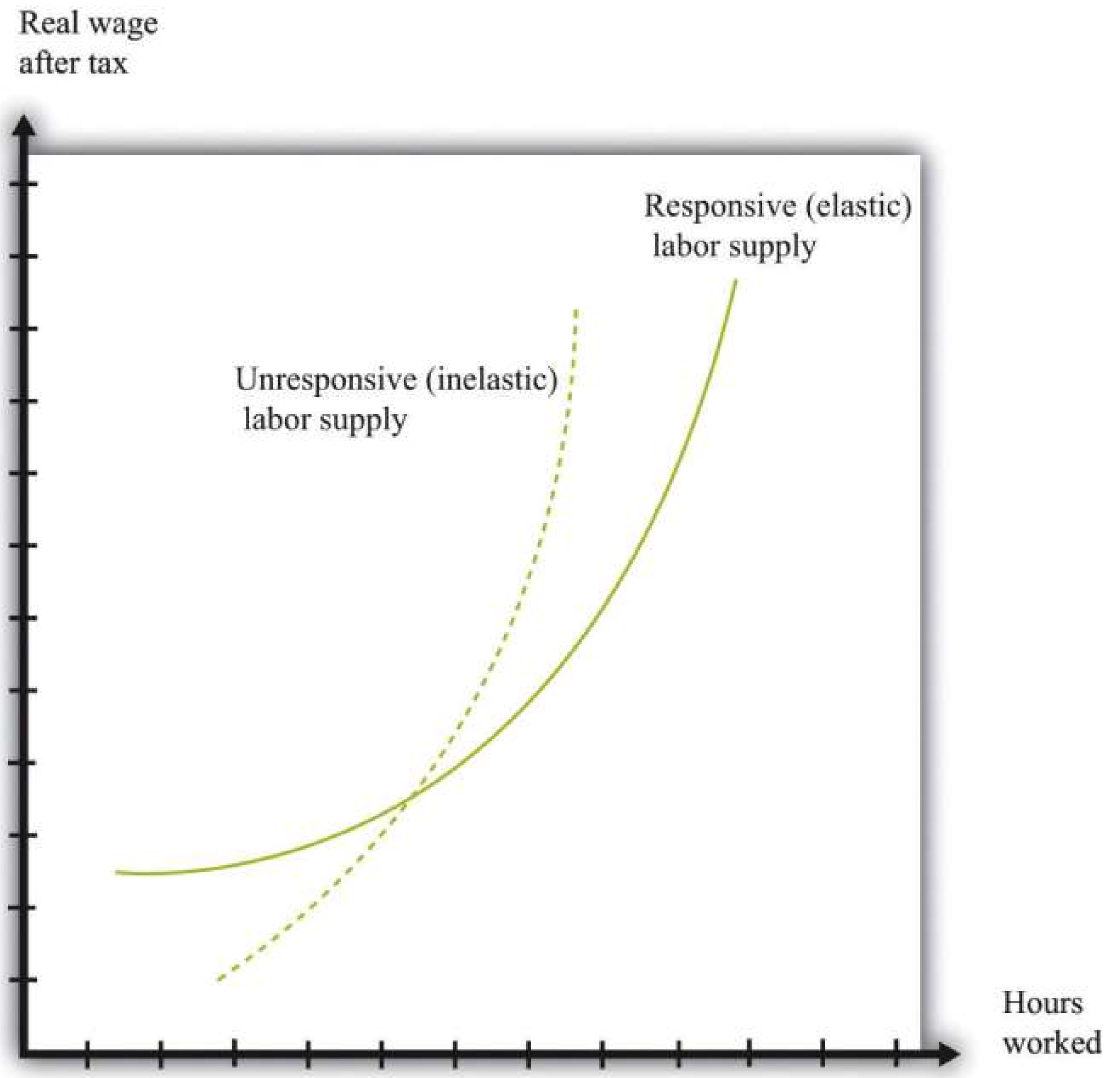

Fig. 8.11: Figure 8.11 Responsive and Unresponsive Labor Supply For the solid labor supply curve, hours worked responds strongly to changes in the real wage after taxes, while for the dashed curve, the response is very weak.

Prescott argues that the difference in taxes between the United States and Europe is enough to account for the differences in hours worked. To make this argument, Prescott holds fixed the labor supply curve () across countries and asks how much of the observed difference in hours can be explained by tax policy. This is a *movement along* the labor supply curve because the vertical axis measures the after-tax real wage. To support this argument, however, Prescott assumes that labor supply is indeed quite responsive to changes in after-tax wages.

KEY TAKEAWAY

The average hours worked varies over countries. In the United States, the average hours worked are greater than in Europe. •

One way to explain differences in hours worked is through the higher marginal labor income taxes paid in Europe.

***

Checking Your Understanding

Draw a diagram of the labor market to show how taste differences might explain differences in hours worked across countries.

In , why is a tax policy change a movement along the labor supply curve and not a shift in the labor supply curve?

8.4 The Government and the Labor Market

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What are common forms of government intervention in labor markets?

Why do governments intervene in labor markets?

The employment and unemployment experience of Europe is quite different from that of the United States. We have developed some frameworks that help us understand the sources of these differences. But we have not yet really addressed the question at the heart of this chapter: what is the impact of different labor market policies in the two places?

Government interventions in the labor market are commonplace in most European countries. In Europe, there are many examples of restrictions on hiring, firing, the closing of plants, and so forth. There are some restrictions of this kind in the United States as well but not to the extent that we observe in Europe. In part this is because public opinion in Europe is more supportive of such regulations, as compared to the United States. For example, in 2003, the French food producer Danone decided to close two unprofitable factories in France. This news, which would almost certainly have been unexceptionable in the United States, led to massive protests, boycotts, and condemnation by politicians.

Europe is not the only part of the world in which governments intervene directly in labor markets. Labor regulations have recently been under consideration in China as well. [***Joseph Kahn and David Barboza, "China Passes a Sweeping Labor Law," New

York Times, World Business, June 30, 2007, accessed June 30, 2011,http://www.nytimes.com/2007/06/30/business/worldbusiness/30chlabor.html.***]

The new labor contract law, enacted by the Standing Committee of the National People's Congress, requires employers to provide written contracts to their workers, restricts the use of temporary laborers and makes it harder to lay off employees.

Because of China's communist history, most workers are not represented by labor unions. It is the government that steps in to represent workers. The need to do so is enhanced by the increasing share of private rather than publically owned firms in China's economy.

We finish this chapter by considering some of the policies that have been adopted by governments in an attempt to influence the functioning of labor markets. We are interested both in why policymakers think these policies are a good idea and in the effect of these policies on the economy.

8.4.1 Unemployment Insurance

In , we described the flow of workers between situations of employment, unemployment, and out of the labor force. We also argued that having a flexible labor market in which people can change jobs easily may more than compensate for the fact that people may sometimes spend time in unemployment.

But this is abstract economist-speak. People who lose their jobs, even if only temporarily, see their livelihood vanish. The reallocations of jobs that are beneficial to the economy as a whole may be costly, even devastating, to the affected individuals. For this reason, most developed economies have some kind of unemployment insurance to protect their workers. Unemployment insurance means that, if you are unemployed, you will receive some income from the government. Exactly how long you receive this income for and exactly how much you get depends on where you live. Some countries have much more generous unemployment insurance than others. Even if you live in the United States, the amount of insurance varies from state to state.

When it comes to buying car insurance, home insurance, or life insurance, households typically decide for themselves how much insurance to purchase. It is not a decision made by the government. Unemployment insurance is different: it is provided by the government rather than by private companies. This insurance is funded by taxes levied on firms and workers together.

The reason unemployment insurance is provided by the government is because it might be difficult for private firms to provide this coverage. Private insurance companies rely on the fact that not everyone makes claims on insurance at the same time. For example, a provider of home insurance knows that 20 percent of the houses that they insure will not burn down in the same month. But in a recession, the high rate of unemployment means that a lot of people claim benefits at the same time. If private insurers were providing the benefits, insurance companies might go bankrupt, leaving workers without insurance. The government, by contrast, can use its ability to borrow, so it can finance unemployment insurance in one year from tax receipts it will receive in the future.

In the United States, the amount of insurance you receive typically depends on how much you have earned over the past year. A rule of thumb is that workers get about 25 percent of their wage income paid back through unemployment insurance. Benefits are available for only 26 weeks, although this is usually extended when the economy is in a recession. Other countries have much more generous programs. [***"The Ins and Outs of Long-Term Unemployment," OECD Employment Outlook 2002, accessed June 30, 2011, http://www.oecd.org/dataoecd/36/48/17652683.pdf. Table 4.1 provides an extensive cross-country comparison.***] In Denmark, for example, unemployment benefits are about 90 percent of labor income and can last for up to 4 years.

Unemployment insurance has two main effects. First, and most obviously, this insurance makes it easier for unemployed people to sustain their level of consumption until they regain employment. Thus this form of insurance helps support **consumption smoothing**. Second, unemployment insurance affects the incentives of the unemployed. If individuals know they will receive some income even when they are unemployed, they are more likely to be willing to search extensively for good jobs. Instead of feeling the need to take the first job that comes along, people can wait longer and search longer for a job that is a really good match.

Unemployment insurance therefore contributes to labor market flexibility. It is, however, tricky to decide just how much unemployment insurance should be provided. After all, if unemployment insurance is too generous, then unemployed workers will be tempted to defer getting a new job for a long time—perhaps indefinitely. For this reason, governments usually restrict the period of time for which a worker can collect insurance to provide an incentive for them to search for a job.

8.4.2 Firing Costs

Imagine that you are the human resources (HR) manager of a firm in the United States. Suppose that the demand for your firm's product has declined, so you need to lay off some workers. You will be obliged to provide two weeks' notice to them. In many cases, that will be the end of your firm's obligations, although workers may sometimes be entitled to additional severance payments as part of their employment contracts. In the United States, employment contracts are largely a private matter between a firm and its workers. A firm cannot fire a worker for a discriminatory reason, but otherwise the government stays out of the contractual agreements among workers and firms. According to the Department of Labor, "In general, if the reason for termination is not because of discrimination on these bases, or because of the employee's protected status as a whistleblower, or because they were involved in a complaint filed under one of the laws enforced by the Department of Labor (see

Whistleblower and Non-Retaliation Protections), then the termination is subject only to any private contract between the employer and employee or a labor contract between the employer and those covered by the labor contract.” [***“Termination,” US Department of Labor, accessed June 30, 2011,http://www.dol.gov/dol/topic/termination/index.htm.***]

In other countries, matters are not so simple. Imagine now that you are the HR manager of a firm in Portugal. Your product demand has fallen off, and you want to reduce output. In contrast to the United States, you may not be able to simply lay off workers. In Portugal, and in many other countries, there are numerous laws that make it costly to dismiss workers.

If you want to design a public policy to reduce the unemployment rate, it is tempting to make it harder to fire workers. If it is difficult to fire people, then fewer individuals will move from employment into unemployment. As we discussed earlier, though, spells of unemployment are sometimes necessary if workers are to move from less productive jobs to more productive ones. An increase in firing costs makes the labor market less flexible, so the economy will adjust less effectively to changes in workers’ productivities.

There is also a more subtle unintended consequence of firing costs. If it is harder to fire workers, then firms become more reluctant to hire workers. Neither firms nor workers know the true value of a match in advance. When you take a part-time job, your productivity at that job and job satisfaction cannot be known ahead of time. Suppose there was a law that stated that once you accept a job you must stay with that employer for five years. You would certainly become very careful about deciding to accept a job offer. Exactly the same applies to firms. If the cost of laying off a worker is very high, then the firm will simply not hire the worker. A policy designed to promote employment can actively discourage it.

The French government, as we saw at the beginning of the chapter, made an attempt to introduce labor market reforms based on exactly this reasoning and tried to make the argument that we have just outlined to the protesters in the streets. If there were more flexibility in the firm’s employment decision, they argued, firms would become more willing to hire young workers. This would help to reduce youth unemployment. The following *New York Times* article tells what happened next. [***Elaine Sciolino, “Chirac Will Rescind Labor Law That Caused Wide French Riots,” New York Times, April 11, 2006, accessed June 30, 2011,http://www.nytimes.com/2006/04/11/world/europe/11france.html?_r=1.***]

President Jacques Chirac crumbled under pressure from students, unions, business executives and even some of his own party leaders on Monday, announcing that he would rescind a disputed youth labor law intended to make hiring more flexible. The retreat was a humiliating political defeat for both Mr. Chirac and his political protégé, Prime Minister Dominique de Villepin [...]

It also laid bare the deep popular resistance to liberalizing France’s rigid labor market, and makes any new economic reform politically impossible before a new government is in place, and perhaps not even then.

“Dead and buried,” is how Jean-Claude Mailly, leader of the leftist union Force Ouvrière, described the fate of the labor law. “The goal has been achieved.”

[…]

The new law was intended to give employers a simpler way of hiring workers under 26 on a trial basis without immediately exposing companies to the cumbersome and costly benefits that make hiring and firing such a daunting enterprise. Opposition to the law reflects the deep-rooted fear among the French of losing their labor and social protection in a globalized world.

[…]

In its initial form, the law allowed employers to fire new employees within two years without cause. In the face of mounting pressure, Mr. Chirac watered it down so that employers could subject new employees to only a yearlong trial period, and then would have to offer a reason for any dismissal. Students and unions, bolstered by support from the opposition Socialists and even some business leaders, had vowed to continue their street protests until the law was rescinded.

The Socialists were quick to proclaim victory on Monday. “This is an unquestionable retreat,” Francois Hollande, the leader of the Socialist Party, told reporters. “It is a grand success for the young and an impressive victory for the unity of the unions.”

[…]

8.4.3 Restrictions on Hours

Another tempting policy to increase employment is to limit the number of hours an employee can work. Suppose that a firm needs 1,200 hours of labor time a week. If a typical worker works 40 hours per week, then the firm will need to hire 30 workers. But if the government were to legislate a 30-hour workweek, then the firm would need to hire 40 workers instead.

This idea of “spreading work” through restrictions on hours was part of the response in the United States to the Great Depression. During the early 1930s, the US government instituted such restrictions under the heading of the “National Economic Recovery Act.” The idea persists to the present day. In France, the government passed a law limiting hours worked to 35 hours per week (for workers at large firms) starting in the year 2000. In Germany, the government operates a policy called Kurzarbeit, whereby it subsidizes firms who retain workers for shorter hours in times of recession.

One problem with such policies is that restrictions on hours reduce the value of a match between a worker and a firm. Consequently, fewer matches will be formed, and more workers will be unemployed. Another problem is that it reduces flexibility in the labor market, which leads to less efficient functioning of the economy.

As a concrete example, consider auto manufacturers in the years following the Great Depression in the United States. This industry had substantial variations in hours worked over the model year. During times of high demand for cars (the spring), factories and their workers were working overtime to meet the increased demand. Restrictions on hours meant that overtime working had to be replaced by increased hiring. Firms that wanted to produce more output had to hire and train new workers. This was costly, so firms sometimes found it was better simply to accept that they would not meet the high demand.

In the case of France's 35-hour workweek, matters were a bit more complicated. The mandated short workweek imposed some rigidity on firms. However, during the negotiations for this change in the laws, French labor unions agreed to some other changes that improved the flexibility of the labor market. France later moved away from the 35-hour workweek by permitting firms and workers to agree to longer work hours if they wish.

KEY TAKEAWAY

Most governments provide workers with unemployment insurance. In many countries, governments also impose costs on firms that fire workers and also restrict hours worked.

One rationale for intervention by governments is to provide insurance to workers that is not available in private markets. Governments also take action in an attempt to increase employment rates.

***

Checking Your Understanding

Can a firm in the United States fire a worker without permission of the government?

What was one of the arguments in France for restricting the hours worked per week?

8.5 End-of-Chapter Material

In Conclusion

Europe and the United States differ in many ways. From the perspective of macroeconomists, some of the most striking differences are in the laws governing labor markets.

In the United States, labor markets are relatively flexible. It is relatively easy for firms to hire and fire workers, and it is relatively easy for workers to move between jobs. This brings many benefits to the economy as a whole, the most important being that it helps ensure good and productive matches between workers and firms. It also has some less attractive implications, particularly for workers. Job security is very limited, and workers might find themselves out of a job with very little warning.

In Europe, labor markets tend to be more rigid. We have explored some of the ways in which this is true. Minimum wages are often higher, unemployment insurance is more generous, and the costs of hiring and firing workers are greater. As a consequence, European countries are typically characterized by higher unemployment than the United States. In addition, unemployment duration tends to be longer: workers who become unemployed tend to take longer to find a new job. This makes the labor market a more difficult place for workers who do not have jobs but a better place for those who do have jobs because they typically enjoy higher salaries and greater security.

We have analyzed the differences between these two parts of the world, but we have not explained why these different economies have settled on such different configurations of labor laws. The explanation is not simple and goes well beyond economics into questions of history, politics, and sociology. Still, there is probably some truth in the simplest explanation: voters have different preferences about how their working lives should look. Perhaps voters in Europe prefer a world of greater job security for the employed, even if it comes at the cost of unemployment problems and a less-efficient economy. Perhaps voters in the United States prefer a dynamic economy, even if it comes at the cost of more uncertainty for working people.

Key Links

- US Department of Labor, information on unemployment insurance:http://www.ows.doleta.gov/unemploy/aboutui.asp
- Organisation for Economic Co-operation and Development (OECD) key employment statistics:http://www.oecd.org/document/53/0,3746,en_2825_495670_42788213_1_1_1 _1,00.html
- European Union statistics: labor market policies:http://epp.eurostat.ec.europa.eu/portal/page/portal/labour_market/introduction
- Bureau of Labor Statistics, labor force statistics:http://www.bls.gov/cps/home.htm
- International Labour Organization, labor policies:http://www.ilo.org/empelm/lang-en/index.htm

EXERCISES

1. A Washington Post article quoted the following opinion from a French student. [***Molly Moore, “French Students Hit Streets to Protest New Labor Law,” Washington Post, World News, March 17, 2006, accessed July 7, 2011, http://www.washingtonpost.com/wpdyn/content/article/2006/03/16/AR2006031601908.html.***] Do you agree or disagree with these views? Do you think of the labor market experience in your country differently? “They’re offering us nothing but slavery,” said Maud Pottier, 17, a student at Jules Verne High School in Sartrouville, north of Paris, who was wrapped in layers of scarves as protection against the chilly, gray day. “You’ll get a job knowing that you’ve got to do every single thing they ask you to do because otherwise you may get sacked. I’d rather spend more time looking for a job and get a real one.”

2. (Advanced) What effect does unemployment insurance have on the savings behavior of employed households? Think about the life-cycle model, discussed inChapter 13 "Social Security" (and in the toolkit). How would you add the prospect of unemployment to the household's life-cycle decisions on consumption and saving?
3. Explain how each of the following factors might affect the duration of unemployment for a single unemployed worker: (a) rate of unemployment in the economy, (b) age of the worker, (c) skills of the worker, (d) country of the worker, (e) generosity of unemployment insurance, (f) wealth of the worker, and (g) employment status of the worker's spouse. What other factors can you contribute to this list?
4. The following table contains information about worker output in two jobs. Explain why worker B has an absolute advantage in both jobs. What is the most efficient assignment? Which worker has a comparative advantage in job 1? Calculate the opportunity cost of assigning the workers to job 2. Which worker has a lower opportunity cost of taking job 2?
5. Consider the following job assignment problem based on the table titled "Output Level per Hour from Assigning Jobs". Here there are three workers, three jobs, and the prospect of not working. In the table, the value of output produced not working can be interpreted as the value of either leisure time or the output produced at home (say, in the garden). Find the optimal assignment of workers to jobs. Should anyone be unemployed? If not, how would you change the table so that someone was not working?
6. Explain why making it easier to fire people might reduce the unemployment rate.
7. Suppose that there is a legal minimum wage, set in nominal terms. Draw a diagram to show how this can lead to unemployment. Now suppose that there is inflation. What happens to the employment rate? What happens to the unemployment rate?

TABLE 8.3 OUTPUT LEVEL PER DAY IN DIFFERENT JOBS

Worker	**Job1**	**Job2**
A	1	9
B	2	12

TABLE 8.4 OUTPUT LEVEL PER HOUR FROM ASSIGNING JOBS

Worker	Job 1	Job 2	Job 3	Not Working
A	10	12	6	0
B	8	1	1	2
C	6	3	5	3

Economics Detective

1. Go to the website for the Organisation for Economic Co-operation and Development (http://www.oecd.org/home/0,2987,en_2649_201185_1_1_1_1_1,00.html). Find he latest table reporting unemployment rates in Europe. How is unemployment defined in this table?
2. Find a recent discussion of employment protection laws across countries. In which countries are jobs most regulated? Has this changed much over time? Can you find any evidence relating the measure of employment protection laws with the unemployment experience of the individual countries?
3. Go to the website for the Current Population Survey (http://www.bls.gov/cps). Develop a figure similar to ***Figure 8.6 "Worker Flows in the United States" for the current month. Why do the numbers differ from those reported in ***Figure 8.6 "Worker Flows in the United States"? Find a year when the United States was in a recession. What were the rates of job flows like during the recession?
4. Find a discussion of the unemployment insurance that would apply to you if you lost a job where you currently live. Does it matter in your state/country *why* you are not currently employed? In your state/country, do you have to continue to look for a job to receive unemployment insurance? If so, what do you have to do?
5. In Europe, is the amount of unemployment insurance determined by individual countries or by the European Union?
6. Go to the website for the Bureau of Labor Statistics (http://www.bls.gov) and find out what ages are classified as working age in the United States.

Chapter 9 Money: A User's Guide

The Color of Money

You wake up one morning, drag yourself out of bed, and, bleary-eyed, throw on some clothes. You stumble out of your apartment and across the road to your neighborhood coffee shop. "Coffee, please," you say to the barista, those being the only two words that you are capable of getting out of your system before you get some caffeine into it. She pours a cup of the coffee of the day and places it on the counter in front of you. Just smelling the coffee makes you feel a little bit better already.

"That'll be a dollar." You reach into your pocket, pull out a crumpled twenty, hand it to her, and reach for the cup. "I'm sorry," she says, pulling the cup away from you, "I can't accept that." "Why on earth not?" you ask, bemused. "It's the wrong color," she says. "You could have used that yesterday, but—look—this is what bills look like now." And she reaches into her register and shows you a bright purple $20 bill, like the one in the following figure .

Fig. 9.1: Figure 9.1 The New $20 Bill Imagine if you woke up one morning and found that all money was now this color.

In this story, normal green dollar bills were accepted as money yesterday, while purple dollar bills were worthless colored pieces of paper. But today, purple dollar bills are accepted as money, and green dollar bills are just worthless pieces of paper. This sounds absurd. Yet it is not so far from what happened in a dozen different countries on January 1, 2002. If you had awakened in Italy on that day and gone down the street to a neighborhood café, you would have noticed that the simple act of buying coffee had changed from the day before. Your local café still looked as it did on December 31, 2001. But where you had previously paid with notes and coins called Italian lira, you would now pay with a completely new currency called the euro.

The same was true in France, Finland, Germany, Greece, and seven other European countries. On that day, 12 countries all officially gave up their own currencies and instead adopted a common currency—the euro. Admittedly, the transition was not quite as stark as in our story: there was a period of about 2 months in which euros and the old local currencies both circulated. But the essence is the same. At one time, euro notes were just colored pieces of paper that shopkeepers would not accept for transactions. Then, not that long afterward, those colored pieces of paper became valuable, while the old currencies turned into worthless pieces of paper.

This was an amazing event for the international economy. Familiar currencies like the French franc, the German deutschmark, the Greek drachma, and the Spanish peseta simply disappeared. The following figure shows some of these vanished currencies. Some of the world's largest economies changed their currency. [***In Chapter 15 "The Global Financial Crisis", we take up another aspect of this event: what it means for a country to disband its central bank and delegate monetary policy to a centralized entity.***] To make sense of this event, we need to answer a disarmingly simple-looking question, which is the theme of this chapter:

Why do people want to hold apparently worthless pieces of paper?

Fig. 9.2: Figure 9.2 Some Vanished Currencies Here are some of the banknotes that disappeared from circulation in Europe upon the advent of the euro.

Road Map

Understanding what happened in Europe requires us to answer two more basic questions:

What is money? and Why is it valuable?

We begin this chapter by looking at what makes something a money. Surprisingly, this is not straightforward: we will see that money has several attributes, and many different things can act as money. Then we look at what we can do with money. We use money to buy goods and services, we use money to buy other kinds of money, and we use money to buy money in the future.

Before exploring the world of money, we need to make one clarification. In everyday language, if you bought a camera for $200 and sold it for $300, we would say that you made money from the deal. Economists, however, use the term *money* more precisely, in ways that we make clear in this chapter. An economist would say that your resale of the camera earned you income, and you received that income in the form of money.

9.1 What Is Money?

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What gives money value?

What are the functions of money?

Take a look at some currency—a dollar bill, for example. It is nothing more than a piece of paper with writing on it. A very pretty piece of paper, perhaps, with fancy writing and some pictures, but it is still just a piece of paper. Yet people voluntarily give up valuable goods or services in exchange for pieces of paper. This is the mystery of money.

The question motivating this chapter—why do people want money?—is a deep one. That may seem a surprising claim because obviously we all like having money. But questions that seem trivial sometimes provide insights into how the world works. If we can understand why people want these intrinsically worthless pieces of paper, then we can understand why money is valuable. And to understand why people want these pieces of paper, we need to know what people want to do with their money.

9.1.1 The Characteristics of Money

A striking feature of modern developed economies is that people are typically *specialists in production and generalists in consumption*. By this we mean that most of us work at one or at most two jobs, producing (or, more often, helping to produce) a very small number of things— for example, a cattle farmer produces beef, a software designer produces computer code, and a nurse produces health services. However, we all purchase hundreds of goods and services.

There is no law that says that we have to buy goods and services using money. An alternative is to trade goods or services directly for one another. This is called **barter**. We do see some barter in the world. A restaurant may allow its employees free meals at the end of the night, which means that some of the employees' wages effectively takes the form of food. If a car mechanic and a caterer live next door to each other, they may have an informal arrangement whereby the mechanic repairs the caterer's truck in exchange for food for a birthday party.

Sometimes we know exactly where to buy the goods and services that we want. At other times, we go looking—perhaps walking or driving from store to store, perhaps searching using a phone book or the Internet. We do this because we don't know which store has the goods we want in stock; in addition, we might not know the prices that different stores are charging, and we want to hunt around for the best deal.

To understand the role that money plays in an economy, begin by imagining a world where we must search for the goods and services that we want to buy and there is no money, so all trades take place through barter. Imagine, for example, that you are a web designer, and you want to buy a used car. You must look around for someone who has a car for sale. This search takes time: it has an opportunity cost in that you would prefer to spend that time working or enjoying leisure. Eventually, you find someone who has a car that you are interested in buying. But your problems are not over. He has a car for sale, but what can you give him in exchange? You have to hope that he is interested in obtaining some web design services in exchange for the car. Successful barter requires a coincidence of wants: you must have what the other person wants, *and* they must have what you want.

A world of nothing but barter is hard to imagine. Each time you wanted to buy something from a seller in a store, you would have to exchange some good or service for that good. If you went to a café, you might have to wash the dishes in return for a coffee. Professors of economics wanting a meal would have to go from restaurant to restaurant trying to find a chef who wanted to hear an economics lecture. They would probably go hungry. It is easy to see why all societies find some way of making these transactions easier.

If you can carry some kind of money around with you to make purchases like these, life is much easier. You still have to hunt for the goods and services that you want, but you don't have to worry about whether the other party in the transaction wants the product that you sell. Money, therefore, plays a key role in ensuring that trades occur. Trades, in turn, create value in our economy. People are not forced to buy or sell things; they do so only if the trade leaves them better off than they were prior to trading. Money therefore plays a critical role in value creation.

The reason that we rarely see exchange without money is that it is so inefficient. Without money, a coincidence of wants is unlikely, so desirable trades do not occur, and value is not created. With money, transactions are much easier. If you want a meal in a restaurant, the owner will always serve it to you if you have money. Likewise, you obtain money by working at your job. You don't care what good or service your employer produces; as long as your employer pays you in money, you are happy to supply your labor time to them. Let us think for a moment about what characteristics this money needs to have:

- Money must be *portable*. If you are going to walk around searching for goods and services, you want to be able to carry money with you. Sacks of coal would not make a very good money.
- Money must be *divisible*. Different goods have different prices, and the money we use must accommodate that. Watches would not make a very good money.
- Money must be *durable*. Daffodils would not make a very good money.

It is easy to list many things that are reasonably portable, divisible, and durable: chocolate chip cookies, cigarettes, and printer paper are just a few examples. These are not typically used as money, although they could be. If you went into a fast-food restaurant, asked for a burger, and then offered to pay using chocolate chip cookies, you can be confident that you would not get the food that you want. That is because there is a fourth characteristic of money that is rather different from the other three.

- • Money must be *acceptable*.

Something can function as money only if people are willing to accept it as money. It is not impossible to imagine a world where chocolate chip cookies function as money. If everyone else is willing to accept cookies in payment for goods and services, then you will be willing to do so as well. But if other people accept only printed pieces of paper as money, then you would be foolish to accept chocolate chip cookies for the product that you sell.

9.1.2 Fiat Money

We know of no country, of course, that actually uses chocolate chip cookies for money. In most countries, money takes a particular form called **fiat money**. Fiat money is money that is not backed by any physical commodity, such as gold. Instead, the currency is intrinsically useless pieces of paper that attain value in exchange.

Fiat is a Latin word that means “let it be.” Fiat money is money just because the government says so. In a fiat money system, the government does not promise to exchange goods for money. In addition, money is not generally something that we can directly consume: most people would not enjoy eating a dollar bill. So if it doesn’t taste good and the government doesn’t promise to give you something in exchange for it, what gives fiat money value? Why are we all willing to work hard to get pieces of these—intrinsically worthless—pieces of paper?

The answer is because these pieces of paper are acceptable as money. Other people will accept them, so you and I will as well. To put it another way, *fiat money has value because everyone believes it has value*. Think back to the story with which we opened the chapter. The US economy uses green and white pieces of paper as money. US residents are willing to give up valuable goods and services in exchange for these green and white pieces of paper because they believe that others, in turn, will accept them. Such an arrangement sounds fragile, and it is. If everyone stopped believing that fiat money had value, this would be a self-fulfilling prophecy. [***Something very much like this happens in the circumstances of very high inflation rates, as explained in Chapter 11 "Inflations Big and Small".***]

Suppose the money in an economy changed overnight from green pieces of paper to purple pieces of paper, as we fancifully suggested at the beginning of this chapter. Everyone now works for and accepts the new purple currency. You are forced to follow. It would be foolish for you to work and accept green paper because no one would give you goods or services in exchange. Instead, you demand to be paid in purple paper because that is what you now need to buy goods and services.

Of course, we do not often observe these switches across colors of paper within an economy. People get used to one type of currency, and it is difficult to change everyone's behavior at once. Still, Europe *did*, in effect, switch from green pieces of paper to purple pieces of paper. Sure enough, no one in Europe these days is willing to accept French francs, Portuguese escudos, or Finnish marks. These are the old pieces of paper. Now people will accept only the new pieces of paper.

That conversion was not truly instantaneous. Prior to the changeover to the euro, there was a switch to a dual unit of account: French bank statements in 2001 gave balances in both French francs and euros, for example. Even now, years after the changeover, bills in Europe often still appear in both the old local currency and euros. It was also possible to use the euro as a store of value before the changeover because banks started establishing accounts in euros.

Even though fiat money issued by the government is, in the end, just pieces of colored paper, it typically does have one particular property that stems from the power of the state. The US government states that it will accept dollars in settlement of government debts—most importantly, tax bills. The government also states that dollars can be used in settlement of private debts. Dollars are legal tender. [***There is a subtle question here about whether this aspect of money means that even intrinsically worthless currency must always have some value. If people owe debts to the government that are specified in money terms, then they will be willing to pay something for legal tender currency.***]

9.1.3 The Functions of Money

Thus far, we have thought about money in terms of its characteristics. We can also think about what makes a good or bad money in terms of the functions that it serves.

9.1.4 Medium of Exchange

If you walk into an electronics store and see a camera with a price tag of $500, the store is making an *offer* to you and other customers: if you hand over ten $50 bills, you can have the camera in exchange. Money serves as a **medium of exchange**. There are other ways to purchase a camera rather than cash. You could write a check, for example, or use a debit card (a card that immediately deducts the $500 from your bank account and pays it into the store's account). The fact that there are different ways of paying for something is a clue that there is, in fact, no single thing that we can call money. Money is anything that does what money does. Interestingly, one common form of purchase does not involve money at all. If you use a credit card to buy a camera, you do not pay at all at the time of purchase, so no money—by any definition—changes hands. In this case, you receive the camera in exchange for a promise to pay for the camera later. It is only when that promise to pay is fulfilled that you hand over the money for the purchase.

9.1.5 Store of Value

Any medium of exchange must also serve as a **store of value**. This just means that money should keep its value between the time that you receive it (in exchange for goods that you sell or work that you do) and you spend it again.

If an object lost all or most of its value over a short period, then it would not be acceptable in exchange. So something that serves as money must be a store of value. Imagine for a moment an economy in which ice played the role of money. Except on the coldest days, the ice you receive on payday would not last long enough for you to buy anything with it. It would be a terrible store of value and, as a result, would not do a good job of facilitating exchange.

Paper money and coins are not like ice. They are durable and do not dissolve with use. Because of this, you can be confident that the dollar you have in your pocket today will still be a dollar you can spend tomorrow. The fact that people are willing to hold money for long periods of time is indicative of the role of money as a store of value. If money were not a store of value, then all people would want to get rid of cash as soon as they received it. To mix our metaphors: if money were ice, it would become a hot potato.

Being a store of value is more than just a physical property of money. Currency in your pocket can remain there for a long periods of time before disintegrating. So, in a physical sense, that currency retains its worth. But, if prices are increasing, then in terms of what the currency can buy, the money in your pocket is not retaining its value. In times of inflation, money functions less well as a store of value.

9.1.6 Unit of Account

Almost universally, prices are quoted in terms of some currency, such as pesos, dollars, or euros. Goods and services sold in the United States have prices in terms of US dollars. The dollar serves as a **unit of account**. But when the very same goods and services are sold in Europe, they are priced in a different unit of account: euros. This role of money is so familiar as to be mundane, yet our economy simply could not function without a commonly accepted monetary measuring stick. It would be like building a house without an accepted measure of length or running an airline without an accepted measure of time.

The unit that people use to keep account of their monetary transactions varies from country to country. In Mexico, prices are quoted in pesos, in India prices are quoted in rupees, and so on. In most countries, the medium of exchange and the unit of account are the same thing, but this need not be true.

Because the US dollar is known throughout the world, it is often used as a unit of account in unexpected places. Prices of commodities in international transactions may be quoted in terms of the dollar even when the transaction does not directly involve the United States. Luxury hotels in China and elsewhere sometimes quote prices in US dollars even to guests who are not coming from the United States. [***In Chapter 3 "The State of the Economy", we discuss both nominal and real gross domestic product (real GDP). Nominal GDP is the value of all the goods and services produced in an economy, measured in terms of money. Money is used as a unit of account to allow us to add together different goods and services. Even the concept of real GDP uses money as a unit of account: the difference is that we use money prices from a base year to value output rather than current money prices.***] As another example, after the changeover to the euro, that currency became the medium of exchange and the “official” unit of account. But many people—at least in terms of their own thinking and mental accounting—continued to use the old currencies. In everyday conversation, people continued to talk in terms of the old currencies for months or even years after the change.[*** On a bike trip in the summer of 2002, one of the authors had lunch in a French country restaurant. Though it was many months after the change to the euro, the menu was still in French francs. An elderly lady running the restaurant painstakingly produced a bill in euros: for each entry (in French francs), she multiplied by the exchange rate (euros to francs) and then added the amounts together.***] Even today, some bills and bank statements in Europe continue to quote the old currency along with the euro.

Meanwhile, merchants in countries who have not adopted the euro may still quote prices in that currency. In Hungary, the local currency is called the forint. ***Figure 9.3 "The Euro as a Unit of Account" shows a sign at a restaurant in Budapest, Hungary, advertising goods in both currencies: goulash soup, for example, is sold for 1,090 forint or 4.40 euro. If, as may well be the case, the restaurant is also willing to accept euros in payment, then the euro is also acting as a medium of exchange alongside the forint.

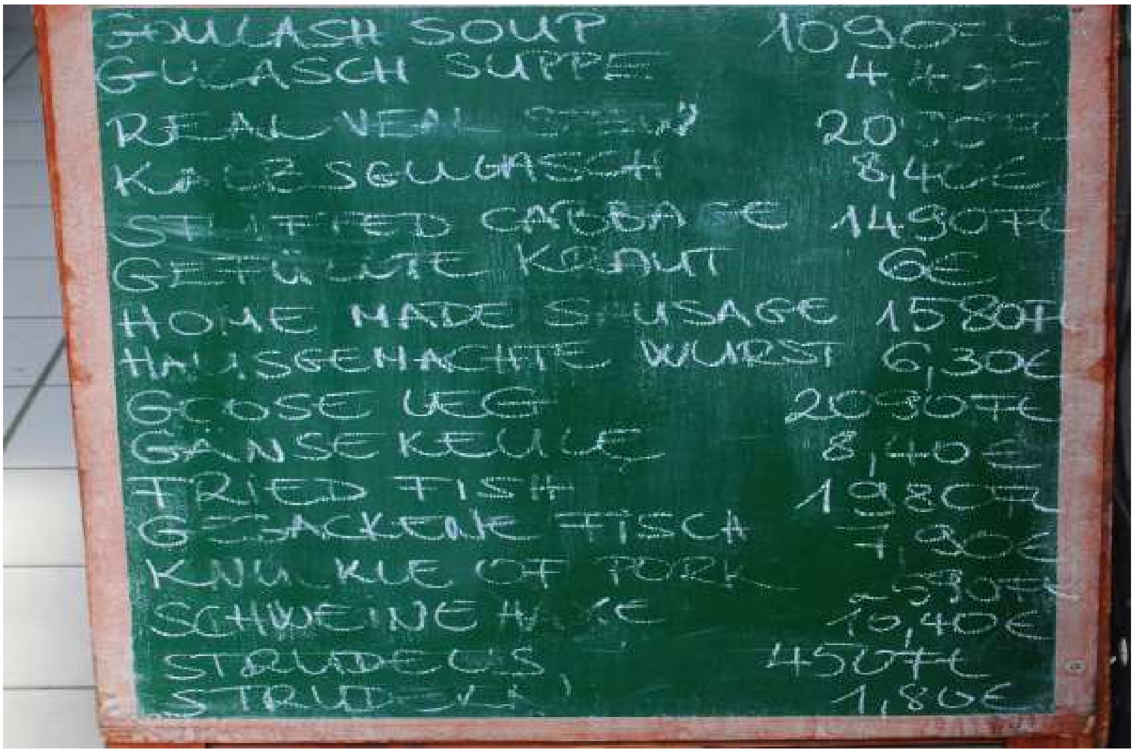

Fig. 9.3: Figure 9.3 The Euro as a Unit of Account A sign at a restaurant in Hungary quotes prices in euros and the local currency (forint). Source: Image taken by the authors

KEY TAKEAWAY

Fiat money has value because everyone believes it has value.

The three functions of money are medium of exchange, store of value, and unit of account.

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Checking Your Understanding

In what sense are you a specialist in production and a generalist in consumption?

Why is money less effective as a store of value when inflation is high?

In times of inflation, money is also less effective as a unit of account. Why?

9.2 Using Money to Buy Goods and Services

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is arbitrage?

What is the law of one price?

Having defined money through its characteristics and functions, we now turn to the uses of money. By looking at what we can do with money, we can understand how intrinsically worthless pieces of paper acquire their value.

Let us imagine, then, that you are lucky enough to find a $100 bill on the sidewalk. You have no way of returning it to its rightful owner. What might you do with this money? The first and most obvious answer is that you can use it to buy something you want: you can take the $100 and purchase some goods and services.

9.2.1 The Value of Money

The observation that we use money to buy things tells us more about the value of money. Economists often make a distinction between *real* and *nominal* values; this distinction can be applied to money as well. First, what is the nominal value of money? This is almost a trick question: we are asking, “How many dollars is a dollar bill worth?” The answer, which does not require a doctorate in economics, is that a dollar bill is worth $1.

Nominal variables—those measured in dollars or other currencies—can be converted into real variables—that is, those measured in units of real gross domestic product (real GDP). To convert a nominal variable to a real variable, we simply divide by the price level. For example, if your nominal wage is $20 per hour and the price level is $10 (meaning that a typical unit of real GDP costs this amount), then your real wage is 2 units of real GDP.

Toolkit: Section 16.5 "Correcting for Inflation" If you want to review the process of correcting for inflation, you will find more details in the toolkit.

Exactly the same principle can be applied to money itself. The real value of a dollar is obtained by dividing one by the price level. Thus

Think of an economy in which real GDP is measured in pizzas and suppose the price level— the price of a pizza—is $10. Then the value of a dollar bill is 1/10 of a pizza.

Although $1 is always worth $1, you are not guaranteed that the dollar bill in your pocket will buy the same amount of goods and services from one day to the next. If your local café increases the price of a cookie from $1.00 to $1.25, then your $1 will no longer buy you a cookie; its value, measured in cookies, has declined. If the price level increases, then the real value of money decreases. For notes and coins to be a good store of value, it must be the case that prices are not increasing too quickly. [***We discuss this problem in more detail in Chapter 11 "Inflations Big and Small".***]

9.2.2 Using Money to Make Money: Arbitrage

An old joke has it that the secret to getting rich is very simple: buy at a low price and sell at a high price. So another use of your $100 would be to buy goods not to consume but to resell—a process known as **arbitrage**.

Suppose you discovered that a particular model of digital camera could be bought much more cheaply in Minneapolis, Minnesota, than in Flagstaff, Arizona. Then you could purchase a large number of cameras in Minneapolis, load them into a suitcase, fly to Flagstaff, and sell them for a profit. If the gap in price were large enough to compensate for your time and travel costs, then this would be a money machine. By buying cameras at a low price and selling them at a high price, you could make as much profit as you wished. This situation would not persist. You, and other entrepreneurs as well, would start to bid up the price of cameras in Minneapolis. Meanwhile, the increased supply of cameras in Flagstaff would cause prices there to decrease. Before too long, your money machine would have dried up: the gap between the Flagstaff price and the Minneapolis price would no longer justify the effort.

Arbitrage ensures that the prices of individual goods do not vary too much across different regions of the United States. Taken to its extreme, it would imply that the price level would be the same throughout the country. Economists call this idea the **law of one price**. The law of one price says that different prices for the same good or service cannot persist because arbitrage eliminates such differences. Arbitrageurs would buy the good at the low price and sell it at the high price. Demand would increase in the market where the price was low, causing that price to increase. Supply would increase in the market where the price was high, causing that price to decrease. This process would continue until the prices were equalized across the two markets.

There are, of course, differences in the prices of individual goods and services in different states and different cities. These differences are primarily due to the fact that some items cannot be arbitraged. If cameras are cheaper in Minneapolis than in Flagstaff, then they can be bought and sold as we described. But if apartments in Flagstaff are cheaper than in

Minneapolis, it isn’t possible to ship them across the country. Likewise services typically cannot be arbitraged. Thus we do not expect the law of one price to be literally true for every good and service. Nevertheless, the law of one price does lead us to expect that the overall price level will not differ too much in different parts of the country.

It can be difficult to apply the law of one price in practice because we have to be careful about what we mean by the "same" product. An apparently identical shirt at two different retailers might not qualify as the same—perhaps one retailer allows goods to be returned, while the other does not allow returns. Identical goods are not the same if they are in different places: a Toyota on a dealership lot in Kentucky is not the same as the identical model car on a lot in Pretoria, South Africa, and so on. In such situations, the law of one price tells us that we should not expect prices of goods to be "too different," depending on the costs of transportation and the other costs of arbitrage.

We said earlier that money makes an economy more efficient because it makes transactions easier. Money makes arbitrage easier as well. Arbitrage would be a less certain way of making money in an economy with barter. First, the lack of a clear unit of account would make arbitrage opportunities less transparent. Second, the lack of a reliable medium of exchange would make arbitrage risky: the person in Flagstaff who wants to buy a digital camera from you might not have anything you want, so you might end up giving up something you own and not getting something you want in return.

KEY TAKEAWAY

Arbitrage is the process of making a profit by buying goods at a low price and selling them at a higher price.

When arbitrage is possible, we expect the same good to sell at the same price. There are no arbitrage profits to be made when the law of one price holds.

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Checking Your Understanding

All else being the same, if the price level increases, what happens to the real value of money?

Explain why the law of one price is less likely to hold for a service than for a good.

9.3 Using Money to Buy Other Monies: Exchange Rates

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is the difference between the nominal exchange rate and the real exchange rate?

How is the law of one price related to the nominal exchange rate?

As we all know, there are multiple currencies in the world. These are most often associated with a single country: the yen in Japan, the yuan in China, the peso in Mexico, and so on. Sometimes many countries will use the same money, with the leading example being the use of the euro by the member countries of the European Union (http://ec.europa.eu/economy_finance/euro/index_en.htm). Sometimes multiple currencies are in use in a single place: when you land at a major European airport, such as Frankfurt, Germany, or Amsterdam, the Netherlands, you will see that you can buy a cup of coffee at the airport using many different currencies. Likewise, the US dollar is freely accepted in some countries in addition to the local currency, British pounds formerly were freely accepted in Ireland, and so on.

If you happened to find your $100 right before going on a trip to another country, you might decide to use it to buy the money of that country. For example, if you were about to take a trip to Canada, you could take the bill into a bank or a foreign exchange merchant and exchange it for Canadian dollars. If you want to buy goods and services in Canada, you need Canadian dollars because they are the medium of exchange in that country.

When you make such an exchange, you buy the local currency using your home currency. If you travel from the United States to Europe, you buy euros using dollars. The price you pay is the *dollar price of the euro*: the amount in dollars you must pay to obtain 1 euro. This is completely analogous to using a dollar to buy a bottle of soda, when you pay the dollar price of soda. In practice, it is often unnecessary to carry out a physical exchange of notes and coins. In most countries, you can go to an automated teller machine (ATM) and withdraw local currency directly. Your bank deducts the equivalent sum in your home currency from your bank account. You are still carrying out an exchange, of course, but it is hidden from view, and you will see it only when you look at your next statement. The same is true if you make a purchase using a credit card.

Just as a US resident traveling to Europe wishes to buy euros with dollars, a visitor to the United States from, say, Holland will need to buy dollars with euros. The price she pays is the euro price of the dollar: the number of euros needed to obtain $1. The price of one currency in terms of another is called an **exchange rate**.

Toolkit:

If you want to review the definition of an exchange rate, you will find more details in the toolkit.

If we think of two currencies—euros and dollars, for example—then there are two exchange rates to keep in mind: the price of euros in dollars and the price of dollars in euros. (You might suspect, correctly, that these two prices are linked; we return to this shortly.) In a world of 3 currencies, each has a price in terms of the other two currencies, so there are 6 (= 3 × 2) different prices. And in a world of 100 currencies, then for each one, there are 99 prices for the other currencies. So there are 100 × 99 = 9,900 prices to quote! A Zambian traveling to Armenia wants to know about the kwacha price of drams, a Malaysian traveling to Oman is interested in the ringgit price of rials, and so on.

9.3.1 Foreign Exchange Markets

Imagine a series of three visitors traveling from the United States to Europe. First, we have someone arriving on vacation. Chances are that she will want to exchange dollars for euros to have money to spend on hotels, meals, and so on. She also buys souvenirs in Europe—goods that she imports back to the United States. Our second visitor spends a lot of time in Europe for work purposes. He might open a bank account in, say, Germany. If he wanted, he could use this bank account to keep some of his wealth in Europe. He would buy euros with his dollars, deposit these euros in the bank to earn interest, and then—at some point in the future—he would take his money out of the bank in Germany and exchange the euros for dollars. (Later, we will consider how you can decide if this is a good investment strategy. For now, our point is that this type of financial investment is another source of demand for euros.) Our third visitor to Europe is a professional wine buyer who wants to purchase wine to sell in a US restaurant. She travels to the wine-growing regions of Europe (France, Spain, Italy, Germany, Portugal, etc.) and must exchange dollars for euros to pay for her purchases.

Our three visitors represent a microcosm of the transactions that take place in the foreign exchange market every day. Households and firms buy euros to pay for their imports of goods and services (souvenirs, wine, etc.). Many different goods and services are produced in Europe and sold in the United States. Some are imported by retailers, others by specialist import-export firms, and still others by individuals, but in all cases there is an associated purchase of euros using dollars.

The demand for euros also arises from financial investment by households, firms, and financial institutions. For example, a wealthy private investor in the United States may purchase stock issued by a company in Europe. To buy that stock, the US investor sells dollars and buys euros. In practice, such transactions are typically carried out by financial institutions that undertake trades on behalf of households and firms.

Most exchanges of dollars for euros do not actually entail someone traveling to Europe. Think about the foreign currency needs of a large multinational firm that produces goods and services in Europe but sells its output in the United States. The company naturally needs euros to pay workers and suppliers in Europe. Since it sells goods and thus earns revenues in dollars, the company must convert from dollars to euros very frequently. But you will not see the company's chief financial officer in an airport line to exchange money. Instead, such currency operations are conducted through financial institutions, such as commercial banks.

Because of all these transactions, there are very active and sophisticated markets in which currencies are traded. We can represent these markets using the familiar **supply-anddemand**framework. shows a picture of the market where euros are bought and sold. Buyers from the United States buy euros with dollars, and European traders sell euros in exchange for dollars. [***Of course, it is not literally the case that everyone who is buying is from the United States and that everyone selling is from Europe. If you have dollars, you can buy euros; if you have euros, you can sell them for dollars. But it is simpler to explain if we think of Europeans selling euros and Americans buying them.***] The supply and demand curves refer to the object being traded—euros. Thus the quantity of euros is shown on the horizontal axis. The price on the vertical axis is in dollars.

This market is just like any other you encounter. The demand curve is downward sloping: as the price of euros increases, the quantity of euros demanded decreases. This is the **law of demand** at work. As the price of euros increases, people in the United States will find that goods and services produced in Europe are more expensive. For example, suppose that 1 euro costs $1, and a Mercedes automobile costs EUR 50,000. [***There is an established set of three-letter symbols for all the currencies in the world. Euros are denoted by EUR, US dollars are denoted by USD, Australian dollars are denoted by AUD, and so forth. In this book we use the familiar $ symbol for US dollars and the three-letter symbols otherwise. A list of the currency codes can be found at http://www.xe.com/iso4217.php.***] Then its cost in dollars is $50,000. Now imagine that euros become more expensive, so that EUR 1 now costs $2. You now need $100,000 to buy the same Mercedes in Europe. So an increase in the price of euros means that Americans choose to buy fewer goods and services produced in Europe. Exactly the same logic tells us that an increase in the price of the euro makes European assets look less attractive to investors. A German government bond, a piece of real estate in Slovenia, or a share in a Portuguese firm might look like good buys when the euro costs $1 yet seem like a bad idea if each euro costs $2.

The supply curve also has a familiar upward slope. As the price of euros increases, more people in Europe sell their euros in exchange for dollars. They do so because with the higher dollar price of euros, they can obtain more dollars for every euro they sell. This means that they can buy more US goods and services or dollar-denominated financial assets.

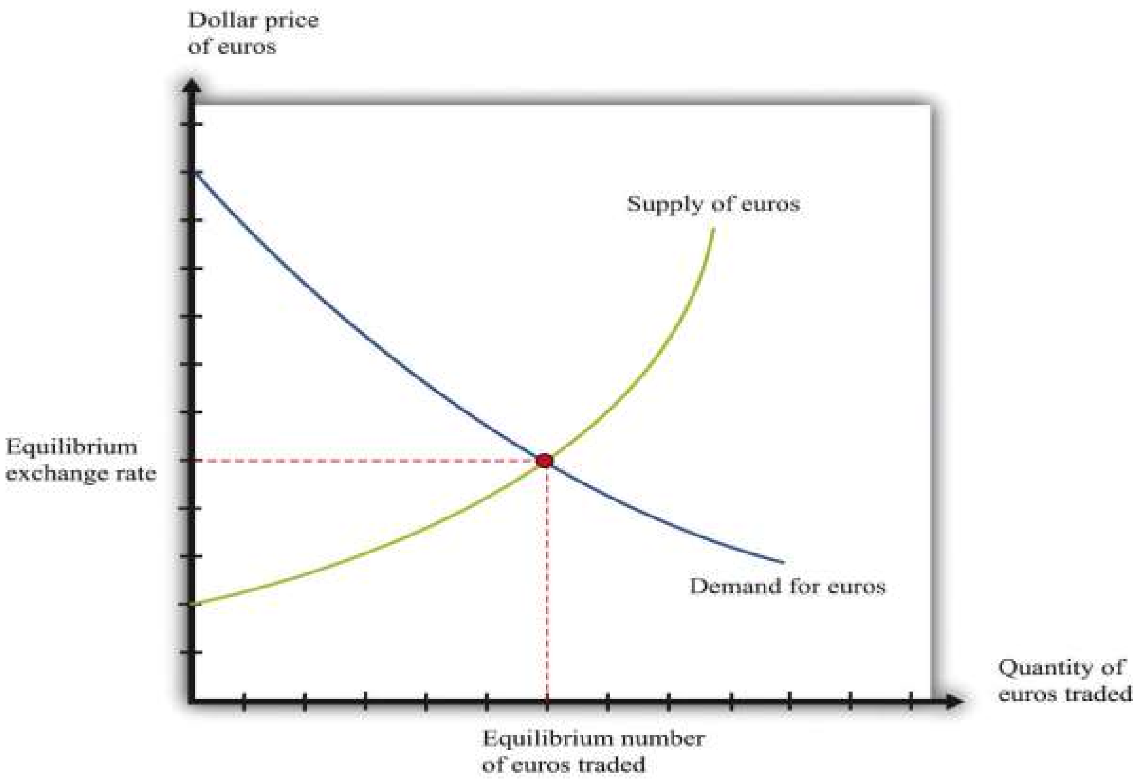

Fig. 9.4: Figure 9.4 The Market for Euros This diagram shows the foreign exchange market in which euros are bought and sold. As the price of euros (in dollars) increases, more euros are supplied to the market, but fewer euros are demanded.

The price where supply equals demand is the **equilibrium** exchange rate. (The market also shows us the equilibrium number of euros traded, but here we are more interested in the price of the euro.)

Toolkit:

The foreign exchange market is an example of a market that we can analyze using the tool of supply and demand. You can review the supply-and-demand framework and the meaning of equilibrium in the toolkit.

9.3.2 Arbitrage with Two Currencies

So far, we have talked about buying foreign currencies to purchase either assets or goods and services. Another reason to buy foreign currencies is in the hope that you could make money by trading them. Let us think about how you might try to make money in the foreign exchange market. You might start with some dollars and exchange them for euros. Then you could take those euros and exchange them for dollars again. Is it possible that, by doing this, you could end up with more money than you started with? Could you buy euros cheaply and then sell them at a high price, thus making a profit?

Begin by supposing that dollars and euros are only two currencies in the world, and there are only two economies: the United States and Europe (a shorthand for “those European countries that use the euro”). Imagine that there are two separate markets:

in the euro market, the price of 1 euro is \$2; in the dollar market, the price of one dollar is EUR 1. With these two prices, there is money to be made by buying and selling currencies. Start with 1 euro. Sell that euro in the market for euros and obtain \$2. Use those dollars to buy euros in the market for euros and obtain 2 euros. Now we are talking business: you started with 1 euro, made some trades, and ended up with 2 euros.

There is, of course, a catch. The prices that we just suggested would not be consistent with equilibrium in the foreign exchange markets. As we have just seen, there is a simple recipe for making unlimited profit at these prices, not only for you but also for everyone else in the market. What would happen? Everyone would try to capitalize on the same opportunity that you saw. Those with euros would want either to sell them in the euro market—because euros are valuable—or to use them to buy dollars in the dollar market—because dollars are cheap. Those with dollars, however, would not want to buy expensive euros in the euro market, and they would not want to sell them in the dollar market. Hence, in the euro market, the supply of euros would shift rightward, and the demand for euros would shift leftward. The forces of supply and demand would make the dollar price of euros decrease. In the dollar market, the supply of dollars would shift leftward, and the demand for dollars would shift rightward, causing the euro price of dollars to increase.

The mechanism we just described is arbitrage at work again. The arbitrage possibility between the dollar market for euros and the euro market for dollars disappears when the following equation is satisfied:

```
price of euro in dollars × price in dollar in euros = 1.
```

When this condition holds, there is no way to buy and sell currencies in the different markets and make a profit. As an example, suppose that EUR 1 costs \$2 and \$1 costs EUR 0.5. These prices satisfy the equation because 2 × 0.5 = 1. Imagine you start with \$1. If you use it in the dollar market for euros to buy euros, then you will have EUR 0.50. If you then use these in the euro market for dollars to buy dollars, you will get \$2 for each euro you supply to the market. Since you have half of a euro, you will end up with \$1, which is what you started with. There is no arbitrage opportunity.

By now you have probably realized that there is a close connection between the market for euros and the market for dollars (where dollars are bought and sold using euros). Whenever someone buys euros, they are selling dollars, and whenever someone sells euros, they are buying dollars. In our two-country, two-currency world, the market for euros and the market for dollars are exactly the same market, just looked at from two different angles.

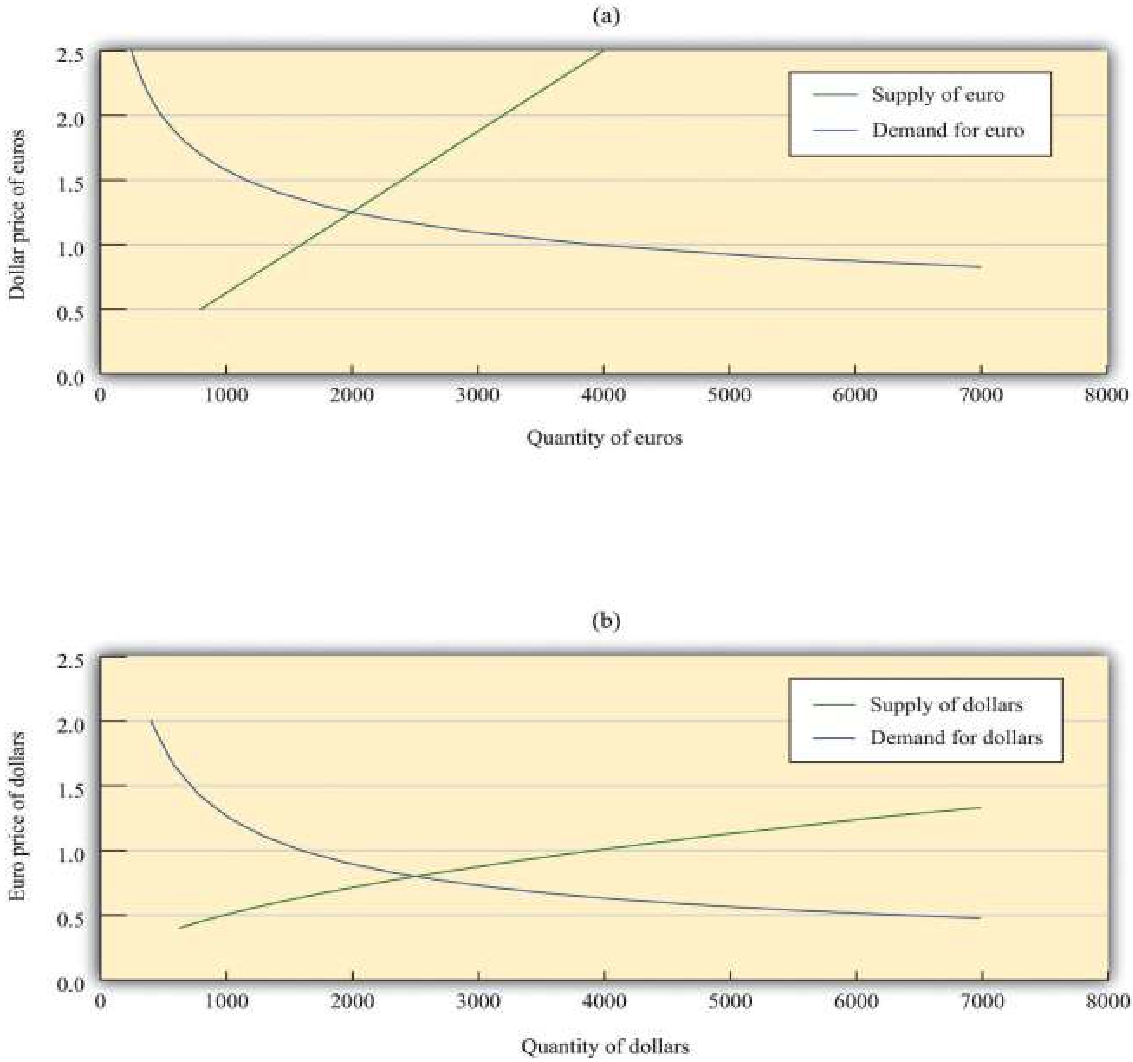

Fig. 9.5: Figure 9.5 The Market for Euros and the Market for Dollars Here we show the market where euros are bought and sold with dollars (a) and the market where dollars are bought and sold with euros (b). Because of arbitrage, these are just two different ways of looking at the same market.

We illustrate this in . In part (a) of , we show the market where euros are bought and sold, and in part (b) of the market where dollars are bought and sold. The supply curve for dollars is just the demand curve for euros, and the demand curve for dollars is the same as the supply curve for euros. For example, suppose 1 euro costs $2. From part (a), we see that, at this price, people would supply EUR 3,200. In other words, there are individuals who are willing to exchange EUR 3,200 for $6,400. If we think about this from the perspective of the market for dollars, these people would demand $6,400 in the market when $1 costs EUR 0.50—and, indeed, we see that this is a point on the demand curve in part (b). The market is in equilibrium when EUR 1.00 costs $1.25, or equivalently when $1 costs EUR 0.80. At this exchange rate, holders of dollars are willing to give up $2,500, and holders of euros are willing to give up EUR 2,000.

9.3.3 Arbitrage with Many Currencies

We live in a world with many different currencies, not just two. shows some exchange rates from http://www.oanda.com, a site that provides current and historical data on exchange rates and that is also an online market where you can trade currencies. So, on March 11, 2007, just after midnight, the price of a euro in dollars was 1.3115. At the same time, the price of a dollar in British pounds was 0.5176.

Real Time Currency Rates
11 March 2007 00:25

	USD	GBP	EUR	JPY
USD	-	1.9321	1.3115	0.00845
GBP	0.5176	-	0.6788	0.00437
EUR	0.7625	1.4732	-	0.00644
JPY	118.3450	228.6520	155.1910	-

Trade with OANDA
- Tighter spreads - 1.2 pips on EUR/USD
- Leading edge market maker
- No minimum trade size

Click here

Sun Mar 11 04:35:02 2007

Real Time Currency Rates by OANDA.com

Currency	bid	offer	Time
EUR/USD	1.31105	1.31205	Fri Mar 9 16:59:45 2007
USD/JPY	118.295	118.395	Fri Mar 9 17:00:00 2007
GBP/USD	1.93158	1.93258	Fri Mar 9 16:58:45 2007
USD/CAD	1.1718	1.1728	Fri Mar 9 17:00:00 2007
USD/CHF	1.2342	1.2352	Fri Mar 9 16:59:33 2007
EUR/JPY	155.141	155.241	Fri Mar 9 17:00:00 2007
EUR/GBP	0.67830	0.67930	Fri Mar 9 16:59:33 2007
EUR/CHF	1.6189	1.6199	Fri Mar 9 16:56:28 2007
GBP/CHF	2.38460	2.38660	Fri Mar 9 16:59:34 2007
GBP/JPY	228.552	228.752	Fri Mar 9 17:00:00 2007

Trade currencies at these rates

This table automatically update every 5 minutes.

Fig. 9.6: Figure 9.6 Exchange Rates These tables come from http://www.oanda.com. The table on the left shows exchange rates among four currencies and the table on the right shows the rates at which you can actually conduct trades at this site.

If you look at the table on the left side of , you see that it provides both the dollar price of the euro and the euro price of the dollar (and similarly for the other currency pairs). Tables such as this one have already built in the arbitrage condition, so you cannot keep buying and selling the same currency in exchange for dollars and make money.

When there are multiple currencies, we can imagine more complicated trading strategies. As an example, consider the following string of transactions.

1. Take a dollar and use it to buy euros.
2. Take the euros and buy Japanese yen.
3. Take the yen and buy dollars.

If you end up with more than $1, then there are profits to be made buying and selling currencies in the manner outlined here. Can you make a profit this way? The answer, once again, is no. If you could, then the markets for foreign currency would not be in equilibrium: everyone would buy euros with dollars, sell them for yen, and then sell the yen for dollars. Once again, exchange rates would rapidly adjust to remove the arbitrage opportunity.

To verify this, let us go through this series of transactions using . One dollar will buy you EUR 0.7625. Now take these and use them to buy yen. You will get 0.7625 × 155.1910 = JPY 118.3331. Now, use these yen to buy dollars, and you will get 118.3331 × 0.00845 = $0.9999. You start with $1; you end with $1 (give or take a rounding error).

These calculations assume that there are no costs to trading foreign currencies. In practice, there are costs involved in these exchanges. A traveler arriving at an airport in need of local currency does not see rates posted as in the left-hand table in . Instead, they see something that looks like the right-hand table, where rates are posted in two columns: bid (buying) and offer (selling). The bid is a statement of how much the currency seller is willing to pay in local currency for the listed currency. The offer column is the price in local currency at which the seller is willing to sell to you. Naturally, the offer price is bigger than the bid: the seller buys currencies at a low price and sells them at a high price. The difference between the bid and offer prices is called the *spread*. The existence of the spread means that if you try to buy and sell currencies with the dealer, you will actually lose money. At the same time, the spread creates a profit margin for the dealer and thus pays for the service that the dealer provides.

9.3.4 Arbitrage with Goods and Currencies

We have talked about arbitrage with goods and arbitrage with foreign currencies. We can also put the two together to study the prices of goods that are traded across international borders. Arbitrage of goods from one country to another is a bit more complicated because it involves buying and selling currencies as well as goods. To see how this works, imagine you are going on a trip to Europe. You are allowed two suitcases filled with belongings free of charge on the airplane. What about filling a suitcase full of new blue jeans, transporting them to Europe, and then selling them there? Could you make money that way?

Suppose that the dollar price of 1 euro is $1.50. Further, suppose that the price of a pair of blue jeans is $70.00 in the United States and EUR 50.00 in Paris. Consider the following sequence of actions.

1. Take $70 out of your pocket and buy a pair of blue jeans.
2. Travel with these blue jeans to Paris.
3. Sell the jeans for euros.
4. Buy dollars with your euros.

The question is whether you can make money in this way. The answer is given by how many dollars you will have in your pocket at the end of these steps. When you sell the jeans in Paris, you will have EUR 50.00. If the dollar price of euros is $1.50, then by selling the jeans in Paris you will get 50 × $1.50 = $75. This is a profit of $5 for each pair of jeans—you are in business.

Once again, the opportunity for arbitrage suggests that this situation is unlikely to persist. Entrepreneurs will buy jeans in the United States, take them to Paris, and sell them there. Market forces in three different markets will work to eliminate the profit. First, the activity of arbitrageurs will increase the demand for jeans in the United States, causing the US price of jeans to increase. Second, the increased supply of jeans in Paris will cause the price there to decrease. And third, there will be an increased supply of euros in the foreign exchange market, which will cause the euro to depreciate. This is shown in.

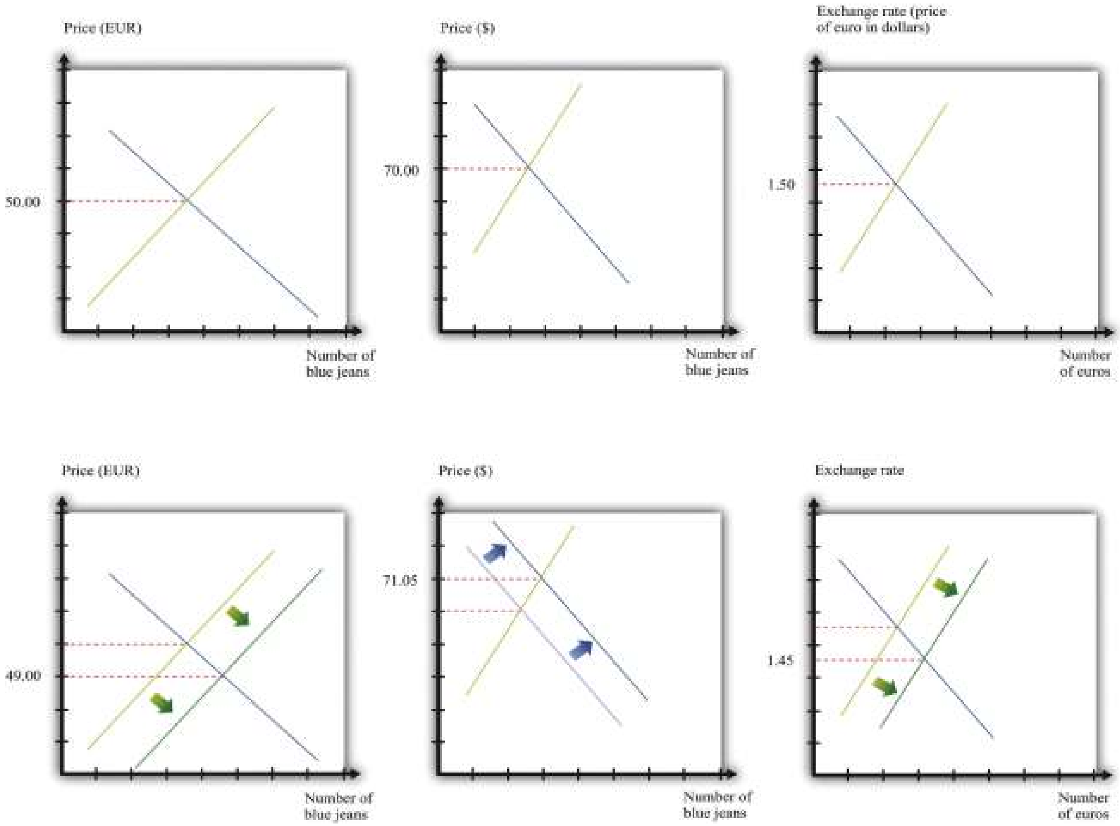

Fig. 9.7: Figure 9.7 International Arbitrage Restores the Law of One Price When blue jeans cost $70 in the United States and EUR 50 in France, and the exchange rate is $1.50 per euro, arbitrageurs can make a profit by importing blue jeans to Europe from the United States.

These price changes continue until there are no profits to be made by arbitrage. Exactly how much of the adjustment will take place in each market depends on the slopes of the supply and demand curves. In , we have drawn the new equilibrium as follows: blue jeans cost EUR 49 in Europe and $71.05 in the United States; and the exchange rate is $1.45 per euro. At these prices,

```
price of blue jeans in dollars = price of blue jeans in euros × price of euro in dollars,
```

and there is no longer any possibility of arbitrage. This is another illustration of the law of one price. If we were literally talking just about arbitrage in blue jeans, most of the adjustment would take place in the markets for blue jeans in the United States and Europe, and there would be a negligible effect on the exchange rate. But if the same kinds of arbitrage opportunities exist for lots of goods, then there will be an impact on the exchange rate as well.

For **tradable goods**, the law of one price says that the

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dollar price of good = euro price of good × dollar price of euro.
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When this condition holds, there are no arbitrage profits to be gained by purchasing the good with dollars, selling it for euros, and then buying dollars with euros. Likewise, if this condition holds, there are also no arbitrage profits from purchasing the good with euros, selling it for dollars, and then buying euros with dollars. In general, we expect that such arbitrage will occur very quickly. There are no profits to be made from arbitrage when the law of one price holds.

The *Economist* has kept track of the price of a McDonald's Big Mac in a number of countries for many years, creating something they call the "the Big Mac index." contains some of their data. The last column of gives the price of a Big Mac in each selected country in July 2011, converted to US dollars at the current exchange rate. That is, the last column is calculated by dividing the local currency price (the second column) by the exchange rate (the third column). A Big Mac costs $4.07 in the United States but more than twice as much in Norway. China is a real deal at only $1.89.

Table 9.1 The Economist's Big Mac Index, July 2011

Country	**Local Currency Price of Big Mac**	**Local Currency Price of a Dollar**	**Price in US Dollars**
United States	USD 4.07	1	4.07
Norway	NOK 45	5.41	8.31
Euro Area	EUR 3.44	0.70	4.93
Czech Republic	CZK 69.3	17.0	4.07
China	CNY 14.7	6.45	1.89

Source: "The Big Mac Index: Currency Comparisons, to Go," Economist online, July 28, 2011, accessed August 2, 2011,http://www.economist.com/blogs/dailychart/2011/07/big-macindex.

The price differentials in this table violate the law of one price: there is (apparently) profit to be made by buying Big Macs at a low price and selling them at a high price. Applying the principle of arbitrage, we should all be flying to China, buying Big Macs, traveling to Norway, and selling them on the streets of Oslo. Of course, there are a few small problems with this scheme, such as the following:

- It is expensive to fly back and forth between China and Norway. •
- There is a limited capacity for transporting Big Macs on the airplane. •

- The quality of the Big Mac might deteriorate while it is being transported. •
- You might not be permitted to import meat products from China into Norway. •
- You might have to pay taxes when you bring Big Macs into Norway. •
- It might be tough to open a McDonald's in Oslo.

This long list easily explains the deviations from the law of one price for Big Macs. Similar considerations explain why the law of one price might not hold for other goods. The law also does not apply to services, such as tattoos, since these cannot be imported and exported. The law of one price is most applicable to goods that are homogeneous and easily traded at low cost. Economists use the law of one price as a guide but certainly do not expect it to hold for all products in all places.

9.3.5 Using the Law of One Price to Understand the Exchange Rate

There is another way to interpret the finding that Big Macs do not cost the same in each country. The *Economist* uses this information to draw conclusions about the values of different currencies and how these values are likely to change over time.

From this perspective, the Big Mac is more expensive in Europe than in the United States because dollars are cheap in Europe. Put differently, we say that the dollar is **undervalued** relative to the euro. If the price of a dollar in euros were 0.85 instead of 0.70, then a Big Mac would cost the same in the United States and Europe. Completely equivalently, we can say that that the euro is **overvalued** relative to the dollar. With this in mind, we might expect the undervalued dollar to increase in value relative to the euro. That is, we would expect the price of a dollar in euros to increase. Similarly, we would conclude that the Norwegian kroner is overvalued relative to the dollar, the Chinese yuan is undervalued, and the Czech Koruna is neither overvalued nor undervalued. To see how this works more generally, look back at our arbitrage condition for blue jeans. If we divide both sides by the price of blue jeans in euros, we get

This equation says that, according to the law of one price, the dollar price of the euro should equal the dollar price of blue jeans divided by the price of blue jeans in euros. This is exactly the kind of calculation that underlies the Big Mac index, only with blue jeans instead of Big Macs. Equivalently, the law of one price says that the

Suppose we think about this equation applying (approximately) to all goods and services. We can then get a better prediction of the exchange rate by looking at a general price index in each country:

Because of all the reasons why the law of one price does not literally hold, economists certainly do not expect this equation to give an exact prediction of the exchange rate. Nevertheless, it can provide a useful indication of whether a currency is undervalued or overvalued.

A currency is undervalued if, following this equation, its price is too low compared to the ratio of price levels in the two countries. A currency is overvalued if, following this equation, its price is too high compared to the ratio of price levels in the two countries. As in our discussion of the euro, if a currency is overvalued, then we would expect its value to decrease over time. This is called a **depreciation** of the currency. Likewise, we would expect the price of an undervalued currency to increase over time. This is called an **appreciation** of the currency.

The market forces behind these currency movements come from the buying and selling of currencies for trading purposes. If the Chinese yuan is undervalued, goods produced in China will be relatively cheap in US dollars. The demand for Chinese exports will be high, and this will lead to a large demand for the yuan. Eventually the dollar price of the yuan will increase— that is, the yuan will appreciate, and the dollar will depreciate.

9.3.6 Changes in the Exchange Rate

Even though the law of one price does not literally hold for all goods and services, it reminds us that the value of $1 in the United States is linked to its value in the rest of the world. As a result, we expect that price level *changes* are likely to lead to changes in the exchange rate. We see this more clearly if we write our previous equation in terms of growth rates. Using the formula for growth rates, we find the following: growth rate of price of dollar in euros = growth rate of price of European bundle of goods− growth rate of price of US bundle of goods.

Toolkit:

The formulas for using growth rates can be found in the toolkit.

If the bundle of goods in each country corresponds roughly to the goods in the **Consumer Price Index (CPI)**, then the growth rate of these prices corresponds to the **inflation rate**. The growth rate of the exchange rate is just another term for the percentage appreciation of the currency. Thus we get the following:

```
percentage appreciation of the dollar ≈ European inflation rate − US inflation rate.
```

So, if the inflation rate in the United States is higher than it is in Europe, we expect the euro price of the dollar to decrease. We expect depreciation of the dollar if US inflation exceeds European inflation. Inflation reduces the real value of money domestically; it will also tend to reduce the value of money in terms of what it can purchase in the rest of the world. This makes sense. If our currency is becoming less valuable at home, then we should also expect it to become less valuable in the rest of the world.

9.3.7 The Real Exchange Rate

The law of one price is connected to another measure of the exchange rate—the **real exchange rate**. This exchange rate is a measure of the price of goods and services in one country relative to another *when prices are expressed in a common currency*. It is about exchanging goods, rather than money, across countries.

The real exchange rate between the United States and Europe is given as follows:

You can think of the real exchange rate as the number of units of European gross domestic product (GDP) you can get for one unit of US GDP. [***Let us check the units of the real exchange rate. The US price level over the European price level is in dollars/euros: it is the price of a unit of US real GDP divided by the price of a unit of European real GDP. The nominal exchange rate is measured in euros per dollar. Thus the units are as follows: The dollars and the euros cancel out in this expression, so the real exchange rate is just a number.***] For example, if the price level in the

United States is $1,600, the price level in Europe is EUR 400, and the price of dollars in euros is EUR 0.5, then the real exchange rate is as follows:

One unit of US GDP will get you two units of European GDP.

The real exchange rate is intimately linked to the law of one price. The easiest way to see this is to suppose that we measure US real GDP and European GDP in the same units: that is, suppose we use the same bundle of goods in each case. We know that the law of one price should hold for tradable goods—that is, goods for which arbitrage is possible and practical. If every good that went into GDP were tradable, then the law of one price would hold for every good, and the real exchange rate would equal 1. If the real exchange rate was not 1, you could make arbitrage profits by buying and selling "units of GDP."

As before, suppose the US price level is $1,600, the European price level is EUR 400, and the nominal exchange rate (dollars per euro) is 0.5. Imagine that US GDP and European GDP measure the same bundle of (tradable) goods. Then you could take $800 and buy EUR 400. With these euros, you could buy a basket of goods in Europe. You could sell this basket in the United States for $1,600. The law of one price is violated. We would expect the following:

- • Prices in the United States would increase.
- • Prices in Europe would decrease.
- • The nominal exchange rate would depreciate (the dollar would become less valuable).

Because arbitrage is not possible for all goods and services, we do not expect—nor do we observe—the real exchange rate to be exactly one. But this benchmark is still useful in understanding movements in the real exchange rate.

9.3.8 The Real Exchange Rate in Action

The real exchange rate matters because it is the price that is relevant for import and export decisions. Suppose you are trying to decide between buying a mobile phone manufactured in the United States and one manufactured in Finland. If the dollar appreciates against the euro, then the US phone retailer needs fewer dollars to purchase euros, so Finnish phones will be cheaper in US stores. If prices decrease in Finland, the imported phone again becomes relatively cheaper. If prices increase in the United States, the US phone will be more expensive. In other words, increasing prices in the United States, decreasing prices in Finland, and appreciation of the dollar all make you more likely to buy the imported phone rather than the domestically produced phone.

More generally, anything that causes the real exchange rate to increase will make imports look more attractive compared to goods produced in the domestic economy. Examined from the point of view of Europe, the same increase in the real exchange rate makes US goods look more expensive relative to goods produced in Europe, so Europeans will be likely to import fewer goods from the United States. An increase in the real exchange rate therefore leads to an increase in US imports and a decrease in US exports—that is, it leads to a decrease in **net exports**.

The real exchange rate can and does vary substantially over time. Argentina in the 1990s provides a nice illustration of real exchange rates in action. [***We discuss this in more detail in .***] Argentina had a**currency board** during this period. Under a currency board, a country maintains a fixed exchange rate by backing its currency completely with another currency. Although Argentina did have its own currency (the Argentine peso), each peso in circulation was backed by a US dollar held by the Argentine central bank. You could at any time exchange pesos for dollars at a nominal exchange rate of 1.

shows what happened to prices in Argentina and the United States over this period. Look at 1992–95. Both countries had some inflation. But prices were increasing faster in Argentina than in the United States. The real exchange rate (Argentina–United States) is given by because the price of the peso in dollars was 1. Therefore the real exchange rate appreciated as Argentine inflation outpaced US inflation.

The appreciation of the real exchange rate meant that Argentine goods became more expensive in other countries, so Argentine exports became less competitive. (The problem was compounded by the fact that the US dollar [and hence the peso] also appreciated against the currencies of neighboring countries such as Brazil.) Without the currency board, it would have been possible for the nominal exchange rate (price of the peso in dollars) to decline, offsetting the effects of the inflation rate. Instead, this appreciation of the real exchange rate ended up causing substantial economic problems in Argentina in the 1990s. In the second half of the decade, the real exchange rate began to depreciate because the inflation rate in Argentina was lower than in the United States. The appreciation at the start of the decade had been so large, however, that the real exchange rate in 1999 was still higher than it had been in 1992.

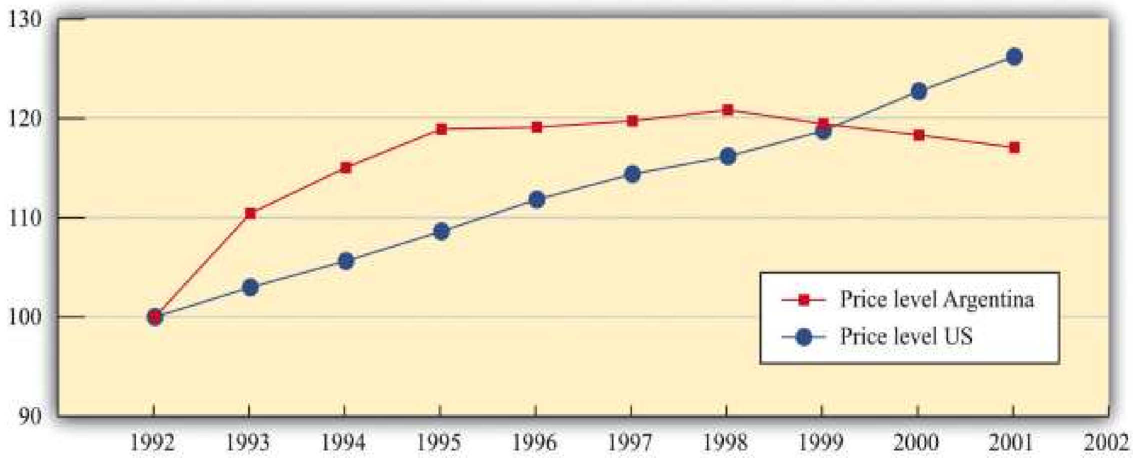

Fig. 9.8: Figure 9.8 The Real Exchange Rate in Argentina Argentina's real exchange rate appreciated between 1992 and 1995 because the nominal (US dollar–Argentine peso) exchange rate was constant and equal to one, and the price level increased more rapidly in Argentina than in the United States.Source: CPI inflation figures from International Monetary Fund World Economic Outlook database (http://www.imf.org/external/pubs/ft/weo/2006/01/data/dbcselm.cfm?G=205) and Bureau of Labor Statistics (http://www.bls.gov).

If countries want to have a permanently fixed exchange rate, there is an option that is more radical than a currency board. Countries can decide to adopt a common currency, like the European countries that adopted the euro. There are several reasons why countries might decide to take such a course of action. The first advantage of a common currency is that it enhances the role of money as a medium of exchange. There is no longer a need to exchange one currency for another, making it easier to trade goods and services across countries. People do not have to deal with the inconveniences of exchanging currencies: individuals do not have to exchange cash at airports, and firms do not need to manage multiple currencies to conduct international business. In the jargon of economics, a single currency removes transaction costs. These costs might be individually small, but they can add up when you consider just how many times households and firms needed to switch from one of the euro area currencies to another.[*** According to studies supporting a common currency, these gains from reduced transactions costs were substantial. One of the key analyses was the Delors report. A summary of that report is available at "Phase 3: the Delors Report," European Commission, October 30, 2010, accessed August 22, 2011, http://ec.europa.eu/economy_finance/euro/emu/road/delors_report_en.htm. A complete report on the history of the euro is available at "One Currency for One Europe: The Road to the Euro," European Commission, 2007, accessed August 22, 2011, http://ec.europa.eu/economy_finance/publications/publication6730_en.pdf. ***]

One way to picture this advantage is to imagine the reverse. Suppose, for example, that each state in the United States decided to adopt its own currency. Trade across state lines would become more complicated and more costly. Even more starkly, imagine that your hometown had its own currency, so you had to exchange money whenever you traveled anywhere else.

A second advantage of a single currency is that it makes business planning easier. A firm in Belgium can write a contract with another firm in Spain without having to worry about the implications of currency appreciation or depreciation. Thus an argument for the move to a single currency was that such a change was likely to encourage trade among countries of the European Union. Again, imagine how much more complicated business would be in the United States if each state had its own freely floating currency. Finally, a common currency enhances capital flows. Just as it is easier for businesses to trade goods and services, it is also easier for investors to shift funds from country to country. With a common currency, investors do not have to pay the transactions costs of converting currencies, and they no longer face the uncertainty of exchange rate changes. When capital flows more easily across borders, investment activity is more productive, enhancing the growth of the countries involved.

KEY TAKEAWAY

The nominal exchange rate is the price of one currency in terms of another. The real exchange rate compares the price of goods and services in one country to the cost of these goods and services in another country when all prices are in a common currency.

From the law of one price, a tradable good in one country should have the same price as that same good in another country when the goods are priced in the same currency. This means that the exchange rate is equal to the ratio of the prices expressed in the two different currencies. Put differently, by the law of one price, the real exchange rate between tradable goods should be 1.

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Checking Your Understanding

If the price of a euro was $2 and the price of a dollar was 1 EUR, how would you make a profit?

If goulash sells for either 1,090 forint or 4.40 euro, what is the price of the forint in terms of the euro? Do the two prices of cabbage quoted in yield a different euro price for the forint? Is there an arbitrage possibility here (or elsewhere on the menu)?

9.4 Using Money to Buy Assets: Interest Rates

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is the difference between nominal interest rates and real interest rates?

What is the yield curve?

What is the Fisher equation?

We have now discussed how you could use your $100 to buy goods and services or the money of another country. You can also use your money to buy money in the future. When we say this, we are simply describing a familiar transaction in an unfamiliar way: we are talking about saving. If you put money in a bank, then you are buying money in the future with money you give up today. When you save in this way, you become a participant in the **credit markets (or loan markets)**.

Toolkit: Section 16.4 "The Credit (Loan) Market (Macro)"

A credit market (or loan market) brings together suppliers of credit, such as households who are saving, and demanders of credit, such as businesses and households who need to borrow. You can review the credit market in the toolkit.

9.4.1 Arbitrage with Credit and Assets

Suppose you do not want to spend your $100 until next year. You could just put the money under your mattress, but a better option is to find some way of getting more than $100 next year. One way to do this is to lend your money to someone else. For you, this might simply mean taking it to your bank and putting it in your savings account. When you do that, you are making a loan to the bank. Of course, the bank probably will not leave the money in its vault; it will lend that money to someone else. Banks and other financial institutions act as intermediaries between those who want to save and those who want to borrow.

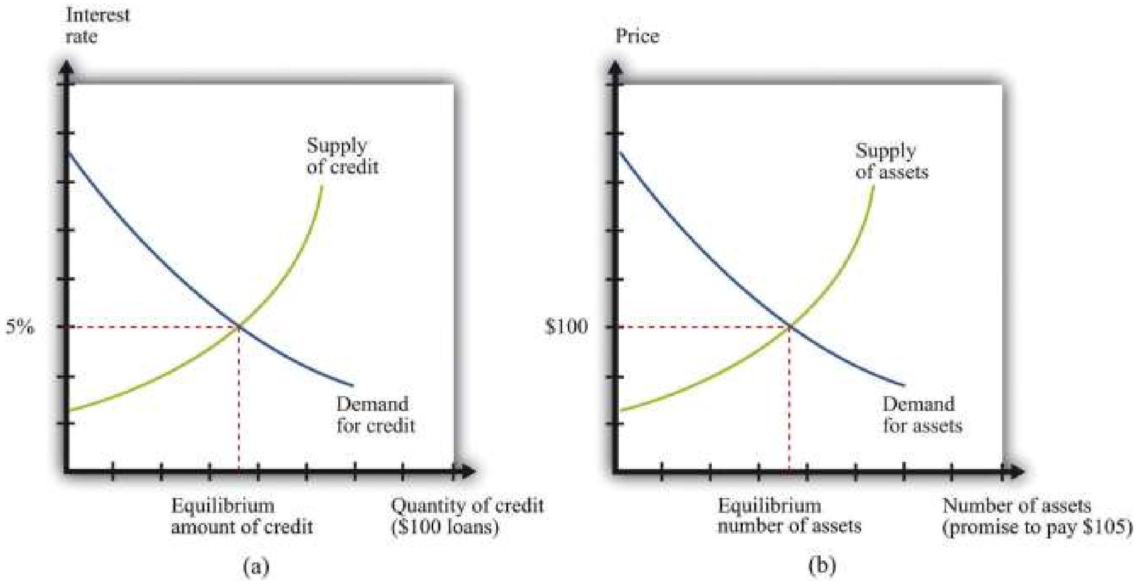

Fig. 9.9: Figure 9.9 The Credit Market and the Asset Market Credit markets and asset markets are two ways of looking at the same market: the market for $100 loans (a) with an equilibrium interest rate of 5 percent is the same as the market for an asset that promises to pay $105 in a year's time (b).

The credit market brings together the suppliers and demanders of credit, and the **nominal interest rate** is the price that brings demand and supply into balance. The supply of credit increases as the interest rate increases: as the return on saving increases, households will generally save more and thus supply more funds to the credit market. The demand for credit decreases as the interest rate increases: when it is expensive to borrow, households and firms will borrow less. At the equilibrium interest rate, the quantity of credit supplied and the quantity of credit demanded are equal. This is shown in part (a) of ***Figure 9.9 "The Credit Market and the Asset Market".

There is another way to look at credit markets. Borrowers get money today in exchange for a promise to pay money later. Lenders purchase those promises by giving up money today. Instead of asking how much the interest rate is for a given $100 loan, we could ask what people would be willing to pay today for the right to receive $105 in a year's time.

The market for the promise to pay $105 in a year is illustrated in part (b) of Figure 9.9 "The Credit Market and the Asset Market". The units on the horizontal axis are $105 payments. These are assets: buyers are purchasing a piece of paper that is a promise to deliver $105 in a year's time. The price on the vertical axis is the current price of that asset.

The nominal rate of return on an asset is the amount that you obtain, in percentage terms, from holding the asset for a year. In the case of the simple one-year asset we are considering, the return is given as follows:

We can also rearrange this to give us the price of the asset:

Notice what happens when we look at the market in this way. Buyers have become sellers, and sellers have become buyers. Borrowers are sellers: they sell the promise to pay. Lenders are buyers: they purchase the promise to pay. If we are looking at the same group of buyers and sellers as before, then the current equilibrium price of this asset would be $100.

The nominal interest rate and the nominal rate of return defined through these two markets must be the same. If not, there would be an arbitrage possibility. Imagine, for example, that the interest rate is 5 percent but the price of the asset is $90. In this case, the rate of the return on asset is 11090−1, which is 22.2 percent. So you could make a lot of money by borrowing at a 5 percent interest rate and then purchasing the promises to pay $110 at price of $90.

If you could do this, so also could many major financial institutions—except that they would operate on a much larger scale, perhaps buying millions worth of assets and borrowing a lot in credit markets. So the demand for credit would shift outward, as would the demand for assets. This would cause the interest rate to increase and the asset price to increase, so the rate of return on the asset decreases. This would continue until the arbitrage opportunity disappeared.

In summary, we would say there is no arbitrage opportunity when the

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nominal rate of return on asset = nominal interest rate.
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The rate of return on the asset, in other words, is equivalent to the interest rate on the asset. Equivalently this means that

In the second line we replaced (1 + nominal interest rate) with the **nominal interest factor**. The two are equivalent, but sometimes we find it more convenient to work with interest factors rather than interest rates.

The argument that we have just made should seem familiar. It is analogous to the argument for why there cannot be distinct dollar-euro and euro-dollar markets; they are just ways of looking at the same asset. Likewise, we can think of the sale of any asset as equivalent to borrowing, while for any example of credit we can also think of there being an underlying asset.

9.4.2 Different Assets

Very often economists and others talk about "the" interest rate, as if there were just a single asset in the economy. In fact, there are many different assets that you could buy with your $100, each with an associated interest rate. The following are various assets that you might purchase:

- • **Currency and coin**. To begin with, your $100 is itself an asset. If you put the money under a mattress and retrieve it after a year, it is very easy to calculate the nominal interest rate on $100. If you give up $100 today, you will get exactly $100 back next year. The nominal interest rate is zero.

- • **Bank deposits.**Bank deposits are also an asset. If you put your money in the bank, you are extending credit to the bank. Depending on the type of bank account, you may or may not earn interest on your deposits.
- • **Foreign exchange.**The money of other countries is likewise an asset. You can take dollars today and use them to purchase, say, euros or Japanese yen (JPY). Even in this case, there is a rate of return. For example, suppose that today you can buy JPY 100 with $1. Suppose also that in a year's time, there are JPY 90 to the dollar. Then with your JPY 100, you can buy $1.11 (100/90 = 1.11). You obtained a nominal rate of return of 11 percent.
- • **Gold and other precious metals.**You could take your $100 and use it to buy gold. Unless you are a dentist or a jeweler, you will not have any direct use for the gold; you simply keep it and resell it at some future date. The rate of return on gold is purely a matter of what happens to the price of gold. If the price of gold (in dollars) increases by 10 percent, then you get a 10 percent rate of return.
- • **Government bonds.**A government bond is also a loan contract; if you buy a government bond, you are extending credit to the government. The bond is a promise to pay a certain amount at some future date. Because the loan will be paid off a number of years in the future, it is slightly more complicated to calculate the interest rate.
- • **Shares.**Another example of an asset is a share in a company, such as Dell Inc. If you purchase a Dell share, you have bought the right to a share in Dell's profits. In this case, you expect not only one payment at a specified future date but also a sequence of payments whenever Dell pays out dividends. Notice that there is also a lot of uncertainty here: you do not know, when you purchase the share, how big these payments will be. The implied interest rate is therefore uncertain as well.
- • **Real estate.**If you purchase a house, you own yet another kind of asset. The value of a house comes from the fact that people can live in it. If you rent your house out, then it gives you a flow of income, much like a share in a company. If you live in your house, then you consume that flow of services, but we still think of the house as an asset because at any time you can sell your house and transfer that flow of services to someone else.

We could list many more assets, but you should be getting the general idea. Most of these assets are more complicated than the simple one-year credit contract with which we began. For one thing, they often involve a whole stream of repayments at different dates, rather than just one repayment. For another, the amounts of these payments may be uncertain.

In Section 9.1 "What Is Money?", we pointed to the different characteristics and functions of money. For most of us, the word *money* conjures up images of currency and coins. But some of the other assets that we listed also can perform more or less well as money. For example, bank deposits in a checking account or with a linked debit card are portable, durable, divisible, and widely acceptable and serve as a medium of exchange. In general, any asset that performs the functions of money *is* money. Gold can be used as a store of value and perhaps also as a unit of account, but it is not often used as a medium of exchange. There are many different assets in the world, and they vary in the extent to which they perform these different functions and thus how good they are as money.

9.4.3 Arbitrage with Different Assets: The Term Structure of Interest Rates

We just observed that there are many different assets and thus many interest rates in the economy. But these interest rates are all linked to each other because the same people (particularly banks and other financial institutions) trade in many different markets. One way in which assets differ is in terms of their **maturity**. To see how the returns on assets of different maturity are linked, consider two government bonds of different maturities: one-year bonds and two-year bonds. Here are two different ways you could save for two years.

1. Buy a one-year government bond. Collect the payment at the end of the year and then reinvest that money in another one-year bond.
2. Buy a two-year government bond.

There are three interest rates relevant to your choice. The first one is the current interest rate on a one-year bond. The second is the interest rate on a one-year bond *next* year. The third interest rate is the annualized nominal interest rate on a two-year government bond. An **annualized interest rate** is the interest rate earned each year on a loan that lasts many years, and the annualized interest factor is (1 + the annualized interest rate). For example, suppose that the annualized rate on a two-year loan is 6 percent. Then you would earn 6 percent per year for two years, and

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repayment after two years = $100 × 1.06 × 1.06 = $112.36.
```

As you might expect, these three interest rates are connected, and we can understand how by again thinking about arbitrage. If you purchase the two-year government bond return, you get

```
100 × (annualized nominal interest factor on two-year bond)2.
```

Conversely, if you purchase the two one-year bonds, you get

```
100 × (nominal interest factor this year) × (expected nominal
interest factor next year).
```

Notice that we have referred to next year's interest factor as "expected." This is because when you make your decision, you do not know what the interest rate will be.

When

(annualized nominal interest factor on two-year bond)2 = nominal interest factor this year× expected nominal interest factor next year, the two transactions have the same return. Once again, we can appeal to an arbitrage argument to say that we expect this equation to hold. There is one twist, however. When you make this decision, you do not know for sure what the interest rate will be on one-year bonds next year. You have to make a guess. Thus this arbitrage involves some risk.

This relationship is an example of the **term structure of interest rates**, which describes the relationship between the actual and expected returns on assets that are identical except for their maturities. A version of the relationship applies to not only assets of one-year and two-year maturity but also assets of all maturities.

From the term structure of interest rates, we learn something very significant: if the annual one-year interest rate is below the annual rate on a two-year loan, then interest rates are expected to increase in the future. For example, if the annual one-year interest rate is 5 percent and the annual rate on two-year loans is 6 percent, this means both borrowers and lenders expect one-year interest rates to be higher than 6 percent next year. (If desired, you can calculate exactly what the expected rate is by using the previous equation.)

We can see the connection between assets of different maturities by looking at the **yield curve**. [***For more details and additional graphs, see J. Huston McCulloch, "The US Real Term Structure of Interest Rates: With Implicit Inflation Premium," updated October 30, 2009, accessed August 22, 2011, http://www.econ.ohio-state.edu/jhm/ts/ts.html.***] The yield curve shows the current annual return for assets of different maturities. ***Figure 9.10 "The Yield Curve" shows the yield curve for US Treasury securities in 2011. [***This is an average of rates in 2011 for US Treasury securities of different maturities fromhttp://www.econstats.com/r/rusa_ew6.htm.***] On the horizontal axis of the yield curve is the number of years to maturity of the asset. On the vertical axis is the current annual yield on the asset. Notice that the yield curve is upward sloping: the longer the maturity, the higher the annual interest rate. This is generally what we observe, although sometimes the yield curve is *inverted*, meaning that higher maturity debt has a lower interest rate.

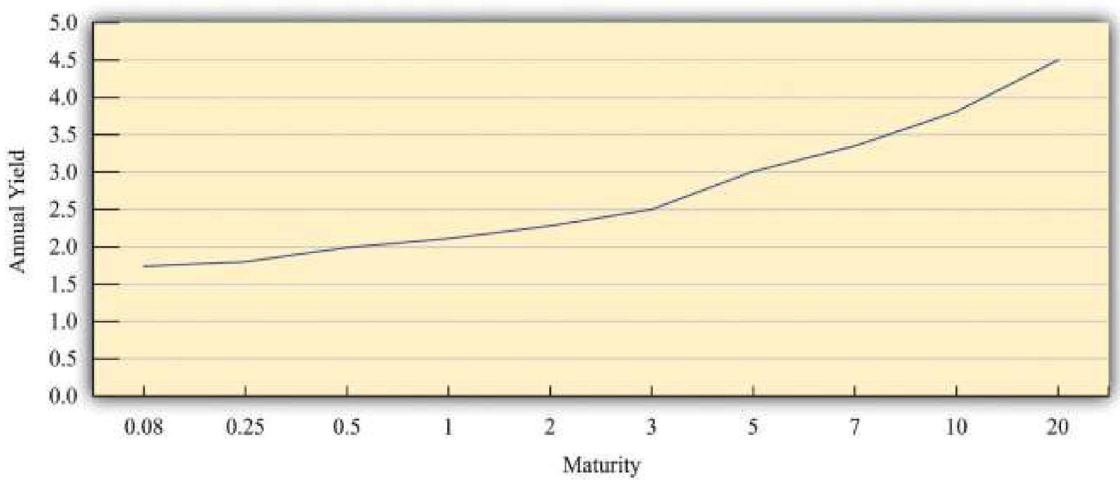

Fig. 9.10: Figure 9.10 The Yield Curve

All assets are linked, not just government bonds of different maturities. Suppose that the interest rate on one-year government bonds increases. To buy these bonds, financial institutions will start selling other assets—not only bonds at other maturities but also stocks, holdings of foreign currencies, and so on. As they sell those other assets, their prices will decrease, and their rate of return will increase. An increase in the interest rate on one-year treasuries therefore increases interest rates on other assets. Thus different interest rates typically move together, and it is usually not too misleading, at least for the purposes of macroeconomics, to think about there being a single interest rate in an economy.

9.4.4 Arbitrage with Assets and Goods: The Real Interest Rate

The exchanges we have described so far have all been in terms of dollars. The interest rates paid on such exchanges are nominal interest rates. In a world where prices are increasing, however, the nominal interest rate does not represent the true cost of borrowing and lending.

To see why, begin by recalling that the inflation rate is defined as the percentage change in the price level. This means that the price level next year is equal to the price this year multiplied by (1 + inflation rate). [***If this is not clear to you, write out the inflation rate as follows: Then add one to both sides and multiply by the price level this year. ***] Now imagine that two individuals, Bert and Ernie, want to write a credit contract. Bert wants to borrow some money to buy a pizza. The price of a pizza this year is $10, so Ernie lends Bert $10, and they agree on a nominal interest rate for this credit arrangement. This means that next year he will repay $10 × (1 + nominal interest rate).

We could also imagine that Bert and Ernie decide to write a different kind of contract to guarantee a return in terms of pizzas. Because this rate of return is specified in terms of goods rather than money, it is a **real interest rate**. Ernie agrees to give Bert (enough dollars to buy) 1 pizza this year in return for being repaid (enough dollars to buy) (1 + real interest rate) pizzas next year. Ernie lends Bert $10 as before (the equivalent of 1 pizza). To repay this loan next year, Bert must give Ernie enough money to buy (1 + real interest rate) pizzas. The price of a pizza has increased to $10 × (1 + inflation rate), so Bert must give Ernie $10 × (1 + real interest rate) × (1 + inflation rate).

If you have worked through this chapter carefully, you probably know what is coming next. Because of arbitrage, we know that these two contracts must be equivalent:

```
1 + nominal interest rate = (1 + real interest rate) × (1 + inflation rate).
```

As an approximation, this equation implies that the [***To see this, multiply out the right-hand side and subtract $1 from each side to obtain nominal interest rate = real interest rate + inflation rate + real interest rate × inflation rate. Now, if the real interest rate and the inflation rate are small numbers, then when we multiply them together, we get a very small number that can be safely ignored. For example, if the real interest rate is 0.02 and the inflation rate is 0.03, then their product is 0.0006, and our approximation is about 99 percent accurate.***]

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nominal interest rate ≈ real interest rate + inflation rate.
```

This relationship is called the **Fisher equation**.

Toolkit: Section 16.5 "Correcting for Inflation"

Nominal interest rates and real interest rates are related by the Fisher equation. To convert from nominal interest rates to real interest rates, we use the following formula:

```
real interest rate ≈ nominal interest rate − inflation rate.
```

If you want to know more about the Fisher equation, you can look in the toolkit.

For example, if a loan has a 12 percent interest rate and the inflation rate is 8 percent, then the real return on that loan is 4 percent. Since the nominal interest rate and the inflation rate are easily observed by most of us, we can use the Fisher equation to calculate the real rate of interest. We use the Fisher equation whenever we see a nominal interest rate and wish to convert it to a real interest rate. Just as it is the real exchange rate that matters for people trading goods and assets between countries, so it is the real interest rate that ultimately matters to borrowers and lenders in the economy.

In macroeconomics, we often look at the credit market for the entire economy, where savings and investment are matched in the economy as a whole. The price in this market is the real interest rate. The response of savings and investment to the real interest rate is shown in **Figure 9.11 "The Credit Market". Once we know the equilibrium real interest rate, we calculate the implied nominal interest rate using the Fisher equation.

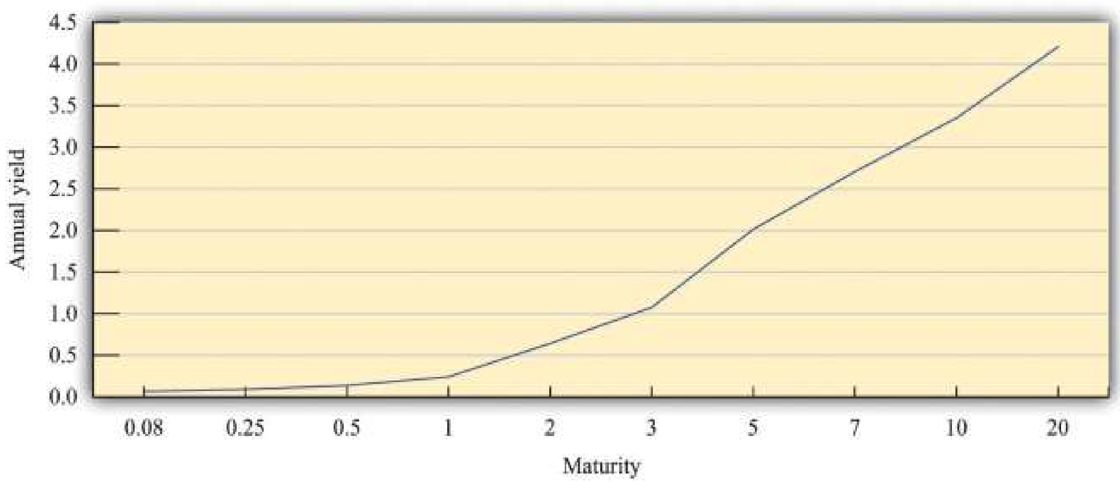

Fig. 9.11: Figure 9.11 The Credit Market Adjustment of the real interest rate ensures that the flows in and out of the financial sector balance.

The (net) supply of loans in the domestic credit market comes from three different sources:

1. The **private savings** of households and firms

2. The savings or borrowing of governments
3. The savings or borrowing of foreigners

Households will generally respond to an increase in the real interest rate by reducing current consumption relative to future consumption. Households that are saving will save more; households that are borrowing will borrow less. Higher interest rates also encourage foreigners to send funds to the domestic economy. Government saving or borrowing is little affected by interest rates.

National savings are defined as private savings plus government savings (or, equivalently, private saving minus the **government deficit**). The total supply of savings is therefore equal to national savings plus the savings of foreigners (that is, borrowing from other countries). The matching of savings and investment in the aggregate economy is described as follows:

```
investment = national savings + borrowing from other countries
```

or

```
investment = national savings − lending to other countries.
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This is the same thing as saying that the flows in and out of the financial sector in the circular

flow must balance.

The demand for loans comes from firms who borrow to finance investment. As the real interest rate increases, investment spending decreases. For firms, a high interest rate represents a high cost of funding investment expenditures. This is evident if the firm borrows to purchase capital. It is also true if the firm uses internal funds (retained earnings) to finance investment since the firm could always put those funds in an interest-bearing asset instead.

Toolkit: Section 16.16 "The Circular Flow of Income"

The toolkit provides more detail on the flows in and out of the financial sector.

9.4.5 Arbitrage with Assets and Currencies: Uncovered Interest Parity

If you are like most people, you do not own assets in another country. You may own multiple assets—a savings account that pays you some interest every month, perhaps a certificate of deposit, or shares of some company—but the chances are that all your financial assets are denominated in a single currency. In fact, there is no reason why you should not own assets denominated in other currencies, such as euros, or pesos, or British pounds. You might consider opening a bank account in another country. Or you might even consider other financial investments in another country, such as purchasing a share in an international mutual fund, buying shares of a foreign company, or buying the debt of a foreign government.

Most of us do not know exactly how to go about making such investments. In fact, they are easy to carry out if you make use of the services of professional financial advisers. In any case, we are not really interested in the mechanics of foreign investment here. We want to answer a more fundamental question: how do you know if buying foreign assets would be a good idea? Consider the choice between two investment strategies.

1. Investing in the United States • Deposit $100 in a US bank. • Wait for a year.
2. Investing in Europe • Take $100 and use it to buy euros. • Deposit the euros in a European bank. • Wait for a year. • Withdraw the deposit and interest and use it to buy dollars.

To decide which is the better strategy, you need to determine how much you will earn in each case.

It is straightforward to determine how much you will get with the first option: you will get your $100 plus the interest payments. For example, if the interest rate at the US bank is 10 percent, then after a year you will earn $10 interest for a total of $110.

What about the second strategy? How many dollars will you have if you deposit money in the European bank? This is a bit more complicated. First, you buy euros with your $100. Second, you deposit these euros in a European bank and earn interest. Third, at the end of the year, you withdraw your euros from the bank and sell them for dollars. For example, suppose that the current dollar price of euros is $1.25 and the interest rate paid on deposits in Europe is 5 percent. Suppose you also expect that the price of a dollar in euros will be EUR 0.70 in a year's time. With the second investment strategy,

- You take your $100 and buy EUR 80. •
- You put these EUR 80 in the European bank for a year, giving you EUR 84 at the end of the year. •
- You take these EUR 84 and use them to purchase $120.

The second strategy therefore earns you more than the first strategy. It would be better to invest in Europe compared to the United States. Moreover, a slight variation on this strategy seems like it is a money machine. Consider the following.

- Borrow $100 from a US bank for one year. •
- Take the $100 and use it to buy euros. •
- Deposit the euros in a European bank. •
- Wait for a year. •
- Withdraw the deposit and interest and use it to buy dollars. •
- Repay the dollar loan plus interest.

Using the same interest rates and exchange rates as previously, this transaction works as follows: you borrow $100, obtain $120 at the end of the year, pay back $110 to the bank, and end up with $10 profit.

To evaluate this arbitrage possibility, you need to know (1) the current dollar price of euros, (2) the annual return on deposits in Europe, and (3) the price of a dollar in euros a year from now. Look carefully at the language we used. You need to know "the euro price of dollars a year from now." But when we went through the example, we said "you expect that the price of dollar in euros will be EUR 0.70 in a year's time." As with the term structure of interest rates, there is some risk involved here. You cannot know the future exchange rate with certainty. This strategy entails a gamble about the future exchange rate. Still, if everyone has the same guess about the future exchange rate as you do, then such a situation could not last. Everyone would pursue the same strategy: borrow in the United States, buy euros, invest in Europe, and convert back in a year's time. What would happen?

- The demand for credit would increase interest rates in the United States. •
- The demand for euros would increase the dollar price of euros. •
- The extra supply of savings in Europe would drive down the interest rate in Europe.
- Investors might anticipate the extra demand for dollars in a year's time and expect the euro price of dollars to increase.

These forces would all tend to eliminate the profit opportunity.

So when do we expect this arbitrage opportunity to disappear? It disappears when investors expect to make the same profit whether they invest in Europe or the United States. The condition for this is as follows:

The left side is the return on investing in the United States. The terms on the right give the return on investing in Europe. When this condition holds, the returns on deposits in US and European banks are the same. This condition is called **uncovered interest parity**.

Because we do not know the price of euros next year for sure, this equation does not hold exactly when we look at actual data from the past. That is, the actual exchange rates combined with the actual returns on deposits do not quite satisfy this equation. This does not contradict the theory. Hindsight is perfect. The important point is that if people hold similar beliefs, then uncovered interest parity will hold ahead of time.

9.4.6 Using Uncovered Interest Parity to Understand the Exchange Rate

We can rearrange the uncovered interest parity condition as follows:

Written this way, the equation tells us that beliefs matter. Suppose everyone in the market believes that the dollar will depreciate relative to the euro in the future: that is, everyone expects a decrease in the euro price of the dollar. This makes investment in euro-denominated assets a better deal since we will get a lot of dollars per euro in the future. Investors will respond by selling dollars now to buy euros. This increase in the supply of dollars will cause the current euro price of dollars to decrease.

Thus we see that if everyone expects the euro price of dollars to decrease in the future, then the euro price of dollars will decrease today. When we talk about the market for currencies, demand and supply today depend on what households and firms think about the future exchange rate.

We can also rearrange the equation to see what it tells us about exchange rate beliefs:

If the interest rate in Europe is greater than the interest rate in the United States, then the condition tells us that investors must be expecting the dollar to appreciate.

KEY TAKEAWAY

The nominal interest rate is the return on an asset in terms of money. The real interest rate is the return on an asset measured in terms of goods.

The yield curve describes the relationship between the (annual) return on an asset and its maturity. Normally, the yield curve is upward sloping: assets with a longer maturity have a higher annual return.

The Fisher equation links the real interest rate to the nominal interest rate. The real interest rate is approximately equal to the difference between the nominal interest rate and the inflation rate.

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Checking Your Understanding

If the nominal interest rate is 5 percent and the inflation rate is 3 percent, what is the real interest rate?

Can the real interest rate ever be negative?

What are the risks involved in investing in a foreign bank?

9.5 End-of-Chapter Material

In Conclusion

We began this chapter with a deceptively simple question about money: why do people want it? To answer that question, we first looked at what money is. We discovered that money is an asset that has certain defining characteristics, such as portability, divisibility, and durability. Most importantly of all, though, we said that money must have acceptability. What turns an asset into a money, ultimately, is the simple fact that enough people are willing to treat it as such.

If we look through history, we find that many different things have served as money in different places and at different times. As well as the familiar notes and coins, these include seashells, stones, cigarettes, cans of food, gold, and silver. These could successfully function as money because they were acceptable as money in their particular context.

We then imagined that you were lucky enough to find a $100 bill on the sidewalk and explored the various things that you could do with this money, including buying goods and services, buying other currencies, and buying assets. As we did so, we explored a number of different arguments, all based on arbitrage, that help us to understand the relationships between interest rates, exchange rates, asset prices, and inflation rates. We argued that arbitrageurs will step in when there are easy profit opportunities. Arbitrage does not say that riskless profit opportunities cannot exist. It says that they will not persist. If a riskless profit opportunity were to exist, then people would very quickly take advantage of it and, by so doing, eliminate it.

Expressed more metaphorically, economists often say that there are no $100 bills lying on the ground waiting to be picked up. It is not that it is impossible for someone to drop a $100 bill, but if one person has dropped a large bill, someone else will almost certainly pick it up very quickly. There is an immediate and powerful lesson of arbitrage, one that you should bear in mind throughout life. If someone tells you of a surefire way to make easy money, beware!

Key Links

- •History of currencies: http://www.frbsf.org/currency/index.html
- •Value of a dollar:http://www.minneapolisfed.org/community_education/teacher/calc
- •Euro overview: http://ec.europa.eu/economy_finance/euro/index_en.htm
- •The Economist: Big Mac Index: http://www.economist.com/markets/bigmac
- •Exchange rates: http://www.oanda.com
- •US Department of the Treasury Daily Treasury Yield Curve:http://www.treasury.gov/resource-center/data-chart-center/Pages/index.aspx

ECERCISES

Suppose you go to a local café to order a drink. Instead of paying with the currency used in your home country, imagine you try to pay with the currency of another country. What do you think the response would be at the café? Why? What could you do to convince them to accept foreign currency at a local café? Imagine that you are at the border of two countries, say in a café near the US border with Canada. Do you think you could use Canadian currency in a US café near the border?

When you are traveling in a foreign country and want to use your debit card, what type of fees do you pay to withdraw money in foreign currency? Usually fees take two forms: a fixed fee, say $5, for any size transaction or a fee that is proportional to the amount you withdraw. If you want to make a large withdrawal, which type of fee do you prefer? If the fee is fixed, will this create an incentive to make more or fewer withdrawals? What does the fixed fee do to the size of the withdrawal you make?

Suppose the dollar price of euros is $10 and the euro price of dollars is EUR 1. Explain how you could make a profit in this market. What would you buy and what would you sell? Can this be an equilibrium in the foreign exchange market? Show that there are no arbitrage profits if the dollar price of the euro is $1.25 and the euro price of the dollar is EUR 0.80.

(Advanced) Using the relationship price of euro in dollars × price of dollar in euros = 1,

how would you draw the supply and demand curves and depict equilibrium in

the market for dollars and the market for euros?

5. Look at the left-hand table in Figure 9.6 "Exchange Rates". How are the numbers on the bottom left connected to the numbers on the top right? The diagonal has been left blank. What number could go on the diagonal?

6. Look at the left-hand table in Figure 9.6 "Exchange Rates". Suppose you start with GBP 100. Convert those pounds into euros and then convert the euros into dollars. How many dollars would you get? How many pounds do you get if you then convert your dollars into pounds?

7. Perform the same exercise as in Question 6 but use the table on the right-hand side of Figure 9.6 "Exchange Rates". How many pounds do you end up with?

8. If the nominal interest rate is 5 percent in France and 3 percent in Europe, according to uncovered interest parity, what do investors think is going to happen to the eurodollar exchange rate?

9. If the real interest rate is 2 percent in China and 6 percent in India, and investors are not expecting any change in the rupee-yuan exchange rate, then what can you conclude about inflation rates in China and India?

10. Explain how inflation reduces the real value of a currency both domestically and in other countries.

Economics Detective

1. Think of a "basket of goods" you buy often. It should include at least four items (for example, an espresso, a CD, a hamburger, and a copy of *Newsweek*). E-mail a friend in another country to find the prices for that same basket of goods. Check the exchange rate between your country's currency and that in your friend's country. Contrasting the prices in the two countries, look for violations of the law of one price. Is there some way you could make some profit?
2. Check rental car rates across two countries. (This is easy to do online at large car rental companies.) Make sure you choose the same car and insurance options. How might you explain the differences in these rates? Are there arbitrage profits for you to make?
3. Find an issue of *the Economist* from the period in the 1990s when Argentina was pegging the peso to the US dollar through a currency board, and look up the Big Mac index. What was the exchange rate then? What was the price of a Big Mac in Argentina during that period? Compare the peso prices of Big Macs and dollars between the two time periods.
4. Which countries use the kwacha, the dram, the ringgit, the leke, the baht, and the rial?
5. Suppose you want to convert some US dollars to euros, deposit them in a bank in Italy for one year, and then convert your euros to dollars. Search the Internet to determine how you could arrange now to buy dollars with euros in one year's time. What price would you have to pay for dollars?
6. Go to http://www.oanda.com and look at the latest exchange rate data. Find two currencies that have recently appreciated relative to the dollar and two currencies that have recently depreciated relative to the dollar.
7. Find a currency that has appreciated relative to the dollar since March 2007. Can you discover any explanations about why there was this change in the exchange rate?
8. Find data on the dollar price of the euro starting from the inception of the euro. Find periods when the dollar was appreciating relative to the euro. Find periods when the dollar was depreciating relative to the euro.
9. Who holds US government debt? What type of foreign exchange supported this?
10. Use http://www.minneapolisfed.org/community%5Feducation/teacher/calc to calculate the value of a dollar at different points in time. What would a dollar in 1955 buy today?

11. When you deposit money in the United States, you receive deposit insurance. If you deposit money in a bank in Italy or Japan or Mexico, will you receive deposit insurance? How does the existence of this insurance influence your decision about making deposits in foreign banks?
12. Call your bank to ask a hypothetical question: What will you have to do to deposit a large euro check in your dollar account? What will the bank charge you for this transaction? Are these costs proportional to the size of the euro check or is the cost a fixed number?

Spreadsheet Exercises

1. Suppose there are three currencies: dollars, pesos, and yuan. Write a spreadsheet program to find the dollar price of yuan given the dollar price of a peso and the peso price of the yuan such that there are no arbitrage profits to be made.
2. Suppose there are two countries: the United States and Mexico. Write a spreadsheet program to determine the interest rate on deposits in Mexico given the interest rate on deposits in the United States, the current exchange rate, and the expected future exchange rate so that there are no arbitrage profits to be made. All else being the same, how does a change in the US deposit rate affect the current exchange rate?

Chapter 10 Understanding the Fed

Money and Power

In August 2011, these 10 individuals were among the most powerful people in the world.

- • Ben S. Bernanke
- • William Dudley
- • Elizabeth Duke
- • Charles Evans
- • Richard Fisher
- • Narayana Kocherlakota
- • Charles Plosser
- • Sarah Raskin
- • Daniel Tarullo
- • Janet L. Yellen

You may not have heard any of these names before. It is certainly unlikely that you have heard of more than one or two of these individuals. Yet they decide how easy or difficult it will be for you to get a job when you graduate. They decide how expensive it is for you to buy a car. They decide how many pesos you get for a dollar if you travel from the United States to Mexico. They decide if the Dow Jones Industrial Average is going to increase or decrease. They decide whether the stock markets in Tokyo, London, Hong Kong, and Frankfurt are going to increase or decrease. They decide the cost of your vacation abroad and the cost of the clothes that you buy at home.

So who are they?

They are the members of a group called the Federal Open Market Committee (FOMC). They are responsible for setting monetary policy in the United States. Of course, they do not literally decide all the things we just mentioned, but their decisions do have a major influence on everything we listed. This chapter is about what these people do and why their choices matter so much for our day-to-day life. We begin with an example of this group at work.

FOMC Policy Announcement: February 2, 2005

For immediate release

The Federal Open Market Committee decided today to raise its target for the federal funds rate by 25 basis points to 2-1/2 percent.

The Committee believes that, even after this action, the stance of monetary policy remains accommodative and, coupled with robust underlying growth in productivity, is providing ongoing support to economic activity. Output appears to be growing at a moderate pace despite the rise in energy prices, and labor market conditions continue to improve gradually. Inflation and longer-term inflation expectations remain well contained.

The Committee perceives the upside and downside risks to the attainment of both sustainable growth and price stability for the next few quarters to be roughly equal. With underlying inflation expected to be relatively low, the Committee believes that policy accommodation can be removed at a pace that is likely to be measured. Nonetheless, the Committee will respond to changes in economic prospects as needed to fulfill its obligation to maintain price stability.

Voting for the FOMC monetary policy action were: Alan Greenspan, Chairman; Timothy F. Geithner, Vice Chairman; Ben S. Bernanke; Susan S. Bies; Roger W. Ferguson, Jr.; Edward M. Gramlich; Jack Guynn; Donald L. Kohn; Michael H. Moskow; Mark W. Olson; Anthony M. Santomero; and Gary H. Stern.

In a related action, the Board of Governors unanimously approved a 25-basis-point increase in the discount rate to 3-1/2 percent. In taking this action, the Board approved the requests submitted by the Boards of Directors of the Federal Reserve Banks of Boston, New York, Philadelphia, Cleveland, Richmond, Atlanta, Chicago, St. Louis, Minneapolis, Kansas City, Dallas, and San Francisco. [***Federal Open Market Committee, "Press Release," Federal Reserve, February 2, 2005, accessed July 20, 2011,http://www.federalreserve.gov/boarddocs/press/monetary/2005/20050202/default.ht ***]

This FOMC statement is from February 2005. We have deliberately chosen a statement from a few years ago because we want to begin with monetary policy prior to the economic crisis that began in 2008. This policy statement contains all the essential elements of monetary policy in normal times.

The 12 people listed in the second-to-last paragraph of this announcement were the FOMC members in February 2005. (These names are different from those we named at the start of the chapter because the composition of the FOMC changes over time.) The president of the United States was not one of them. And none of them are members of Congress. You did not vote for any of them. None of the three main branches of the US government (executive, legislative, or judicial) is involved in the setting of US monetary policy. The FOMC is part of a government body called the US Federal Reserve Bank, commonly known as the Fed. The Fed is *independent*: decisions made by the Fed do not have to be approved by other branches of the government.

In this statement we find the following phrases:

• "The Federal Open Market Committee decided today to raise its target for the federal funds rate by 25 basis points to 2-1/2 percent." • "The Committee perceives the upside and downside risks to the attainment of both sustainable growth and price stability for the next few quarters to be roughly equal." • "In a related action, the Board of Governors unanimously approved a 25-basis-point increase in the discount rate to 3-1/2 percent."

The first phrase indicates an *action* undertaken by the Fed: it changed its "target" for something called the "federal funds rate." This is a particular interest rate related to the rate banks pay each other for loans. Although you will never borrow to buy a car or a house at this rate, the interest rates you confront are heavily influenced by the federal funds rate. For example, over the past few years, the federal funds rate has decreased from 5.25 percent in 2006 to a value of 0.25 percent at the time of writing (mid-2011). Over this same period of time, rates on other types of loans, including mortgages and car loans, decreased as well. For example, typical car loan rates were about 7–8 percent in 2006 and about 3–4 percent in mid2011. In this way, the actions of the Fed affect all of us.

The second phrase contains the FOMC's assessment of the state of the economy, expressed in terms of two *goals*: economic growth and the stability of prices. The Fed is charged with the joint responsibility of stabilizing prices and ensuring the full employment of economic resources. The final statement details another action with respect to a different interest rate, called the discount rate.

The FOMC issues statements such as this on a regular basis. Our goal in this chapter is to equip you with the knowledge to understand these statements, which will in turn help you make sense of the discussions of the Fed's actions on television or in the newspapers. We want to answer the following questions:

What does the Federal Reserve do? And why are its actions so important?

Road Map

The FOMC statement reveals that, to understand the Fed, we need to know both the goals and the tools of the Fed. From the statement, we learn that the goals of the Fed are *sustainable growth* and *stable prices*. The Fed cannot do much to affect the long-run growth rate of the economy, but it can and does try to keep the economy close to potential output. At the same time, it tries to ensure that the overall price level does not change very much—in other words, it tries to keep inflation low. The Fed pursues these goals by means of several tools that it has at its disposal. The FOMC statement informs us that these tools include two different interest rates.

We begin with a little bit of background information. We briefly explain what the Federal Reserve does, and we note that other monetary authorities are similar, although not identical, in terms of goals and behavior. Because we have seen that the Fed's actions frequently revolve around interest rates, we make sure that we know exactly what an interest rate is.

We then get to the meat of the chapter, which discusses the workings of monetary policy. We explain how the Fed uses its tools to affect the things it ultimately cares about. Broadly speaking, we can summarize the cyclic behavior of the Fed as follows:

- The Fed observes current economic conditions. •
- The Fed decides on policy actions. •
- These policy actions affect real GDP (gross domestic product) and inflation. •
- The Fed observes the new economic conditions.

There is a long chain of connections between the Fed's tools and the ultimate state of the economy. To make sense of what the Fed does, we follow these connections, step by step. As we do so, we create a framework for understanding the effects of monetary policy, called the monetary transmission mechanism. We must also look at the connection in the other direction: how does the state of the economy influence the Fed's decisions? Figure 10.1 "The Links between Monetary Policy and the State of the Economy", which we use as a template for the chapter, summarizes the interaction between the monetary transmission mechanism and the behavior of the Fed. We conclude the chapter by looking at the tools of the Fed in more detail and by discussing some historical episodes through the lens of monetary policy.

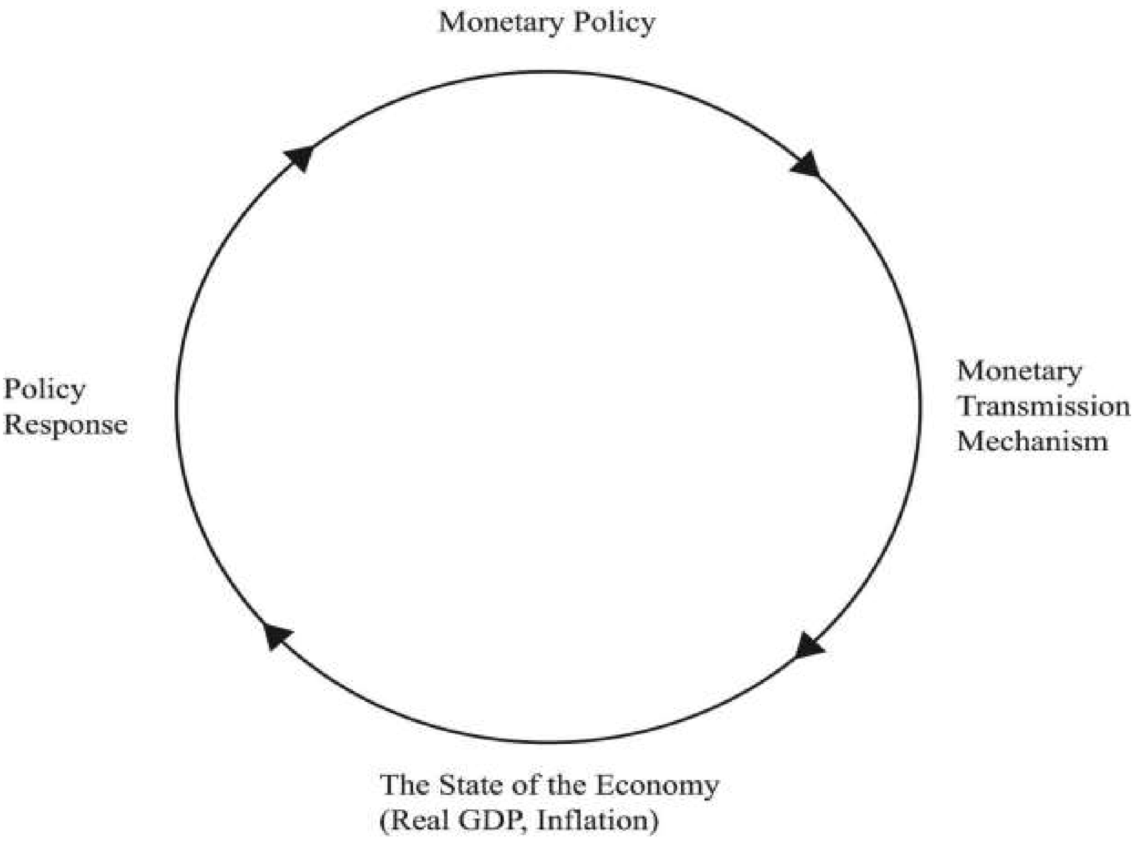

Fig. 10.1: Figure 10.1The Links between Monetary Policy and the State of the Economy The Federal Reserve looks at current economic conditions and decides on a policy response. This policy affects the state of the economy. The Fed then observes the new economic conditions and decides on a new policy response, and so forth.

10.1 Central Banks

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

When and why was the Federal Reserve System created in the United States?

What are the connections between the Federal Reserve System and the executive and legislative branches of the US government?

How does our study of monetary policy apply to other central banks around the world?

We start our discussion with institutions.

The Federal Reserve

The Federal Reserve System was formally established in an act of Congress on December 23, 1913, called the Federal Reserve Act (http://www.federalreserve.gov/aboutthefed/fract.htm). The stated purpose of the act was as follows: “To provide for the establishment of Federal reserve banks, to furnish an elastic currency, to afford means of rediscounting commercial paper, to establish a more effective supervision of banking in the United States, and for other purposes.” [***The Federal Reserve Act is found at “Federal Reserve Act,” Board of Governors of the Federal Reserve System, accessed September 20, 2011,http://www.federalreserve.gov/aboutthefed/fract.htm, and the structure of the Federal Reserve System is presented at “The Structure of the Federal Reserve System,” The Federal Reserve Board, accessed September 20, 2011, http://www.federalreserve.gov/pubs/frseries/frseri.htm. ***] The Federal Reserve System is built around a 7-member Board of Governors together with 12 regional banks. The members of the board are appointed by the president and approved by Congress to serve for 14 years. The FOMC, which is instrumental in the conduct of monetary policy, has 12 members.

Although the president and Congress play a role in the appointment of members of the Fed, their direct control stops there. The Fed is an independent body. The executive and congressional branches of the government have no formal input into the determination of monetary policy. Congressional control is limited to the fact that the chair of the Fed is required to report to Congress periodically and to Congress eventually having the power to change the laws governing the Fed’s conduct. The goals of the Fed are specified in the section of the Federal Reserve Act titled “Monetary Policy Objectives”: “The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy’s long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.” [***“Federal Reserve Act: Monetary Policy Objectives,” Federal Reserve, December 27, 2000, accessed August 6, 2011, http://www.federalreserve.gov/aboutthefed/section2a.htm.***] These objectives provide guidance to the Fed: it is required to pay attention to the level of economic activity (“maximum employment”) and to the level of inflation (“stable prices”). Exactly how the Fed promotes these goals—and chooses among them if necessary—is not specified. In some cases, the different aims of the Fed may conflict. For example, promoting employment may not be consistent with low inflation. The February 2, 2005, statement explicitly notes the balance between these goals.

The Fed has three main ways of affecting what goes on in the economy. The first was alluded to, although not mentioned by name, in the February 2, 2005, policy announcement. It is called open-market operations and represents the main way that the Fed influences interest rates. A second tool—the discount rate—was mentioned explicitly in the policy announcement. The third tool—reserve requirements—was not mentioned on February 2, 2005, but is nonetheless an important weapon in the Fed’s arsenal. Later on in this chapter, we examine the tools of the Fed in detail. For the moment, it is enough to know that the Fed affects the economy through changes in interest rates.

10.1.1 Central Banks in Other Countries

Our discussion in this chapter applies to not only the United States but also other countries. Wherever there is a currency, there is a monetary authority—a central bank—charged with the control of that currency. For example, in Europe, the European Central Bank (ECB; http://www.ecb.int/home/html/index.en.html) dictates monetary policy for all those countries that use the euro. In Australia, the Reserve Bank of Australia (RBA;http://www.rba.gov.au) manages monetary policy.

Different central banks do not all function in exactly the same way. To illustrate, here are policy announcements from the Bank of England (BOE;http://www.bankofengland.co.uk/publications/news/2006/078.htm), the Central Bank of Egypt (CBE;http://www.cbe.org.eg/public/PRESS_Release_For_Monetary_Policy/2011/MP C_PressRelease_09_06_2011_E.pdf), and the RBA (http://www.rba.gov.au/mediareleases/2011/mr-11-09.html). The details of the announcements are not critical. However, all have a "Monetary Policy Committee" rather than an FOMC. The different banks target slightly different interest rates: the BOE targets the "Bank rate paid on commercial bank reserves"; the CBE refers to overnight deposit and lending rates, the "7-day repo," and the discount rate; and the RBA refers to the "cash rate." You do not need to worry about exactly what these different rates are. All three banks are looking at the overall state of the economy, in terms of both output and inflation, and are setting interest rates to pursue broadly similar goals.

News Release: Bank of England Raises Bank Rate by 0.25 Percentage Points to 4.75 Percent, 3 August 2006[***"News Release," Bank of England, August 3, 2006, accessed July 20, 2011,http://www.bankofengland.co.uk/publications/news/2006/078.htm.***]

The Bank of England's Monetary Policy Committee today voted to raise the official Bank rate paid on commercial bank reserves by 0.25 percentage points to 4.75 percent.

The pace of economic activity has quickened in the past few months...As a result, over the past few quarters GDP [gross domestic product] growth has been at, or a little above, its long-run average and business surveys point to continued firm growth....

CPI [Consumer Price Index] inflation picked up to 2.5 percent in June, and is expected to remain above the 2.0 percent target for some while. Higher energy prices have led to greater inflationary pressures, notwithstanding muted earnings growth and a squeeze on profit margins....

Against the background of firm growth, limited spare capacity, rapid growth of broad money and credit, and with inflation likely to remain above the target for some while, the Committee judged that an increase of 0.25 percentage points in the official Bank rate to 4.75 percent was necessary to bring CPI inflation back to the target in the medium term.

Press Release, June 9, 2011: The Central Bank of Egypt Decided Not to Raise Its Policy Rates [***“Press Release,” Central Bank of Egypt, June 9, 2011, accessed July 20, 2011,http://www.cbe.org.eg/public/PRESS_Release_For_Monetary_Policy/2011/ MPC_Pres sRelease_09_06_2011_E.pdf.***]

In its meeting held on June 9, 2011, the Monetary Policy Committee (MPC) decided to keep the overnight deposit and lending rate unchanged at 8.25 and 9.75 percent, respectively, and the 7-day repo at 9.25 percent. The discount rate was also kept unchanged at 8.5 percent.

Headline CPI increased by 0.20 percent in May [month to month] following the 1.21 percent in April, bringing the annual rate down to 11.79 percent from 12.07 percent registered in April. ...

Meanwhile, real GDP contracted by 4.2 percent in 2010/2011 Q3 which marks the first negative year-on-year growth since the release of quarterly data in 2001/2002. ...

Against the above background, the slowdown in economic growth should limit upside risks to the inflation outlook. Given the balance of risks on the inflation and GDP outlooks and the increased uncertainty at this juncture, the MPC judges that the current key CBE [Central Bank of Egypt] rates are appropriate.

Media Release Number 2011-09: Statement by Glenn Stevens, Governor: Monetary Policy Decision [***Glenn Stevens, “Media Release,” Reserve Bank of Australia, June 7, 2011, accessed July 20, 2011, http://www.rba.gov.au/media-releases/2011/ mr-11-09.html.***]

At its meeting today, the Board decided to leave the cash rate unchanged at 4.75 per cent.

The global economy is continuing its expansion, led by very strong growth in the Asian region, though the recent disaster in Japan is having a major impact on Japanese production, and significant effects on production of some manufactured products further afield. Commodity prices have generally softened a little of late, but they remain at very high levels, which is weighing on income and demand in major countries and also pushing up measures of consumer price inflation. ...

Growth in employment has moderated over recent months and the unemployment rate has been little changed, near 5 per cent. Most leading indicators suggest that this slower pace of employment growth is likely to continue in the near term...

CPI inflation has risen over the past year, reflecting the effects of extreme weather and rises in utilities prices, with lower prices for traded goods providing some offset. The weather-affected prices should fall back later in the year, though substantial rises in utilities prices are still occurring. The Bank expects that, as the temporary price shocks dissipate over the coming quarters, CPI inflation will be close to target over the next 12 months.

At today’s meeting, the Board judged that the current mildly restrictive stance of monetary policy remained appropriate. In future meetings, the Board will continue to assess carefully the evolving outlook for growth and inflation.

In this chapter, we talk, for the most part, about the Federal Reserve. We focus on the United States principally because we do not want to get too bogged down in learning the different languages used by different central banks. From looking at the statements of the Fed, the BOE, the CBE, and the RBA, we see that the terminology of monetary policy varies greatly from country to country, the names of the key interest rates differ, and so forth. The underlying principles of monetary policy are largely the same in all countries, however.

KEY TAKEAWAY

The Federal Reserve System of the United States was created in 1913. A key motivation for the creation of a central bank was to manage the stock of currency and thus influence the state of the aggregate economy, particularly output and prices.

In the United States, the central bank is independent. Decisions about monetary policy are made within the Federal Reserve System. Members of the Board of Governors of the Federal Reserve System are nominated by the president and approved by the Senate.

There are central banks around the world, conducting monetary policy with similar tools and with the same basic model of the aggregate economy in mind.

***

Checking Your Understanding

What is the input of the US president in determining monetary policy?

By learning about how the Federal Reserve System in the United States conducts monetary policy, what can we learn about other countries?

10.2 The Monetary Transmission Mechanism

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What is the link between the actions of the Fed and the state of the economy?

What interest rate does the Fed target?

What components of aggregate spending depend on the interest rate?

The actions of monetary authorities, such as the Fed and other central banks around the world, influence interest rates and thus the levels of employment, output, and prices. The links between a central bank's actions and overall economic performance are far from straightforward, however. The process is summarized by the **monetary transmission mechanism** (shown in Figure 10.2 "The Monetary Transmission Mechanism"), which is the heart of this chapter. The monetary transmission mechanism is more than just some theory that economists have devised to try to make sense of monetary policy. It summarizes *how the Fed thinks about its own actions*.

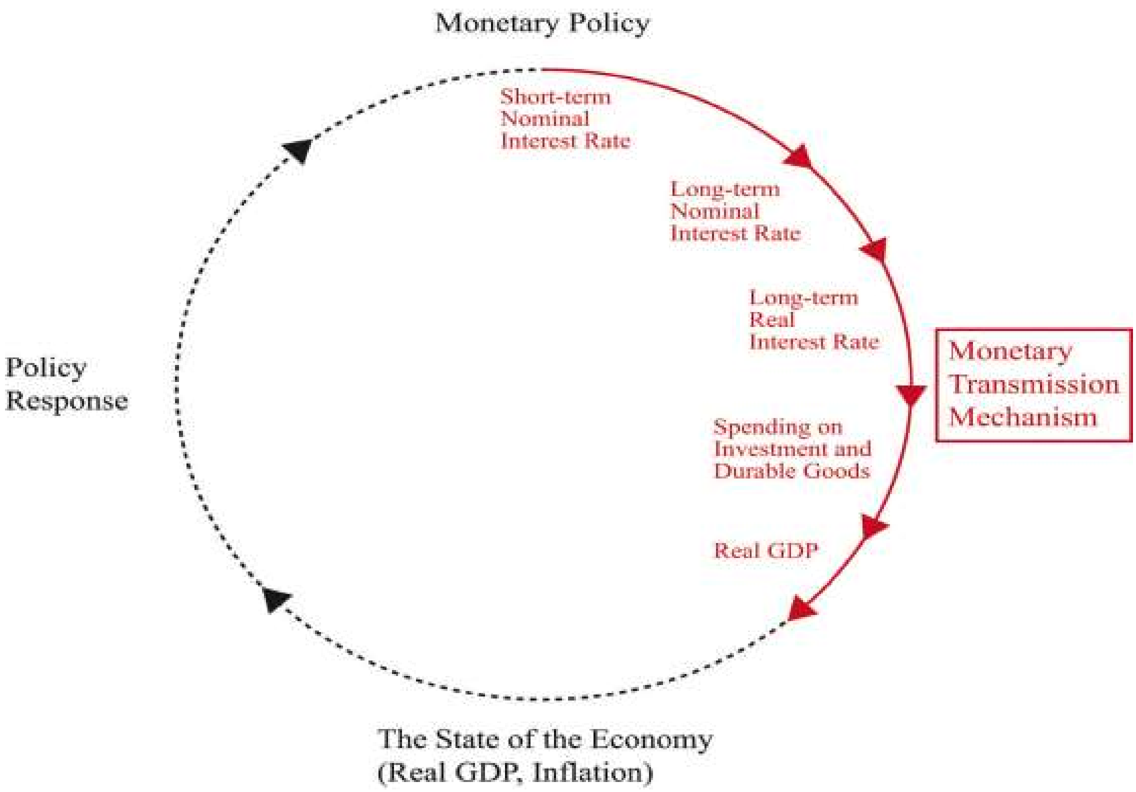

Fig. 10.2: Figure 10.2 The Monetary Transmission Mechanism The Fed targets a short-term nominal interest rate. Changes in this rate lead to changes in long-term real interest rates, which affect spending on investment and durable goods, ultimately leading to a change in real GDP.

The monetary transmission mechanism explains how the actions of the Federal Reserve Bank affect aggregate economic variables, and in particular real gross domestic product (real GDP). More specifically, it shows how changes in the Federal Reserve's target interest rate affect different interest rates in the economy and thus influence spending in the economy. Through open-market operations, the Fed targets a *short-term* **nominal interest rate**. Changes in that interest rate in turn affect *long-term* nominal interest rates. Changes in long-term nominal rates lead to changes in long-term **real interest rates**. Changes in long-term real interest rates affect **investment** and **durable goods** spending. Finally, changes in spending affect real GDP. We will examine every step of this process.

This chapter focuses on the effects of Fed actions, but essentially the same analysis applies to the study of monetary policy in other countries. The channels of influence are to a large degree independent of which country we study, although the magnitudes of the policy effects might differ across countries. Monetary policy differs across countries more through the targets set by different central banks than through the transmission mechanism.

How Well Can the Fed Meet Its Target?

On February 2, 2005, the Federal Open Market Committee (FOMC) decided to increase the target federal funds rate to 2.5 percent. The word *target* is critical here. If you listen to television news, you might get the impression that the Fed sets interest rates. It does not. It influences them, with greater or lesser success at different times.

***Figure 10.3 "Target and Actual Federal Funds Rate, 1971–2005" shows the monthly target and actual federal funds rate between 1971 and 2008. From this picture, it is evident that the target and actual federal funds rates move together. We can conclude that the first stage of the monetary transmission mechanism is reliable. The Fed can influence the federal funds rate. So far so good—at least for this period of time. As we shall see later, when we consider more recent events, the Fed was much less successful in targeting the federal funds rate during the periods of financial distress in 2007 and 2008.

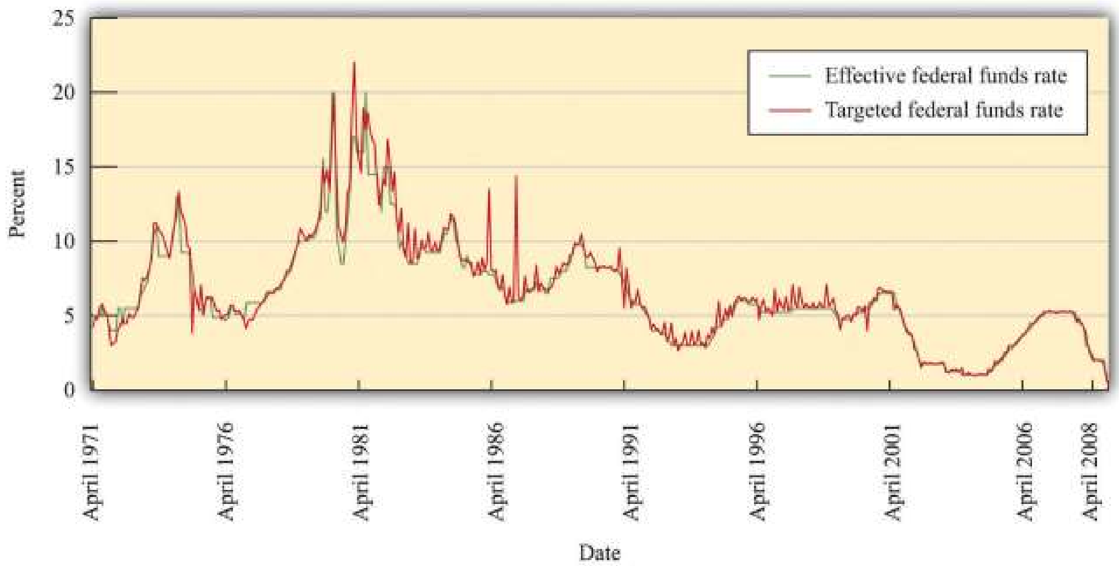

Fig. 10.3: Figure 10.3 Target and Actual Federal Funds Rate, 1971–2005 The target and actual federal funds rates move closely together.

10.2.1 From Short-Term Interest Rates to Long-Term Interest Rates

The next question is, do movements in the federal funds rate lead to corresponding movements in long-term interest rates? By “long-term,” we mean the rates on assets that have a maturity of at least 1 year and, in particular, assets that have a maturity of 5 years, 10 years, or even longer. **Arbitrage** among different assets means that annual interest rates on assets with different **maturities** are linked. As a result, the actions of the Fed to influence short-term rates also affect long-term rates.

***Figure 10.4 "Short-Term and Long-Term Interest Rates" shows the relationship between the federal funds rate and longer-term interest rates. Broadly speaking, these long rates move with the federal funds rate. But it is also clear that the longer the horizon on the debt, the less responsive is the interest rate to movements in the federal funds rate.

This is one of the difficulties faced by the Fed: it can target short-term rates very accurately, but its influence on long-term rates is much less precise. Since—as we shall see—many economic decisions depend on long-term rates, the Fed's ability to influence the economy is imperfect. Some writers have suggested that the Fed is an all-powerful organization that can move the economy around on a whim. There is no doubt that the Fed wields a great deal of power over the economy. Nevertheless, the Fed's influence is substantially limited by the fact that it cannot control long-term interest rates with anything like the same precision that it brings to bear on the federal funds rate.

Fig. 10.4: Figure 10.4 Short-Term and Long-Term Interest Rates The Fed's ability to influence long interest rates is much more limited than its ability to affect short rates.

10.2.2 From Nominal Interest Rates to Real Interest Rates

So far in this section, we have been considering nominal interest rates, but we know that the decisions of firms and households are based on real interest rates. The link between nominal and real interest rates is given by the **Fisher equation**:

```
real interest rate ≈ nominal interest rate - inflation rate.
```

To use this relationship, we simply subtract the inflation rate from the nominal interest rate. So if the nominal interest rate were 15 percent, as it was in the early 1980s, and the inflation rate were 12 percent, then the real interest rate would be 3 percent. But if the inflation rate were higher—say, 18 percent—then the real interest rate would be minus 3 percent.

Toolkit: Section 16.14 "The Fisher Equation: Nominal and Real Interest Rates"

The toolkit reviews the derivation of the Fisher equation.

***Figure 10.5 "Real and Nominal Interest Rates" shows the nominal and real rates of return for a one-year Treasury bond. Because inflation is positive, the nominal interest rate exceeds the real rate. The figure shows that the nominal and real rates typically move closely together. In the early 1980s, for example, the real interest rate was negative. Presumably when households lent money in the early 1980s, they did not expect a negative return on their saving but instead expected that the nominal interest rate would exceed the inflation rate. From that perspective, the negative real interest rate is a consequence of higher than anticipated inflation.

The Fed's ability to influence longer-term nominal rates through its influence on the federal funds rate apparently extends to the real interest rate as well. The connection is not perfect, however. On some occasions, movements in nominal rates are decoupled from movements in real rates.

Figure 10.5 Real and Nominal Interest Rates Changes in nominal interest rates generally lead to changes in real interest rates, but the link between the two is imperfect.

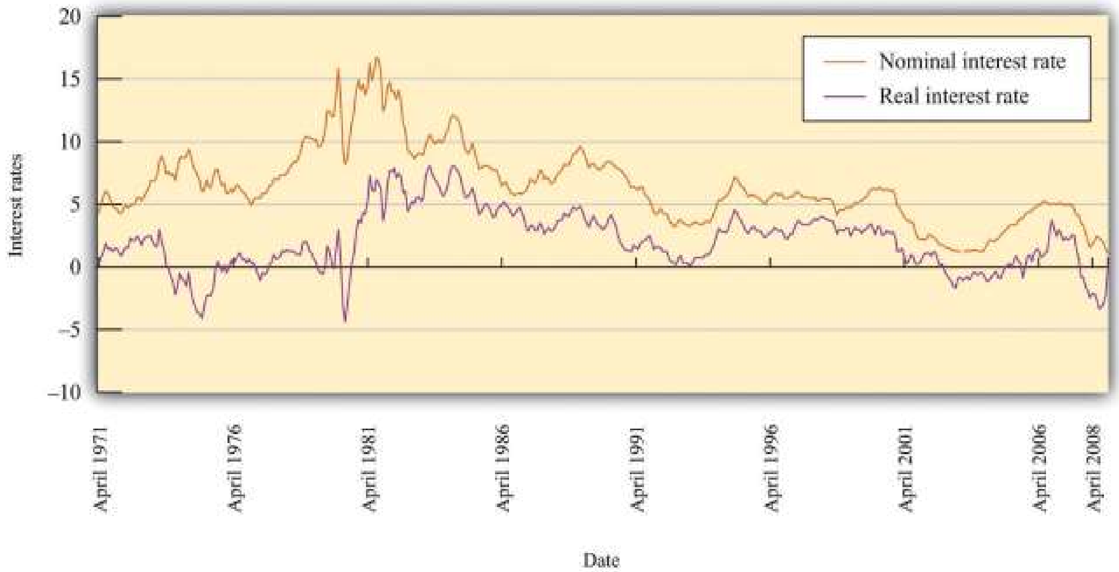

Fig. 10.5:

10.2.3 From Real Interest Rates to Spending on Durable Goods

Real rates of interest influence spending by both households and firms. The main categories of purchases that are affected by interest rates are as follows:

- • Investment spending by firms
- • Housing purchases by households
- • Durable goods purchases by households

What do these have in common? In each case, the purchase yields a flow of benefits that extends over some significant period of time. If a firm builds a new factory or purchases a new piece of machinery, it typically expects to be able to use that plant and equipment for years or decades. When a household buys a new home, it expects either to live there for a long time or else to sell it to someone else who can live there. If you buy a durable good such as a new car or a refrigerator, you expect to obtain the benefits of that purchase for several years.

Figure 10.6 "Real Interest Rates and Spending on Durable Goods" shows the relationship between the real interest rate and spending on durable goods. The higher the real interest rate is, the lower is the amount of spending on durable goods. Of course, the relationship need not be a straight line; we have just drawn it this way for simplicity. As you might imagine, monetary policymakers are very interested in the exact form of this relationship. They want to know exactly how big a change in durable goods spending is likely to follow from a given change in interest rates.

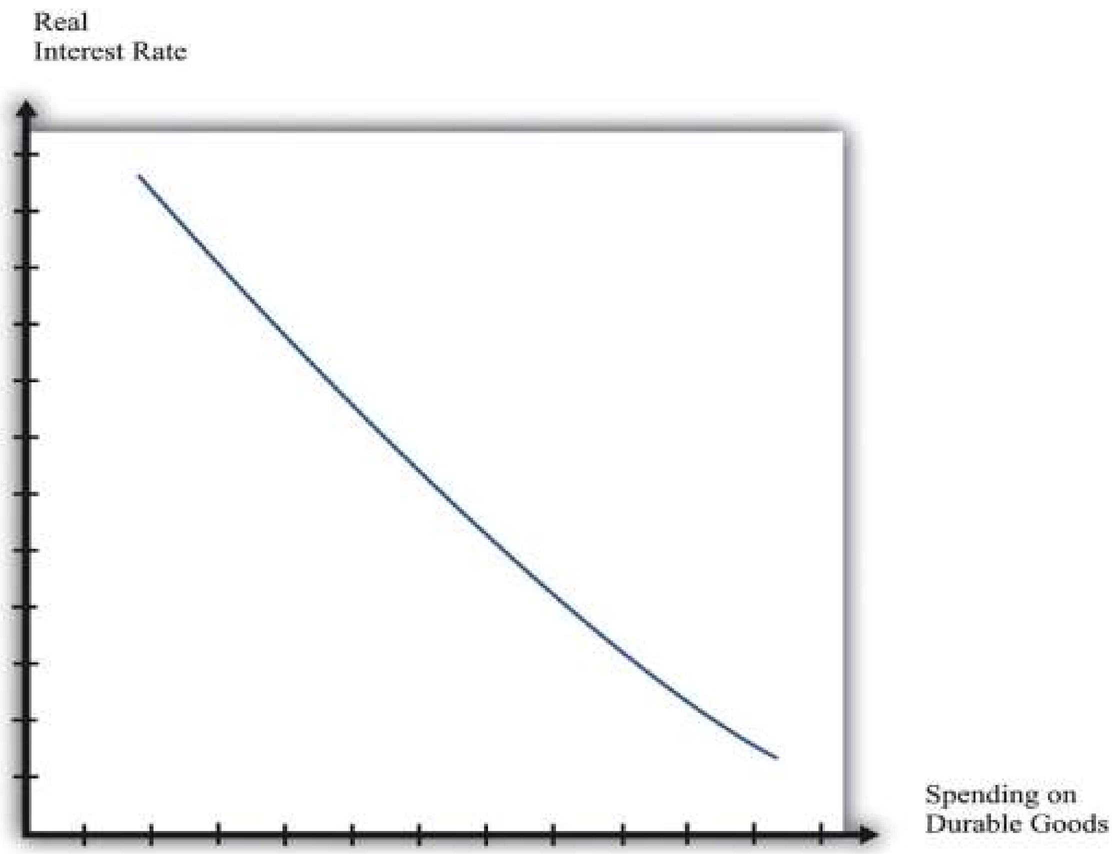

Fig. 10.6: Figure 10.6 Real Interest Rates and Spending on Durable Goods At higher interest rates, firms are less likely to borrow for investment projects, and households are less likely to borrow to purchase housing and durable goods such as new cars. Thus spending on durable goods is lower at higher interest rates and vice versa.

10.2.4 Discounted Present Value and Spending on Durable Goods

To understand in more detail why interest rates affect spending on durable goods, consider the purchase of a machine by a firm. Firms carry out such investment spending because they expect the machine to yield a flow of profits not only in the present but also for several years into the future. A machine is a capital good; it is used in the production of other goods and is *not* used up during the production process. The fact that the returns from the machine accrue over several years is what we mean by the term *durable*. It is not correct to simply add profit flows in different years because a dollar today is usually worth more than a dollar next year. Why? If you take a dollar today and put it in a savings account at the bank, you will get your dollar plus interest back next year. If the interest rate is 10 percent, then $1 this year is worth $1.10 next year. Turning it around, $1 next year is worth only about 91 cents this year (because 1/1.1 = 0.91).

The technique for adding together flows of resources in different periods is called **discounted present value**. To work out whether a given investment is profitable, a firm must calculate the value, in today's terms, of the flows of profits that it expects to receive. It then compares this to the cost of the investment. If the discounted present value of the profits exceeds the cost, the firm will undertake the investment.

Toolkit: Section 16.3 "Discounted Present Value"

You can review discounted present value in the toolkit.

Table 10.1 "Return on Investment" illustrates a simple investment decision. In year 1, you pay for a machine, and it yields some profit in that year. The next year, the machine yields further profit. Suppose you, as a manager of a firm, must decide whether or not to buy this machine. How do you make this decision? In the first year, you pay $970 for the machine and earn only $500 back, so you are down $470. In the second year, you will earn an additional $500—but you have to wait a year to get this money. Think of the profits in year 2 as being in real terms— that is, already corrected for inflation.

Table 10.1 Return on Investment

Year	**Payment for**	**Real Profit from**
	Machine	**Machine**
1	970	500
2	0	500

To decide about the purchase of the machine, you need to know the interest rate. If the interest rate were zero, the calculation would be easy. You could just add together the profit flows in the 2 years, observe that $1,000 is more than the $970 that you have to pay for the machine, and conclude that the purchase is a good idea. Now suppose the real interest rate is 5 percent, which means that the real interest factor is 1.05. Then the discounted present value of the profit flows from the machine is given by the following equation:

In this case, the purchase is still a good idea. You will earn $976 in present value terms, exceeding the $970 that you have to pay, so you still come out ahead.

But what if that the real interest rate is 10 percent? In this case,

This is less than the amount that you had to pay for the machine. The investment no longer looks like a good idea. The higher the interest rate, the more we must *discount* future earnings, so the less likely it is that a current investment will be profitable.

In most real-life cases, the flow of profits extends for several years, so the discounted present value calculation is somewhat harder. (Still, even harder calculations can be done easily with a calculator or a spreadsheet.) Our example may be simple, but it illustrates our key point. As the real interest rate decreases, the discounted present value of profits from a machine increases. In the economy, there are at any given time many possible investment opportunities. Some have higher profit flows than others.

At lower interest rates, more machines will be profitable to purchase: investment increases as the real interest rate decreases.

Households purchase homes and durable consumption goods, such as cars and household appliances. If the household borrows to make such purchases (through mortgages, car loans, or other personal loans), then exactly the same logic applies. Higher interest rates will tend to deter the household from these purchases, whereas lower interest rates will encourage purchases. [***Even if the household uses its own accumulated saving to buy the durable good, there is an opportunity cost of using these funds: it could have put the money in the bank instead. The higher the real interest rate, the better it looks to put money in the bank.***] Households usually have some choice about when exactly to purchase such goods. If interest rates are high this year, it probably makes sense to put off that purchase of a new washing machine until next year, when rates might be lower.

The effect of an increase in the real interest rate on spending on durable goods is captured in Figure 10.7 "The Relationship between the Real Interest Rate and Spending on Durable Goods".

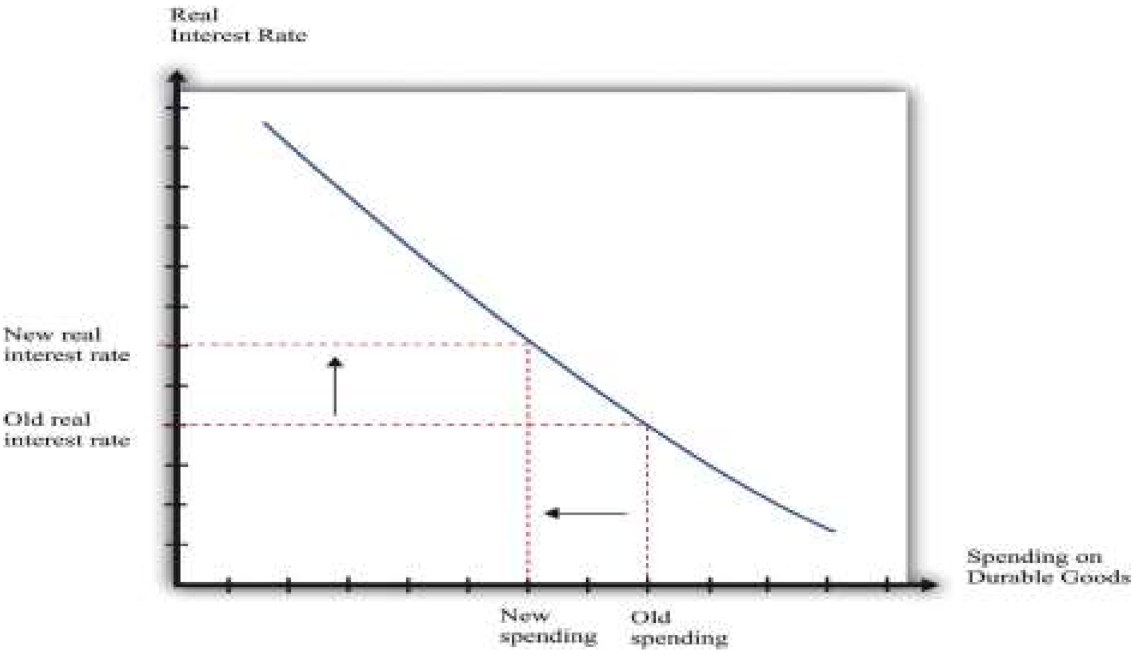

Fig. 10.7: Figure 10.7 The Relationship between the Real Interest Rate and Spending on Durable Goods When the real interest rate increases, spending on durable goods decreases.

10.2.5 From Spending on Durable Goods to Real GDP

Look again at Figure 10.2 "The Monetary Transmission Mechanism". We have so far explored the links from the Fed's decision on a target to spending on durable goods and net exports. Now we examine how changes in spending affect total output in the economy. The **aggregate expenditure model** allows us to see how changes in aggregate spending translate into changes in GDP, at a given price level. The idea underlying the aggregate expenditure model is that, by the rules of national income accounting, real GDP must equal both production and spending. If spending increases, then it must be the case that production increases as well. The key diagram of the aggregate expenditure model is shown in Figure 10.8 "Aggregate Spending Depends Positively on Income".

Variations in the real interest rate influence the level of aggregate spending through the level of autonomous spending (the intercept term). To see why, recall that total spending is the sum of consumption, investment, government purchases, and net exports. The intercept term of the expenditure relationship includes all the influences on spending*other than output*. Thus any changes in consumption, investment, or net exports that are*not*induced by changes in output show up as changes in the intercept term. In particular, if an increase in interest rates causes firms to cut back on their investment spending, then the planned spending line shifts downward.

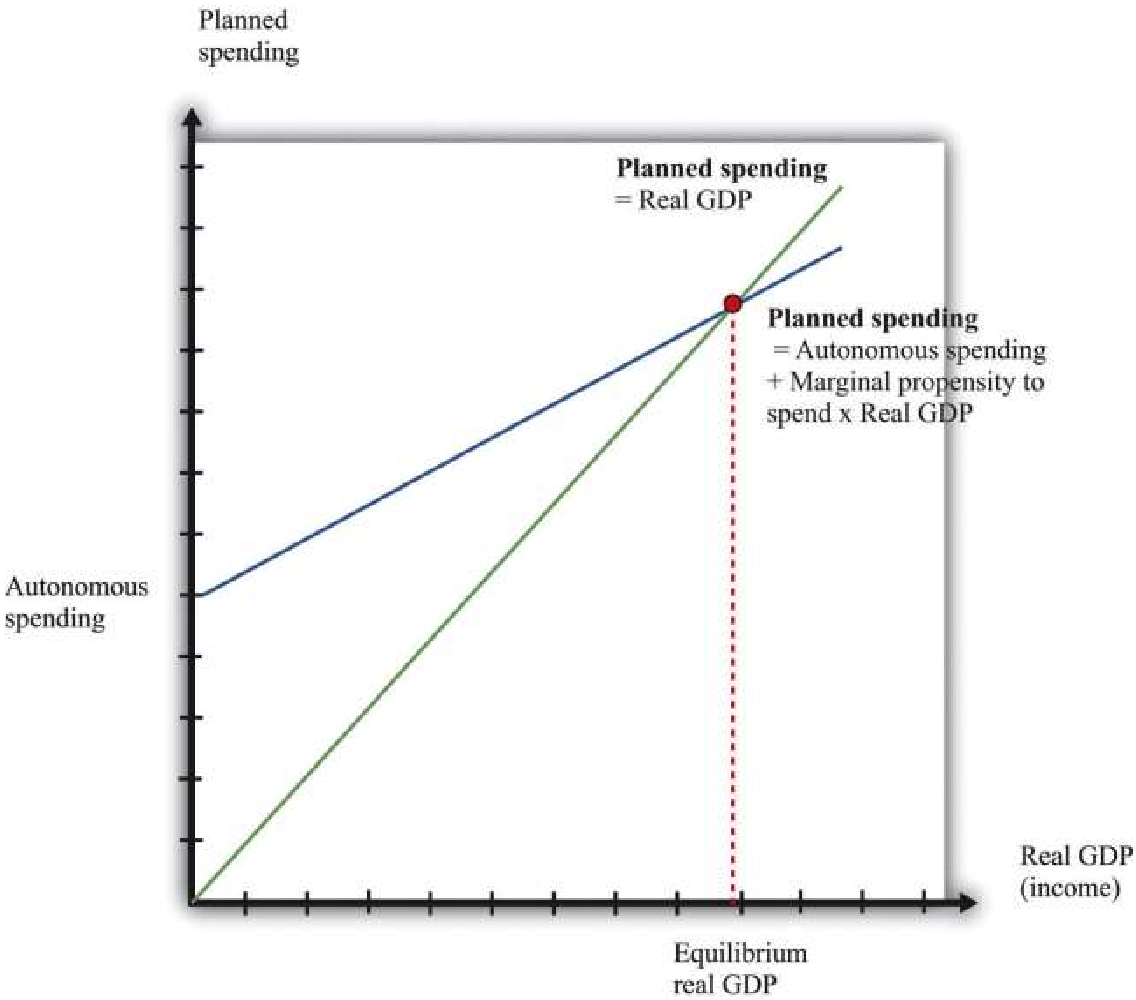

Fig. 10.8: Figure 10.8 Aggregate Spending Depends Positively on Income The economy is in equilibrium when spending equals real GDP.

We saw in Figure 10.7 "The Relationship between the Real Interest Rate and Spending on Durable Goods" that, as the real interest rate increases, the level of spending on durables decreases. This leads to a decrease in spending, given the level of income, and thus a decrease in the intercept of the spending line, as shown in Figure 10.9 "Increases in Real Interest Rates Reduce Real GDP". The magnitude of the reduction in spending—that is, the shift downward in the spending line—will depend on the sensitivity of durable spending to real interest rates. *The more sensitive durable spending is to changes in the real interest rate, the larger the shift in the spending line will be when the real interest rate changes.*

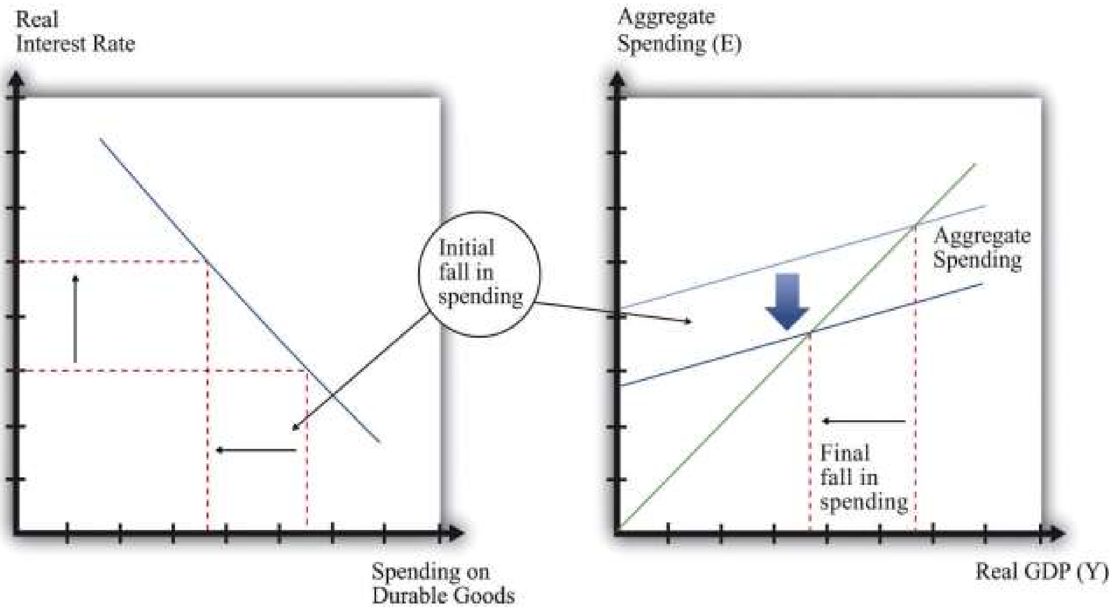

Fig. 10.9: Figure 10.9 Increases in Real Interest Rates Reduce Real GDP As a consequence of increases in real interest rates, aggregate spending decreases.

The initial reduction in spending induced by the increased real interest rate is then magnified by the **multiplier** process. The reduction in durable spending leads to a contraction in output. The resulting decrease in income leads households to spend less, leading to further contractions in output and income. In the end, the overall reduction in output exceeds the initial reduction in spending. This is visible in Figure 10.9 "Increases in Real Interest Rates Reduce Real GDP" from the fact that the horizontal difference between the old and new equilibrium points is larger than the vertical shift in the spending line.

Toolkit: Section 16.19 "The Aggregate Expenditure Model"

You can review the aggregate expenditure model and the multiplier in the toolkit.

10.2.6 The Real Interest Rate–Real GDP Line

We can summarize much of the monetary transmission mechanism by means of a relationship between real interest rates and real GDP, as shown in ***Figure 10.10 "The Relationship between the Real Interest Rate and Real GDP". After we work through all the connections from real interest rates to the various components of spending and real GDP, we find that there is a level of real GDP associated with each real interest rate. The higher the interest rate, the lower is real GDP.

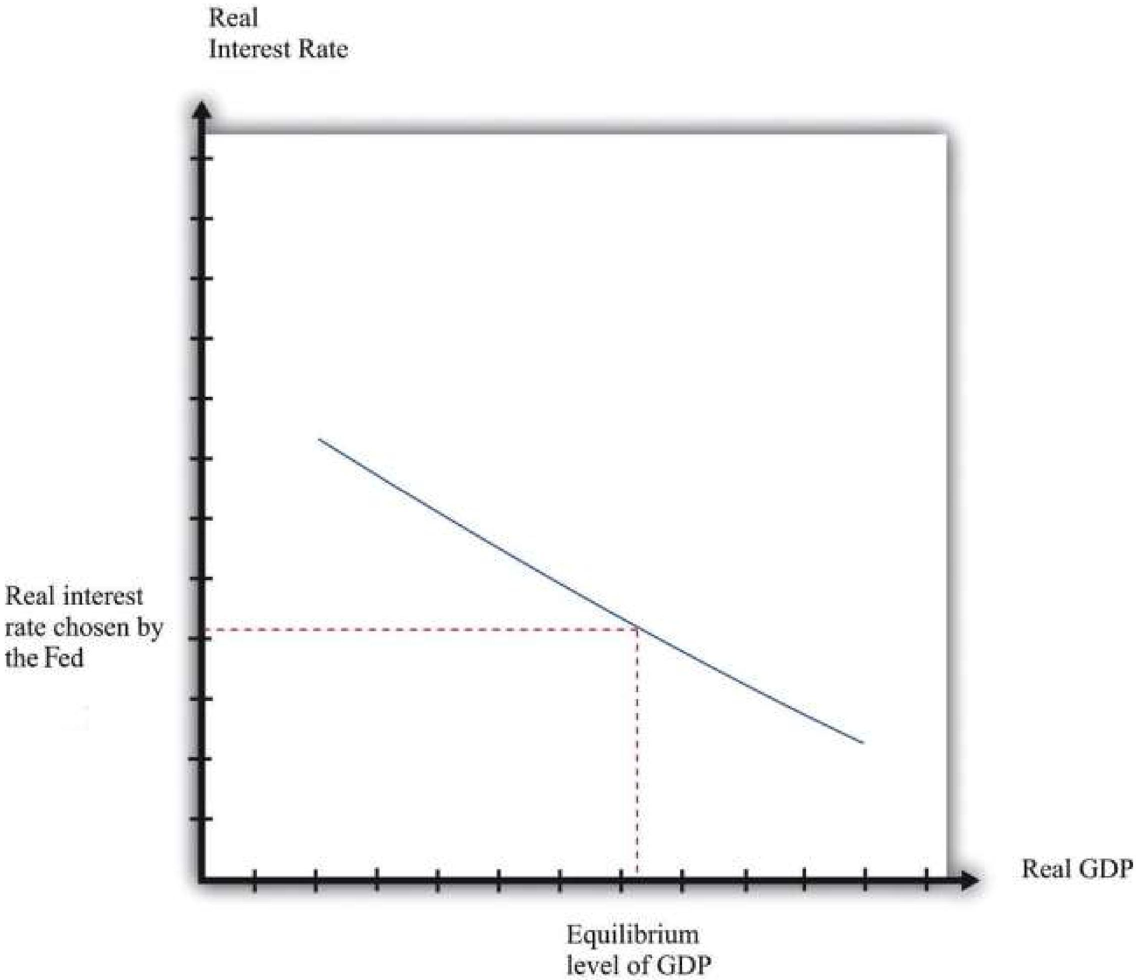

Fig. 10.10: Figure 10.10 The Relationship between the Real Interest Rate and Real GDP This picture summarizes several steps in the monetary transmission mechanism to show the relationship between real interest rates and real GDP.

As the monetary authority changes the real interest rate, the economy moves along this curve. So, for example, a reduction in the real interest rate leads to increased spending on durables, which, through the **multiplier** process, increases aggregate output. The shape of the curve tells us something about the Fed's ability to influence the economy. Suppose that (1) durable spending is very sensitive to the real interest rate and (2) the multiplier is large; then imagine that the Fed cuts interest rates. Firms and households both respond to this change. Firms decide to carry out more investment: they buy new machinery, open new plants, and so forth. Households, attracted by the low interest rates, borrow to buy new cars and new homes. As a result, durable spending increases substantially. Furthermore, this increase in spending leads to higher income and thus to further increases in spending by households. The end result is a large increase in real GDP. In this case, the curve is flat.

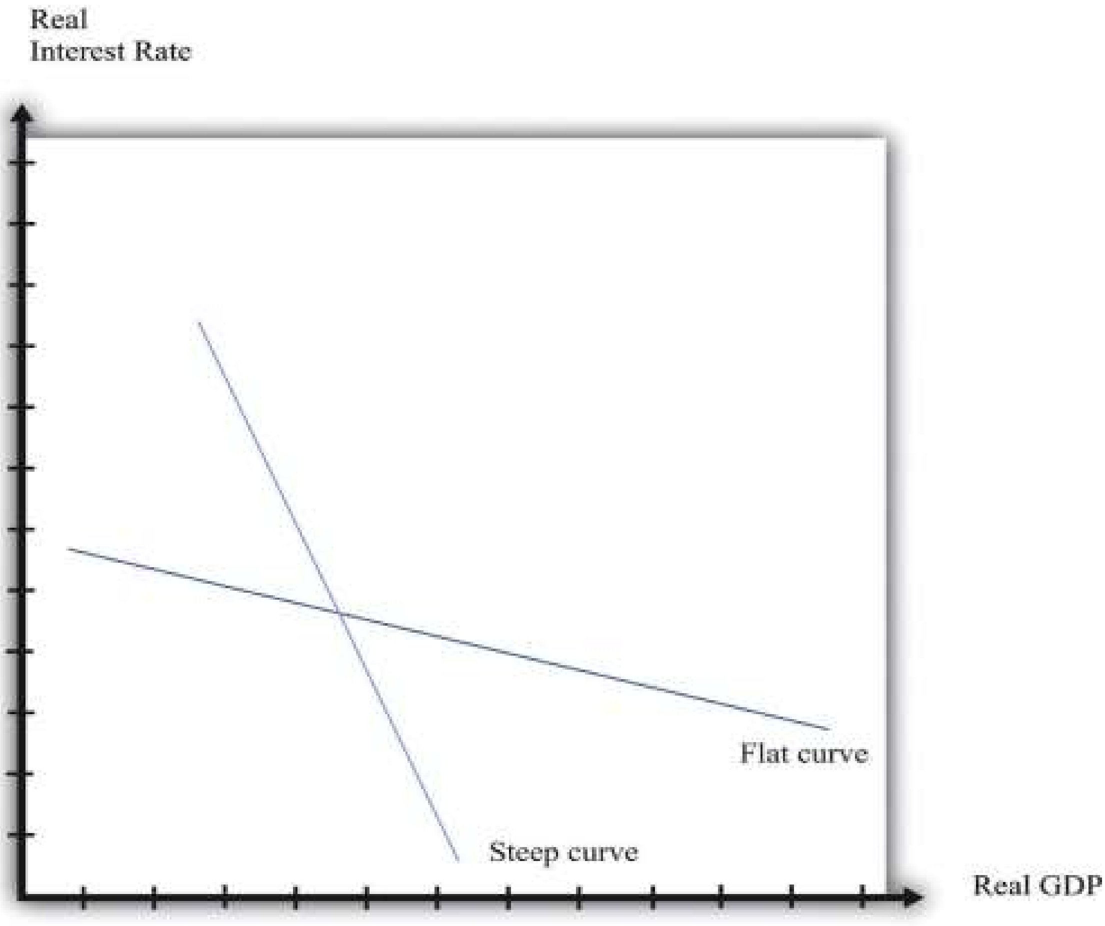

Fig. 10.11: Figure 10.11 The Fed's Influence on the Economy Depends on the Real Interest Rate–Real GDP Relationship When the curve is flat, the Fed is able to have a big influence on the economy. When thecurve is steep, it is harder for the Fed to affect economic activity.

Figure 10.11 "The Fed's Influence on the Economy Depends on the Real Interest Rate–Real GDP Relationship" shows both this case and the case where it is harder for the Fed to influence the economy. If spending on durable goods is not very responsive to changes in the real interest rate and the multiplier is small, then changes in interest rates end up having only a small effect on real GDP. In the diagram, this shows up as a steep curve. The Fed's ability to use the monetary transmission mechanism to its advantage requires good knowledge of the shape of this relationship between interest rates and output.

KEY TAKEAWAY

The monetary transmission mechanism describes the links between the actions of the Fed and the state of the aggregate economy.

The Fed targets a short-term nominal interest rate called the federal funds rate. The Fed does not set this rate directly but rather uses its tools to influence this interest rate.

The main components of spending that depend on the real interest rate are spending by households on durable goods and investment. When these components of spending are sensitive to the interest rate, then the Fed can influence the economy through small variations in its target federal funds rate.

***

Checking Your Understanding

Which interest rate determines investment spending—the real interest rate or the nominal interest rate?

Some newspapers state that the Fed sets the interest rate. Is that right?

10.3 Monetary Policy, Prices, and Inflation

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How do prices adjust in the economy?

What are the effects of monetary policy on prices and inflation?

What is the Taylor rule?

We now understand the effect of an interest rate increase on output. According to the monetary transmission mechanism, we expect that this will result in lower spending and a lower real gross domestic product (GDP). Remember, though, that the Fed is also charged with worrying about prices and inflation. Look back at the Federal Open Market Committee (FOMC) announcement with which we opened the chapter. Much of that announcement concerns inflation, not output. It states that "inflation and longer-term inflation expectations remain well contained," that "underlying inflation [is] expected to be relatively low," and that "the Committee will respond to changes in economic prospects as needed to fulfill its obligation to maintain price stability." [***Federal Open Market Committee, "Press Release," Federal Reserve, February 2, 2005, accessed July 20, 2011,http://www.federalreserve.gov/boarddocs/press/monetary/2005/20050202/default.ht ****]

The statements by the Bank of England, the Central Bank of Egypt, and the Reserve Bank of Australia likewise betray a strong concern with inflation. The policy of many central banks is directed toward the inflation rate. This policy, appropriately called inflation targeting, focuses the attention of the monetary authority squarely on forecasting inflation and then controlling inflation through its current policy choices.

10.3.1 Price Adjustment and Inflation

The **inflation rate** is defined as the *growth rate* of the overall **price level**. In turn, the price level in the economy is based on the prices of all the goods and services in an economy. From one month to the next, some prices increase, others decrease, and still others stay the same. The overall inflation rate depends on what is happening to prices on average. If most prices are increasing and few are decreasing, then we expect to see inflation.

A complete explanation of inflation requires an understanding of all the decisions made by managers throughout the economy as they decide whether to change the prices of the goods and services that they sell. Some managers might find themselves facing increasing costs and strong demand for their product, so they would choose to increase prices. Others might have decreasing costs and weak demand, so they would choose to decrease prices. The overall inflation rate depends on the aggregation of these decisions throughout the economy and is summarized in a **price adjustment equation**. The price adjustment equation is shown in ***Figure 10.12 "Price Adjustment".

Toolkit: Section 16.20 "Price Adjustment"

The net effect of all the price-setting decisions of firms yields a price adjustment equation, which is as follows:

```
inflation rate = autonomous inflation − inflation sensitivity ×
output gap.
```

The price adjustment equation summarizes, at the level of the entire economy, all the decisions about prices that are made by managers throughout the economy. It tells us that there are two reasons for increasing prices. The first is that there may be underlying (autonomous) inflation in the economy, even when it is at potential output. This depends, among other things, on the inflation rate that firms anticipate. The second reason for increasing prices is if the output gap is negative. The output gap is the difference between potential output and actual output:

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output gap = potential real GDP − actual real GDP.
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A positive gap means that the economy is in recession—below potential output. If the economy is in a boom, then the output gap is negative.

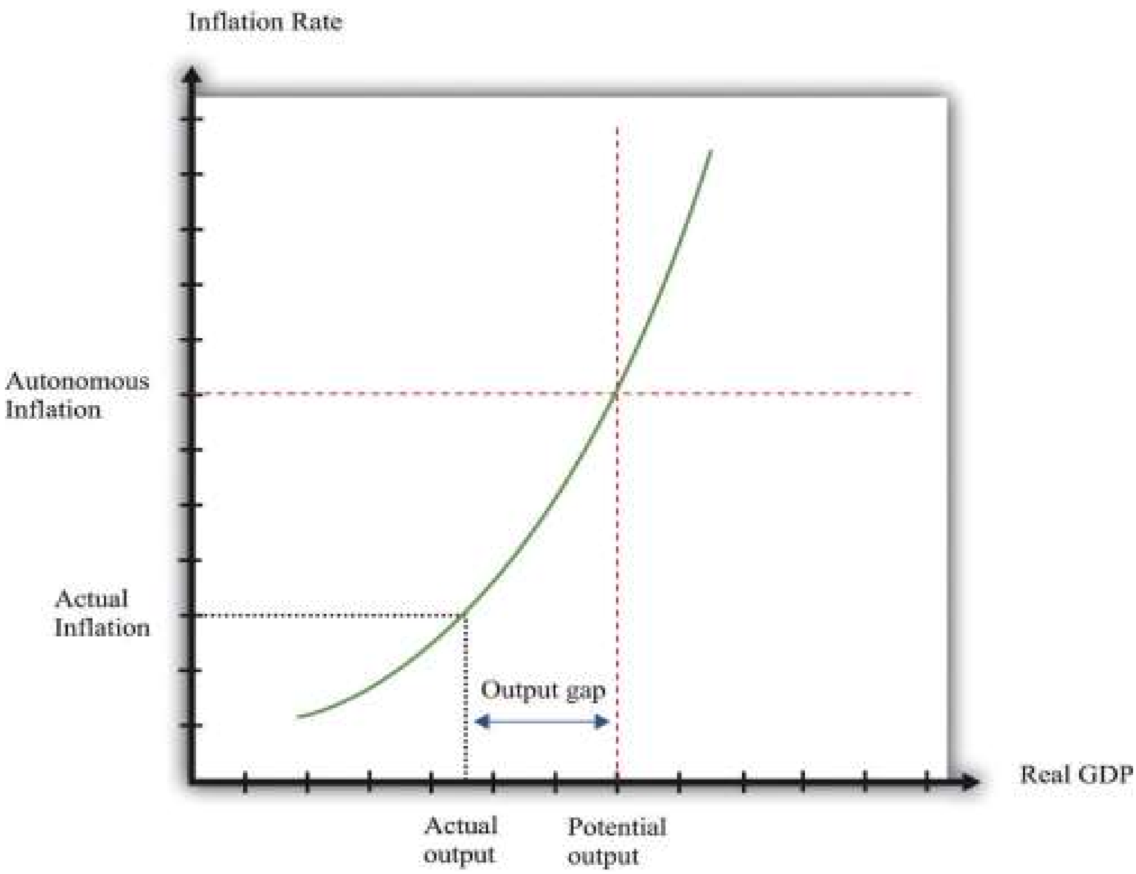

Fig. 10.12: Figure 10.12 Price Adjustment The price-adjustment equation tells us that when real GDP is below potential output, the output gap is positive, and the actual inflation rate is below its autonomous level. The opposite is true if real GDP is above potential output.

The output gap matters for inflation because as GDP increases relative to potential output, labor and other inputs become scarcer. Firms see increasing costs and increase their prices as a consequence. The second term of the price adjustment equation shows that when real GDP is above potential output (the output gap is negative), there is upward pressure on prices in the economy. The inflation rate exceeds autonomous inflation. By contrast, when real GDP is below potential output (the output gap is negative), there is downward pressure on prices. The inflation rate is below the autonomous inflation rate. The “inflation sensitivity” tells us how responsive the inflation rate is to the output gap.

If the output gap were the only factor affecting prices in the economy, then we would often expect to see **deflation**—decreasing prices. In particular, we would see deflation whenever the economy was in a recession. Although the United States and some other economies have occasionally experienced deflation, it is relatively rare. We can conclude that there must be factors other than the output gap that cause inflation to be positive.

Autonomous inflation is the inflation rate that prevails in the economy when the economy is at potential output (the output gap is zero). In the United States in recent decades, the inflation rate has been positive but low, meaning that prices have been increasing on average but at a relatively slow rate. Autonomous inflation is typically positive because most economies have some growth of the overall money supply in the long run. A positive output gap then translates not into deflation but simply into an inflation rate below the level of autonomous inflation. Thus in the FOMC statement with which we opened this chapter, the discussion is not about how contractionary policy will cause deflation; it is about how this policy will moderate the inflation rate. Positive autonomous inflation means that firms will typically anticipate that their suppliers or their competitors are likely to increase prices in the future. A natural response is to increase prices, so actual inflation is positive.

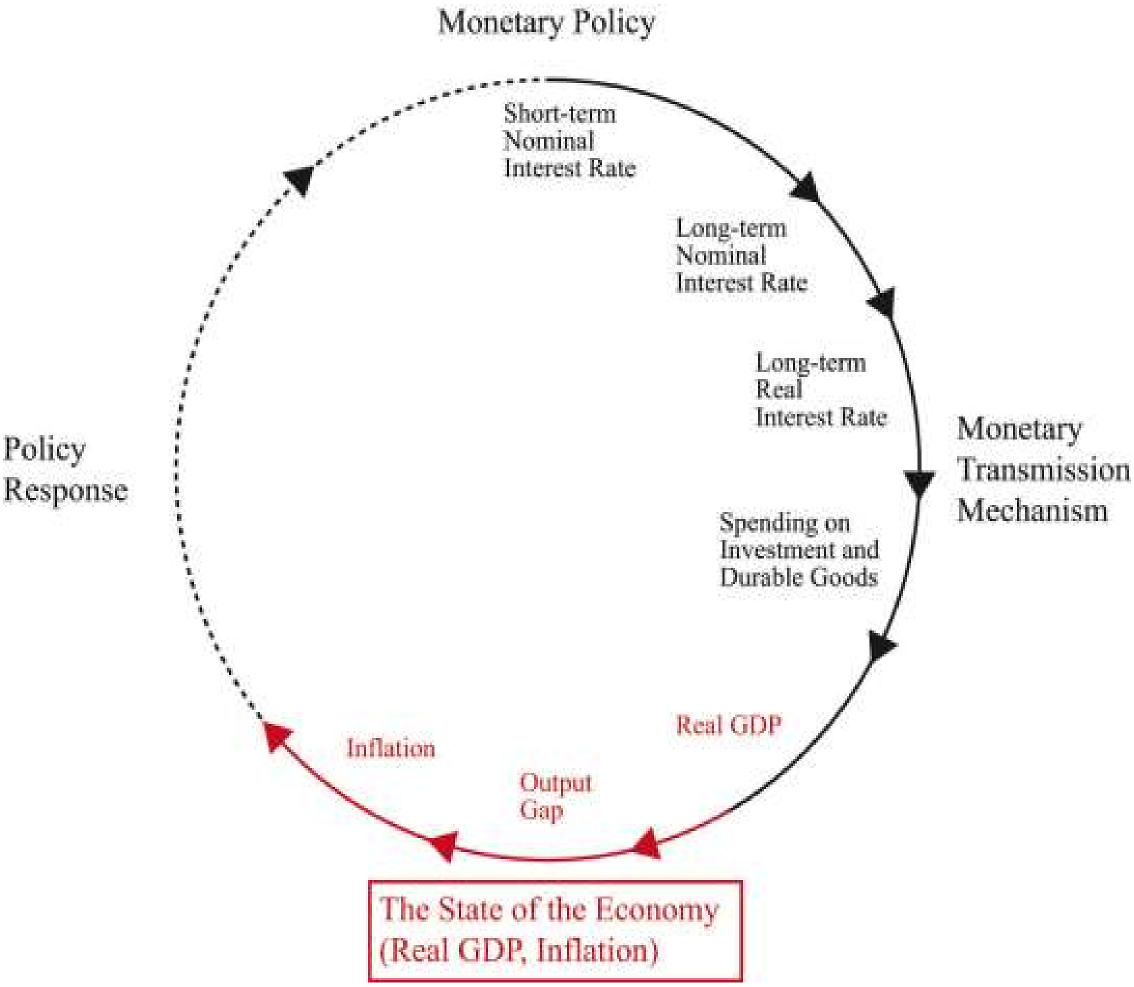

Fig. 10.13: Figure 10.13 Interactions among Interest Rates, Output, and Inflation

10.3.2 The Effect of an Increase in Interest Rates on Prices and Inflation

The monetary transmission mechanism teaches us that an increase in real interest rates reduces spending and hence leads to a reduction in real GDP. In the (very) short run, the reduction in spending translates directly into a decrease in real GDP because prices are fixed. The reduction in GDP increases the output gap in the economy. Our price adjustment equation tells us in turn that this will tend to reduce the inflation rate in the economy.

Some firms will then adjust prices very quickly to the changing economic conditions. We do not think that the price level in the economy is literally fixed—unable to move—for any significant period of time. That said, some firms are likely to keep their prices unchanged for several months, even in the face of changing economic conditions. Thus the adjustment of prices in the economy takes some time. It will be months, perhaps years, before all firms have adjusted their prices.

In summary, an increase in interest rates leads to a gradual reduction in the inflation rate in the economy. Contractionary monetary policy leads to a reduction in economic activity and, over time, lower inflation. US monetary policy in the early 1980s provides a good illustration. At the start of that decade, the inflation rate was over 10 percent. To reduce inflation, the Fed, under Chairman Paul Volcker, conducted a contractionary monetary policy that sharply increased real interest rates. The immediate result was a severe recession, and the eventual result was a reduction in inflation, just as the model suggests.

10.3.3 Closing the Circle: From Inflation to Interest Rates

We have now traced the effects of monetary policy from interest rates to spending to real GDP to inflation. The effects of monetary policy do not stop there. Instead, as inflation adjusts in response to monetary policy, there is a feedback to interest rates through monetary policy itself. This is shown in ***Figure 10.14 "Completing the Circle of Monetary Policy".

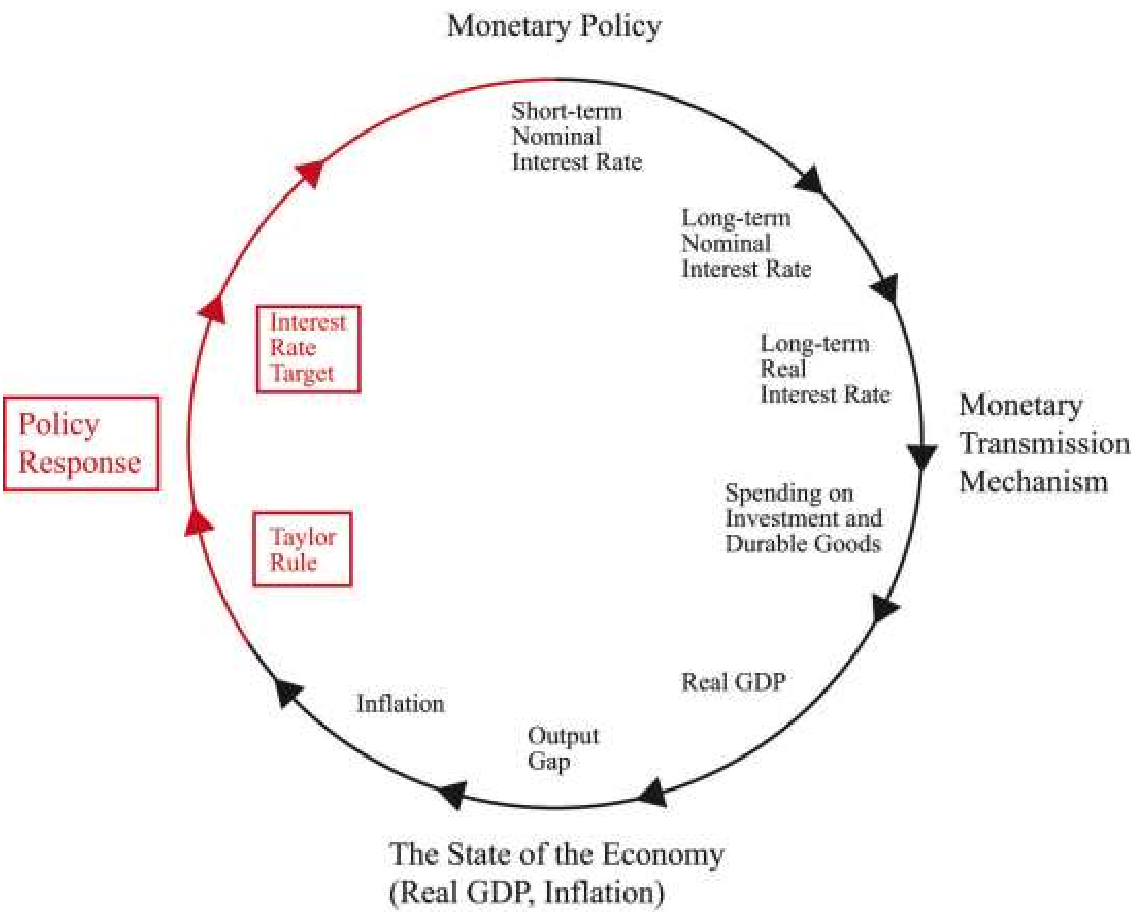

Fig. 10.14: Figure 10.14 Completing the Circle of Monetary Policy We close the monetary policy circle by observing that the Fed’s policies depend on the state of the economy.

Observers of the Fed's behavior over the past 20 or so years have argued that the Fed generally follows a rule that makes its choice of a target interest rate somewhat predictable. The rule that summarizes the behavior of the Fed is sometimes called the **Taylor rule**; it is named after John Taylor, an economist who first characterized Fed behavior in this manner. [***Comments on John Taylor's career and his contributions to monetary economics by Fed Chairman Ben Bernanke are available at "Opening remarks to the Conference on John Taylor's Contributions to Monetary Theory and Policy, Federal Reserve Bank of Dallas, Dallas, Texas," Federal Reserve, October 12, 2007, accessed September 20, 2011,http://www.federalreserve.gov/newsevents/speech/bernanke20071012a.htm. ***] The Taylor rule stipulates a relationship between the target interest rate and the state of the economy, typically represented by both the inflation rate and some measure of economic activity (such as the gap between actual and potential GDP). Usually, we think that the monetary authority operates with a lag so that the interest rate the monetary authority sets at a point in time reflects the output gap and inflation from the recent past. According to the Taylor rule, the Fed will increase real interest rates when

- • inflation is greater than the target inflation rate,
- • output is above potential GDP (a negative output gap).

Conversely, the Fed will decrease real interest rates when

- • inflation is less than the target inflation rate, •
- output is below potential GDP (a positive output gap).

The Fed will want to increase interest rates and thus "put the brakes on the economy" when inflation is high and when they think that real GDP is above its long-run level (potential output). The Fed will want to decrease interest rates when inflation is relatively low and the economy is in a recession.

An example of a Taylor rule is shown in ***Figure 10.15 "The Taylor Rule". The vertical axis is the real interest rate target of the Fed, and the horizontal axis is the inflation rate. As the inflation rate increases, the Fed, according to this rule, then increases the interest rate.

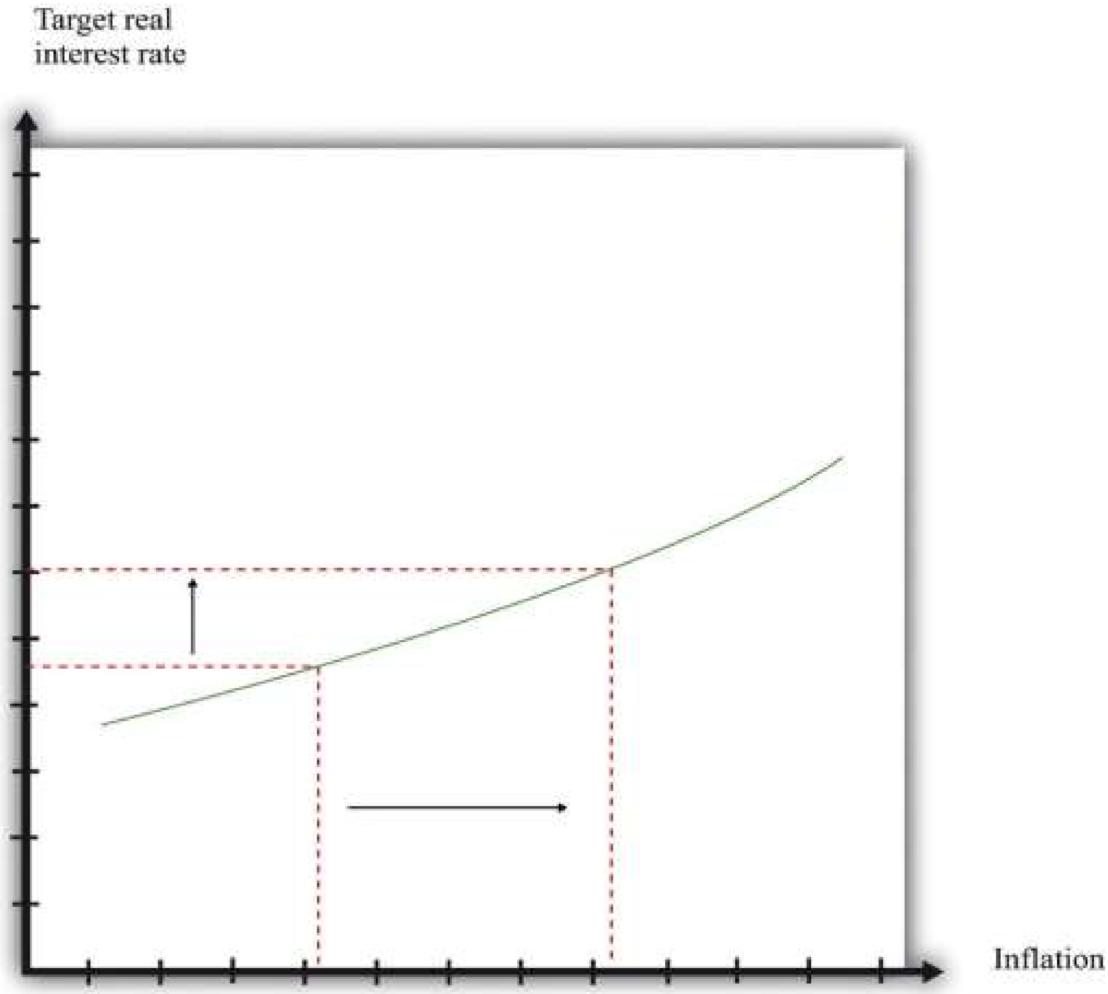

Fig. 10.15: Figure 10.15 The Taylor Rule The monetary policy rule shows how the Fed adjusts real interest rates in response to changes in inflation rates. As inflation increases, the monetary authority targets a higher real interest rate.

The different pieces of the Taylor rule can be in conflict. For example, the Fed may face a situation where inflation is relatively high, yet the economy is in recession. The precise specification of the rule then provides guidance as to how the Fed trades off its inflation and output goals. The rule is largely descriptive: it summarizes in a succinct manner the actions of the Fed. In doing so, it allows individuals to predict with some accuracy what actions the Fed is likely to take in the future.

The Taylor rule describes Fed policy in terms of the *real* interest rate. We know, however, that the Fed actually targets a nominal rate. This has a surprising implication when we examine how the Fed responds to inflation. Suppose the Fed is currently meeting its target inflation rate—say, 3 percent—and the federal funds rate is currently 5 percent. The real interest rate is therefore 2 percent (remember the Fisher equation). Now suppose the Fed sees that inflation has increased from 3 percent to 4 percent. The increase in the inflation rate has the effect of decreasing the real interest rate—again, this comes directly from the Fisher equation. The real interest rate is now only 1 percent. Yet the Taylor rule tells us that the Fed wants to *increase* the real interest rate. To do so, it must increase nominal interest rates by *more* than the increase in the inflation rate. In our example, the inflation rate increased by one percentage point, so the Fed will have to increase its target for the federal funds rate by more than one percentage point—perhaps to 6.5 percent.

The Taylor rule completes the circle of monetary policy. As indicated by ***Figure 10.14 "Completing the Circle of Monetary Policy", the monetary policy rule links the state of the economy, represented by the inflation rate and the output gap, to the interest rate. There is usually a lag in the response of the Fed to the state of the economy. So, for example, the decision made at the FOMC meeting in February 2005 reflected information on the state of the economy through the end of 2004, at best.

10.3.4 In Summary: The Three Key Pieces of the Monetary Transmission Mechanism

We now have the three pieces we need to understand the relationship between monetary policy, inflation, and real GDP:

1. The Taylor rule linking the real interest rate to the inflation rate (***Figure 10.15 "The Taylor Rule")
2. The inverse relationship between the real interest rate and real GDP (***Figure 10.10 "The Relationship between the Real Interest Rate and Real GDP")
3. The price adjustment process (***Figure 10.12 "Price Adjustment")

Together, these three pieces paint a complete picture of the monetary policy process. The top left panel in Figure 10.16 "The Adjustment of Inflation over Time" is taken from**Figure 10.15 "The Taylor Rule" and shows a positive relationship between inflation and the real interest rate. The top right panel in Figure 10.16 "The Adjustment of Inflation over Time" is taken from **Figure 10.10 "The Relationship between the Real Interest Rate and Real GDP" and shows the relationship between real GDP and the interest rate. As shown in the figure, the higher the real interest rate, the lower real GDP is. As a reminder, higher real interest rates lead to lower aggregate spending. Finally, from the price-setting equation, changes in real GDP lead to changes in the inflation rate. We showed this previously in **Figure 10.12 "Price Adjustment", and it appears in the bottom right panel of **Figure 10.16 "The Adjustment of

Inflation over Time". If real GDP decreases, the output gap increases, and the inflation rate decreases.

We can use ********Figure 10.16 "The Adjustment of Inflation over Time" to summarize the conduct of monetary policy. In this diagram, we see the Taylor rule in action: the Fed sees high inflation and so increases the real interest rate.

- Start at the top right panel with “Last Period’s Interest Rate.” The panel shows us the level of real GDP that resulted from the interest rate choice. The bottom right panel then shows the inflation rate that came from the price adjustment equation. Point A therefore shows the state of the economy last period—that is, it shows last period’s inflation and last period’s real GDP. This is the information that the Fed uses when making its decision for this period.

- Given last period's inflation rate, the top left panel shows us the value of the real interest rate that the Fed wants to choose this period. The Fed therefore sets a new target for the federal funds rate. This increases real interest rates, both short term and long term, which in turn leads to a decrease in durable goods spending.
- From the top right panel we can see that the Fed has chosen a higher interest rate than last period, which means that there is a decrease in real GDP. •
- Decreased real GDP causes the inflation rate to decrease, as we see in the bottom right panel. •
- Coming up to its next meeting, the FOMC again looks at the current state of the economy (point B), and the process begins again.

We have simplified the discussion here in two ways. First, we neglected the fact that the output gap also enters into the Taylor rule. The basic idea remains the same in that more complicated case. Second, we did not discuss autonomous inflation. Autonomous inflation, remember, captures managers' expectations of future inflation and future demand conditions. It, too, will tend to change over time. Theories of autonomous inflation are a subject for more advanced courses in macroeconomics.

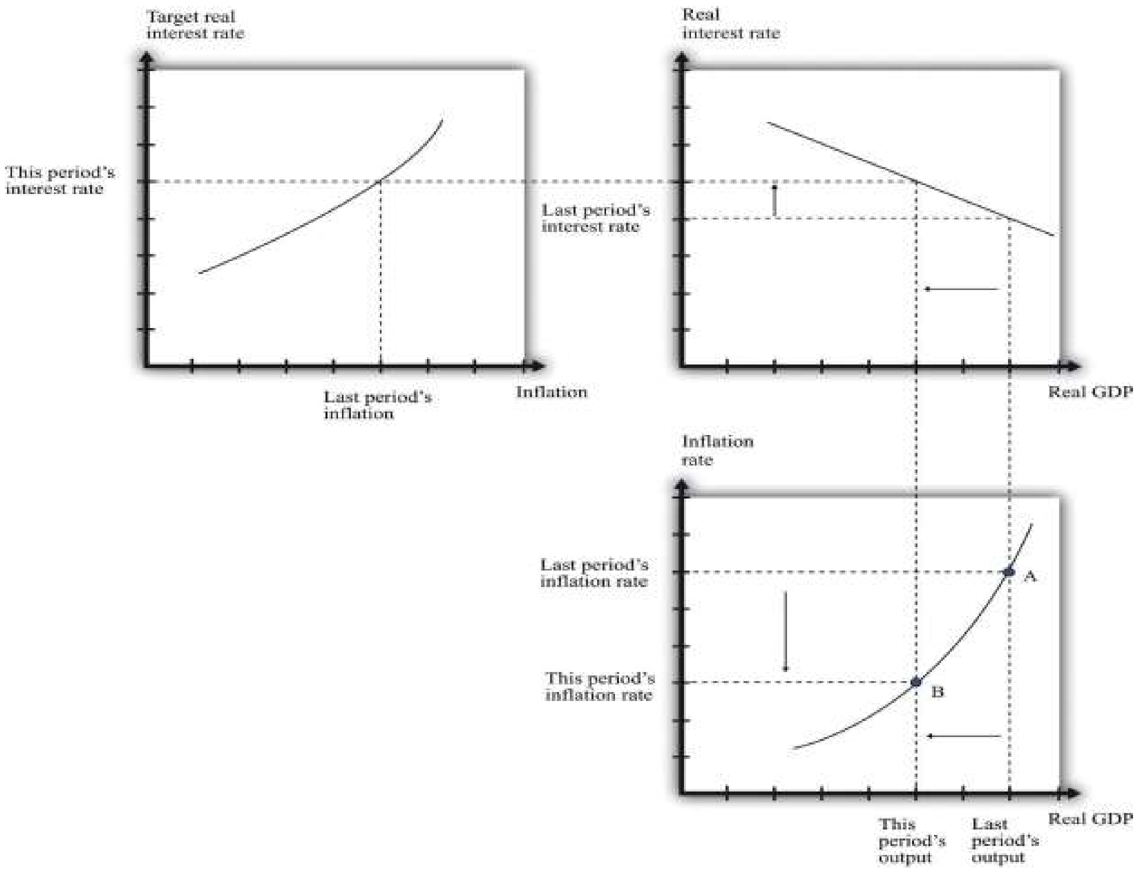

Fig. 10.16: Figure 10.16 The Adjustment of Inflation over Time Last period the economy was at point A, with high output and high inflation. Because inflation is too high, the Fed increases the real interest rate (top left). This reduces this period's output (top right), which in turn leads to a reduction in the inflation rate (bottom right). The economy ends up at point B.

KEY TAKEAWAY

The price adjustment equation describes the dependence of price changes (inflation) on the output gap, given the autonomous inflation rate.

Given prices, monetary policy influences the output gap. Over time, prices adjust in response to the effects of monetary policy on the output gap.

The Taylor rule describes the dependence of the interest rate targeted by the Fed on the inflation rate and the output gap.

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Checking Your Understanding

Describe why a reduction in the target interest rate will ultimately lead to higher inflation.

If the economy is in a recession, what should happen to the target interest rate according to the Taylor rule?

10.4 Monetary Policy in the Open Economy

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

How does monetary policy operate in an open economy?

How does monetary policy in other countries influence the US economy?

Monetary policy has international implications as well. Changes in interest rates lead to changes in supply and demand in the **foreign exchange market**. [***Chapter 9 "Money: A User's Guide" explains this connection.***] In turn, changes in exchange rates affect exports and imports and influence the overall demand for goods and services. Among other things, this means that the monetary policy of other countries will have an effect on your own country. So if you live in Europe, you are not immune to Federal Open Market Committee (FOMC) actions. And if you live in the United States, you are not immune to the actions of the European Central Bank (ECB).

10.4.1 The Monetary Transmission Mechanism in the Open Economy

The key element in the monetary transmission mechanism is the ability of the central bank to influence the real interest rate. Changes in real interest rates lead to changes in spending on durable goods, which are a component of aggregate expenditures. But there is also another channel of influence. If the Fed cuts interest rates, for example, then the demand for dollars to invest in US asset markets will be reduced. This will reduce the foreign currency price of dollars. The weaker dollar means that goods produced in the United States are cheaper, so US exports will increase, and US imports will decrease. Thus changes in interest rates lead to changes in **exchange rates**, which in turn lead to changes in **net exports**. Net exports are also a component of aggregate expenditures. This is illustrated in ***Figure 10.17.

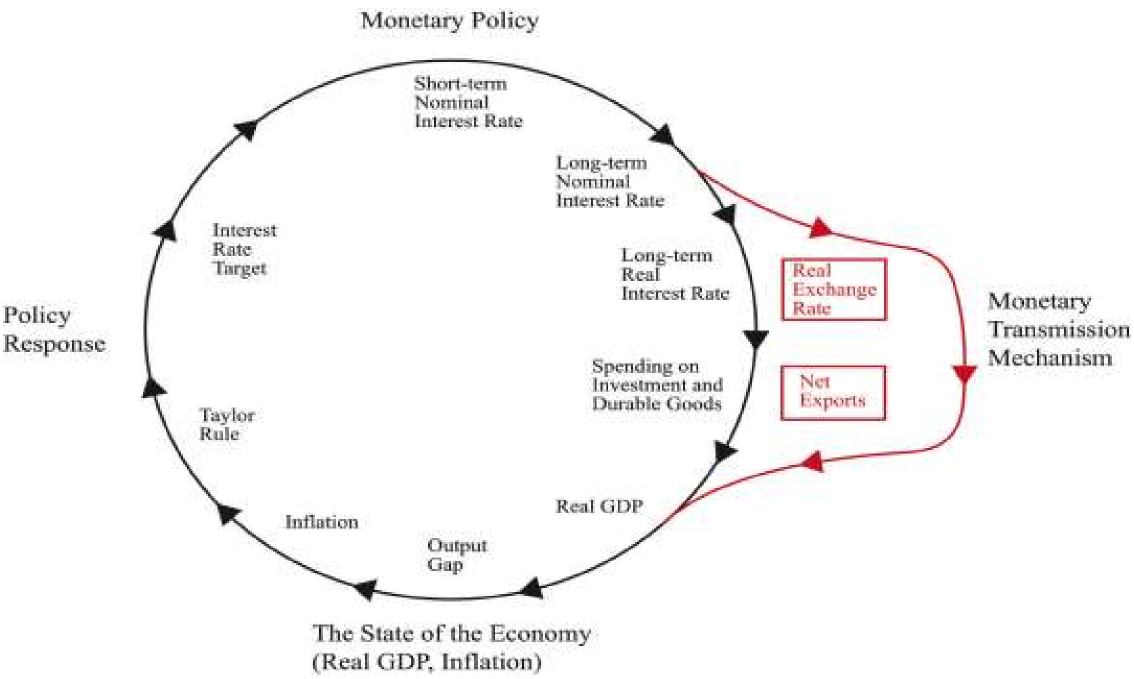

Fig. 10.17: Figure 10.17 There is an additional channel of the monetary transmission mechanism that operates through the exchange rate. Changes in interest rates lead to changes in exchange rates, which in turn lead to changes in net exports. This channel reinforces the effect operating through interest rates.

Even when we include this channel, it is just as easy to understand the monetary transmission mechanism as it was before. When interest rates are cut, there is an increase both in spending on durables and net exports. Both channels lead to higher aggregate spending and thus higher output.

Toolkit: Section 16.10 "Foreign Exchange Market"

You can review the workings of the foreign exchange market and the definition of the exchange rate in the toolkit.

10.4.2 Monetary Policy in the Rest of the World

The United States does not exist alone in the world economy. US financial markets are influenced by events in other countries, such as the actions of the ECB. Likewise, citizens in Europe are influenced by monetary policy in the United States.

Suppose the ECB cuts interest rates in Europe. As in the United States, the typical mechanism for this would be a purchase of debt issued by European governments. An increase in the price of this debt is equivalent to a decrease in interest rates. If nothing else happens, this decrease in European interest rates gives rise to an arbitrage opportunity. Investors want to move funds to the United States to take advantage of the higher interest rates. There is an increased demand for US assets and hence an increased demand for dollars. Interest rates in the United States decrease, which tends to increase durable goods spending and stimulate the US economy. Against that, the higher value of the dollar leads to fewer exports from the United States and more imports into the United States, so US net exports will decrease.

Completely analogously, monetary policy in the United States influences interest rates in other countries. If the Fed undertakes an open market sale of US government debt, for example, interest rates will increase in other countries as well as in the United States. The US Federal Reserve and the ECB are big players in world financial markets. Their actions move world interest rates and world currency markets. There are other countries that are relatively small in the world economy. For example, suppose the Central Bank of Iceland increases interest rates in that country. The mechanisms that we have explained still apply: investors will find Icelandic assets more attractive, and there will be an increased demand for the Icelandic krona. However, the flows of capital into Iceland will be negligible in terms of the world economy. They will not have any noticeable effect on interest rates in Europe or the United States.

KEY TAKEAWAY

In an open economy, interest rate changes induced by monetary policy influence exchange rates and thus net exports.

Actions by monetary authorities in other countries influence the net exports of the United States through exchange rate changes and through the level of aggregate spending on the United States by households in other countries.

***

Checking Your Understanding

If the Fed increases its target value for the federal funds rate, what happens to the value of the dollar?

If the ECB increases its target interest rate, what happens to US net exports?

10.5 The Tools of the Fed

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What do banks do?

What are the tools of the Fed?

We have not yet said very much about exactly *how* the Fed changes interest rates. The Fed has three major tools at its disposal: open-market operations, the reserve requirement, and the discount rate. We discuss these in turn. Monetary policy operates through the Fed's interactions with the banking system, so we first must make sure we understand what banks do in the economy. [***If your find this material interesting, a course on Money and Banking will delve much further into the details of how banks operate and how they interact with the monetary authority.***] Throughout this discussion, we use the credit market to think about how the Fed operates.

Toolkit: Section 16.4 "The Credit (Loan) Market (Macro)"

You can review the workings of the credit market in the toolkit.

10.5.1 What Do Banks Do?

Financial markets (that is, banks and other financial institutions) provide the link between savings and investment in the economy. A bank is a profit-making entity that takes in deposits from households and firms and makes loans to firms, households, and the government.

Banks can be fragile institutions. [***The fragility of banks is discussed in more detail in Chapter 7 "The Great Depression".***] They must ensure that their depositors are not worried that the bank might go out of business, taking their money with it. Banks do many things to ensure that their customers have confidence in them. Perhaps the most important is that they keep a certain amount of their assets in a very liquid form, such as cash. This means that if a depositor comes in to withdraw his or her money, the bank will be able to meet that demand. These liquid deposits are called the **reserves** of the bank.

Most banks in the United States are members of the Federal Reserve System. This membership comes with a responsibility to hold some fraction of deposits on reserve. This is called a **reserve requirement**. [***Current reserve requirements are at “Reserve Requirements,” Federal Reserve, accessed September 20, 2011, http://www.federalreserve.gov/monetarypolicy/reservereq.htm#table1.***] Reserve requirements limit the amount of deposits that banks are able to loan out to firms and households. Suppose a bank has $1,000 on deposit and the reserve requirement is 10 percent. Then the bank must hold at least $100 on reserve and can loan out at most $900. We say “at least $100” since the bank is free to hold more than 10 percent on reserve. In uncertain times, when a bank is unsure how many depositors are likely to want to withdraw their money, the bank may choose to keep reserves above and beyond the level required by the Fed.

What does a bank do if it finds itself with insufficient reserves on a given day to meet its reserve requirements? The answer is that it borrows—either from other banks or from the Federal Reserve itself. Because the Federal Reserve can influence the interest rates at which banks borrow, it can influence the behavior of banks.

10.5.1.1

In the memo with which we opened the chapter, the Federal Open Market Committee (FOMC) decided to increase the target federal funds rate to 2.5 percent. But what exactly does this mean, and how did the Fed accomplish it? The federal funds rate is the interest rate in a particular market—the market where banks make overnight loans to each other. Overnight loans, as the name suggests, are assets that have a very short time to maturity (one day). The interest rate on these loans is therefore one of the “shortest” interest rates in the economy, which is why it is targeted by the Fed. The interest rate is so named because the loans are made using the funds that banks have available in their accounts at the Federal Reserve.

The Federal Reserve does not participate directly in this market. It influences the federal funds rate by buying and selling in a different market—the market for short-term government debt. These purchases and sales are called **open-market operations**. [***Section 14 of the Federal Reserve Act describes open-market operations.***]Let us examine how this works. The effect of open-market operations can be seen in the market for government debt. Part (a) of Figure 10.18 "The Market for Government Bonds"shows the supply and demand of this asset. The horizontal axis shows the quantity of assets (think of this as the amount traded on a given day), and the vertical axis shows the price of those assets. The participants in this market are financial institutions and others who hold, or want to hold, bonds as part of their portfolio of assets. Current owners will be willing to sell bonds if their price is sufficiently high. Conversely, if the price of bonds decreases, more people will want to purchase them. The same institution could be either a supplier or a demander, depending on the price. It is perfectly possible that a financial institution would want to buy bonds if their price were low and sell them if their price were high.

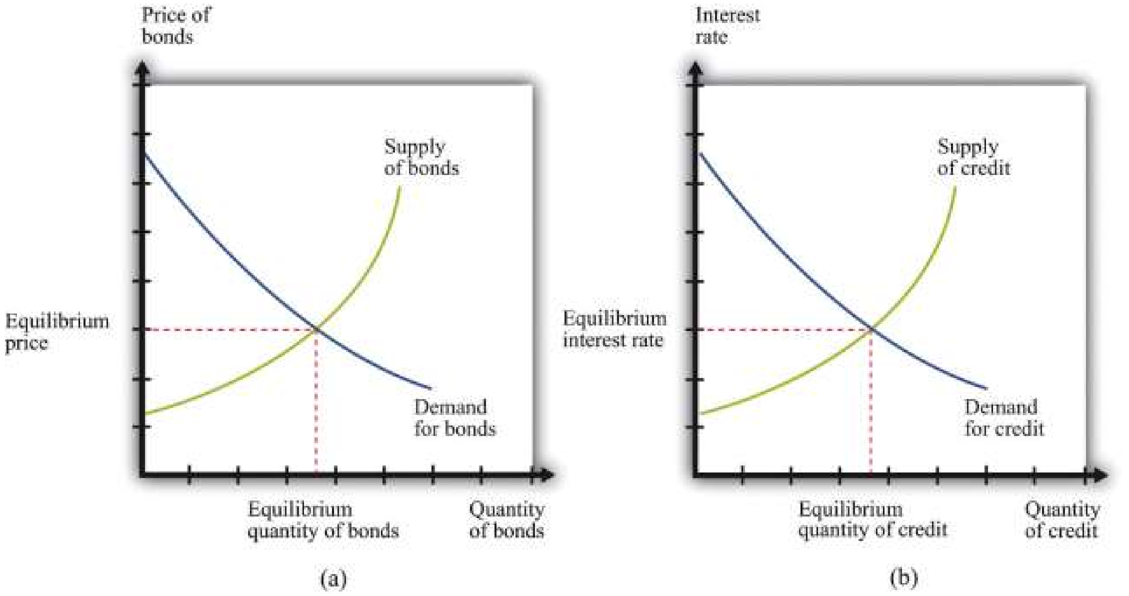

Fig. 10.18: Figure 10.18 The Market for Government Bonds

(a) The price of bonds is determined by supply and demand. (b) These same transactions are represented in a credit market, which is another way of looking at exactly the same market.

Part (b) of ***Figure 10.18 "The Market for Government Bonds" shows the equivalent representation of this as a credit market. When the Fed buys bonds, it is making a loan. When the government or private investors sell bonds to the Fed, they are borrowing from the Fed. The crossing of the supply and demand curves tells us the equilibrium price of government bonds. It also tells us how many bonds changed hands that day, but our interest here is in what is happening to prices.

Now suppose the Federal Reserve steps into this market and buys some government bonds. This increases the demand for bonds, so the price of bonds will increase. This is shown in part (a) of ***Figure 10.19 "Intervention by the Federal Reserve". Part (b) of ***Figure 10.19 "Intervention by the Federal Reserve" shows the same action viewed through the lens of a credit market. Conversely, if the Fed decides to sell some of its stock of government bonds, the supply of bonds will shift out, and the price of bonds will decrease (see ***Figure 10.20 "Intervention by the Federal Reserve").

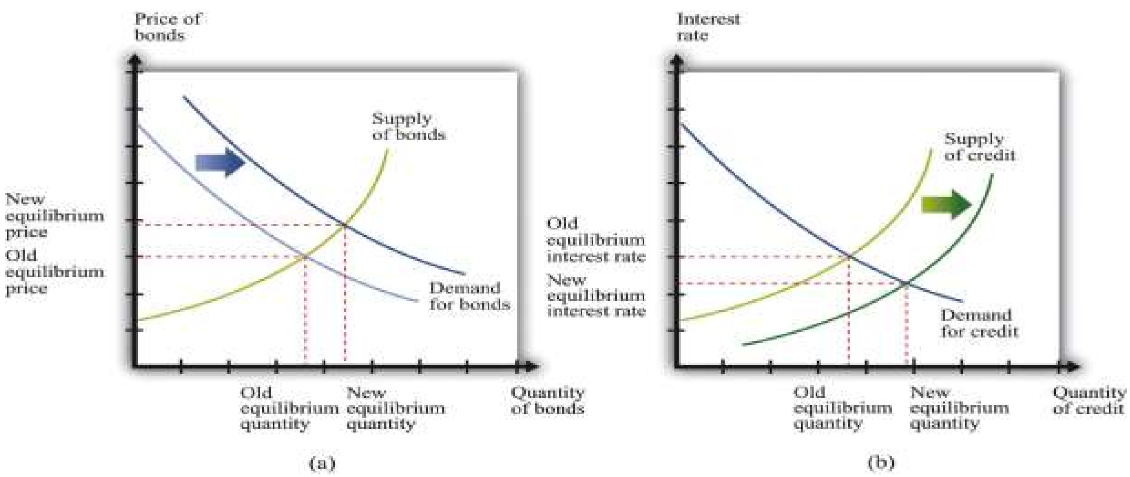

Fig. 10.19: Figure 10.19 Intervention by the Federal Reserve

When the Federal Reserve conducts an expansionary open-market operation, it purchases bonds (a) or, equivalently, supplies more credit (b). The price of bonds increases, or, equivalently, the interest rate decreases.

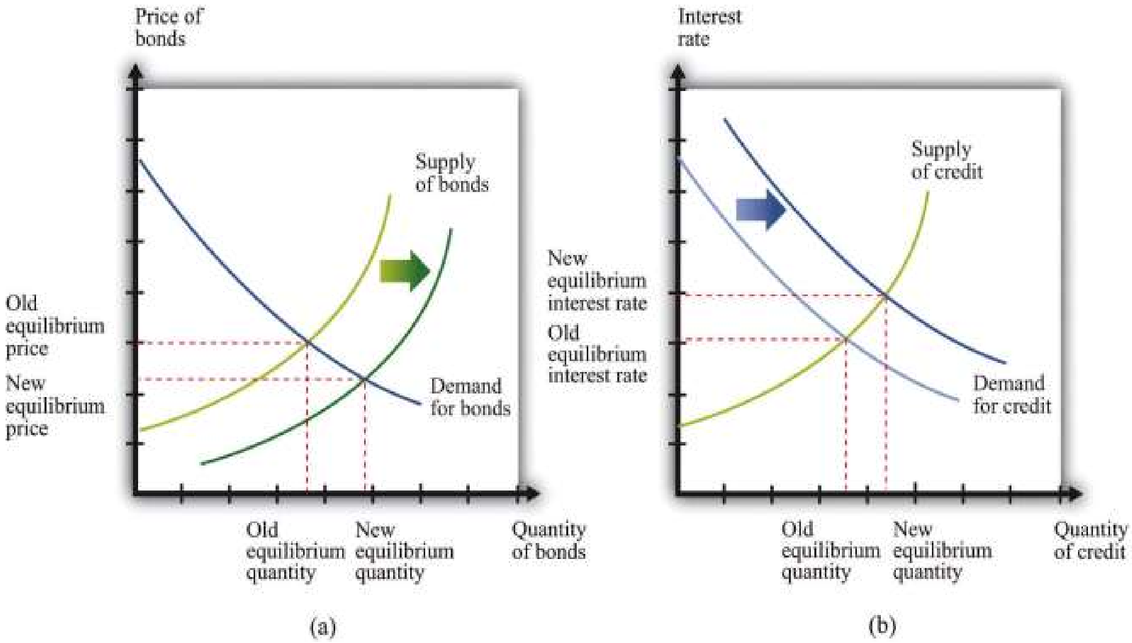

Fig. 10.20: Figure 10.20 Intervention by the Federal Reserve

When the Federal Reserve conducts a contractionary open-market operation, it sells bonds (a) or, equivalently, demands more credit (b). The price of bonds decreases, or, equivalently, the interest rate increases.

Thus the Federal Reserve, by buying or selling government bonds in this market, has the ability to influence the price of bonds. This means that it can affect the interest rate on those bonds.

From this relationship, we know the following:

- • If the Fed buys bonds, then the price of bonds increases, and interest rates decrease.
- • If the Fed sells bonds, then the price of bonds decreases, and interest rates increase.

The Fed's actions in this market have an effect on interest rates in other markets, as banks and other financial institutions adjust their portfolios in response to the changing interest rate on government bonds. The Fed calibrates its buying and selling to try to achieve its target interest rate in the federal funds market.

10.5.1.2

The February 2005 announcement by the FOMC also included an increase in the discount rate. The discount rate is the interest rate from another market—in this case a market established by the Fed itself.

We have said that if a bank is short on reserves, it can borrow. One source of loans is the federal funds market. Another source of loans is the Fed itself. Member banks have the privilege of borrowing from the Fed, and the rate at which a bank can borrow is called the **discount rate**. The Fed directly controls this interest rate. The Federal Reserve's policies on such loans are set out in “Regulation A” of the Fed's Board of Governors: “A Federal Reserve

Bank [that is, a Regional Fed] may extend primary credit on a very short-term basis, usually overnight, as a backup source of funding to a depository institution that is in generally sound financial condition in the judgment of the Reserve Bank. Such primary credit ordinarily is extended with minimal administrative burden on the borrower.” [***“Regulation A (12 C.F.R. 201 as amended effective December 9, 2009),” Federal Reserve, accessed July 20, 2011, http://www.frbdiscountwindow.org/regulationa.cfm?hdrID=14&dtlID=77. ***] Once a bank has established the right to borrow at the Fed's “discount window,” the execution of such a loan is straightforward. The bank simply makes a toll-free call and provides a few pieces of basic information.

To see how this tool works, suppose the discount rate were very high, much higher than the interest the bank can earn by making a loan. Then the bank would find it prohibitively expensive to borrow from the Fed. If the bank were unsure that it could meet the needs of depositors, it would respond by holding reserves in excess of the reserve requirement. That is, with a very high discount rate, the bank would lend out a smaller fraction of its deposits. By contrast, if the Fed were to set the discount rate very low, the bank would make more loans and hold fewer reserves, safe in the knowledge that it could always borrow from the Fed if necessary. From this reasoning, we can see that as the discount rate is increased, banks hold more excess reserves and lend less. This shows up in ***Figure 10.21 "An Increase in the Discount Rate" as a shift inward in the supply of credit. Thus the Fed *can increase interest rates by increasing the discount rate*.

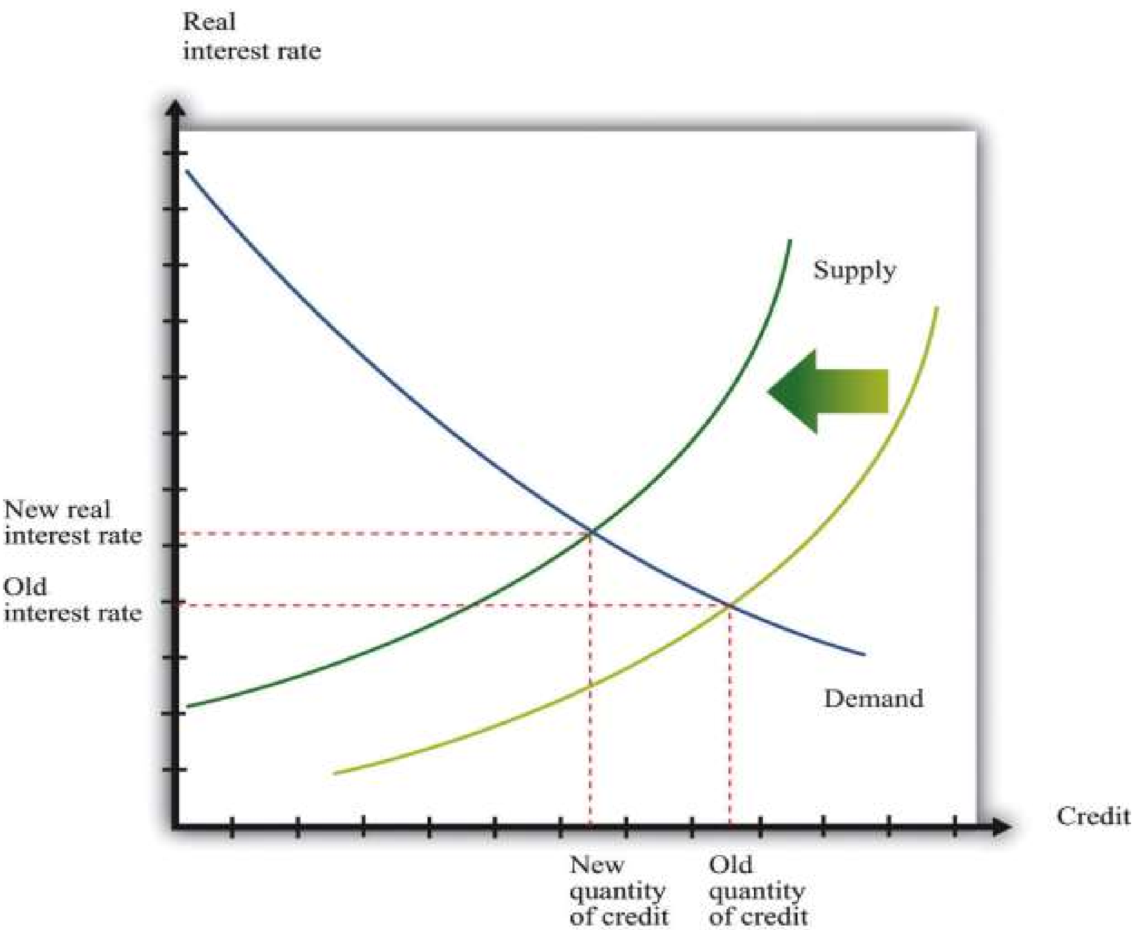

Fig. 10.21: Figure 10.21 An Increase in the Discount Rate An increase in the discount rate reduces the supply of credit and therefore increases the real interest rate.

10.5.1.3

Reserve requirements are outlined in Section 19 (A) of the Federal Reserve Act:

(A) Each depository institution shall maintain reserves against its transaction accounts as the Board may prescribe by regulation solely for the purpose of implementing monetary policy—

1. in the ratio of 3 per centum for that portion of its total transaction accounts of $25,000,000 or less, subject to subparagraph (C); and
2. in the ratio of 12 per centum, or in such other ratio as the Board may prescribe not greater than 14 per centum and not less than 8 per centum, for that portion of its total transaction accounts in excess of $25,000,000, subject to subparagraph (C) [which stipulate that the reserve requirements could be changed].

Suppose the Fed were to increase the reserve requirement from 10 percent to 20 percent. In the previous example, all else being the same, a bank with deposits of $1,000 would be required to have at least $200 on deposit, rather than the $100 that was required originally. To fulfill this larger reserve requirement, the bank would be allowed to lend only $800 at most. Banks therefore respond to an increase in the reserve requirement by holding a larger fraction of deposits on reserve and lending out a smaller fraction of their deposits. This reduces the supply of credit in the economy since a smaller fraction of saving is actually being lent.

As shown in ***Figure 10.22 "An Increase in Reserve Requirements", the supply of credit shifts inward, and the interest rate increases. This picture is exactly the same as ***Figure 10.21 "An Increase in the Discount Rate". When we think about the credit market, the increase in the discount rate and the increase in the reserve requirement have the same effect. Thus we learn that the Fed *can increase interest rates by increasing the reserve requirement*. Often, increases in the reserve requirement are coupled with other measures, such as open-market operations, to increase interest rates. A decrease in the reserve requirement works in a symmetric fashion, though in the opposite direction.

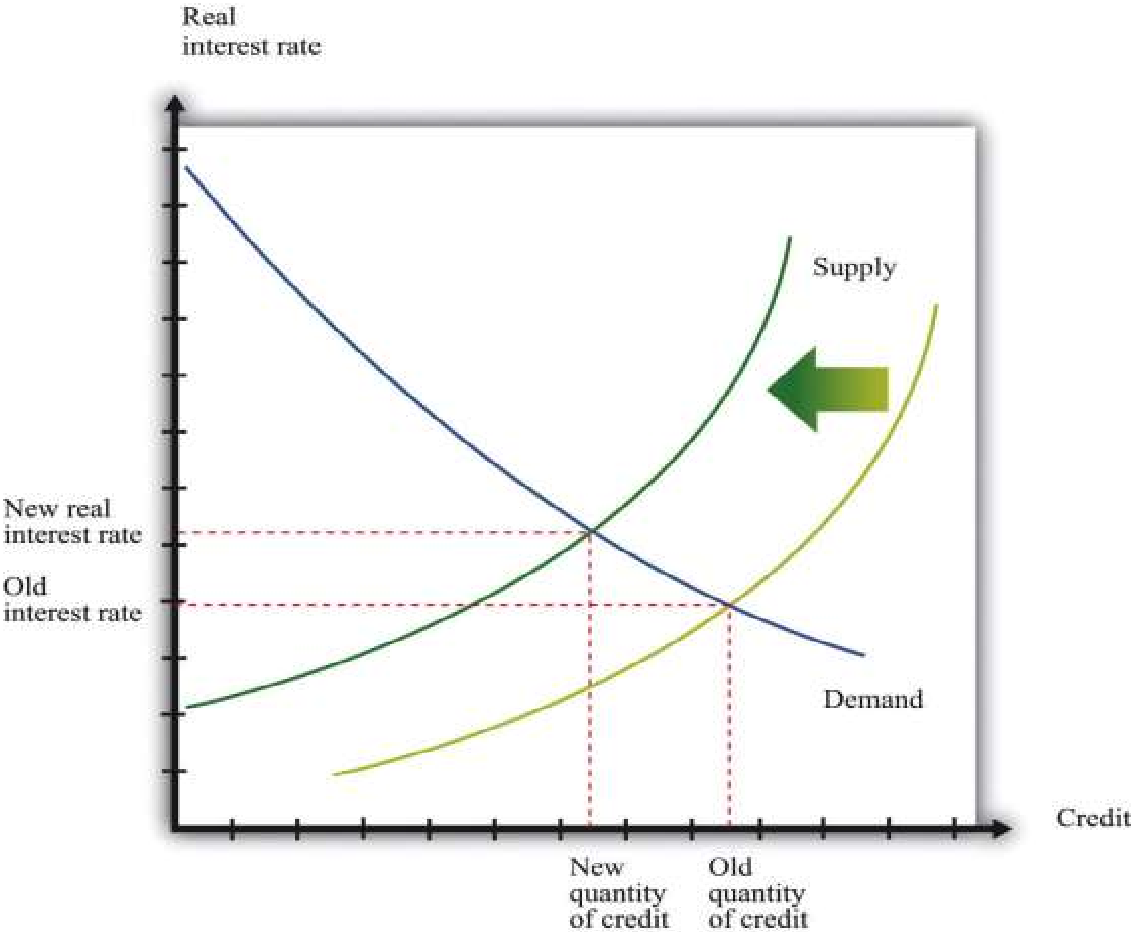

Fig. 10.22: Figure 10.22 An Increase in Reserve Requirements An increase in reserve requirements reduces the supply of credit and therefore increases the real interest rate.

KEY TAKEAWAY

Banks act as intermediaries, taking the deposits of households and making loans to firms and households who wish to borrow. Banks also borrow from other banks and from the Fed.

The main tools of the Fed are as follows: (a) open-market operations, (b) lending at the discount rate to member banks, and (c) setting the reserve requirements on member banks.

***

Checking Your Understanding

Can a bank borrow from the Fed?

What are reserve requirements?

In an open market sale, does the money supply increase or decrease?

10.6 The Fed in Action

LEARNING OBJECTIVES

After you have read this section, you should be able to answer the following questions:

What monetary policy did the Fed pursue during the Great Depression?

Why is stabilization of the economy through monetary policy so difficult?

We finish this chapter by going back to the actual actions of the Fed and focusing on two periods. First, we consider the Great Depression from a monetary perspective. [***Chapter 7 "The Great Depression" discusses that period in more detail and pays more attention to fiscal policy.***] Then we consider the period leading up to the February 2005 announcement.

10.6.1 The Great Depression Revisited

The Fed was in fact not very active during the Great Depression (some commentators might even say that this section should be titled "The Fed Inaction"). Yet monetary events were still critical.

A key short-term interest rate at that time was the so-called commercial paper rate. This rate decreased from about 6 percent in 1929 to a low of 0.8 percent by 1935. At first glance, therefore, it seems as if the monetary authority was implementing cuts in interest rates that could stimulate the economy. On closer examination, however, the picture is not so simple. During the Great Depression the inflation rate was negative—prices were decreasing on average. From the Fisher equation, a negative inflation rate means that the nominal interest rate *understates* the cost of borrowing. Decreasing prices mean that the nominal interest rate is smaller than the real interest rate. Even though nominal interest rates were decreasing in the early 1930s, the inflation rate was decreasing faster. As a result, the real interest rate increased. It became more expensive for households and firms to borrow, so spending decreased. When prices decrease, the obligations of borrowers increase in real terms. People at the time did not typically anticipate these decreasing prices, so there was *unanticipated deflation*. Unanticipated deflation redistributes wealth from borrowers to lenders. Many firms, banks, and households were left with large (real) debts during the Great Depression. These led to bankruptcies and contributed to the contraction in economic activity.

Thus along with the high real interest rates came a series of bank failures. In addition, banks tended to hold more in excess reserves during this period, and thus loans, relative to deposits, decreased. These banking problems meant that the financial markets became less effective at connecting the savings of individual households with the investment plans of firms. It is perhaps not surprising that investment and spending on consumer durable goods decreased so much during the Great Depression.

In retrospect, the monetary authority could have been much more aggressive in dealing with the high real interest rates. They could have conducted open-market operations, buying bonds and decreasing interest rates. At the same time, this would have provided additional funds (sometimes called *liquidity*) to the banking system. Yet the Fed did not do so. Many observers now think that the severity of the Depression can be blamed in large part on these failures of the Fed. If so, this is good news, for it tells us that we are much more likely to be able to avert similar economic catastrophes in the future.

10.6.2 Monetary Policy from 1999 to 2005

Here is a brief summary of the target federal funds rate over the period from June 1999 to May 2005. Remember that these are nominal interest rates.

- Starting in June 1999, the target federal funds rate increased from 4.75 percent to 6.5 percent by January 2001.
- Starting in February 2001, the target federal funds rate decreased from 6.5 percent to a low of 1 percent by July 2004. •
- In August 2004 the target federal funds rate was increased to 1.25 percent and was increased steadily to a level of 2.75 percent by May 2005.

We have already examined these targets, together with the actual federal funds rates, in***Figure 10.3 "Target and Actual Federal Funds Rate, 1971–2005".

The time of tighter monetary policy, from June 1999 to January 2001, was a period of inflation concern. In the first part of 1999, the inflation rate averaged about 2 percent, and the unemployment rate was decreasing, reaching 4 percent in May 1999. Even though inflation was low, the Federal Open Market Committee (FOMC) statement from June 1999 called for an increase in the target federal funds rate, pointing to *potential inflation* as a rationale for increasing the target rate: “The Committee, nonetheless, recognizes that in the current dynamic environment it must be especially alert to the emergence, or potential emergence, of inflationary forces that could undermine economic growth.” [***Federal Open Market Committee, “Press Release,” Federal

Reserve, June 30, 1999, accessed August 8, 2011,http://www.federalreserve.gov/boarddocs/press/general/1999/19990630/default.htm.***] The Fed's tightening had the effect of reducing durable spending and thus bringing gross domestic product (GDP) down closer to potential output. As a consequence, there was less pressure on prices.

This policy continued through January 2001. By that point, the United States was very close to recession. (According to the National Bureau of Economic Research Business Cycle dating group, a recession began in March 2001.) From December 2000 to January 2001, the unemployment rate jumped from 3.7 percent to 4.7 percent. The Fed responded by allowing the federal funds rate to decrease steadily, starting in February 2001. This policy led to a federal funds rate of 1 percent by July 2003, a level that was maintained for a year. Historically, this was a very low rate. Over the year, inflation averaged about 2.3 percent, so the real federal funds rate was actually negative.

A turnaround in Fed policy occurred in August 2004. Inflation had started to increase somewhat in early 2004, and the unemployment rate had decreased to 5.3 percent in May 2004. So in August 2004, the Fed started a gradual increase of the target federal funds rate. Look back at Figure 10.4 "Short-Term and Long-Term Interest Rates". Recall that part of the monetary transmission mechanism is the link between the nominal federal funds rate, which is very short term, and much longer-term rates. Figure 10.4 "Short-Term and Long-Term Interest Rates" shows the federal funds rate along with the 1-year and 10-year Treasury bond yields. The loosening of monetary policy in February 2001 is evident from the decrease in the federal funds rate and the 1-year Treasury rate.

But the long-term Treasury rate seems not to follow the short-term rates that closely. In fact, it seems that the long-term rates started to decrease before the reductions in the federal funds rate began, and then the long-term rates did not decrease nearly as much over the February 2001–August 2004 period. After that time, although the federal funds rate was increased, the long-term rate did not respond much at all.

This reminds us of one the biggest challenges of monetary policy. Although the Fed is able to closely target the federal funds rate, it has much less ability to control longer-term rates. Someone making a loan for a long period of time will try to anticipate economic events over the course of the entire loan period. As a consequence, the loan rate may reflect anticipated events (such as the Fed's loosening of monetary policy in February 2001) and may also not respond as much to rate changes that are seen as temporary.

10.6.3 Why Do Central Bankers Get Paid So Much?

We have made monetary policy look easy. The effects of the actions of the monetary authority are summarized by Figure 10.2 "The Monetary Transmission Mechanism". Given a choice of a target inflation rate and a target level of economic activity, the Fed (and other central banks) ought to know exactly what to do to reach these goals. So why are central bankers so vital to the functioning of the macroeconomy?

10.6.4 What Is the State of the Economy?

In Section 10.3.3 "Closing the Circle: From Inflation to Interest Rates", we described the Taylor rule as relating the target federal funds rate to the state of the economy, specifically the inflation rate and the output gap. As a matter of theory, this is straightforward to describe. The practice is rather harder.

First, it is a significant challenge simply to know the current state of the economy. In the United States, part of the preparation for FOMC meetings is an attempt to figure out the current output gap and other variables. The Board of Governors of the Federal Reserve has a large staff of professional economists, as do the various regional Federal Reserve banks. These economists spend much of their time helping the members of the FOMC understand the current state of the economy.

One particular problem is that the level of real GDP itself is calculated only on a quarterly basis. Potential GDP, meanwhile, is a theoretical construct that requires some guesses about "full employment." It is not directly measured. So if the Fed learns that real GDP is growing rapidly, it has to judge whether this is because potential GDP is growing rapidly or because actual GDP is above potential.

Since the Fed does not meet to determine policy each day and the Fed's policies themselves take time to work through the economy, it is not even enough to know the current state of the economy. The FOMC must also forecast the state of the economy for the near future. One talent of the previous Fed chairman, Alan Greenspan, was apparently his use of relatively unorthodox sources to get a sense of the state of the economy.

10.6.5 What Are the Effects of Monetary Policy?

Even if there were no uncertainty about the current state of the economy—that is, the inflation rate and the output gap—monetary policy is still difficult for other reasons. First, as we emphasized earlier, the Fed does not have direct control over the long-term real interest rates that matter for durable goods spending. The Fed can influence a short-term nominal rate, which in turn influences the long-term real rates. But the exact link from one interest rate to the other is not known by the Fed and may change over time. The Fed may fail to achieve the long-term rate that it is aiming for.

Second, the Fed does not have perfect knowledge of the monetary transmission mechanism. Consider again the links between real interest rates and output, as shown in***Figure 10.10 "The

Relationship between the Real Interest Rate and Real GDP". In reality, the Fed does not know exactly what the relationship between interest rates and output looks like. Reality looks more like*** Figure 10.23 "Controlling the Economy". In this picture the Fed is aiming for a high level of output. However, it misses its target real interest rate and actually ends up setting a higher real rate than it wanted. In addition, real GDP is more sensitive to interest rates than it thought, so the high rate leads to a big reduction in GDP. Thus because the Fed fails to achieve its target interest rate and also misjudges the monetary transmission mechanism, it ends up with much lower real GDP than it wanted.

Finally, the Fed has imperfect knowledge of the link between economy activity and price adjustment. Recall that the price setting equation stipulates that inflation depends on the output gap and something called autonomous inflation. As we have seen, this last term captures several factors, including the influence of expectations about the future on current price-setting behavior. This presents a double challenge to the Fed. First, to evaluate the effects of its policy on prices, the Fed needs to know the expectations that underlie autonomous inflation. Second, the Fed must recognize that *its actions and statements influence these expectations*. This is why the individuals involved in the making of monetary policy are so careful both about what they do and about what they say about what they do.

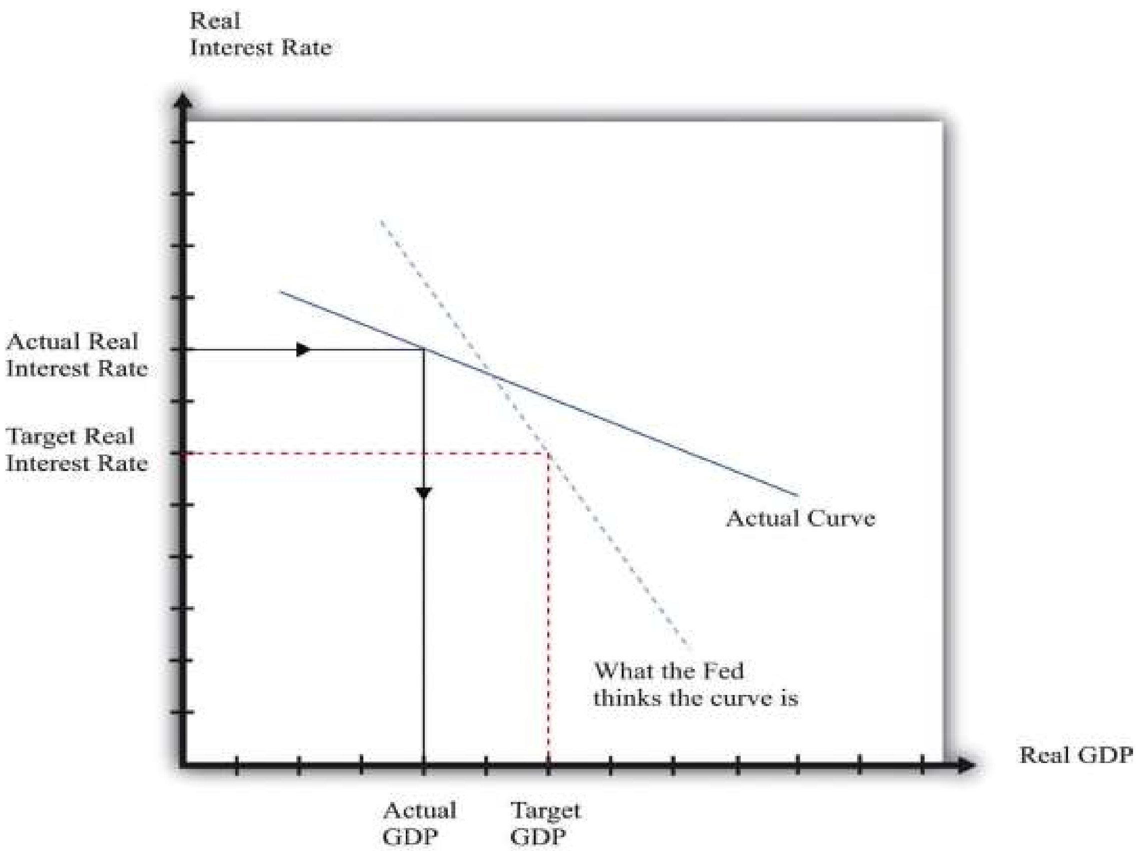

Fig. 10.23: Figure 10.23 Controlling the Economy The Fed's ability to control the economy depends on how knowledgeable it is about the state of the economy and on how accurately it can target interest rates.

10.6.6 What Should the Fed Do When Its Goals Are in Conflict?

We know that the goals of the Fed include price and output stability. Sometimes these goals conflict, and when they do, the task of central bankers becomes even more complicated.

The FOMC statement with which we opened this chapter stated that the "Committee perceives the upside and downside risks to the attainment of both sustainable growth and price stability for the next few quarters to be roughly equal." But what if instead it had said the "Committee perceives the risks of low output growth and high inflation for the next few quarters to be roughly equal"? What would the appropriate monetary policy be in this case? Should the Fed use its power to stabilize prices or to promote economic activity?

The tension is evident from the Taylor rule. Here is an example: the target real interest rate increases when inflation is high and decreases when the output gap is high:

```
real interest rate = −(1/2) × (output gap) + (1/2) × (inflation rate
− 4 percent).
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Remember that a positive output gap means that that the economy is in a recession: actual GDP is below potential. When the economy is in recession and inflation is not very high, the Taylor rule says that the Fed should reduce the real interest rate. And—from this same rule— the Fed should increase the real interest rate in the face of high inflation and a negative output gap. But what should the Fed do when inflation is high *and* there is a recession? High inflation argues for increasing real interest rates, but a positive output gap argues for a cut in rates.

The Fed—and, indeed, monetary authorities throughout the world—faced exactly this conflict in the mid-1970s when oil prices increased substantially as a result of actions by the Organization of Petroleum Exporting Countries. Researchers who have examined data over the past three decades have found that an increase in oil prices is typically met with an increase in the federal funds rate. [***The following discussion elaborates on the Fed's response to oil price increases: Federal Reserve Bank of Cleveland, accessed July 20, 2011,http://www.clevelandfed.org/Research/inflation/Readingroom/Viewpoint/2005/oilprices-economy04-05.cfm. A speech by then Fed Governor Ben Bernanke in 2004 provides more details: "Remarks by Governor Ben S. Bernanke at the Distinguished Lecture Series, Darton College, Albany, Georgia," Federal Reserve, October 21, 2004, accessed July 20, 2011,http://www.federalreserve.gov/boardDocs/speeches/2004/20041021/default.htm. ***] Thus, when faced with conflicting goals stemming from an oil price increase, the Fed seems to have put more weight on the goal of price stability.

10.6.7 When Things Go Badly Wrong

Everything that we have talked about in this section helps to explain why central bankers must be skilled and knowledgeable individuals with a good grasp of both economics and the workings of financial markets. Still, we have essentially been describing the job of a technocrat. Central bankers really earn their salaries in abnormal rather than normal times.

Starting in 2007 and stretching well into 2008, the United States and other countries began to experience financial crises that were similar in some ways to those experienced in the Great Depression. [***The financial crisis of 2008 is discussed in Chapter 4 "The Interconnected Economy" andChapter 15 "The Global Financial Crisis".***] The crisis seemed to begin innocently enough, with a decrease in housing prices that left some people unable or unwilling to cover their mortgage payments. But because of the way financial markets work, it became very hard for lenders to work out which of their assets were “nonperforming”—that is, unlikely to be repaid. As a result, financial markets froze up.

Part of the Fed’s response was an aggressive use of the tools that we have described in this chapter. For example, the Fed reduced the federal funds rate down to 0.25 percent. At that point, the Fed had just about reached the limit of what was possible with monetary stimulus. The problem is that nominal interest rates cannot go below zero because cash has a nominal interest rate of zero. If you keep a dollar bill from this year to next year, it is worth $1 next year. Therefore it would always be better just to keep cash rather than invest in an asset with a negative nominal return. The Fed had hit what is known as the **zero lower bound**.

Even though it was at the zero lower bound, the Fed still had other options. In normal circumstances, it operates in the economy by buying and selling short-term government debt, one of the many assets in the economy. But these were highly abnormal circumstances, and it is possible for the Fed to buy and sell other assets as well. This is what the Fed did. During the crisis, the Fed started purchasing many other assets, such as commercial paper. In other words, instead of just lending to banks, the Fed started lending directly to firms in the economy. Central banks in some other countries, such as the United Kingdom, pursued similar policies. [***Explaining what happened in 2008 involves understanding the actions of the Fed, but it requires many of our other tools as well. For that reason, we take up this crisis in more detail in Chapter 15 "The Global Financial Crisis".***]

KEY TAKEAWAY

Despite the large reduction in aggregate economy activity and deflation during the Great Depression, the Fed did not pursue a very aggressive policy. The effectiveness of the Fed was hampered by the unwillingness of households to deposit funds in banks and the unwillingness of banks to make loans.

The conduct of monetary policy is made difficult by uncertainty over the current state of the economy and the inexact nature of the effects of interest rates on real GDP and prices.

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Checking Your Understanding

In what ways was the Fed not very aggressive during the Great Depression?

How could the goals of the Fed be in conflict?

Does the Fed know the current state of the economy when it makes decisions?

10.7 End-of-Chapter Material

In Conclusion

A driving analogy is sometimes used to illustrate the problems of the Fed. In the best of all worlds, we would drive a car in perfect weather along straight, wide, dry roads. We would look out crystal clear windows with complete knowledge of exactly where we are on the road and what driving conditions are like up ahead. Then, with complete control over the car, we could adjust speed and direction to reach our destination. This is not the right picture for monetary policy. Instead, the windshield is very dirty, obscuring current conditions and making predictions almost impossible. Although the driver is well trained, the connection between the tools of the car and its direction and speed is haphazard.

Suppose the driver sees a steep downhill in the distance that requires some slowing down. Putting on the brakes will eventually slow the car down, but the delay is hard to predict. Making matters worse, by the time the car slows, the road may be going uphill again. More precisely, the first challenge for the Fed is determining the current state of the economy. The Fed must rely on economic data to determine the current state of the economy. This is not easy; data often arrive with lags and with measurement error. Furthermore, the data often provide conflicting signals about the current state of the economy.

The second challenge for the Fed is that the transmission mechanism is not cast in stone. Reducing real interest rates by, say, one percentage point does not create the same response in spending at all times. Instead, the links in the monetary transmission mechanism change over time and depend on numerous other variables in the economy. Understanding these links remains a key area of research in economics and is also a challenge for those responsible for the conduct of monetary policy.

Key Links

- • Board of Governors purposes and functions:http://www.federalreserve.gov/aboutthefed/default.htm
- • Federal Reserve Act:http://www.federalreserve.gov/generalinfo/fract/default.htm
- • Board of Governors, Federal Open Market Committee (FOMC), monetary policy tools: http://www.federalreserve.gov/monetarypolicy/fomc.htm
- • European Central Bank: http://www.ecb.int/home/html/index.en.html
- • History of money
- • Public Broadcasting System:http://www.pbs.org/newshour/on2/money/history.html
- • Federal Reserve Bank of Minneapolis:http://www.minneapolisfed.org/community_education/teacher/history.c fm

EXERCISES

Have you ever noticed that banks are often housed in big imposing buildings? Why do you think this is the case?

Consider a Taylor rule given by

real interest rate = −(1/2) × (output gap) + (1/2) × (inflation rate − 4 percent).

a) Describe this rule in words. What is the target inflation rate in this rule?

b) If the inflation rate is 6 percent and the GDP gap is −2 percent, what should the real interest rate be? What nominal interest rate should the Fed set?

(Advanced) Draw a version of Figure 10.15 "The Taylor Rule" where you show how to relate the target interest rate to the output gap. Explain in words what it means to move along the curve. What shifts the curve you have drawn?

What would happen if the Fed set the discount rate below the rate of return on government bonds?

Do open-market operations have to be in the form of the Fed buying and selling government debt? Could an open-market operation occur with the Fed buying the stock of a company?

Explain why an increase in interest rates reduces the demand for durable goods.

Suppose the relationship between investment and interest rates is investment = 100 − 4 × real interest rate and suppose the multiplier is 2

If the interest rate decreases by one percentage point, what happens to real GDP (assuming no change inthe price level)?

Give two reasons why it is difficult to conduct monetary policy.

Suppose the central bank in country A is more worried about inflation than the output gap, but the opposite is true in country B. What differences in the Taylor rule would you expect to see in the two countries? Must it be the case that country A has a lower target inflation rate than country B?

Explain why a positive output gap does not necessarily lead to decreasing prices.

Economics Detective

1. Find the most recent announcement of the Federal Open Market Committee (FOMC). How does it differ from the one from February 2, 2005? Who is currently on the FOMC?

2. Use the site http://www.hsh.com/calc-payment.html to calculate how your monthly payment would change as you vary the interest rate charged on a car loan for a $30,000 car. This will give you a sense of how actions of the Fed would affect your monthly payments on a loan.
3. Find the names of five other central banks in the world economy. Find some information about their history (when were they established, for example), their design (are they independent?), and their operating procedures.
4. Find the web page for the Board of Governors of the Federal Reserve System and read about the tools of monetary policy. Based on your reading, (a) how often does the FOMC meet, and (b) how is its membership determined?
5. If you live in the United States, find the web page for the regional Fed closest to you. Try to find its most recent report on local economic conditions. Do you agree with this assessment of the local economy? What can you learn about the president of the regional Fed? What about the director of research, who is the staff member most likely to give advice to the president of the regional Fed about monetary policy?
6. Using your web research skills, find a discussion of Fed policy during times of high oil prices. How did the Fed resolve the tensions between increasing rates to combat inflation and decreasing rates to deal with unemployment? Try to find data on (real) oil prices and the federal funds rate. Did these two economic variables move together during periods of high oil prices?
7. In March 2008, the Fed opened the discount window to add liquidity into the financial system. Find the policy statements associated with this action and describe exactly what the Fed did.
8. Get data on the US economy to see how well the Taylor rule, real interest rate = −(1/2) × (output gap) + (1/2) × (inflation rate − 4 percent), fits the facts for the past five years.
9. Find an occasion when the Fed has changed reserve requirements. Did it also make other policy adjustments at the same time?