

MICROECONOMICS



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Applications in Microeconomics

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To beginning students everywhere, which we all were at one time.

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“If you want to be listened to, you should put in time listening.”

Marge Piercy

FROM PAUL AND ROBIN

We both believe that a successful second edition is an exercise in listening. Writing a successful first edition is largely a matter of capitalizing on one's strengths, but writing a successful second edition means listening to those who used the first edition and using that feedback to address one's oversights and misjudgments. In many ways, writing a second edition can be as challenging as writing a first edition.

We've been fortunate to have a devoted group of adopters and reviewers to help guide us in this revision. Their input has prompted us to undertake a major reorganization of the microeconomics chapters, moving to a more traditional sequence. While there were good theoretical reasons behind the first edition chapter sequence, in which the producer theory chapters preceded the consumer theory chapters, we learned from our commenters that a more traditional sequence of chapters better served adopters' pedagogical objectives. And in this edition we've also responded to a demand for hearing more of Paul's unique voice. We've also eliminated some chapters, written two new ones, devised a new feature, updated extensively (adding many new applications and cases), and, where needed, simplified. As you peruse the second edition, you'll see the extent of the changes. It is no exaggeration to say that the second edition you are holding in your hands is a significant revision of this book.

However, the principles that guided us in writing the first edition have not changed. In the second edition we've aimed to keep the writing fresh and lively. We find that, like Paul's *New York Times* readers, students are able to more easily absorb economic concepts when they enjoy what they are reading. In addition, we've maintained our commitment to help students go beyond a “one model fits all” version of economics. As we stated in the first edition, “To achieve deeper levels of understanding of the real world through economics, students must learn to appreciate the kinds of trade-offs and ambiguities that economists and policy makers face when applying their models to real-world problems. We believe this approach will make students more insightful and more effective participants in our common economic, social, and political lives.” The events over the past few years, since the first edition was written, lead us to believe more than ever in this approach to teaching economics.

The Second Edition: What's New

Although the first edition was a resounding success, quickly becoming one of the best-selling economics textbooks, there is always room for improvement. For the second edition, we have undertaken a significant revision. We hope that these revisions lead to a more successful teaching experience for you. We look forward to your comments.

Here are the major second-edition changes:

New Chapter Order The most substantive change is the new organization of chapters, reflecting a more traditional sequence.

Organizational changes include the following:

- **Tax coverage has been consolidated into a single new chapter.** Our first edition treatment of taxes had been spread across several chapters. The second edition consolidates the material into one early chapter: Chapter 7, “Taxes.”
- **Consumer theory now precedes producer theory, so that the market structure chapters are grouped together.** Although many instructors choose not to teach consumer theory, the majority of those who do cover it before producer theory. In response, we've rearranged the chapters so that consumer theory (Chapters 10 and 11) now precedes producer theory (Chapters 12 and 13). As a result, chapters on perfectly competitive industries are now immediately followed by the monopoly, oligopoly, and monopolistic competition chapters (Chapters 14, 15, and 16), allowing a continuous treatment of industrial organization.
- **The international trade chapter appears earlier.** Along with adding the new “Global Comparison” feature, described on the next page, placing international trade earlier greatly enhances the international focus of the text.
- **The consumer and producer surplus chapter has moved earlier to follow the demand and supply chapter.** This change allows for an earlier introduction to the modern tools of consumer and producer surplus, giving readers a better sense of what happens

under price ceilings and price floors. We believe this change results in better motivation and clearer exposition of the benefits of competitive markets.

- **Optional chapters on factors markets and risk have moved to the end of the microeconomics text.** While some instructors will find these chapters very useful to teach, placing these optional chapters at the end of the microeconomics portion of the text improves the pedagogical flow of core material.

New Chapter 7, “Taxes” Material that previously appeared in the various contexts of quotas, elasticity, and consumer and producer surplus has been consolidated into a single early chapter. This change allows an instructor to give a comprehensive overview of the economics of taxation, with early applications of concepts from supply and demand, consumer and producer surplus, and elasticity.

New Chapter 19, “The Economics of the Welfare State” This new chapter on the welfare state, although optional for many of you, covers a topic that is deeply important to us and is at the heart of much of today’s political debates. It is also a response to those who have asked to see more of Paul’s unique voice in the book. The chapter focuses on timely topics such as the economics of health care and federal entitlement spending, carefully presenting the arguments for both expanding the welfare state as well as the arguments for reducing it. As in Paul’s *New York Times* columns, this chapter takes a complex topic and reduces it to its essential elements, illuminating the intellectual foundations of our policy choices. In addition, this chapter provides a timely and engaging examination of the challenges that economists and policy makers face when applying economic concepts to daily realities. We believe that this chapter and the new examples of SCHIP (The State Children’s Health Insurance Program), poverty in the world’s rich nations, a comparison of the welfare state in France and the United States, and much more will motivate students to think more deeply about economic trade-offs, social welfare, and the political process.

New “Global Comparison” Boxed Feature Another major change is greater international focus and global coverage of issues. Toward this end, we’ve created a new feature, Global Comparison boxes, which use data-driven examples to illustrate the international dimension of economic concepts. These examples will help students develop a greater appreciation for how economics really works. From international differences in institutional structures, resource endowments, and preferences, students will learn how different countries arrive at different economic destinations. Some Global Comparisons will give students

deeper understanding of how the United States is similar to and different from other advanced countries. Others focus on differences between advanced and developing countries for an understanding of the promise and challenge of international growth; see, for example, the Chapter 9 Global Comparison “Portion Sizes” (page 236), which addresses the question of why restaurant portion sizes in the United States are typically larger than in European countries. With this example, students see a practical application of marginal analysis and come to understand that America’s large portions are the optimal response to lower food prices. Similarly, the Chapter 7 Global Comparison “You Think You Pay High Taxes?” (page 189), compares tax rates in the United States to those in other advanced countries, giving students a more informed view of U.S. tax policy. For a complete listing of Global Comparison boxes, see the inside front cover.

An Even Stronger Focus on Global Issues Throughout In addition to the new Global Comparison feature, we’ve enhanced our focus on global issues in two more ways. First, the international trade chapter (Chapter 8) has moved up in the sequence to give students an early grounding in the importance of comparative advantage and trade. Second, we include globally focused examples in every single chapter of this book except for one (we were at a loss in the chapter on indifference curves). Some of our favorites include the For Inquiring Minds “Chinese Pants Explosion” (page 217), a discussion of the significant distributional consequences arising from the elimination of a U.S. quota on imports of Chinese pants and the Economics in Action “The Doha Deadlock” (page 219), which explains why world trade negotiations have stalled. Throughout the text, global examples are highlighted with an orange globe stamp. For a list of all such examples, see the inside cover and its facing page.

Advantages of This Book

Although a lot is new in this second edition, our basic approach to textbook writing remains the same:

- **Chapters build intuition through realistic examples.** In every chapter, we use real-world examples, stories, applications, and case studies to teach the core concepts and motivate student learning. The best way to introduce concepts and reinforce them is through real-world examples; students simply relate more easily to them.
- **Pedagogical features reinforce learning.** We’ve crafted what we believe are a genuinely helpful set of features that are described in the next section, “Tools for Learning.”

- **Chapters are accessible and entertaining.** We use a fluid and friendly writing style to make concepts accessible. Whenever possible, we use examples that are familiar to students: choosing which course to take, paying a high price for a cup of coffee, buying a used textbook, or deciding where to eat at the food court at the local shopping mall.
- **Although easy to understand, the book also prepares students for further coursework.** Too often, instructors find that selecting a textbook means choosing between two unappealing alternatives: a textbook that is “easy to teach” but leaves major gaps in students’ understanding, or a textbook that is “hard to teach” but adequately prepares students for future coursework. We offer an easy-to-understand textbook that offers the best of both worlds.

Tools for Learning

Every chapter is structured around a common set of features that help students learn while keeping them engaged.

Opening Story Each chapter opens with a compelling story that often extends through the entire chapter. Stories were chosen to accomplish three things: to illustrate important concepts in the chapter, to build intuition with realistic examples, and then to encourage students to read on and learn more. For example, Chapter 3 uses the price of coffee at the local Starbucks and the supply of coffee beans to teach the supply and demand model. Chapter 4 teaches consumer and producer surplus in the context of a market for used textbooks. Because each chapter is introduced with a real-world story, students are drawn in and can relate more easily to the material. Five of our opening stories in this edition are new. A complete list of opening stories appears on the inside front cover.

“What You Will Learn in This Chapter” Following every opening story is a preview of the chapter in an easy-to-review bulleted list format that alerts students to critical concepts and chapter objectives.

“Economics in Action” Case Studies In addition to the vivid stories that open every chapter, we conclude virtually every major text section with still more examples: a real-world case study called Economics in Action. This much-lauded feature provides a short but compelling application of the major concept just covered in that section. Students experience an immediate payoff when they can apply concepts they’ve just read about to real phenomena. For example, in Chapter 3 we use the tortilla crisis of 2007 to illustrate how changes in supply

impact consumers as bread-and-butter (and tortilla) issues (page 87). In Chapter 4, we use the case of eBay, the online auctioneer, to communicate the concept of efficiency (page 110). For a list of all the Economics in Action cases, see the page facing the inside front cover and the table of contents.

Unique End-of-Section Review: “Quick Review” and “Check Your Understanding” Questions Every Economics in Action case study is followed by two opportunities for review: Quick Reviews and Check Your Understanding questions. Because jargon and abstract concepts can quickly overwhelm the principles student, the Quick Reviews (short, bulleted summaries of key concepts) help ensure that students understand what they have just read. Then the Check Your Understanding questions (a short set of review questions with solutions at the back of the book) allow students to immediately test their understanding of a section. If they’re not getting the questions right, it’s a clear signal for them to go back and reread before moving on.

We’ve received a lot of positive feedback about this end-of-section pedagogy that encourages students to apply what they’ve learned (via the Economics in Action) and then review it (with the Quick Reviews and Check Your Understanding questions).

Boxed Features We include three types of boxes:

“For Inquiring Minds”: To further our goal of helping students build intuition with real-world examples and infuse chapters with Paul’s voice, every chapter contains one or more For Inquiring Minds boxes. In these boxes, concepts are applied to real-world events in unexpected and sometimes surprising ways, generating a sense of the power and breadth of economics. These boxes show students that economics can be fun despite being labeled “the dismal science.” In a Chapter 18 box on water bottling in Maine, students learn how one of America’s favorite bottled waters, Poland Spring, is at the center of a dispute over the management of a common resource (page 471). For a list of all For Inquiring Minds boxes, see the page facing the inside front cover and the table of contents.

“Global Comparison”: As explained earlier, in this new box we explore concepts using real data to illustrate how and why countries reach different economic outcomes.

“Pitfalls”: Certain concepts are prone to be misunderstood when students begin their study of economics. We alert students to these mistakes in the Pitfalls boxes. Here common misunderstandings are spelled out and corrected. For example, in a Chapter 3 Pitfalls, we clarify the difference between demand and quantity demanded (page 66). The distinction between increasing total cost and increasing marginal cost is the topic of Pitfalls in Chapter 9 (page 232). For an overview of all the Pitfalls boxes in chapters, see the table of contents.

Definitions of Key Terms Every key term is defined in the text and then again in the margin, making it easier for students to study and review.

“A Look Ahead” Each chapter ends with A Look Ahead, a short overview of what lies ahead in upcoming chapters. This conclusion provides students with a sense of continuity among chapters.

End-of-Chapter Review In addition to the opportunities for review at the end of every major section, each chapter ends with a brief but complete Summary of the key concepts, a list of key terms, and a comprehensive set of end-of-chapter problems. Users and reviewers alike have praised the problem sets for how effectively they test intuition as well as the ability to calculate important variables. We have also responded to requests for more problems drawn from real life. So for the second edition we’ve added news- and data-based problems to every chapter.

The Organization of This Book

The organization of the second edition has been inspired by users and reviewers who spoke loudly and clearly about their desire for a more traditional sequence of chapters: consumer theory before producer theory, consolidated coverage of taxes, consecutive market structure chapters, and earlier treatment of consumer and producer surplus. We have revised accordingly. But our chapters are still grouped into building blocks in which conceptual material learned at one stage is built upon and then integrated into the conceptual material covered in the next stage. And our organization remains flexible: we recognize that a number of chapters will be considered optional and that many instructors will prefer to teach the chapters using a different order. Chapters and sections have been written to incorporate a degree of flexibility in the sequence in which they are taught, without sacrificing conceptual continuity. Following is a walkthrough of coverage in the second edition.

Part 1: What Is Economics? The **Introduction** initiates students into the study of economics in the context of a shopping trip on any given Sunday in everyday America. It provides students with definitions of basic terms such as *economics*, the *invisible hand*, and *market structure* and serves as a “tour d’horizon” of economics, explaining the difference between microeconomics and macroeconomics. It is followed by **Chapter 1, “First Principles,”** with its twelve principles underlying the study of economics: four principles of individual choice, covering concepts such as opportunity cost, marginal analysis, and incentives; five principles of interaction between individuals, covering concepts such as gains

from trade, market efficiency, and market failure; and three principles of economy-wide interaction, covering concepts that underlie the multiplier effect, recession and inflation, and macroeconomic policy. In later chapters, we build intuition by referring to these principles in the explanation of specific models. Students learn that these twelve principles form a cohesive conceptual foundation for all of economics.

Chapter 2, “Economic Models: Trade-offs and Trade,” shows students how to think like economists by using two models—the production possibility frontier and comparative advantage. It gives students an early introduction to gains from trade and to international comparisons. The Chapter 2 appendix offers a comprehensive math and graphing review that provides a solid preparation for later material in the book.

Part 2: Supply and Demand **Chapter 3, “Supply and Demand,”** begins with an all-new opening story that uses the market for coffee beans to illustrate supply and demand, market equilibrium, and surplus and shortage. Students learn how the demand and supply curves of coffee beans shift in response to events like changes in consumer tastes and changes in global coffee production. By showing how increases in the cost of a cappuccino at Starbucks can be traced to drought in Vietnam, we introduce students to the standard material in a way that is fresh and compelling. The story is supplemented with a Global Comparison on gas prices that shows how differences in gas prices across countries have led to different consumer choices. Through examples such as the market for used textbooks and eBay, students learn how markets increase welfare in **Chapter 4, “Consumer and Producer Surplus.”** This revised chapter contains an expanded discussion of market efficiency and the ways in which markets fail, addressing topics such as the role of prices as signals and property rights. A new For Inquiring Minds on the best mechanism for allocating transplant organs prompts students to think about nonmarket allocation systems and how they compare to markets.

Chapter 5, “The Market Strikes Back,” covers various types of market interventions and their consequences: price and quantity controls, inefficiency, and deadweight loss. Through tangible examples such as New York City rent-control regulations and New York City taxi licenses, as well as rent control in Mumbai, India, and shopping in Hugo Chavez’s Venezuela, the costs generated by attempts to control markets are made real to students. **Chapter 6, “Elasticity,”** introduces the various elasticity measures. It contains a new opening story on the flu vaccine shortage of 2004–2005. Through a discussion of how patients and vaccine suppliers responded to a sudden shortfall of available flu vaccine, students are given a real-world example of how markets respond to events.

Part 3: Individuals and Markets In new **Chapter 7, “Taxes,”** we aggregate material on taxation that had previously appeared in several first edition chapters. Basic tax analysis is covered, along with a review of the burden of taxation and considerations of equity versus efficiency. The chapter also provides an in-depth overview of the structure of taxation, current tax policy, and public spending in the United States. The chapter on taxes is paired with **Chapter 8, “International Trade,”** which now appears much earlier in the sequence. The chapter’s new opening story on conflict arising from increased importation of shrimp into the United States builds on the material in Chapter 2 on comparative advantage and trade. Here we trace the sources of comparative advantage, consider tariffs and quotas, and explore the politics of trade protection. We also provide in-depth coverage on the controversy over imports from low-wage countries.

Part 4: Economic Decision Making **Chapter 9, “Making Decisions,”** is unique and important because microeconomics is fundamentally a science of how to make decisions. In the chapter we focus on developing an understanding of how decisions should be made in any context rather than placing the emphasis on comprehending the consequences of decisions. We want students to be able to distinguish between what is and what isn’t a marginal decision, and to do that we have included an entire section on “either-or” versus “how much” decisions—a distinction that is particularly useful when students are asked to compare a firm’s output decision to its entry/exit decision. In this chapter we also reprise the concept of opportunity cost, present a thorough treatment of marginal analysis, explain the concept of sunk cost, and cover present discounted value. This chapter will help students develop a deeper intuition about the common conceptual foundations of microeconomic models, and it will serve a valuable foundation for the following four chapters on consumer and producer theory.

Part 5: The Consumer Chapters on consumer theory now precede the chapters on producer theory. **Chapter 10, “The Rational Consumer,”** provides a complete treatment of consumer behavior for instructors who don’t cover indifference curves. There is a simple, intuitive exposition of the budget line, the optimal consumption choice, diminishing marginal utility, and income and substitution effects and their relationship to market demand. Students learn, for example, that a budget line constructed using prices is much like a Weight Watchers’ diet plan constructed using a “point” system. **Chapter 11, “Consumer Preferences and Consumer Choice,”** offers a more detailed treatment for those who wish to cover indifference curves. It contains an analysis of the optimal consumption choice using the marginal

rate of substitution as well as income and substitution effects. An Economics in Action on the relationship between music file downloads and albums prompts students to think more deeply about the problem of classifying a pair of goods as substitutes rather than complements.

Part 6: The Production Decision In **Chapter 12, “Behind the Supply Curve: Inputs and Costs,”** we develop the production function and the various cost measures of the firm. There is an extensive discussion of the difference between average cost and marginal cost, illustrated by examples such as a student’s grade point average. **Chapter 13, “Perfect Competition and the Supply Curve,”** explains the output decision of the perfectly competitive firm, its entry/exit decision, the industry supply curve, and the equilibrium of a perfectly competitive market. Here, a timely Economics in Action on the ethanol-driven rise in the demand for corn and the accompanying rise in the cost of inputs for corn production provides students with a real-world illustration of the adjustment to long-term equilibrium in a competitive industry.

Part 7: Market Structure: Beyond Perfect Competition The market structure chapters now appear consecutively. **Chapter 14, “Monopoly,”** is a full treatment of monopoly, including topics such as price discrimination and the welfare effects of monopoly. We provide an array of compelling examples, such as De Beers diamonds, price manipulation by California power companies, and airline ticket-pricing. A Global Comparison features an analysis of why Americans pay higher prices for prescription drugs. In **Chapter 15, “Oligopoly,”** we present basic game theory in both a one-shot and repeated-game context, as well as an integrated treatment of the kinked demand curve model. The models are applied to a wide set of actual examples, such as Archer Daniels Midland, a European vitamin cartel, OPEC, and airline ticket-pricing wars. We’ve expanded our treatment of antitrust policy, enhancing it with a discussion of the differences between American and European enforcement policies. In **Chapter 16, “Monopolistic Competition and Product Differentiation,”** students are brought face to face early on with an example of monopolistic competition that is a familiar feature of their lives: the food court at the local mall. We go on to cover entry and exit, efficiency considerations, and advertising in monopolistic competition.

Part 8: Microeconomics and Public Policy **Chapter 17, “Externalities,”** covers negative externalities and solutions to them, such as Coasian private trades, emissions taxes, and a system of tradable permits. We also

examine positive externalities, technological spillovers, and the resulting arguments for industrial policy. We've added a new section, "Network Externalities," with an Economics in Action on the Microsoft case, which brings to life the unique qualities and challenges posed by goods like software and music downloads. **Chapter 18, "Public Goods and Common Resources,"** makes an immediate impression by opening with the story of how "The Great Stink" of 1858 compelled Londoners to build a public sewer system. Students learn how to classify goods into four categories (private goods, common resources, public goods, and artificially scarce goods) based on two dimensions: excludability and rivalry in consumption. With this system, they can develop an intuitive understanding of why some goods but not others can be efficiently managed by markets. New **Chapter 19, "The Economics of the Welfare State,"** provides a comprehensive overview of the American welfare state as well as its philosophical foundations. Sure to pique students' interests is a section on the American health care system, written with Paul's signature lucidity. It also provides a cogent analysis of the problem of poverty and the issue of income inequality.

Part 9: Factor Markets and Risk Chapter 20, "Factor Markets and the Distribution of Income," covers the competitive factor market model and the factor distribution of income. It also contains modifications and alternative interpretations of the labor market: the efficiency-wage model of the labor market and the influences of education, discrimination, and market power. For instructors who covered indifference curves in Chapter 11, the Chapter 20 appendix offers a detailed examination of the labor-leisure trade-off and the backward-bending labor supply curve.

Finally, in **Chapter 21, "Uncertainty, Risk, and Private Information,"** we explain attitudes toward risk in a careful and methodical way, grounded in the basic concept of diminishing marginal utility. This allows us to analyze a simple competitive insurance market and to examine the benefits and limits of diversification. Next comes an easily comprehensible and intuitive presentation of private information in the context of adverse selection and moral hazard, with illustrations drawn from the market for used cars (lemons) and franchising. Instructors have told us how easy it is to teach this chapter and how much it helps to enlighten students about the relevance of economics to their everyday lives.

What's Core, What's Optional?

To help with lecture planning, on the facing page we list the chapters we view as core and those that could be considered optional—with helpful explanatory annotations for each optional chapter.

Supplements and Media

Worth Publishers is pleased to offer an enhanced and completely revised supplements and media package to accompany this textbook. The package has been crafted to help instructors teach their principles course and to give students the tools to develop their skills in economics.

For Instructors

Instructor's Resource Manual with Solutions Manual

The Instructor's Resource Manual, written by Margaret Ray, University of Washington, is a resource meant to provide materials and tips to enhance the classroom experience. The Instructor's Resource Manual provides the following:

- Chapter-by-chapter learning objectives
- Chapter outlines
- Teaching tips and ideas that include:
 - Hints on how to create student interest
 - Tips on presenting the material in class
- Discussion of the examples used in the text, including points to emphasize with your students
- Activities that can be conducted in or out of the classroom
- Hints for dealing with common misunderstandings that are typical among students
- Web resources
- Solutions manual with detailed solutions to all of the end-of-chapter Problems from the textbook

Printed Test Bank *Coordinator and Consultant:* Doris Bennett, Jacksonville State University. *Contributing Authors:* Eric R. Dodge, Rivers Institute at Hanover College; Karen Gebhardt, Colorado State University; Solina Lindahl, California Polytechnic State University; and Janice Yee, Worcester State College. The Test Bank provides a wide range of questions appropriate for assessing your students' comprehension, interpretation, analysis, and synthesis skills. Totalling over 5,500 questions, the Test Bank offers multiple-choice, true/false, and short-answer questions designed for comprehensive coverage of the text concepts. Questions have been checked for continuity with the text content, overall usability, and accuracy.

The Test Bank features include the following:

- To aid instructors in building tests, each question has been categorized according to its general *degree of difficulty*. The three levels are: *easy*, *moderate*, and *difficult*.
 - *Easy* questions require students to recognize concepts and definitions. These are questions that can be answered by direct reference to the textbook.

WHAT'S CORE, WHAT'S OPTIONAL: MICROECONOMICS

Core	Optional
1. First Principles 2. Economic Models: Trade-offs and Trade 3. Supply and Demand 4. Consumer and Producer Surplus 5. The Market Strikes Back 6. Elasticity 7. Taxes 9. Making Decisions 10. The Rational Consumer 12. Behind the Supply Curve: Inputs and Costs 13. Perfect Competition and the Supply Curve 14. Monopoly 15. Oligopoly 16. Monopolistic Competition and Product Differentiation 17. Externalities 18. Public Goods and Common Resources	Introduction: The Ordinary Business of Life Appendix: Graphs in Economics A comprehensive review of graphing and math for students who would find such a refresher helpful. This appendix is more detailed than most because our goal is to reduce students' difficulty in grasping the concepts found in this book as well as to better prepare them for economic literacy in the real world. 8. International Trade This chapter recaps comparative advantage, considers tariffs and quotas, and explores the politics of trade protection. Coverage here links back to the international coverage in Chapter 2. 11. Consumer Preferences and Consumer Choice This chapter offers a more detailed treatment of consumer behavior for instructors who wish to cover indifference curves. 19. The Economics of the Welfare State A unique chapter that gives a succinct overview of the American welfare state and its intellectual foundation. It provides a brief introduction to the economics of health care provision, as well as addressing the topics of poverty and income inequality. 20. Factor Markets and the Distribution of Income Plus Appendix: Indifference Curve Analysis of Labor Supply For instructors who want to go into more depth, this chapter covers the efficiency-wage model of the labor market as well as the influences of education, discrimination, and market power. The appendix examines the labor-leisure trade-off and the backward-bending labor supply curve. 21. Uncertainty, Risk, and Private Information This unique, applied chapter explains attitudes toward risk, examines the benefits and limits of diversification, and considers private information in the context of adverse selection and moral hazard.

- *Moderate* questions require some analysis on the student's part.
- *Difficult* questions usually require more detailed analysis by the student.
- Each question has also been categorized according to a *skill descriptor*. These include: *Fact-Based*, *Definitional*, *Concept-Based*, *Critical-Thinking*, and *Analytical-Thinking*.
- *Fact-Based Questions* require students to identify facts presented in the text.
- *Definitional Questions* require students to define an economic term or concept.
- *Concept-Based Questions* require a straightforward knowledge of basic concepts.
- *Critical-Thinking Questions* require the student to apply a concept to a particular situation.
- *Analytical-Thinking Questions* require another level of analysis to answer the question. Students must be able to apply a concept and use this knowledge for further analysis of a situation or scenario.
- To further aid instructors in building tests, each question is conveniently cross-referenced to the appropriate topic heading in the textbook. Questions are presented in the order in which concepts are presented in the text.
- The Test Bank includes questions with tables that students must analyze to solve for numerical answers. It contains questions based on the graphs that appear in the book. These questions ask students to use the graphical models developed in the textbook and to interpret the information presented in the graph. Selected questions are paired with scenarios to reinforce comprehension.
- Questions have been designed to correlate with the various questions in the text. *Study Guide Questions* are also available in each chapter. This is a unique set of 25–30 questions per chapter that are parallel to the *Chapter Review Questions* in the printed Study Guide. These questions focus on the key concepts from the text that students should grasp after reading the chapter. These questions reflect the types of questions that the students have likely already worked through in homework assignments or in self-testing. These questions can also be used for testing or for brief in-class quizzes.

Diploma 6 Computerized Test Bank The Krugman/Wells printed Test Banks are also available in CD-ROM format for both Windows and Macintosh users. WebCT and Blackboard-formatted versions of the Test



Bank are also available on the CD-ROM. With Diploma, you can easily write and edit questions as well as cre-

ate and print tests. You can sort questions according to various information fields and scramble questions to create different versions of your tests. You can preview and reformat tests before printing them. Tests can be printed in a wide range of formats. The software's unique synthesis of flexible word-processing and database features creates a program that is extremely intuitive and capable.

Lecture PowerPoint Presentation Created by Can Erbil, Brandeis University, the enhanced PowerPoint presentation slides are designed to assist you with lecture preparation and presentations. The slides are organized by topic and contain graphs, data tables, and bulleted lists of key concepts suitable for lecture presentation. Key figures from the text are replicated and animated to demonstrate how they build. *Notes to the Instructor* are now also included to provide added tips, class exercises, examples, and explanations to enhance classroom presentations. The slides have been designed to allow for easy editing of graphs and text. These slides can be customized to suit your individual needs by adding your own data, questions, and lecture notes. These files may be accessed on the instructor's side of the website or on the Instructor's Resource CD-ROM.

Instructor's Resource CD-ROM Using the Instructor's Resource CD-ROM, you can easily build classroom presentations or enhance your online courses. This CD-ROM contains all text figures (in JPEG and PPT formats), PowerPoint lecture slides, and detailed solutions to all end-of-chapter Problems. You can choose from the various resources, edit, and save for use in your classroom. The Instructor's Resource CD-ROM includes:

- **Instructor's Resource Manual** (PDF): containing chapter-by-chapter learning objectives, chapter outlines, teaching tips, examples used in the text, activities, hints for dealing with common student misunderstandings, and web resources.
- **Solutions Manual** (PDF): including detailed solutions to all of the end-of-chapter Problems from the textbook.
- **Lecture PowerPoint Presentations** (PPT): PowerPoint slides including graphs, data tables, and bulleted lists of key concepts suitable for lecture presentation.
- **Images from the Textbook** (JPEG): a complete set of textbook images in high-res and low-res JPEG formats.
- **Illustration PowerPoint Slides** (PPT): a complete set of figures and tables from the textbook in PPT format.

For Students

Study Guide Prepared by Elizabeth Sawyer-Kelly, University of Wisconsin–Madison, the Study Guide reinforces the topics and key concepts covered in the text. For each chapter, the Study Guide is organized as follows:

- *Before You Read the Chapter*
 - **Summary:** an opening paragraph that provides a brief overview of the chapter.
 - **Objectives:** a numbered list outlining and describing the material that the student should have learned in the chapter. These objectives can be easily used as a study tool for students.
 - **Key Terms:** a list of boldface key terms with their definitions—including room for note-taking.
- *After You Read the Chapter*
 - **Tips:** numbered list of learning tips with graphical analysis.
 - **Problems and Exercises:** a set of 10–15 comprehensive problems.
- *Before You Take the Test*
 - **Chapter Review Questions:** a set of 30 multiple-choice questions that focus on the key concepts from the text students should grasp after reading the chapter. These questions are designed for student exam preparation. A parallel set of these questions is also available to instructors in the Test Bank.
- *Answer Key*
 - **Answers to Problems and Exercises:** detailed solutions to the Problems and Exercises in the Study Guide.
 - **Answers to Chapter Review Questions:** solutions to the multiple-choice questions in the Study Guide—along with thorough explanations.

ONLINE OFFERINGS

VERSION 2.0

Companion Website for Students and Instructors www.worthpublishers.com/krugmanwells

The companion website for the Krugman/Wells text offers valuable tools for both the instructor and students.

For instructors, the site gives you the ability to track students' interaction with the site and gives you access to additional instructor resources.

The following instructor resources are available:

- **Quiz Gradebook:** The site gives you the ability to track students' work by accessing an online gradebook. Instructors also have the option to have student results e-mailed directly to them. All student answers to the Self-Test Quizzes are saved in this online database. Student responses and interactions with the Graphing Exercises are also tracked and stored.
- **Lecture PowerPoint Presentations:** Instructors have access to helpful lecture material in PowerPoint® format. These PowerPoint slides are

designed to assist instructors with lecture preparation and presentation.

- **Illustration PowerPoint Slides:** A complete set of figures and tables from the textbook in PowerPoint format is available.
- **Images from the Textbook:** Instructors have access to a complete set of figures and tables from the textbook in high-res and low-res JPEG formats. The textbook art has been processed for “high-resolution” (150 dpi). These figures and photographs have been especially formatted for maximum readability in large lecture halls and follow standards that were set and tested in a real university auditorium.
- **Instructor's Resource Manual:** Instructors have access to the files for the Instructor's Resource Manual.
- **Solutions Manual:** Instructors have access to the files for the detailed solutions to the text's end-of-chapter Problems.

For students, the site offers many opportunities for self-testing and review.

The following resources are available for students:

- **Self-Test Quizzes:** This quizzing engine provides 20 multiple-choice questions per chapter. Immediate and appropriate feedback is provided to students along with topic references for further review. The questions as well as the answer choices are randomized to give students a different quiz with every refresh of the screen.
- **Key Term Flashcards:** Students can test themselves on the key terms with these pop-up electronic flashcards.
- **Graphing Exercises:** Selected graphs from the textbook have been animated in a Flash format. Working with these animated figures enhances student understanding of the effects of concepts such as the shifts or movements of the curves. Every interactive graph is accompanied by questions that quiz students on key concepts from the textbook and provide instructors with feedback on student progress.
- **Web Links:** Created and continually updated by Jules Kaplan, University of Colorado–Boulder, these Web Links allow students to easily and effectively locate outside resources and readings that relate to topics covered in the textbook. They list web addresses that hotlink to relevant websites; each URL is accompanied by a detailed description of the site and its relevance to each chapter. This allows students to conduct research and explore related readings on specific topics with ease. Also hotlinked are relevant articles by Paul Krugman.

► Aplia



Aplia, founded by Paul Romer, Stanford University, is the first web-based company to integrate pedagogical features from a textbook with interactive media. Aplia and Worth Publishers were the first to offer an Integrated Text Solution and all Aplia tools. The features of the Krugman/Wells text have been combined with Aplia's interactive media to save time for professors and encourage students to exert more effort in their learning. The structure adheres to that of the Krugman/Wells text and works consistently within the Aplia framework. The Krugman/Wells Aplia ITS offers a content section, followed up by an application (*Economics in Action*), a Quick Review, and a short quiz (*Check Your Understanding*). With this structure, students are presented bite-sized, easily-digestible portions of content and are immediately tested on that material before moving on.

The integrated online version of the Aplia media and the Krugman/Wells text includes:

- Extra problem sets (derived from in-chapter questions in the book) suitable for homework and keyed to specific topics from each chapter
- Regularly updated news analyses
- Real-time online simulations of market interactions
- Interactive tutorials to assist with math
- Graphs and statistics
- Instant online reports that allow instructors to target student trouble areas more efficiently

With Aplia, you retain complete control and flexibility for your course. You choose the content you want students to cover, and you decide how to organize it. You decide whether online activities are practice (ungraded or graded).

For a preview of Aplia materials and to learn more, visit <http://www.aplia.com/worth>.

WebCT E-pack



The Krugman/Wells WebCT E-packs enable you to create a thorough, interactive, and pedagogically sound online course or course website. The Krugman/Wells E-pack provides you with online materials that facilitate critical thinking and learning, including Test Bank material, quizzes, links, and graphing exercises. Best of all, this material is preprogrammed and fully functional in the WebCT environment. Prebuilt materials eliminate hours of course-preparation work and offer significant support as you develop your online course.

Blackboard The Krugman/Wells Blackboard Course Cartridge allows you to combine Blackboard's popular tools and easy-to-use interface with the Krugman/Wells' text-specific resources: Test Bank material, quizzes, links, and graphing exercises. The result is an interactive, comprehensive online course that allows for effortless implementation, management, and use. The Worth electronic files are organized and prebuilt to work within the Blackboard software and can be easily downloaded from the Blackboard content showcases directly onto your department server.



VERSION 3.0—AVAILABLE WITH KRUGMAN/WELLS MICROECONOMICS FOR SPRING 2010

EconPortal

EconPortal is the digital gateway to Krugman/Wells *Microeconomics*, designed to enrich your course, help you organize and better utilize resources, and improve your students' understanding of economics. EconPortal provides a powerful, easy-to-use, completely customizable teaching and learning management system complete with the following:

- **An Interactive eBook with Embedded Learning Resources and Enhanced Assessment:** The eBook's functionality will provide for highlighting, note-taking, graph and example enlargements, a fully searchable glossary, as well as a full text search. You can customize any eBook page with comments, external web links, and supplemental resources. Unlike most eBooks, which are static pages of text, this interactive eBook will bring the book to life with embedded icons that link directly to resources that include *Tutorials*, *Graphing Exercises*, and *Quizzes*.
- Student Tutorials will be available in coordination with key topics in the text. The tutorials are meant to provide a detailed, guided tour through a specific concept (such as shift of a curve vs. movement along a curve). They will cover topics that students typically have trouble understanding or concepts that require more class time to fully explain. They'll bring these concepts to life with pictures, animations, and useful worked-out examples. These tutorials would be available to students as a self-guided resource. *Optional* assessment will be tied to each tutorial to assess whether students have grasped the concepts presented. You can choose how to use the tutorials to best meet

your students' needs. Assigning these tutorials ensures that valuable class time isn't spent on remediation of topics already covered.

➤ **A Personalized Study Plan for Students Featuring Diagnostic Quizzing:**

A Personalized Study Plan is available to assess students' knowledge of the material and to guide further study. Students will be asked to take the PSP: Self-Check Quiz after they have read the chapter and before they come to the lecture that discusses that chapter. Once they've taken the quiz, they can view their Personalized Study Plan based on the quiz results. This Personalized Study Plan will provide a path to the appropriate eBook materials and resources for further study and exploration.

➤ **A Fully Integrated Learning Management System:**

The EconPortal is meant to be a one-stop shop for all the resources tied to the book. The system will carefully integrate the teaching and learning resources for the book into an easy-to-use system. The Assignment Center organizes pre-loaded assignments centered on a comprehensive course outline, but it also provides the flexibility for you to add your own assignments. EconPortal will enable you to create assignments from a variety of question types to prepare self-graded homework, quizzes, or tests. Assignments may be created from the following:

- **End-of-Chapter Quiz Questions:** The Krugman/Wells end-of-chapter Problems will be available in a self-graded format—perfect for quick in-class quizzes or homework assignments. The questions have been carefully edited to ensure that they maintain the integrity of the text's end-of-chapter Problems.
- **Algorithmic Questions:** A question generator will be available that allows the variables of each question to be algorithmically generated—an ideal resource for creating randomized sets of quizzes and for ensuring that students get as much practice as they need.
- **Graphing Questions:** Pulled from our graphing tool engine, EconPortal can provide electronically gradable graphing-related problems. Students will be asked to draw their response to a question, and the software will grade that response. These graphing exercises are meant to replicate the pencil-and-paper experience of drawing graphs—with the bonus to you of not having to hand-grade each assignment!
- **Multipart Assignments:** This allows a great degree of flexibility in assigning sections of the eBook, Tutorials, Quizzes, or any resources available within the EconPortal as one complete assignment for your students to complete.

- **Test Bank Questions:** Assignments can be generated by pulling from the pool of Krugman/Wells Test Bank questions.

The EconPortal's Assignment Center will allow you to select your preferred policies for scheduling, maximum attempts, time limitations, feedback, and more. A wizard will guide you through the creation of assignments. You can assign and track any aspect of your students' EconPortal. The Gradebook will capture your students' results and allow for easily exporting reports.

The ready-to-use course can save you many hours of preparation time. It is fully customizable and highly interactive.

ADDITIONAL OFFERINGS

i>clicker

Developed by a team of University of Illinois physicists, i>clicker is the most flexible and most reliable classroom response system available. It is the only solution created for educators, by educators, with continuous product improvements made through direct classroom testing and faculty feedback. You'll love i>clicker no matter your level of technical expertise because the focus is on *your* teaching, *not the technology*. To learn more about packaging i>clicker with this textbook, please contact your local sales rep or visit www.iclicker.com.

Wall Street Journal Edition: For adopters of the Krugman/Wells text, Worth Publishers and the *Wall Street Journal* are offering a 15-week subscription to students at a tremendous savings. Professors also receive their own free *Wall Street Journal* subscription plus additional instructor supplements created exclusively by the *Wall Street Journal*. Please contact your local sales rep for more information or go to the *Wall Street Journal* online at www.wsj.com.

Financial Times Edition: For adopters of the Krugman/Wells text, Worth Publishers and the *Financial Times* are offering a 15-week subscription to students at a tremendous savings. Professors also receive their own free *Financial Times* subscription for one year. Students and professors may access research and archived information at www.ft.com.

Dismal Scientist: A high-powered business database and analysis service comes to the classroom! Dismal Scientist offers real-time monitoring of the global economy, produced locally by economists and professionals at Economy.com's London, Sydney, and West Chester offices. Dismal Scientist is *free* when packaged with the Krugman/Wells text. Please contact your local sales rep for more information or go to www.economy.com.

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Paul Krugman



Robin Wells

>> Introduction: The Ordinary Business of Life

ANY GIVEN SUNDAY

IT'S SUNDAY AFTERNOON IN THE SPRING OF 2008, and Route 1 in central New Jersey is a busy place. Thousands of people crowd the shopping malls that line the road for 20 miles, all the way from Trenton to New Brunswick. Most of the shoppers are cheerful—and why not? The stores in those malls offer an extraordinary range of choice; you can buy everything from sophisticated electronic equipment to fashionable

The scene along Route 1 on this spring day is, of course, perfectly ordinary—very much like the scene along hundreds of other stretches of road, all across America, that same afternoon. And the discipline of economics is mainly concerned with ordinary things. As the great nineteenth-century economist Alfred Marshall put it, economics is “a study of mankind in the ordinary business of life.”



Robert Landau/Corbis

Delivering the goods: the market economy in action

clothes to organic carrots. There are probably 100,000 distinct items available along that stretch of road. And most of these items are not luxury goods that only the rich can afford; they are products that millions of Americans can and do purchase every day.

What can economics say about this “ordinary business”? Quite a lot, it turns out. What we’ll see in this book is that even familiar scenes of economic life pose some very important questions—questions that economics can help answer. Among these questions are:

- How does our economic system work? That is, how does it manage to deliver the goods?
 - When and why does our economic system go astray, leading people into counterproductive behavior?
 - Why are there ups and downs in the economy? That is, why does the economy sometimes have a “bad year”?
- Finally, why is the long run mainly a story of ups rather than downs? That is, why has America, along with other advanced nations, become so much richer over time?
- Let’s take a look at these questions and offer a brief preview of what you will learn in this book.

The Invisible Hand

That ordinary scene in central New Jersey would not have looked at all ordinary to an American from colonial times—say, one of the patriots who helped George Washington win the Battle of Trenton in 1776. At the time, Trenton was a small village, and farms lined the route of Washington’s epic night march from Trenton to Princeton—a march that took him right past the future site of the giant Quakerbridge shopping mall.

Imagine that you could transport an American from the colonial period forward in time to our own era. (Isn’t that the plot of a movie? Several, actually.) What would this time-traveler find amazing?

Surely the most amazing thing would be the sheer prosperity of modern America—the range of goods and services that ordinary families can afford. Looking at all that wealth, our transplanted colonial would wonder, “How can I get some of that?” Or perhaps he would ask himself, “How can my society get some of that?”

The answer is that to get this kind of prosperity, you need a well-functioning system for coordinating productive activities—the activities that create the goods and services people want and get them to the people who want them. That kind of system is what we mean when we talk about the **economy**. And **economics** is the social science that studies the production, distribution, and consumption of goods and services.

An economy succeeds to the extent that it, literally, delivers the goods. A time-traveler from the eighteenth century—or even from 1950—would be amazed at how many goods and services the modern American economy delivers and at how many people can afford them. Compared with any past economy and with all but a few other countries today, America has an incredibly high standard of living.

So our economy must be doing something right, and the time-traveler might want to compliment the person in charge. But guess what? There isn’t anyone in charge. The United States has a **market economy**, in which production and consumption are the result of decentralized decisions by many firms and individuals. There is no central authority telling people what to produce or where to ship it. Each individual producer makes what he or she thinks will be most profitable; each consumer buys what he or she chooses.

The alternative to a market economy is a *command economy*, in which there is a central authority making decisions about production and consumption. Command economies have been tried, most notably in the Soviet Union between 1917 and 1991. But they didn’t work very well. Producers in the Soviet Union routinely found themselves unable to produce because they did not have crucial raw materials, or they succeeded in producing but then found that nobody wanted their products. Consumers were often unable to find necessary items—command economies are famous for long lines at shops.

Market economies, however, are able to coordinate even highly complex activities and to reliably provide consumers with the goods and services they want. Indeed, people quite casually trust their lives to the market system: residents of any major city would starve in days if the unplanned yet somehow orderly actions of thousands of businesses did not deliver a steady supply of food. Surprisingly, the unplanned “chaos” of a market economy turns out to be far more orderly than the “planning” of a command economy.

In 1776, in a famous passage in his book *The Wealth of Nations*, the pioneering Scottish economist Adam Smith wrote about how individuals, in pursuing their own

An **economy** is a system for coordinating society’s productive activities.

Economics is the social science that studies the production, distribution, and consumption of goods and services.

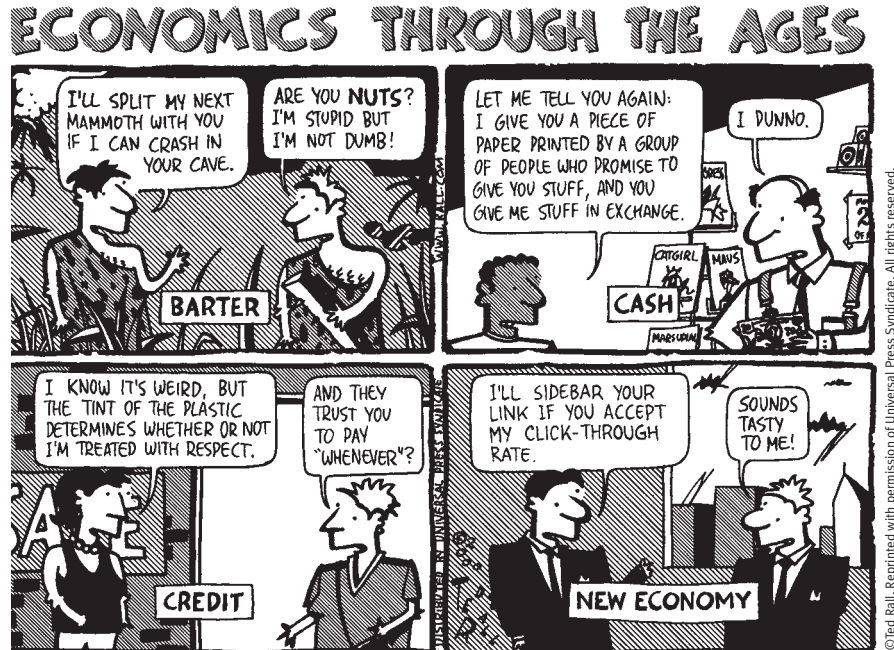
A **market economy** is an economy in which decisions about production and consumption are made by individual producers and consumers.

interests, often end up serving the interests of society as a whole. Of a businessman whose pursuit of profit makes the nation wealthier, Smith wrote: “[H]e intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention.” Ever since, economists have used the term **invisible hand** to refer to the way a market economy manages to harness the power of self-interest for the good of society.

The study of how individuals make decisions and how these decisions interact is called **microeconomics**. One of the key themes in microeconomics is the validity of Adam Smith’s insight: individuals pursuing their own interests often do promote the interests of society as a whole.

So part of the answer to our time-traveler’s question—“How can my society achieve the kind of prosperity you take for granted?”—is that his society should learn to appreciate the virtues of a market economy and the power of the invisible hand.

But the invisible hand isn’t always our friend. It’s also important to understand when and why the individual pursuit of self-interest can lead to counterproductive behavior.



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My Benefit, Your Cost

One thing that our time-traveler would not admire about modern Route 1 is the traffic. In fact, although most things have gotten better in America over time, traffic congestion has gotten a lot worse.

When traffic is congested, each driver is imposing a cost on all the other drivers on the road—he is literally getting in their way (and they are getting in his way). This cost can be substantial: in major metropolitan areas, each time someone drives to work, instead of taking public transportation or working at home, he can easily impose \$15 or more in hidden costs on other drivers. Yet when deciding whether or not to drive, commuters have no incentive to take the costs they impose on others into account.

Traffic congestion is a familiar example of a much broader problem: sometimes the individual pursuit of one’s own interest, instead of promoting the interests of society as a whole, can actually make society worse off. When this happens, it is known as **market failure**. Other important examples of market failure involve air and water pollution as well as the overexploitation of natural resources such as fish and forests.

The good news, as you will learn as you use this book to study microeconomics, is that economic analysis can be used to diagnose cases of market failure. And often, economic analysis can also be used to devise solutions for the problem.

Good Times, Bad Times

Route 1 was bustling on that day in 2008. But if you’d visited the malls in 2002, the scene wouldn’t have been quite as cheerful. That’s because New Jersey’s economy, along with that of the United States as a whole, was somewhat depressed in 2002: in early 2001, businesses began laying off workers in large numbers, and employment didn’t start bouncing back until the summer of 2003.

The **invisible hand** refers to the way in which the individual pursuit of self-interest can lead to good results for society as a whole.

Microeconomics is the branch of economics that studies how people make decisions and how these decisions interact.

When the individual pursuit of self-interest leads to bad results for society as a whole, there is **market failure**.

A **recession** is a downturn in the economy.

Macroeconomics is the branch of economics that is concerned with overall ups and downs in the economy.

Economic growth is the growing ability of the economy to produce goods and services.

Such troubled periods are a regular feature of modern economies. The fact is that the economy does not always run smoothly: it experiences *fluctuations*, a series of ups and downs. By middle age, a typical American will have experienced three or four downs, known as **recessions**. (The U.S. economy experienced serious recessions beginning in 1973, 1981, 1990, and 2001.) During a severe recession, millions of workers may be laid off.

Like market failure, recessions are a fact of life; but also like market failure, they are a problem for which economic analysis offers some solutions. Recessions are one of the main concerns of the branch of economics known as **macroeconomics**, which is concerned with the overall ups and downs of the economy. If you study macroeconomics, you will learn how economists explain recessions and how government policies can be used to minimize the damage from economic fluctuations.

Despite the occasional recession, however, over the long run the story of the U.S. economy contains many more ups than downs. And that long-run ascent is the subject of our final question.

Onward and Upward

At the beginning of the twentieth century, most Americans lived under conditions that we would now think of as extreme poverty. Only 10 percent of homes had flush toilets, only 8 percent had central heating, only 2 percent had electricity, and almost nobody had a car, let alone a washing machine or air conditioning.

Such comparisons are a stark reminder of how much our lives have been changed by **economic growth**, the growing ability of the economy to produce goods and services.

Why does the economy grow over time? And why does economic growth occur faster in some times and places than in others? These are key questions for economics because economic growth is a good thing, as those shoppers on Route 1 can attest, and most of us want more of it.

An Engine for Discovery

We hope we have convinced you that the “ordinary business of life” is really quite extraordinary, if you stop to think about it, and that it can lead us to ask some very interesting and important questions.

In this book, we will describe the answers economists have given to these questions. But this book, like economics as a whole, isn’t a list of answers: it’s an introduction to a discipline, a way to address questions like those we have just asked. Or as Alfred Marshall, who described economics as a study of the “ordinary business of life,” put it: “Economics . . . is not a body of concrete truth, but an engine for the discovery of concrete truth.”

So let’s turn the key and start the ignition.

KEY TERMS

Economy, p. 2

Economics, p. 2

Market economy, p. 2

Invisible hand, p. 3

Microeconomics, p. 3

Market failure, p. 3

Recession, p. 4

Macroeconomics, p. 4

Economic growth, p. 4



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>> First Principles

COMMON GROUND

THE ANNUAL MEETING OF THE AMERICAN Economic Association draws thousands of economists, young and old, famous and obscure. There are booksellers, business meetings, and quite a few job interviews. But mainly the economists gather to talk and listen. During the busiest times, 60 or more presentations may be taking place simultaneously, on questions that range from the future of the stock market to who does the cooking in two-earner families.

What do these people have in common? An expert on the stock market probably knows very little about the economics of housework, and vice versa. Yet an economist who wanders into the wrong seminar and ends up listening to presentations on some unfamiliar topic is nonetheless likely to hear much that is familiar. The reason is that all economic analysis is based on a set of common principles that apply to many different issues.

Some of these principles involve *individual choice*—for economics is, first of all, about the choices that individuals make. Do you choose to work over the summer or take a backpacking trip? Do you buy a new CD or go to a movie? These decisions involve *making a choice* from among a limited number of alternatives—limited because no one can have everything that he or she wants. Every question in economics at its most basic level involves individuals making choices.

But to understand how an economy works, you need to understand more than how individuals make choices. None of us are Robinson Crusoe, alone on an island—we must make decisions in an environment that is shaped by the decisions of others. Indeed, in a modern economy even the simplest decisions you make—say, what to have for breakfast—are shaped by the decisions of thousands of

other people, from the banana grower in Costa Rica who decided to grow the fruit you eat to the farmer in Iowa who provided the corn in your cornflakes. And because each of us in a market economy depends on so many others—and they, in turn, depend on us—our choices interact. So although all economics at a basic level is about individual choice, in order to understand how market economies behave we must also understand economic *interaction*—how my choices affect your choices, and vice versa.



One must choose.

Many important economic interactions can be understood by looking at the markets for individual goods, like the market for corn. But an economy as a whole has its ups and downs—and we therefore need to understand economy-wide interactions as well as the more limited interactions that occur in individual markets.

In this chapter, we will look at twelve basic principles of economics—four principles involving individual choice, five involving the way individual choices interact, and three more involving economy-wide interactions.

WHAT YOU WILL LEARN IN THIS CHAPTER:

- A set of principles for understanding the economics of how individuals make choices
- A set of principles for understanding how individual choices interact
- A set of principles for understanding economy-wide interactions

Individual Choice: The Core of Economics

Every economic issue involves, at its most basic level, **individual choice**—decisions by an individual about what to do and what *not* to do. In fact, you might say that it isn't economics if it isn't about choice.

Step into a big store like a Wal-Mart or Target. There are thousands of different products available, and it is extremely unlikely that you—or anyone else—could afford to buy everything you might want to have. And anyway, there's only so much space in your dorm room or apartment. So will you buy another bookcase or a mini-refrigerator? Given limitations on your budget and your living space, you must choose which products to buy and which to leave on the shelf.

The fact that those products are on the shelf in the first place involves choice—the store manager chose to put them there, and the manufacturers of the products chose to produce them. All economic activities involve individual choice.

Four economic principles underlie the economics of individual choice, as shown in Table 1-1. We'll now examine each of these principles in more detail.

TABLE 1-1

Principles That Underlie the Economics of Individual Choice

1. Resources are scarce.
2. The real cost of something is what you must give up to get it.
3. "How much?" is a decision at the margin.
4. People usually exploit opportunities to make themselves better off.

Resources Are Scarce

You can't always get what you want. Everyone would like to have a beautiful house in a great location (and help with the housecleaning), two or three luxury cars, and frequent vacations in fancy hotels. But even in a rich country like the United States, not many families can afford all that. So they must make choices—whether to go to Disney World this year or buy a better car, whether to make do with a small backyard or accept a longer commute in order to live where land is cheaper.

Limited income isn't the only thing that keeps people from having everything they want. Time is also in limited supply: there are only 24 hours in a day. And because the time we have is limited, choosing to spend time on one activity also means choosing not to spend time on a different activity—spending time studying for an exam means forgoing a night at the movies. Indeed, many people are so limited by the number of hours in the day that they are willing to trade money for time. For example, convenience stores normally charge higher prices than a regular supermarket. But they fulfill a valuable role by catering to time-pressured customers who would rather pay more than travel farther to the supermarket.

Why do individuals have to make choices? The ultimate reason is that *resources are scarce*. A **resource** is anything that can be used to produce something else. Lists of the economy's resources usually begin with land, labor (the time of workers), capital (machinery, buildings, and other man-made productive assets), and human capital (the educational achievements and skills of workers). A resource is **scarce** when there's not enough of the resource available to satisfy all the various ways a society wants to use it. There are many scarce resources. These include natural resources—resources that come from the physical environment, such as minerals, lumber, and petroleum. There is also a limited quantity of human resources—labor, skill, and intelligence. And in a growing world economy with a rapidly increasing human population, even clean air and water have become scarce resources.

Just as individuals must make choices, the scarcity of resources means that society as a whole must make choices. One way for a society to make choices is simply to allow them to emerge as the result of many individual choices, which is what usually happens in a market economy. For example, Americans as a group have only so many

Individual choice is the decision by an individual of what to do, which necessarily involves a decision of what not to do.

A **resource** is anything that can be used to produce something else.

Resources are **scarce**—there is not enough of the resources available to satisfy all the various ways a society wants to use them.

hours in a week: how many of those hours will they spend going to supermarkets to get lower prices, rather than saving time by shopping at convenience stores? The answer is the sum of individual decisions: each of the millions of individuals in the economy makes his or her own choice about where to shop, and the overall choice is simply the sum of those individual decisions.

But for various reasons, there are some decisions that a society decides are best not left to individual choice. For example, the authors live in an area that until recently was mainly farmland but is now being rapidly built up. Most local residents feel that the community would be a more pleasant place to live if some of the land were left undeveloped. But no individual has an incentive to keep his or her land as open space, rather than sell it to a developer. So a trend has emerged in many communities across the United States of local governments purchasing undeveloped land and preserving it as open space. We'll see in later chapters why decisions about how to use scarce resources are often best left to individuals but sometimes should be made at a higher, community-wide, level.

The real cost of an item is its **opportunity cost**: what you must give up in order to get it.

The Real Cost of Something Is What You Must Give Up to Get It

It is the last term before you graduate, and your class schedule allows you to take only one elective. There are two, however, that you would really like to take: History of Jazz and Beginning Tennis.

Suppose you decide to take the History of Jazz course. What's the cost of that decision? It is the fact that you can't take Beginning Tennis, your next best alternative choice. Economists call that kind of cost—what you must give up in order to get an item you want—the **opportunity cost** of that item. So the opportunity cost of taking the History of Jazz class is the enjoyment you would have derived from the Beginning Tennis class.

The concept of opportunity cost is crucial to understanding individual choice because, in the end, all costs are opportunity costs. That's because every choice you make means forgoing some other alternative. Sometimes critics claim that economists are concerned only with costs and benefits that can be measured in dollars and cents. But that is not true. Much economic analysis involves cases like our elective course example, where it costs no extra tuition to take one elective course—that is, there is no direct monetary cost. Nonetheless, the elective you choose has an opportunity cost—the other desirable elective course that you must forgo because your limited time permits taking only one. More specifically, the opportunity cost of a choice is what you forgo by not choosing your next best alternative.

You might think that opportunity cost is an add-on—that is, something *additional* to the monetary cost of an item. Suppose that an elective class costs additional tuition of \$750; now there is a monetary cost to taking History of Jazz. Is the opportunity cost of taking that course something separate from that monetary cost?

Well, consider two cases. First, suppose that taking Beginning Tennis also costs \$750. In this case, you would have to spend that \$750 no matter which class you take. So what you give up to take the History of Jazz class is still the Beginning Tennis class, period—you would have to spend that \$750 either way. But suppose there isn't any fee for the tennis class. In that case, what you give up to take the jazz class is the enjoyment from the tennis class *plus* the enjoyment that you could have gained from spending the \$750 on other things.

Either way, the real cost of taking your preferred class is what you must give up to get it. As you expand the set of decisions that underlie each choice—whether to take an elective or not, whether to finish this term or not, whether to drop out or not—you'll realize that *all* costs are ultimately opportunity costs.

Sometimes the money you have to pay for something is a good indication of its opportunity cost. But many times it is not. One very important example of how poorly monetary cost can indicate opportunity cost is the cost of attending college. Tuition

FOR INQUIRING MINDS

Got a Penny?

At many cash registers—for example, the one downstairs in our college cafeteria—there is a little basket full of pennies. People are encouraged to use the basket to round their purchases up or down: if it costs \$5.02, you give the cashier \$5 and take two pennies from the basket; if it costs \$4.99, you pay \$5 and the cashier throws in a penny. It makes everyone's life a bit easier. Of course, it would be easier still if we just abolished the penny, a step that some economists have urged.

But then why do we have pennies in the first place? If it's too small a sum to worry about, why calculate prices that exactly?

The answer is that a penny wasn't always such a negligible sum: the purchasing power of a penny has been greatly reduced by inflation, a general rise in the prices of all goods and services over time. Forty years ago, a penny had more purchasing power than a nickel does today.

Why does this matter? Well, remember the saying: "A penny saved is a penny earned." But there are other ways to earn money, so you must decide whether saving a penny is a productive use of your time. Could you earn more by devoting that time to other uses?

Sixty years ago, the average wage was about \$1.20 an hour. A penny was equivalent to 30 seconds' worth of work—it was worth saving a penny if doing so took less than 30 seconds. But wages have risen along with overall prices, so that the average worker is now paid more than \$17 per hour. A penny is therefore equivalent to just over 2 seconds of work—and so it's not worth the opportunity cost of the time it takes to worry about a penny more or less.

In short, the rising opportunity cost of time in terms of money has turned a penny from a useful coin into a nuisance.



Photo by David Liam Kyle/NBAE via Getty Images

LeBron James understood the concept of opportunity cost.

and housing are major monetary expenses for most students; but even if these things were free, attending college would still be an expensive proposition because most college students, if they were not in college, would have a job. That is, by going to college, students *forgo* the income they could have made if they had worked instead. This means that the opportunity cost of attending college is what you pay for tuition and housing *plus* the forgone income you would have earned in a job.

It's easy to see that the opportunity cost of going to college is especially high for people who could be earning a lot during what would otherwise have been their college years. That is why star athletes like LeBron James often skip college. Some, like Tiger Woods, leave before graduating.

"How Much?" Is a Decision at the Margin

Some important decisions involve an "either-or" choice—for example, you decide either to go to college or to begin working; you decide either to take economics or to take something else. But other important decisions involve "how much" choices—for example, if you are taking both economics and chemistry this semester, you must decide how much time to spend studying for each. When it comes to understanding "how much" decisions, economics has an important insight to offer: "how much" is a decision made *at the margin*.

Suppose you are taking both economics and chemistry. And suppose you are a pre-med student, so that your grade in chemistry matters more to you than your grade in economics. Does that therefore imply that you should spend *all* your study time on chemistry and wing it on the economics exam? Probably not; even if you think your chemistry grade is more important, you should put some effort into studying for economics.

Spending more time studying for economics involves a benefit (a higher expected grade in that course) and a cost (you could have spent that time doing something else, such as studying to get a higher grade in chemistry). That is, your decision involves a **trade-off**—a comparison of costs and benefits.

How do you decide this kind of "how much" question? The typical answer is that you make the decision a bit at a time, by asking how you should spend the next hour. Say both exams are on the same day, and the night before you spend time reviewing your notes for both courses. At 6:00 P.M., you decide that it's a good idea to spend at least an hour on each course. At 8:00 P.M., you decide you'd better spend another

You make a **trade-off** when you compare the costs with the benefits of doing something.

hour on each course. At 10:00 P.M., you are getting tired and figure you have one more hour to study before bed—chemistry or economics? If you are pre-med, it's likely to be chemistry; if you are pre-MBA, it's likely to be economics.

Note how you've made the decision to allocate your time: at each point the question is whether or not to spend *one more hour* on either course. And in deciding whether to spend another hour studying for chemistry, you weigh the costs (an hour forgone of studying for economics or an hour forgone of sleeping) versus the benefits (a likely increase in your chemistry grade). As long as the benefit of studying one more hour for chemistry outweighs the cost, you should choose to study for that additional hour.

Decisions of this type—what to do with your next hour, what to do with your next dollar, and so on—are **marginal decisions**. They involve making trade-offs *at the margin*: comparing the costs and benefits of doing a little bit more of an activity versus doing a little bit less. The study of such decisions is known as **marginal analysis**.

Many of the questions that we face in economics—as well as in real life—involve marginal analysis: How many workers should I hire in my shop? At what mileage should I change the oil in my car? What is an acceptable rate of negative side effects from a new medicine? Marginal analysis plays a central role in economics because it is the key to deciding “how much” of an activity to do.

Decisions about whether to do a bit more or a bit less of an activity are **marginal decisions**. The study of such decisions is known as **marginal analysis**.

An **incentive** is anything that offers rewards to people who change their behavior.

People Usually Exploit Opportunities to Make Themselves Better Off

One day, while listening to the morning financial news, the authors heard a great tip about how to park cheaply in Manhattan. Garages in the Wall Street area charge as much as \$30 per day. But according to the newscaster, some people had found a better way: instead of parking in a garage, they had their oil changed at the Manhattan Jiffy Lube, where it costs \$19.95 to change your oil—and they keep your car all day!

It's a great story, but unfortunately it turned out not to be true—in fact, there is no Jiffy Lube in Manhattan. But if there were, you can be sure there would be a lot of oil changes there. Why? Because when people are offered opportunities to make themselves better off, they normally take them—and if they could find a way to park their car all day for \$19.95 rather than \$30, they would.

When you try to predict how individuals will behave in an economic situation, it is a very good bet that they will exploit opportunities to make themselves better off. Furthermore, individuals will *continue* to exploit these opportunities until they have been fully exhausted—that is, people will exploit opportunities until those opportunities have been fully exploited.

If there really was a Manhattan Jiffy Lube and an oil change really was a cheap way to park your car, we can safely predict that before long the waiting list for oil changes would be weeks, if not months.

In fact, the principle that people will exploit opportunities to make themselves better off is the basis of *all* predictions by economists about individual behavior. If the earnings of those who get MBAs soar while the earnings of those who get law degrees decline, we can expect more students to go to business school and fewer to go to law school. If the price of gasoline rises and stays high for an extended period of time, we can expect people to buy smaller cars with higher gas mileage—making themselves better off in the presence of higher gas prices by driving more fuel-efficient cars.

When changes in the available opportunities offer rewards to those who change their behavior, we say that people face new **incentives**. If the price of parking in Manhattan rises, those who can find alternative ways to get to their Wall Street jobs will save money by doing so—and so we can expect fewer people to drive to work.

One last point: economists tend to be skeptical of any attempt to change people's behavior that *doesn't* change their incentives. For example, a plan that calls on manufacturers to reduce pollution voluntarily probably won't be effective; a plan that gives them a financial incentive to reduce pollution is a lot more likely to work.

FOR INQUIRING MINDS

Pay for Grades?

The true reward for learning is, of course, the learning itself. But teachers and schools often feel that it's worth throwing in a few extras. Elementary school students who do well get gold stars; at higher levels, students who score well on tests may receive trophies, plaques, or even gift certificates.

But what about cash?

A few years ago, some Florida schools stirred widespread debate by offering actual cash bonuses to students who scored high on the state's standardized exams. At Parrott Middle School, which offered the highest amounts, an eighth-grader with a top score on an exam received a \$50 savings bond.

Many people questioned the monetary awards. In fact, the great majority of teachers feel that cash rewards for learning are a bad idea—the dollar amounts can't be made large enough to give students a real sense of how important their education is, and they make learning seem like work-for-pay. So why did the schools engage in the practice?

The answer, it turns out, is that the previous year the state government had introduced a pay-for-performance scheme for schools: schools whose students earned high marks on the state exams received extra state funds. The problem arose of how to motivate the students to take the exams as seriously as the school

administrators did. Parrott's principal defended the pay-for-grades practice by pointing out that good students would often "Christmas tree" their exams—ignore the questions and fill out the bubble sheets in the shape of Christmas trees. With large sums of money for the school at stake, he decided to set aside his misgivings and pay students to do well on the exams.

Does paying students for grades lead to higher grades? Interviews with students suggest that it does spur at least some students to try harder on state exams. And some Florida schools that have introduced rewards for good grades on state exams report substantial improvements in student performance.

Individual Choice: Summing It Up

We have just seen that there are four basic principles of individual choice:

- *Resources are scarce.* It is always necessary to make choices.
- *The real cost of something is what you must give up to get it.* All costs are opportunity costs.
- *"How much?" is a decision at the margin.* Usually the question is not "whether" but "how much." And that is a question whose answer hinges on the costs and benefits of doing a bit more or a bit less.
- *People usually exploit opportunities to make themselves better off.* As a result, people will respond to incentives.

So are we ready to do economics? Not yet—because most of the interesting things that happen in the economy are the result not merely of individual choices but of the way in which individual choices *interact*.

►ECONOMICS IN ACTION

A Woman's Work

One of the great social transformations of the twentieth century was the change in the nature of women's work. In 1900, only 6 percent of married women worked for pay outside the home. By 2005, the number was about 60 percent.

What caused this transformation? Changing attitudes toward work outside the home certainly played a role: in the first half of the twentieth century, it was often considered improper for a married woman to work outside the home if she could afford not to, whereas today it is considered normal. But an important driving force was the invention and growing availability of home appliances, especially washing machines. Before these appliances became available, housework was an extremely laborious task—much more so than a full-time job. In 1945, government researchers clocked a farm wife as she did the weekly wash by hand; she spent 4 hours washing clothes and 4½ hours ironing, and she walked more than a mile. Then she was

equipped with a washing machine; the same wash took 41 minutes, ironing was reduced to $1\frac{3}{4}$ hours, and the distance walked was reduced by 90 percent.

The point is that in pre-appliance days, the opportunity cost of working outside the home was very high: it was something women typically did only in the face of dire financial necessity. With modern appliances, the opportunities available to women changed—and the rest is history. ▲

> > > > > > > > > > > > >

▶ CHECK YOUR UNDERSTANDING 1-1

- Explain how each of the following situations illustrates one of the four principles of individual choice.
 - You are on your third trip to a restaurant's all-you-can-eat dessert buffet and are feeling very full. Although it would cost you no additional money, you forgo a slice of coconut cream pie but have a slice of chocolate cake.
 - Even if there were more resources in the world, there would still be scarcity.
 - Different teaching assistants teach several Economics 101 tutorials. Those taught by the teaching assistants with the best reputations fill up quickly, with spaces left unfilled in the ones taught by assistants with poor reputations.
 - To decide how many hours per week to exercise, you compare the health benefits of one more hour of exercise to the effect on your grades of one less hour spent studying.
- You make \$45,000 per year at your current job with Whiz Kids Consultants. You are considering a job offer from Brainiacs, Inc., which will pay you \$50,000 per year. Which of the following are elements of the opportunity cost of accepting the new job at Brainiacs, Inc.?
 - The increased time spent commuting to your new job
 - The \$45,000 salary from your old job
 - The more spacious office at your new job

Solutions appear at back of book.

▶ QUICK REVIEW

- ▶ All economic activities involve **individual choice**.
- ▶ People must make choices because **resources are scarce**.
- ▶ The real cost of something is what you must give up to get it—specifically, giving up your next best alternative. All costs are **opportunity costs**. Monetary costs are sometimes a good indicator of opportunity costs, but not always.
- ▶ Many choices are not *whether* to do something but *how much*. “How much” choices are made by making a **trade-off** at the margin. The study of **marginal decisions** is known as **marginal analysis**.
- ▶ Because people usually exploit opportunities to make themselves better off, **incentives** can change people's behavior.

Interaction: How Economies Work

As we learned in the Introduction, an economy is a system for coordinating the productive activities of many people. In a market economy, such as the one we live in, that coordination takes place without any coordinator: each individual makes his or her own choices. Yet those choices are by no means independent of each other: each individual's opportunities, and hence choices, depend to a large extent on the choices made by other people. So to understand how a market economy behaves, we have to examine this **interaction** in which my choices affect your choices, and vice versa.

When studying economic interaction, we quickly learn that the end result of individual choices may be quite different from what any one individual intends.

For example, over the past century farmers in the United States have eagerly adopted new farming techniques and crop strains that have reduced their costs and increased their yields. Clearly, it's in the interest of each farmer to keep up with the latest farming techniques. But the end result of each farmer trying to increase his or her own income has actually been to drive many farmers out of business. Because American farmers have been so successful at producing larger yields, agricultural prices have steadily fallen. These falling prices have reduced the incomes of many farmers, and as a result fewer and fewer people find farming worth doing. That is, an individual farmer who plants a better variety of corn is better off; but when many farmers plant a better variety of corn, the result may be to make farmers as a group worse off.

A farmer who plants a new, more productive corn variety doesn't just grow more corn. Such a farmer also affects the market for corn through the increased yields attained, with consequences that will be felt by other farmers, consumers, and beyond.

Just as there are four economic principles that fall under the theme of choice, there are five principles that fall under the theme of interaction. These five principles are summarized in Table 1-2. We will now examine each of these principles more closely.

Interaction of choices—my choices affect your choices, and vice versa—is a feature of most economic situations. The results of this interaction are often quite different from what the individuals intend.

TABLE 1-2

Principles That Underlie the Interaction of Individual Choices

- There are gains from trade.
- Markets move toward equilibrium.
- Resources should be used as efficiently as possible to achieve society's goals.
- Markets usually lead to efficiency.
- When markets don't achieve efficiency, government intervention can improve society's welfare.

In a market economy, individuals engage in **trade**: they provide goods and services to others and receive goods and services in return.

There are **gains from trade**: people can get more of what they want through trade than they could if they tried to be self-sufficient. This increase in output is due to **specialization**: each person specializes in the task that he or she is good at performing.

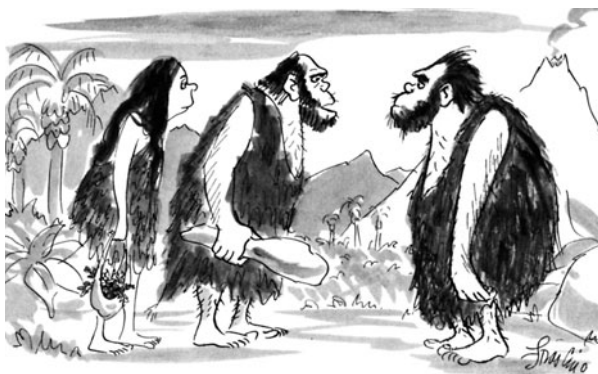
There Are Gains from Trade

Why do the choices I make interact with the choices you make? A family could try to take care of all its own needs—growing its own food, sewing its own clothing, providing itself with entertainment, writing its own economics textbooks. But trying to live that way would be very hard. The key to a much better standard of living for everyone is **trade**, in which people divide tasks among themselves and each person provides a good or service that other people want in return for different goods and services that he or she wants.

The reason we have an economy, not many self-sufficient individuals, is that there are **gains from trade**: by dividing tasks and trading, two people (or 6 billion people) can each get more of what they want than they could get by being self-sufficient. Gains from trade arise, in particular, from this division of tasks, which economists call **specialization**—a situation in which different people each engage in a different task.

The advantages of specialization, and the resulting gains from trade, were the starting point for Adam Smith's 1776 book *The Wealth of Nations*, which many regard as the beginning of economics as a discipline. Smith's book begins with a description of an eighteenth-century pin factory where, rather than each of the 10 workers making a pin from start to finish, each worker specialized in one of the many steps in pin-making:

One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on, is a particular business, to whiten the pins is another; it is even a trade by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about eighteen distinct operations. . . . Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. But if they had all wrought separately and independently, and without any of them having been educated to this particular business, they certainly could not each of them have made twenty, perhaps not one pin a day. . . .



"I hunt and she gathers—otherwise we couldn't make ends meet."

The same principle applies when we look at how people divide tasks among themselves and trade in an economy. *The economy, as a whole, can produce more when each person specializes in a task and trades with others.*

The benefits of specialization are the reason a person typically chooses only one career. It takes many years of study and experience to become a doctor; it also takes many years of study and experience to become a commercial airline pilot. Many doctors might well have had the potential to become excellent pilots, and vice versa; but it is very unlikely that anyone who decided to pursue both careers would be as good a pilot or as good a doctor as someone who decided at the beginning to specialize in that field. So it is to everyone's advantage that individuals specialize in their career choices.

Markets are what allow a doctor and a pilot to specialize in their own fields. Because markets for commercial flights and for doctors' services exist, a doctor is assured that she can find a flight and a pilot is assured that he can find a doctor. As long as individuals know that they can find the goods and services that they want in the market, they are willing to forgo self-sufficiency and are willing to specialize. But what assures people that markets will deliver what they want? The answer to that question leads us to our second principle of how individual choices interact.

Markets Move Toward Equilibrium

It's a busy afternoon at the supermarket; there are long lines at the checkout counters. Then one of the previously closed cash registers opens. What happens?

The first thing that happens, of course, is a rush to that register. After a couple of minutes, however, things will have settled down; shoppers will have rearranged

themselves so that the line at the newly opened register is about the same length as the lines at all the other registers.

How do we know that? We know from our fourth principle of individual choice that people will exploit opportunities to make themselves better off. This means that people will rush to the newly opened register in order to save time standing in line. And things will settle down when shoppers can no longer improve their position by switching lines—that is, when the opportunities to make themselves better off have all been exploited.

A story about supermarket checkout lines may seem to have little to do with how individual choices interact, but in fact it illustrates an important principle. A situation in which individuals cannot make themselves better off by doing something different—the situation in which all the checkout lines are the same length—is what economists call an **equilibrium**. An economic situation is in equilibrium when no individual would be better off doing something different.

Recall the story about the mythical Jiffy Lube, where it was supposedly cheaper to leave your car for an oil change than to pay for parking. If that opportunity had really existed and people were still paying \$30 to park in garages, the situation would *not* have been an equilibrium. And that should have been a giveaway that the story couldn't be true. In reality, people would have seized an opportunity to park cheaply, just as they seize opportunities to save time at the checkout line. And in so doing they would have eliminated the opportunity! Either it would have become very hard to get an appointment for an oil change or the price of a lube job would have increased to the point that it was no longer an attractive option (unless you really needed a lube job).

As we will see, markets usually reach equilibrium via changes in prices, which rise or fall until no opportunities for individuals to make themselves better off remain.

The concept of equilibrium is extremely helpful in understanding economic interactions because it provides a way of cutting through the sometimes complex details of those interactions. To understand what happens when a new line is opened at a supermarket, you don't need to worry about exactly how shoppers rearrange themselves, who moves ahead of whom, which register just opened, and so on. What you need to know is that any time there is a change, the situation will move to an equilibrium.



Rhoda Sydney/Photo Edit

Witness equilibrium in action at the checkout lines in your neighborhood supermarket.

An economic situation is in **equilibrium** when no individual would be better off doing something different.

FOR INQUIRING MINDS

Choosing Sides

Why do people in America drive on the right side of the road? Of course, it's the law. But long before it was the law, it was an equilibrium.

Before there were formal traffic laws, there were informal "rules of the road," practices that everyone expected everyone else to follow. These rules included an understanding that people would normally keep to one side of the road. In some places, such as England, the rule was to keep to the left; in others, such as France, it was to keep to the right.

Why would some places choose the right and others, the left? That's not completely clear, although it may have

depended on the dominant form of traffic. Men riding horses and carrying swords on their left hip preferred to ride on the left (think about getting on or off the horse, and you'll see why). On the other hand, right-handed people walking but leading horses apparently preferred to walk on the right.

In any case, once a rule of the road was established, there were strong incentives for each individual to stay on the "usual" side of the road: those who didn't would keep colliding with oncoming traffic. So once established, the rule of the road would be self-enforcing—that is, it would be an equilibrium. Nowadays, of

course, which side you drive on is determined by law; some countries have even changed sides (Sweden went from left to right in 1967). But what about pedestrians? There are no laws—but there are informal rules. In the United States, urban pedestrians normally keep to the right. But if you should happen to visit a country where people drive on the left, watch out: people who drive on the left also typically walk on the left. So when in a foreign country, do as the locals do. You won't be arrested if you walk on the right, but you will be worse off than if you accept the equilibrium and walk on the left.



An economy is **efficient** if it takes all opportunities to make some people better off without making other people worse off.

Equity means that everyone gets his or her fair share. Since people can disagree about what's "fair," equity isn't as well defined a concept as efficiency.

The fact that markets move toward equilibrium is why we can depend on them to work in a predictable way. In fact, we can trust markets to supply us with the essentials of life. For example, people who live in big cities can be sure that the supermarket shelves will always be fully stocked. Why? Because if some merchants who distribute food *didn't* make deliveries, a big profit opportunity would be created for any merchant who did—and there would be a rush to supply food, just like the rush to a newly opened cash register. So the market ensures that food will always be available for city dwellers. And, returning to our previous principle, this allows city dwellers to be city dwellers—to specialize in doing city jobs rather than living on farms and growing their own food.

A market economy also allows people to achieve gains from trade. But how do we know how well such an economy is doing? The next principle gives us a standard to use in evaluating an economy's performance.

Resources Should Be Used as Efficiently as Possible to Achieve Society's Goals

Suppose you are taking a course in which the classroom is too small for the number of students—many people are forced to stand or sit on the floor—despite the fact that large, empty classrooms are available nearby. You would say, correctly, that this is no way to run a college. Economists would call this an *inefficient* use of resources.

But if an inefficient use of resources is undesirable, just what does it mean to use resources *efficiently*? You might imagine that the efficient use of resources has something to do with money, maybe that it is measured in dollars-and-cents terms. But in economics, as in life, money is only a means to other ends. The measure that economists really care about is not money but people's happiness or welfare. Economists say that *an economy's resources are used efficiently when they are used in a way that has fully exploited all opportunities to make everyone better off*. To put it another way, an economy is **efficient** if it takes all opportunities to make some people better off without making other people worse off.

In our classroom example, there clearly was a way to make everyone better off—moving the class to a larger room would make people in the class better off without hurting anyone else in the college. Assigning the course to the smaller classroom was an inefficient use of the college's resources, whereas assigning the course to the larger classroom would have been an efficient use of the college's resources.

When an economy is efficient, it is producing the maximum gains from trade possible given the resources available. Why? Because there is no way to rearrange how resources are used in a way that can make everyone better off. When an economy is efficient, one person can be made better off by rearranging how resources are used *only* by making someone else worse off. In our classroom example, if all larger classrooms were already occupied, the college would have been run in an efficient way: your class could be made better off by moving to a larger classroom only by making people in the larger classroom worse off by making them move to a smaller classroom.

Should economic policy makers always strive to achieve economic efficiency? Well, not quite, because efficiency is not the only criterion by which to evaluate an economy. People also care about issues of fairness, or **equity**. And there is typically a trade-off between equity and efficiency: policies that promote equity often come at a cost of decreased efficiency in the economy, and vice versa.

To see this, consider the case of disabled-designated parking spaces in public parking lots. Many people have great difficulty walking due to age or disability, so it seems only fair to assign closer parking spaces specifically for their use. You may have noticed, however, that a certain amount of inefficiency is involved. To make sure that there is always an appropriate space available should a disabled person want one, there are typically quite a number of disabled-designated spaces. So at any one time there are typically more such spaces available than there are disabled people who want one. As a result, desirable parking spaces are unused. (And the

temptation for nondisabled people to use them is so great that we must be dissuaded by fear of getting a ticket.) So, short of hiring parking valets to allocate spaces, there is a conflict between *equity*, making life “fairer” for disabled people, and *efficiency*, making sure that all opportunities to make people better off have been fully exploited by never letting close-in parking spaces go unused.

Exactly how far policy makers should go in promoting equity over efficiency is a difficult question that goes to the heart of the political process. As such, it is not a question that economists can answer. What is important for economists, however, is always to seek to use the economy’s resources as efficiently as possible in the pursuit of society’s goals, whatever those goals may be.

Markets Usually Lead to Efficiency

No branch of the U.S. government is entrusted with ensuring the general economic efficiency of our market economy—we don’t have agents who go around making sure that brain surgeons aren’t plowing fields, that Minnesota farmers aren’t trying to grow oranges, that prime beachfront property isn’t taken up by used-car dealerships, that colleges aren’t wasting valuable classroom space. The government doesn’t need to enforce efficiency because in most cases the invisible hand does the job.

In other words, the incentives built into a market economy already ensure that resources are usually put to good use, that opportunities to make people better off are not wasted. If a college were known for its habit of crowding students into small classrooms while large classrooms go unused, it would soon find its enrollment dropping, putting the jobs of its administrators at risk. The “market” for college students would respond in a way that induces administrators to run the college efficiently.

A detailed explanation of why markets are usually very good at making sure that resources are used well will have to wait until we have studied how markets actually work. But the most basic reason is that in a market economy, in which individuals are free to choose what to consume and what to produce, opportunities for mutual gain are normally taken. If there is a way in which some people can be made better off, people will usually be able to take advantage of that opportunity. And that is exactly what defines efficiency: all the opportunities to make some people better off without making other people worse off have been exploited.

As we learned in the Introduction, however, there are exceptions to this principle that markets are generally efficient. In cases of *market failure*, the individual pursuit of self-interest found in markets makes society worse off—that is, the market outcome is inefficient. And, as we will see in examining the next principle, when markets fail, government intervention can help. But short of instances of market failure, the general rule is that markets are a remarkably good way of organizing an economy.

When Markets Don’t Achieve Efficiency, Government Intervention Can Improve Society’s Welfare

Let’s recall from the Introduction the nature of the market failure caused by traffic congestion—a commuter driving to work has no incentive to take into account the cost that his or her action inflicts on other drivers in the form of increased traffic congestion. There are several possible remedies to this situation; examples include charging road tolls, subsidizing the cost of public transportation, and taxing sales of gasoline to individual drivers. All these remedies work by changing the incentives of would-be drivers—motivating them to drive less and use alternative transportation. But they also share another feature: each relies on government intervention in the market.

This brings us to our fifth and last principle of interaction: *When markets don’t achieve efficiency, government intervention can improve society’s welfare*. That is, when markets go wrong, an appropriately designed government policy can sometimes move society closer to an efficient outcome by changing how society’s resources are used.

A very important branch of economics is devoted to studying why markets fail and what policies should be adopted to improve social welfare. We will study these problems and their remedies in depth in later chapters, but here we give a brief overview of three principal ways in which they fail:

- Individual actions have *side effects* that are not properly taken into account by the market. An example is an action that causes pollution.
- One party prevents mutually beneficial trades from occurring in an attempt to capture a greater share of resources for itself. An example is a drug company that keeps its prices so high that some people who would benefit from their drugs cannot afford to buy them.
- Some goods, by their very nature, are unsuited for efficient management by markets. An example of such a good is air traffic control.

An important part of your education in economics is learning to identify not just when markets work but also when they don't work—and to judge what government policies are appropriate in each situation.

► **ECONOMICS IN ACTION**

Restoring Equilibrium on the Freeways

Back in 1994 a powerful earthquake struck the Los Angeles area, causing several freeway bridges to collapse and thereby disrupting the normal commuting routes of hundreds of thousands of drivers. The events that followed offer a particularly clear example of interdependent decision making—in this case, the decisions of commuters about how to get to work.

In the immediate aftermath of the earthquake, there was great concern about the impact on traffic, since motorists would now have to crowd onto alternative routes or detour around the blockages by using city streets. Public officials and news programs warned commuters to expect massive delays and urged them to avoid unnecessary travel, reschedule their work to commute before or after the rush, or use mass transit. These warnings were unexpectedly effective. In fact, so many people heeded them that in the first few days following the quake, those who maintained their regular commuting routine actually found the drive to and from work faster than before.

Of course, this situation could not last. As word spread that traffic was actually not bad at all, people abandoned their less convenient new commuting methods and reverted to their cars—and traffic got steadily worse. Within a few weeks after the quake, serious traffic jams had appeared. After a few more weeks, however, the situation stabilized: the reality of worse-than-usual congestion discouraged enough drivers to prevent the nightmare of citywide gridlock from materializing. Los Angeles traffic, in short, had settled into a new equilibrium, in which each commuter was making the best choice he or she could, given what everyone else was doing.

This was not, by the way, the end of the story: fears that the city would strangle on traffic led local authorities to repair the roads with record speed. Within only 18 months after the quake, all the freeways were back to normal, ready for the next one. ▲

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► **QUICK REVIEW**

- A feature of most economic situations is the **interaction** of choices made by individuals, the end result of which may be quite different from what was intended. In a market economy, interaction takes the form of **trade** between individuals.
- Individuals interact because there are **gains from trade**. Gains from trade arise from **specialization**.
- Economic situations normally move toward **equilibrium**.
- As far as possible, there should be an **efficient** use of resources to achieve society's goals. But efficiency is not the only way to evaluate an economy; **equity** may also be desirable, and there is often a trade-off between equity and efficiency.
- Markets normally *are* efficient, except for certain well-defined exceptions.
- When markets fail to achieve efficiency, government intervention can improve society's welfare.

► **CHECK YOUR UNDERSTANDING** 1-2

1. Explain how each of the following situations illustrates one of the five principles of interaction.
 - a. Using the college website, any student who wants to sell a used textbook for at least \$30 is able to sell it to someone who is willing to pay \$30.
 - b. At a college tutoring co-op, students can arrange to provide tutoring in subjects they are good in (like economics) in return for receiving tutoring in subjects they are poor in (like philosophy).

- c. The local municipality imposes a law that requires bars and nightclubs near residential areas to keep their noise levels below a certain threshold.
 - d. To provide better care for low-income patients, the local municipality has decided to close some underutilized neighborhood clinics and shift funds to the main hospital.
 - e. On the college website, books of a given title with approximately the same level of wear and tear sell for about the same price.
2. Which of the following describes an equilibrium situation? Which does not? Explain your answer.
- a. The restaurants across the street from the university dining hall serve better-tasting and cheaper meals than those served at the university dining hall. The vast majority of students continue to eat at the dining hall.
 - b. You currently take the subway to work. Although taking the bus is cheaper, the ride takes longer. So you are willing to pay the higher subway fare in order to save time.

Solutions appear at back of book.

Economy-Wide Interactions

As we mentioned in the Introduction, the economy as a whole has its ups and downs. For example, business in America's shopping malls was somewhat depressed in 2002, because the economy hadn't fully recovered from the 2001 recession. To understand recessions, we need to understand economy-wide interactions, and understanding the big picture of the economy requires understanding three more important economic principles. Those three economy-wide principles are summarized in Table 1-3.

One Person's Spending Is Another Person's Income

In 2001, corporations that had been buying a lot of computers, software, and other high-tech supplies in the late 1990s suddenly decided to cut back on their purchases. The result, economists agree, was a recession caused mainly by these cuts in business investment spending. As we mentioned in the previous chapter, this was followed by a sharp drop-off in spending at the nation's retail stores.

But why should a cut in spending by businesses mean empty stores in the shopping malls? After all, malls are places where families, not businesses, do their shopping. The answer is that lower business spending led to lower incomes throughout the economy, because people who had been making those computers or designing that software either lost their jobs or were forced to take pay cuts. And as incomes fell, so did spending by consumers.

This story illustrates a general principle: *One person's spending is another person's income*. In a market economy, people make a living selling things—including their labor—to other people. If some group in the economy decides, for whatever reason, to spend more, the income of other groups will rise. If some group decides to spend less, the income of other groups will fall.

Because one person's spending is another person's income, a chain reaction of changes in spending behavior tends to have repercussions that spread through the economy. For example, a cut in business investment spending, like the one that happened in 2001, leads to reduced family incomes; families respond by reducing consumer spending; this leads to another round of income cuts; and so on. These repercussions play an important role in our understanding of recessions and recoveries.

Overall Spending Sometimes Gets Out of Line With the Economy's Productive Capacity

Macroeconomics emerged as a separate branch of economics in the 1930s, when a collapse of consumer and business spending, a crisis in the banking industry, and other factors led to a plunge in overall spending. This plunge in spending, in turn, led to a period of very high unemployment known as the Great Depression.

TABLE 1-3

Principles That Underlie Economy-Wide Interactions

1. One person's spending is another person's income.
2. Overall spending sometimes gets out of line with the economy's productive capacity.
3. Government policies can change spending.

The lesson economists learned from the troubles of the 1930s is that overall spending—the amount of goods and services that consumers and businesses want to buy—sometimes doesn’t match the amount of goods and services the economy is capable of producing. In the 1930s, spending fell far short of what was needed to keep American workers employed, and the result was a severe economic slump. In fact, shortfalls in spending are responsible for most, though not all, recessions—although nothing like the Great Depression has happened since the 1930s.

It’s also possible for overall spending to be too high. In that case, the economy experiences *inflation*, a rise in prices throughout the economy. This rise in prices occurs because when the amount that people want to buy outstrips the supply, producers can raise their prices and still find willing customers.

Government Policies Can Change Spending

Overall spending sometimes gets out of line with the economy’s productive capacity. But can anything be done about that? Yes, a lot. Government policies can have strong effects on spending.

For one thing, the government itself does a lot of spending on everything from military equipment to education—and it can choose to do more or less. The government can also vary how much it collects from the public in taxes, which in turn affects how much income consumers and businesses have left to spend. And the government’s control of the quantity of money in circulation, it turns out, gives it another powerful tool with which to affect total spending. Government spending, taxes, and control of money are the tools of *macroeconomic policy*.

Modern governments deploy these tools of macroeconomic policy in an effort to manage overall spending in the economy, trying to steer it between the perils of recession and inflation. These efforts aren’t always successful—recessions still happen, and so do periods of inflation. But it’s widely believed that the growing sophistication of macroeconomic policy is an important reason why the United States and other major economies seem to be more stable today than they were in the past.

►ECONOMICS IN ACTION

Adventures in Babysitting

The website myarmylifetoo.com, which offers advice to army families, suggests that parents join a babysitting cooperative—an arrangement that is common in many walks of life. In a babysitting cooperative, a number of parents exchange babysitting services rather than hire someone to babysit. But how do these organizations make sure that everyone does their fair share of the work? As myarmylifetoo.com explains, “Instead of money, most co-ops exchange tickets or points. When you need a sitter, you call a friend on the list, and you pay them with tickets. You earn tickets by babysitting other children within the co-op.”

In other words, a babysitting co-op is a miniature economy in which people buy and sell babysitting services. And it happens to be a type of economy that can have macroeconomic problems! A famous article titled “Monetary Theory and the Great Capitol Hill Babysitting Co-Op Crisis,” published in 1977, described the troubles of a babysitting cooperative that issued too few tickets. Bear in mind that, on average, people in a babysitting co-op want to have a reserve of tickets stashed away in case they need to go out several times before they can replenish their stash by doing some more babysitting.

In this case, because there weren’t that many tickets out there to begin with, most parents were anxious to add to their reserves by babysitting but reluctant to run them down by going out. But one parent’s decision to go out was another’s chance to babysit, so it became difficult to earn tickets. Knowing this, parents became even more reluctant to use their reserves except on special occasions.

In short, the co-op had fallen into a recession.

Recessions in the larger, nonbabysitting economy are a bit more complicated than this, but the troubles of the Capitol Hill babysitting co-op demonstrate two of our three principles of economy-wide interactions. One person's spending is another person's income: opportunities to babysit arose only to the extent that other people went out. And an economy can suffer from too little spending: when not enough people were willing to go out, everyone was frustrated at the lack of babysitting opportunities.

And what about government policies to change spending? Actually, the Capitol Hill co-op did that, too. Eventually, it solved its problem by handing out more tickets, and with increased reserves, people were willing to go out more. ▲

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► CHECK YOUR UNDERSTANDING 1-3

1. Explain how each of the following examples illustrates one of the three principles of economy-wide interactions.
 - a. The White House urged Congress to pass major tax cuts in the spring of 2001, when it became clear that the U.S. economy was experiencing a slump.
 - b. Oil companies are investing heavily in projects that will extract oil from the "oil sands" of Canada. In Edmonton, Alberta, near the projects, restaurants and other consumer businesses are booming.
 - c. In the mid-2000s, Spain, which was experiencing a big housing boom, also had the highest inflation rate in Europe.

Solutions appear at back of book.

►► QUICK REVIEW

- Because individuals in a market economy derive their income from selling things, including their labor, to other people, one person's spending is another person's income. As a result, changes in spending behavior tend to have repercussions that spread through the economy.
- Overall spending sometimes gets out of line with the economy's capacity to produce goods and services. When spending is too low, the result is a recession. When spending is too high, it causes inflation.
- Governments have a number of tools at their disposal that can strongly affect the overall level of spending. Modern governments use these tools in an effort to steer the economy between the perils of recession and inflation.

►► A LOOK AHEAD...

The twelve basic principles we have described lie behind almost all economic analysis. Although they can be immediately helpful in understanding many situations, they are usually not enough. Applying the principles to real economic issues takes one more step.

That step is the creation of *models*—simplified representations of economic situations. Models must be realistic enough to provide real-world guidance but simple enough to allow us to clearly see the implications of the principles described in this chapter. So our next step is to show how models are used to actually do economic analysis.]

SUMMARY

1. All economic analysis is based on a list of basic principles. These principles apply to three levels of economic understanding. First, we must understand how individuals make choices; second, we must understand how these choices interact; and third, we must understand how the economy functions overall.
2. Everyone has to make choices about what to do and what *not* to do. **Individual choice** is the basis of economics—if it doesn't involve choice, it isn't economics.
3. The reason choices must be made is that **resources**—anything that can be used to produce something else—are **scarce**. Individuals are limited in their choices by money and time; economies are limited by their supplies of human and natural resources.
4. Because you must choose among limited alternatives, the true cost of anything is what you must give up to get it—all costs are **opportunity costs**.
5. Many economic decisions involve questions not of "whether" but of "how much"—how much to spend on some good, how much to produce, and so on. Such decisions must be taken by performing a **trade-off at the margin**—by comparing the costs and benefits of doing a bit more or a bit less. Decisions of this type are called **marginal decisions**, and the study of them, **marginal analysis**, plays a central role in economics.
6. The study of how people *should* make decisions is also a good way to understand actual behavior. Individuals usually exploit opportunities to make themselves better off.

If opportunities change, so does behavior: people respond to **incentives**.

7. **Interaction**—my choices depend on your choices, and vice versa—adds another level to economic understanding. When individuals interact, the end result may be different from what anyone intends.
8. The reason for interaction is that there are **gains from trade**: by engaging in the **trade** of goods and services with one another, the members of an economy can all be made better off. Underlying gains from trade are the advantages of **specialization**, of having individuals specialize in the tasks they are good at.
9. Economies normally move toward **equilibrium**—a situation in which no individual can make himself or herself better off by taking a different action.
10. An economy is **efficient** if all opportunities to make some people better off without making other people

worse off are taken. Resources should be used as efficiently as possible to achieve society's goals. But efficiency is not the sole way to evaluate an economy: **equity**, or fairness, is also desirable, and there is often a trade-off between equity and efficiency.

11. Markets usually lead to efficiency, with some well-defined exceptions.
12. When markets fail and do not achieve efficiency, government intervention can improve society's welfare.
13. One person's spending is another person's income.
14. Overall spending in the economy can get out of line with the economy's productive capacity, leading to recession or inflation.
15. Governments have the ability to strongly affect overall spending, an ability they use in an effort to steer the economy between recession and inflation.

KEY TERMS

Individual choice, p. 6
Resource, p. 6
Scarce, p. 6
Opportunity cost, p. 7
Trade-off, p. 8

Marginal decisions, p. 9
Marginal analysis, p. 9
Incentive, p. 9
Interaction, p. 11
Trade, p. 12

Gains from trade, p. 12
Specialization, p. 12
Equilibrium, p. 13
Efficient, p. 14
Equity, p. 14

PROBLEMS

1. In each of the following situations, identify which of the twelve principles is at work.
 - a. You choose to shop at the local discount store rather than paying a higher price for the same merchandise at the local department store.
 - b. On your spring break trip, your budget is limited to \$35 a day.
 - c. The student union provides a website on which departing students can sell items such as used books, appliances, and furniture rather than giving them away to their roommates as they formerly did.
 - d. After a hurricane did extensive damage to homes on the island of St. Crispin, homeowners wanted to purchase many more building materials and hire many more workers than were available on the island. As a result, prices for goods and services rose dramatically across the board.
 - e. You buy a used textbook from your roommate. Your roommate uses the money to buy songs from iTunes.
 - f. You decide how many cups of coffee to have when studying the night before an exam by considering how much more work you can do by having another cup versus how jittery it will make you feel.
 - g. There is limited lab space available to do the project required in Chemistry 101. The lab supervisor assigns lab time to each student based on when that student is able to come.
 - h. You realize that you can graduate a semester early by forgoing a semester of study abroad.
 - i. At the student union, there is a bulletin board on which people advertise used items for sale, such as bicycles. Once you have adjusted for differences in quality, all the bikes sell for about the same price.
 - j. You are better at performing lab experiments, and your lab partner is better at writing lab reports. So the two of you agree that you will do all the experiments, and she will write up all the reports.
 - k. State governments mandate that it is illegal to drive without passing a driving exam.
 - l. Your parents' after-tax income has increased because of a tax cut passed by Congress. They therefore increase your allowance, which you spend on a spring break vacation.
2. Describe some of the opportunity costs when you decide to do the following.
 - a. Attend college instead of taking a job

- b. Watch a movie instead of studying for an exam
 - c. Ride the bus instead of driving your car
3. Liza needs to buy a textbook for the next economics class. The price at the college bookstore is \$65. One online site offers it for \$55 and another site, for \$57. All prices include sales tax. The accompanying table indicates the typical shipping and handling charges for the textbook ordered online.

Shipping method	Delivery time	Charge
Standard shipping	3–7 days	\$3.99
Second-day air	2 business days	8.98
Next-day air	1 business day	13.98

- a. What is the opportunity cost of buying online instead of at the bookstore? Note that if you buy the book online, you must wait to get it.
 - b. Show the relevant choices for this student. What determines which of these options the student will choose?
4. Use the concept of opportunity cost to explain the following.
- a. More people choose to get graduate degrees when the job market is poor.
 - b. More people choose to do their own home repairs when the economy is slow and hourly wages are down.
 - c. There are more parks in suburban than in urban areas.
 - d. Convenience stores, which have higher prices than supermarkets, cater to busy people.
 - e. Fewer students enroll in classes that meet before 10:00 A.M.
5. In the following examples, state how you would use the principle of marginal analysis to make a decision.
- a. Deciding how many days to wait before doing your laundry
 - b. Deciding how much library research to do before writing your term paper
 - c. Deciding how many bags of chips to eat
 - d. Deciding how many lectures of a class to skip
6. This morning you made the following individual choices: you bought a bagel and coffee at the local café, you drove to school in your car during rush hour, and you typed your roommate's term paper because you are a fast typist—in return for which she will do your laundry for a month. For each of these actions, describe how your individual choices interacted with the individual choices made by others. Were other people left better off or worse off by your choices in each case?
7. The Hatfield family lives on the east side of the Hatatoochie River, and the McCoy family lives on the west side. Each family's diet consists of fried chicken and corn-on-the-cob, and each is self-sufficient, raising their own chickens and growing their own corn. Explain the conditions under which each of the following would be true.

- a. The two families are made better off when the Hatfields specialize in raising chickens, the McCoys specialize in growing corn, and the two families trade.
 - b. The two families are made better off when the McCoys specialize in raising chickens, the Hatfields specialize in growing corn, and the two families trade.
8. Which of the following situations describes an equilibrium? Which does not? If the situation does not describe an equilibrium, what would an equilibrium look like?
- a. Many people regularly commute from the suburbs to downtown Pleasantville. Due to traffic congestion, the trip takes 30 minutes when you travel by highway but only 15 minutes when you go by side streets.
 - b. At the intersection of Main and Broadway are two gas stations. One station charges \$3.00 per gallon for regular gas and the other charges \$2.85 per gallon. Customers can get service immediately at the first station but must wait in a long line at the second.
 - c. Every student enrolled in Economics 101 must also attend a weekly tutorial. This year there are two sections offered: section A and section B, which meet at the same time in adjoining classrooms and are taught by equally competent instructors. Section A is overcrowded, with people sitting on the floor and often unable to see the chalkboard. Section B has many empty seats.
9. In each of the following cases, explain whether you think the situation is efficient or not. If it is not efficient, why not? What actions would make the situation efficient?
- a. Electricity is included in the rent at your dorm. Some residents in your dorm leave lights, computers, and appliances on when they are not in their rooms.
 - b. Although they cost the same amount to prepare, the cafeteria in your dorm consistently provides too many dishes that diners don't like, such as tofu casserole, and too few dishes that diners do like, such as roast turkey with dressing.
 - c. The enrollment for a particular course exceeds the spaces available. Some students who need to take this course to complete their major are unable to get a space even though others who are taking it as an elective do get a space.
10. Discuss the efficiency and equity implications of each of the following policies. How would you go about balancing the concerns of equity and efficiency in these areas?
- a. The government pays the full tuition for every college student to study whatever subject he or she wishes.
 - b. When people lose their jobs, the government provides unemployment benefits until they find new ones.
11. Governments often adopt certain policies in order to promote desired behavior among their citizens. For each of the following policies, determine what the incentive is and what behavior the government wishes to promote. In each case, why do you think that the government might wish to change people's behavior, rather than allow their actions to be solely determined by individual choice?
- a. A tax of \$5 per pack is imposed on cigarettes.

- b. The government pays parents \$100 when their child is vaccinated for measles.
 - c. The government pays college students to tutor children from low-income families.
 - d. The government imposes a tax on the amount of air pollution that a company discharges.
12. In each of the following situations, explain how government intervention could improve society's welfare by changing people's incentives. In what sense is the market going wrong?
- a. Pollution from auto emissions has reached unhealthy levels.
 - b. Everyone in Woodville would be better off if streetlights were installed in the town. But no individual resident is willing to pay for installation of a streetlight in front of his or her house because it is impossible to recoup the cost by charging other residents for the benefit they receive from it.
13. In his January 31, 2007, speech on the state of the economy, President George W. Bush said that "Since we enacted major tax relief into law in 2003, our economy has created nearly 7.2 million new jobs. Our economy has expanded by more than 13 percent." Which two of the three principles of economy-wide interaction are at work in this statement?
14. In August 2007, a sharp downturn in the U.S. housing market reduced the income of many who worked in the home construction industry. A *Wall Street Journal* news article reported that Wal-Mart's wire-transfer business was likely to suffer because many construction workers are Hispanics who regularly send part of their wages back to relatives in their home countries via Wal-Mart. With this information, use one of the principles of economy-wide interaction to trace a chain of links that explains how reduced spending for U.S. home purchases is likely to affect the performance of the Mexican economy.
15. In 2005, Hurricane Katrina caused massive destruction to the U.S. Gulf Coast. Tens of thousands of people lost their homes and possessions. Even those who weren't directly affected by the destruction were hurt because businesses and jobs dried up. Using one of the principles of economy-wide interaction, explain how government intervention can help in this situation.
16. During the Great Depression, food was left to rot in the fields or fields that had once been actively cultivated were left fallow. Use one of the principles of economy-wide interaction to explain how this could have occurred.



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>> Economic Models: Trade-offs and Trade

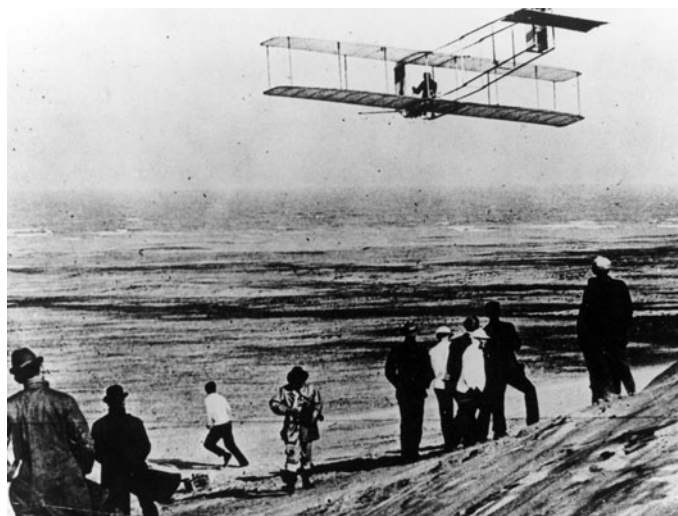
TUNNEL VISION

IN 1901 WILBUR AND ORVILLE WRIGHT BUILT something that would change the world. No, not the airplane—their successful flight at Kitty Hawk would come two years later. What made the Wright brothers true visionaries was their wind tunnel, an apparatus that let them experiment with many different designs for wings and control surfaces. These experiments gave them the knowledge that would make heavier-than-air flight possible.

A miniature airplane sitting motionless in a wind tunnel isn't the same thing as an actual aircraft in flight. But it is a very useful model of a flying plane—a simplified representation of the real thing that can be used to answer crucial questions, such as how much lift a given wing shape will generate at a given air-speed.

Needless to say, testing an airplane design in a wind tunnel is cheaper and safer than building a full-scale version and hoping it will fly. More generally, models play a crucial role in almost all scientific research—economics very much included.

In fact, you could say that economic theory consists mainly of a collection of models, a series of simplified representations of economic reality that allow us to understand a variety of economic issues. In this chapter, we will look at two economic models that are crucially important in their own right and also illustrate why such models are so useful. We'll conclude with a look at how economists actually use models in their work.



Clearly, the Wright brothers believed in their model.

WHAT YOU WILL LEARN IN THIS CHAPTER:

- Why **models**—simplified representations of reality—play a crucial role in economics
- Two simple but important models: the **production possibility frontier** and **comparative advantage**
- The **circular-flow diagram**, a schematic representation of the economy
- The difference between **positive economics**, which tries to describe the economy and predict its behavior, and **normative economics**, which tries to prescribe economic policy
- When economists agree and why they sometimes disagree

A **model** is a simplified representation of a real situation that is used to better understand real-life situations.

The **other things equal assumption** means that all other relevant factors remain unchanged.

Models in Economics: Some Important Examples

A **model** is any simplified representation of reality that is used to better understand real-life situations. But how do we create a simplified representation of an economic situation?

One possibility—an economist’s equivalent of a wind tunnel—is to find or create a real but simplified economy. For example, economists interested in the economic role of money have studied the system of exchange that developed in World War II prison camps, in which cigarettes became a universally accepted form of payment even among prisoners who didn’t smoke.

Another possibility is to simulate the workings of the economy on a computer. For example, when changes in tax law are proposed, government officials use *tax models*—large mathematical computer programs—to assess how the proposed changes would affect different types of people.

Models are important because their simplicity allows economists to focus on the effects of only one change at a time. That is, they allow us to hold everything else constant and study how one change affects the overall economic outcome. So an important assumption when building economic models is the **other things equal assumption**, which means that all other relevant factors remain unchanged.

But you can’t always find or create a small-scale version of the whole economy, and a computer program is only as good as the data it uses. (Programmers have a saying: garbage in, garbage out.) For many purposes, the most effective form of economic modeling is the construction of “thought experiments”: simplified, hypothetical versions of real-life situations.

In Chapter 1 we illustrated the concept of equilibrium with the example of how customers at a supermarket would rearrange themselves when a new cash register opens. Though we didn’t say it, this was an example of a simple model—an imaginary

FOR INQUIRING MINDS

Models for Money

What’s an economic model worth, anyway? In some cases, quite a lot of money.

Although many economic models are developed for purely scientific purposes, others are developed to help governments make economic policies. And there is a growing business in developing economic models to help corporations make decisions.

Who models for money? There are dozens of consulting firms that use models to predict future trends, offer advice based on their models, or develop custom models for business and government clients. A notable example is Global Insight, the world’s biggest economic consulting firm. It was created by a merger between Data Resources, Inc., founded by professors from Harvard and MIT, and Wharton Economic Forecasting Associates, founded by professors at the University of Pennsylvania.

One particularly lucrative branch of economics is finance theory, which helps investors figure out what assets, such as

shares in a company, are worth. Finance theorists often become highly paid “rocket scientists” at big Wall Street firms because financial models demand a high level of technical expertise.

Unfortunately, the most famous business application of finance theory came spectacularly to grief. In 1994 a group of Wall Street traders teamed up with famous finance theorists—including two Nobel Prize winners—to form Long-Term Capital Management (LTCM), a fund that used sophisticated financial models to invest the money of wealthy clients. At first, the fund did very well. But in 1998 bad economic news from all over the world—with countries as disparate as Russia, Japan, and Brazil in financial trouble at the same time—inflicted huge losses on LTCM’s investments. For a few anxious days, many people feared not only that the fund would collapse but also that it would bring many other companies down with it. Thanks in

part to a rescue operation organized by government officials, this did not happen; but LTCM was closed a few months later, having lost millions of dollars and with some of its investors losing most of the money they had put in.

What went wrong? Partly it was bad luck. But experienced hands also faulted the economists at LTCM for taking too many risks. Although LTCM’s models indicated that a run of bad news like the one that actually happened was extremely unlikely, a sensible economist knows that sometimes even the best model misses important possibilities.

Interestingly, a similar phenomenon occurred in the summer of 2007, when problems in the financial market for home mortgage loans caused severe losses for several investment funds. It turns out that these funds had made the same mistake as LTCM—omitting from their models the possibility of a severe downturn in the home mortgage loan market.

supermarket, in which many details were ignored (what are the customers buying? never mind), that could be used to answer a “what if” question: what if another cash register were opened?

As the cash register story showed, it is often possible to describe and analyze a useful economic model in plain English. However, because much of economics involves changes in quantities—in the price of a product, the number of units produced, or the number of workers employed in its production—economists often find that using some mathematics helps clarify an issue. In particular, a numerical example, a simple equation, or—especially—a graph can be key to understanding an economic concept.

Whatever form it takes, a good economic model can be a tremendous aid to understanding. The best way to grasp this point is to consider some simple but important economic models and what they tell us. First, we will look at the *production possibility frontier*, a model that helps economists think about the trade-offs every economy faces. Then we will turn to *comparative advantage*, a model that clarifies the principle of gains from trade—trade both between individuals and between countries. In addition, we’ll examine the *circular-flow diagram*, a schematic representation that helps us understand how flows of money, goods, and services are channeled through the economy.

In discussing these models, we make considerable use of graphs to represent mathematical relationships. Such graphs will play an important role throughout this book. If you are already familiar with the use of graphs, the material that follows should not present any problem. If you are not, this would be a good time to turn to the appendix of this chapter, which provides a brief introduction to the use of graphs in economics.

Trade-offs: The Production Possibility Frontier

The hit movie *Cast Away*, starring Tom Hanks, was an update of the classic story of Robinson Crusoe, the hero of Daniel Defoe’s eighteenth-century novel. Hanks played the sole survivor of a plane crash, stranded on a remote island. As in the original story of Robinson Crusoe, the character played by Hanks had limited resources: the natural resources of the island, a few items he managed to salvage from the plane, and, of course, his own time and effort. With only these resources, he had to make a life. In effect, he became a one-man economy.

The first principle of economics we introduced in Chapter 1 was that resources are scarce and that, as a result, any economy—whether it contains one person or millions of people—faces trade-offs. For example, if a castaway devotes resources to catching fish, he cannot use those same resources to gather coconuts.

To think about the trade-offs that face any economy, economists often use the model known as the **production possibility frontier**. The idea behind this model is to improve our understanding of trade-offs by considering a simplified economy that produces only two goods. This simplification enables us to show the trade-off graphically.

Figure 2-1 on the next page shows a hypothetical production possibility frontier for Tom, a castaway alone on an island, who must make a trade-off between production of fish and production of coconuts. The frontier—the line in the diagram—shows the maximum quantity of fish Tom can catch during a week given the quantity of coconuts he gathers, and vice versa. That is, it answers questions of the form, “What is the maximum quantity of fish Tom can catch if he also gathers 9 (or 15, or 30) coconuts?”

There is a crucial distinction between points *inside* or *on* the production possibility frontier (the shaded area) and *outside* the frontier. If a production point lies inside or on the frontier—like point C, at which Tom catches 20 fish and gathers 9 coconuts—it is feasible. After all, the frontier tells us that if Tom catches 20 fish, he could also gather a maximum of 15 coconuts, so he could

The **production possibility frontier** illustrates the trade-offs facing an economy that produces only two goods. It shows the maximum quantity of one good that can be produced for any given quantity produced of the other.

What to do? Even a castaway faces trade-offs.

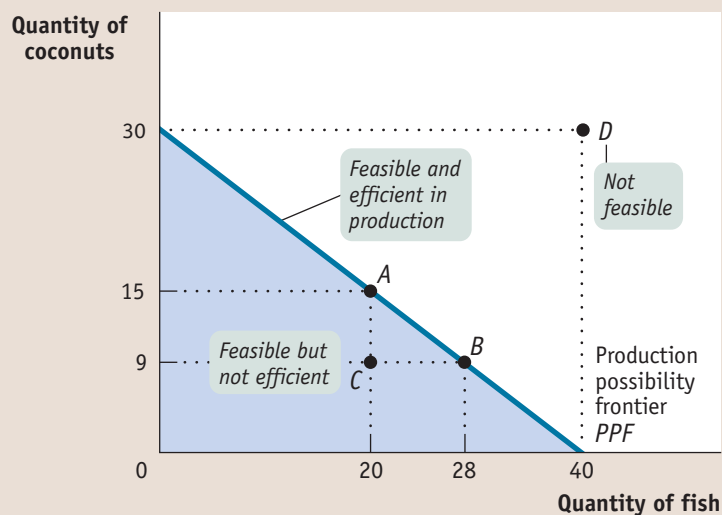


Photo by 20th Century FOX Photo/ZUMA Press. © Copyright 2002 by 20th Century FOX

FIGURE 2-1

The Production Possibility Frontier

The production possibility frontier illustrates the trade-offs facing an economy that produces two goods. It shows the maximum quantity of one good that can be produced given the quantity of the other good produced. Here, the maximum quantity of coconuts that Tom can gather depends on the quantity of fish he catches, and vice versa. His feasible production is shown by the area *inside or on* the curve. Production at point *C* is feasible but not efficient. Points *A* and *B* are feasible and efficient in production, but point *D* is not feasible.



certainly gather 9 coconuts. However, a production point that lies outside the frontier—such as the hypothetical production point *D*, where Tom catches 40 fish and gathers 30 coconuts—isn't feasible. (In this case, Tom could catch 40 fish and gather no coconuts *or* he could gather 30 coconuts and catch no fish, but he can't do both.)

In Figure 2-1 the production possibility frontier intersects the horizontal axis at 40 fish. This means that if Tom devoted all his resources to catching fish, he would catch 40 fish per week but would have no resources left over to gather coconuts. The production possibility frontier intersects the vertical axis at 30 coconuts. This means that if Tom devoted all his resources to gathering coconuts, he could gather 30 coconuts per week but would have no resources left over to catch fish.

The figure also shows less extreme trade-offs. For example, if Tom decides to catch 20 fish, he is able to gather at most 15 coconuts; this production choice is illustrated by point *A*. If Tom decides to catch 28 fish, he can gather at most only 9 coconuts, as shown by point *B*.

Thinking in terms of a production possibility frontier simplifies the complexities of reality. The real-world economy produces millions of different goods. Even a castaway on an island would produce more than two different items (for example, he would need clothing and housing as well as food). But in this model we imagine an economy that produces only two goods.

By simplifying reality, however, the production possibility frontier helps us understand some aspects of the real economy better than we could without the model: efficiency, opportunity cost, and economic growth.

Efficiency First of all, the production possibility frontier is a good way to illustrate the general economic concept of *efficiency*. Recall from Chapter 1 that an economy is efficient if there are no missed opportunities—there is no way to make some people better off without making other people worse off.

One key element of efficiency is that there are no missed opportunities in production—there is no way to produce more of one good without producing less of other goods. As long as Tom is on the production possibility frontier, his production is efficient. At point *A*, the 15 coconuts he gathers are the maximum quantity he can get *given* that he has chosen to catch 20 fish; at point *B*, the 9 coconuts he gathers are the maximum he can get *given* his choice to catch 28 fish; and so on. If an economy is producing at a point on its production possibility frontier, we say that the economy is *efficient in production*.

But suppose that for some reason Tom was at point C, producing 20 fish and 9 coconuts. Then this one-person economy would definitely not be efficient in production, and would therefore be *inefficient*: it could be producing more of both goods. Another example of this occurs when people are involuntarily unemployed: they want to work but are unable to find jobs. When that happens, the economy is not efficient in production because it could be producing more output if these people were employed.

Although the production possibility frontier helps clarify what it means for an economy to be efficient in production, it's important to understand that efficiency in production is only *part* of what's required for the economy as a whole to be efficient. Efficiency also requires that the economy allocate its resources so that consumers are as well off as possible. If an economy does this, we say that it is *efficient in allocation*. To see why efficiency in allocation is as important as efficiency in production, notice that points A and B in Figure 2-1 both represent situations in which the economy is efficient in production, because in each case it can't produce more of one good without producing less of the other. But these two situations may not be equally desirable. Suppose that Tom prefers point B to point A—that is, he would rather consume 28 fish and 9 coconuts than 20 fish and 15 coconuts. Then point A is inefficient from the point of view of the economy as a whole: it's possible to make Tom better off without making anyone else worse off. (Of course, in this castaway economy there isn't anyone else: Tom is all alone.)

This example shows that efficiency for the economy as a whole requires *both* efficiency in production and efficiency in allocation: to be efficient, an economy must produce as much of each good as it can given the production of other goods, and it must also produce the mix of goods that people want to consume. In the real world, command economies, such as the former Soviet Union, were notorious for inefficiency in allocation. For example, it was common for consumers to find a store stocked with a few odd items of merchandise, but lacking such basics as soap and toilet paper.

Opportunity Cost The production possibility frontier is also useful as a reminder of the fundamental point that the true cost of any good is not just the amount of money it costs to buy, but everything else in addition to money that must be given up in order to get that good—the *opportunity cost*. If, for example, Tom decides to go from point A to point B, he will produce 8 more fish but 6 fewer coconuts. So the opportunity cost of those 8 fish is the 6 coconuts not gathered. Since 8 extra fish have an opportunity cost of 6 coconuts, each 1 fish has an opportunity cost of $\frac{6}{8} = \frac{3}{4}$ of a coconut.

Is the opportunity cost of an extra fish in terms of coconuts always the same, no matter how many fish Tom catches? In the example illustrated by Figure 2-1, the answer is yes. If Tom increases his catch from 28 to 40 fish, the number of coconuts he gathers falls from 9 to zero. So his opportunity cost per additional fish is $\frac{9}{12} = \frac{3}{4}$ of a coconut, the same as it was when he went from 20 fish caught to 28. However, the fact that in this example the opportunity cost of an additional fish in terms of coconuts is always the same is a result of an assumption we've made, an assumption that's reflected in how Figure 2-1 is drawn. Specifically, whenever we assume that the opportunity cost of an additional unit of a good doesn't change regardless of the output mix, the production possibility frontier is a straight line.

Moreover, as you might have already guessed, the slope of a straight-line production possibility frontier is equal to the opportunity cost—specifically, the opportunity cost for the good measured on the horizontal axis in terms of the good measured on the vertical axis. In Figure 2-1, the production possibility frontier has a *constant slope* of $-\frac{3}{4}$, implying that Tom faces a *constant opportunity cost* for 1 fish equal to $\frac{3}{4}$ of a coconut. (A review of how to calculate the slope of a straight line is found in this chapter's appendix.) This is the simplest case, but the production possibility frontier model can also be used to examine situations in which opportunity costs change as the mix of output changes.

FIGURE 2-2

Increasing Opportunity Cost

The bowed-out shape of the production possibility frontier reflects increasing opportunity cost. In this example, to produce the first 20 fish, Tom must give up 5 coconuts. But to produce an additional 20 fish, he must give up 25 more coconuts.

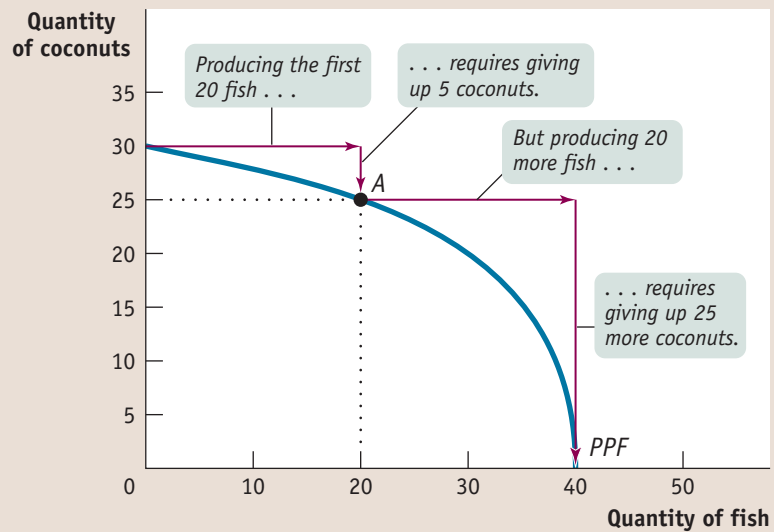


Figure 2-2 illustrates a different assumption, a case in which Tom faces *increasing opportunity cost*. Here, the more fish he catches, the more coconuts he has to give up to catch an additional fish, and vice versa. For example, to go from producing zero fish to producing 20 fish, he has to give up 5 coconuts. That is, the opportunity cost of those 20 fish is 5 coconuts. But to increase his fish production to 40—that is, to produce an additional 20 fish—he must give up 25 more coconuts, a much higher opportunity cost. As you can see in Figure 2-2, when opportunity costs are increasing rather than constant, the production possibility frontier is a bowed-out curve rather than a straight line.

Although it's often useful to work with the simple assumption that the production possibility frontier is a straight line, economists believe that in reality opportunity costs are typically increasing. When only a small amount of a good is produced, the opportunity cost of producing that good is relatively low because the economy needs to use only those resources that are especially well suited for its production. For example, if an economy grows only a small amount of corn, that corn can be grown in places where the soil and climate are perfect for corn-growing but less suitable for growing anything else, like wheat. So growing that corn involves giving up only a small amount of potential wheat output. Once the economy grows a lot of corn, however, land that is well suited for wheat but isn't so great for corn must be used to produce corn anyway. As a result, the additional corn production involves sacrificing considerably more wheat production. In other words, as more of a good is produced, its opportunity cost typically rises because well-suited inputs are used up and less adaptable inputs must be used instead.

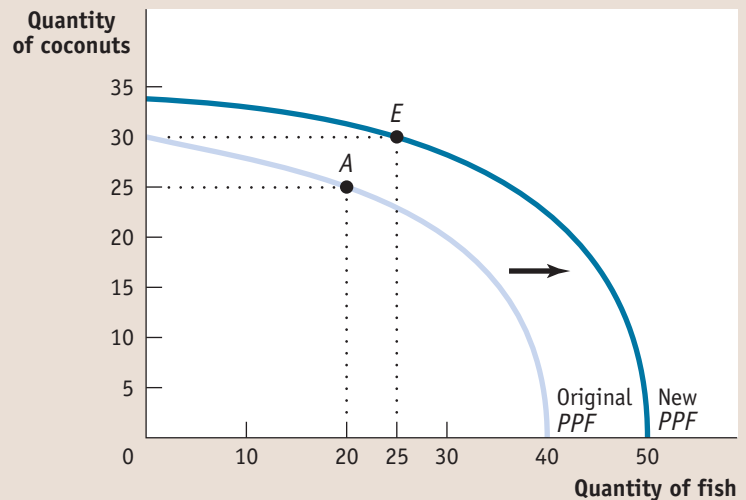
Economic Growth Finally, the production possibility frontier helps us understand what it means to talk about *economic growth*. We introduced the concept of economic growth in the Introduction, defining it as *the growing ability of the economy to produce goods and services*. As we saw, economic growth is one of the fundamental features of the real economy. But are we really justified in saying that the economy has grown over time? After all, although the U.S. economy produces more of many things than it did a century ago, it produces less of other things—for example, horse-drawn carriages. Production of many goods, in other words, is actually down. So how can we say for sure that the economy as a whole has grown?

The answer, illustrated in Figure 2-3, is that economic growth means an *expansion of the economy's production possibilities*: the economy *can* produce more of everything. For example, if Tom's production is initially at point A (20 fish and 25 coconuts),

FIGURE 2-3

Economic Growth

Economic growth results in an *outward shift* of the production possibility frontier because production possibilities are expanded. The economy can now produce more of everything. For example, if production is initially at point A (20 fish and 25 coconuts), it could move to point E (25 fish and 30 coconuts).



economic growth means that he could move to point E (25 fish and 30 coconuts). E lies outside the original frontier; so in the production possibility frontier model, growth is shown as an outward shift of the frontier.

What can lead the production possibility frontier to shift outward? There are basically two sources of economic growth. One is an increase in the economy's **factors of production**, the resources used to produce goods and services. Economists usually use the term *factor of production* to refer to a resource that is not used up in production. For example, workers use sewing machines to convert cloth into shirts; the workers and the sewing machines are factors of production, but the cloth is not. Once a shirt is made, a worker and a sewing machine can be used to make another shirt; but the cloth used to make one shirt cannot be used to make another. Broadly speaking, the main factors of production are the resources land, labor, capital, and human capital. Land is a resource supplied by nature; labor is the economy's pool of workers; capital refers to "created" resources such as machines and buildings; and human capital refers to the educational achievements and skills of the labor force, which enhance its productivity. Of course, each of these is really a category rather than a single factor: land in North Dakota is quite different from land in Florida.

To see how adding to an economy's factors of production leads to economic growth, suppose that Tom finds a fishing net washed ashore on the beach that is larger than the net he currently uses. The fishing net is a factor of production, a resource he can use to produce more fish in the course of a day spent fishing. We can't say how many more fish Tom will catch; that depends on how much time he decides to spend fishing now that he has the larger net. But because the larger net makes his fishing more productive, he can catch more fish without reducing the number of coconuts he gathers, or gather more coconuts without reducing his fish catch. So his production possibility frontier shifts outward.

The other source of economic growth is progress in **technology**, the technical means for the production of goods and services. Suppose Tom figures out a better way either to catch fish or to gather coconuts—say, by inventing a fishing hook or a wagon for transporting coconuts. Either invention would shift his production possibility frontier outward. In real-world economies, innovations in the techniques we use to produce goods and services have been a crucial force behind economic growth.

Again, economic growth means an increase in what the economy *can* produce. What the economy actually produces depends on the choices people make. After his production possibilities expand, Tom might not choose to produce both more fish and more

Factors of production are resources used to produce goods and services.

Technology is the technical means for producing goods and services.

coconuts—he might choose to increase production of only one good, or he might even choose to produce less of one good. For example, if he gets better at catching fish, he might decide to go on an all-fish diet and skip the coconuts—just as the introduction of motor vehicles led most people to give up on horse-drawn carriages. But even if, for some reason, he chooses to produce either fewer coconuts or fewer fish than before, we would still say that his economy has grown—because he *could* have produced more of everything.

The production possibility frontier is a very simplified model of an economy. Yet it teaches us important lessons about real-life economies. It gives us our first clear sense of what constitutes economic efficiency, it illustrates the concept of opportunity cost, and it makes clear what economic growth is all about.

Comparative Advantage and Gains from Trade

Among the twelve principles of economics described in Chapter 1 was the principle of *gains from trade*—the mutual gains that individuals can achieve by specializing in doing different things and trading with one another. Our second illustration of an economic model is a particularly useful model of gains from trade—trade based on *comparative advantage*.

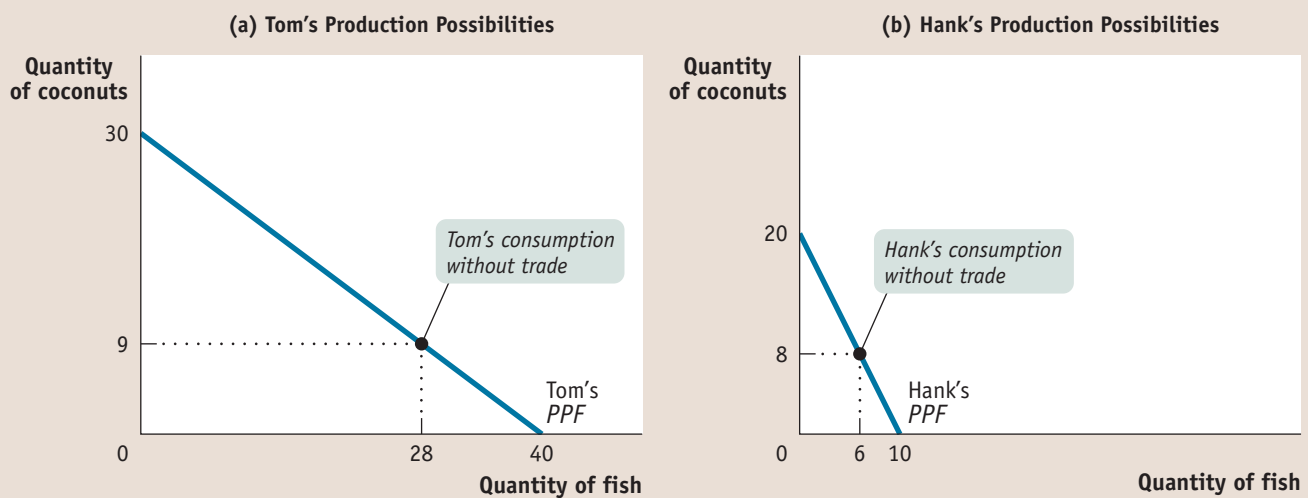
Let's stick with Tom stranded on his island, but now let's suppose that a second castaway, who just happens to be named Hank, is washed ashore. Can they benefit from trading with each other?

It's obvious that there will be potential gains from trade if the two castaways do different things particularly well. For example, if Tom is a skilled fisherman and Hank is very good at climbing trees, clearly it makes sense for Tom to catch fish and Hank to gather coconuts—and for the two men to trade the products of their efforts.

But one of the most important insights in all of economics is that there are gains from trade even if one of the trading parties isn't especially good at anything. Suppose, for example, that Hank is less well suited to primitive life than Tom; he's not nearly as good at catching fish, and compared to Tom even his coconut-gathering leaves something to be desired. Nonetheless, what we'll see is that both Tom and Hank can live better by trading with each other than either could alone.

For the purposes of this example, let's go back to the simpler case of straight-line production possibility frontiers. Tom's production possibilities are represented by the

FIGURE 2-4 Production Possibilities for Two Castaways



Here, each of the two castaways has a constant opportunity cost of fish and a straight-line production possibility frontier. In Tom's case, each fish always has an opportunity

cost of $\frac{3}{4}$ of a coconut. In Hank's case, each fish always has an opportunity cost of 2 coconuts.

production possibility frontier in panel (a) of Figure 2-4, which is the same as the production possibility frontier in Figure 2-1. According to this diagram, Tom could catch 40 fish, but only if he gathered no coconuts, and could gather 30 coconuts, but only if he caught no fish, as before. Recall that this means that the slope of his production possibility frontier is $-3/4$: his opportunity cost of 1 fish is $3/4$ of a coconut.

Panel (b) of Figure 2-4 shows Hank's production possibilities. Like Tom's, Hank's production possibility frontier is a straight line, implying a constant opportunity cost of fish in terms of coconuts. His production possibility frontier has a constant slope of -2 . Hank is less productive all around: at most he can produce 10 fish or 20 coconuts. But he is particularly bad at fishing; whereas Tom sacrifices $3/4$ of a coconut per fish caught, for Hank the opportunity cost of a fish is 2 whole coconuts. Table 2-1 summarizes the two castaways' opportunity costs of fish and coconuts.

Now, Tom and Hank could go their separate ways, each living on his own side of the island, catching his own fish and gathering his own coconuts. Let's suppose that they start out that way and make the consumption choices shown in Figure 2-4: in the absence of trade, Tom consumes 28 fish and 9 coconuts per week, while Hank consumes 6 fish and 8 coconuts.

But is this the best they can do? No, it isn't. Given that the two castaways have different opportunity costs, they can strike a deal that makes both of them better off.

Table 2-2 shows how such a deal works: Tom specializes in the production of fish, catching 40 per week, and gives 10 to Hank. Meanwhile, Hank specializes in the production of coconuts, gathering 20 per week, and gives 10 to Tom. The result is shown in Figure 2-5 on the next page. Tom now consumes more of both goods than before: instead of 28 fish and 9 coconuts, he consumes 30 fish and 10 coconuts. And Hank also consumes more, going from 6 fish and 8 coconuts to 10 fish and 10 coconuts. As Table 2-2 also shows, both Tom and Hank experience gains from trade: Tom's consumption of fish increases by two, and his consumption of coconuts increases by one. Hank's consumption of fish increases by four, and his consumption of coconuts increases by two.

So both castaways are better off when they each specialize in what they are good at and trade. It's a good idea for Tom to catch the fish for both of them because his opportunity cost of a fish is only $3/4$ of a coconut not gathered versus 2 coconuts for Hank. Correspondingly, it's a good idea for Hank to gather coconuts for both of them.

Or we could put it the other way around: Because Tom is so good at catching fish, his opportunity cost of gathering coconuts is high: $4/3$ of a fish not caught for every coconut gathered. Because Hank is a pretty poor fisherman, his opportunity cost of gathering coconuts is much less, only $1/2$ of a fish per coconut.

What we would say in this case is that Tom has a comparative advantage in catching fish and Hank has a comparative advantage in gathering coconuts. An individual has a **comparative advantage** in producing something if the opportunity cost of that production is lower for that individual than for other people. In other words, Hank has a comparative advantage over Tom in producing a particular good or service if Hank's opportunity cost of producing that good or service is lower than Tom's.

An individual has a **comparative advantage** in producing a good or service if the opportunity cost of producing the good or service is lower for that individual than for other people.

TABLE 2-1

Tom's and Hank's Opportunity Costs of Fish and Coconuts

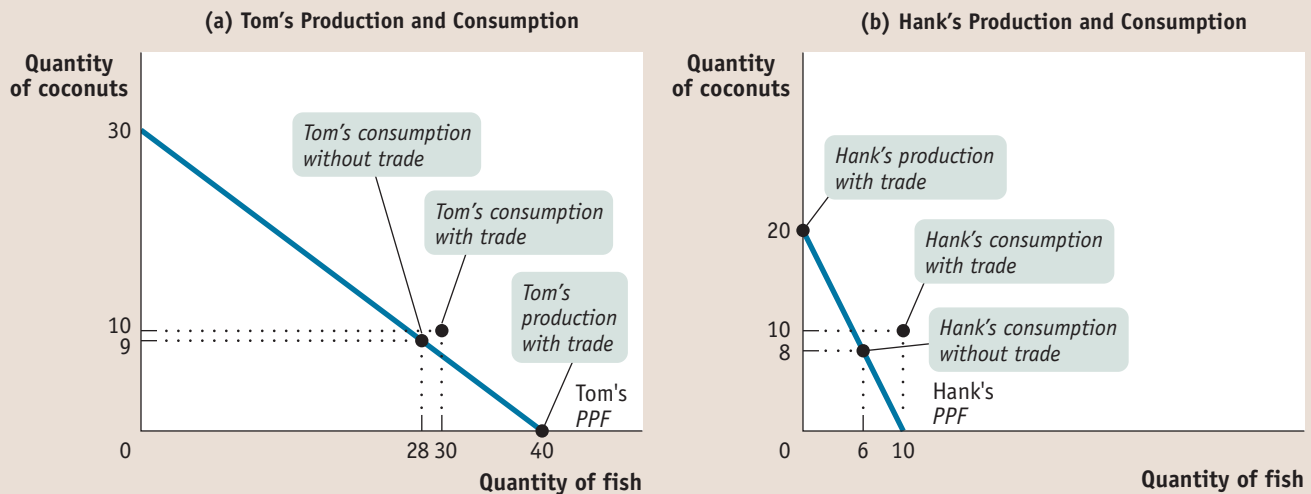
	Tom's Opportunity Cost	Hank's Opportunity Cost
One fish	$3/4$ coconut	2 coconuts
One coconut	$4/3$ fish	$1/2$ fish

TABLE 2-2

How the Castaways Gain from Trade

	Without Trade		With Trade		Gains from Trade
	Production	Consumption	Production	Consumption	
Tom	Fish	28	40	30	+2
	Coconuts	9	0	10	+1
Hank	Fish	6	0	10	+4
	Coconuts	8	20	10	+2

FIGURE 2-5 Comparative Advantage and Gains From Trade



By specializing and trading, the two castaways can produce and consume more of both goods. Tom specializes in catching fish, his comparative advantage, and Hank—who has an *absolute* disadvantage in both goods but a

comparative advantage in coconuts—specializes in gathering coconuts. The result is that each castaway can consume more of both goods than either could without trade.

One point of clarification before we proceed further. You may have wondered why Tom and Hank traded 10 fish for 10 coconuts. Why not some other deal, like trading 15 coconuts for 5 fish? The answer to that question has two parts. First, there may indeed be deals other than 10 fish for 10 coconuts that Tom and Hank are willing to agree to. Second, there are some deals that we can, however, safely rule out—one like 15 coconuts for 5 fish. To understand why, reexamine Table 2-1 and consider Hank first. When Hank works on his own without trading with Tom, his opportunity cost of 1 fish is 2 coconuts. Therefore, it's clear that Hank will not accept any deal with Tom in which he must give up more than 2 coconuts per fish—otherwise, he's better off not trading at all. So we can rule out a deal that requires Hank to pay 3 coconuts per fish—such as trading 15 coconuts for 5 fish. But Hank will accept a trade in which he pays less than 2 coconuts per fish—such as paying 1 coconut for 1 fish. Likewise, Tom will reject a deal that requires him to give up more than $\frac{4}{3}$ of a fish per coconut. For example, Tom would refuse a trade that required him to give up 10 fish for 6 coconuts. But he will accept a deal where he pays less than $\frac{4}{3}$ of a fish per coconut—and 1 fish for 1 coconut works. You can check for yourself why a trade of 1 fish for 1.5 coconuts would also be acceptable to both Tom and Hank. So the point to remember is that Tom and Hank will be willing to engage in a trade only if the “price” of the good each person is obtaining from the trade is less than his own opportunity cost of producing the good himself. Moreover, that's a general statement that is true whenever two parties trade voluntarily.

The story of Tom and Hank clearly simplifies reality. Yet it teaches us some very important lessons that apply to the real economy, too.

First, the model provides a clear illustration of the gains from trade: by agreeing to specialize and provide goods to each other, Tom and Hank can produce more and therefore both be better off than if they tried to be self-sufficient.

Second, the model demonstrates a very important point that is often overlooked in real-world arguments: as long as people have different opportunity costs, *everyone has a comparative advantage in something, and everyone has a comparative disadvantage in something.*

Notice that in our example Tom is actually better than Hank at producing both goods: Tom can catch more fish in a week, and he can also gather more coconuts. That is, Tom has an **absolute advantage** in both activities: he can produce more output with a given amount of input (in this case, his time) than Hank. You might therefore be tempted to think that Tom has nothing to gain from trading with the less competent Hank.

But we've just seen that Tom can indeed benefit from a deal with Hank because *comparative*, not *absolute*, advantage is the basis for mutual gain. It doesn't matter that it takes Hank more time to gather a coconut; what matters is that for him the opportunity cost of that coconut in terms of fish is lower. So Hank, despite his absolute disadvantage, even in coconuts, has a comparative advantage in coconut-gathering. Meanwhile Tom, who can use his time better by catching fish, has a comparative *disadvantage* in coconut-gathering.

If comparative advantage were relevant only to castaways, it might not be that interesting. In fact, however, the idea of comparative advantage applies to many activities in the economy. Perhaps its most important application is to trade—not between individuals, but between countries. So let's look briefly at how the model of comparative advantage helps in understanding both the causes and the effects of international trade.

Comparative Advantage and International Trade

Look at the label on a manufactured good sold in the United States, and there's a good chance you will find that it was produced in some other country—in China, or Japan, or even in Canada, eh? On the other side, many U.S. industries sell a large fraction of their output overseas. (This is particularly true of agriculture, high technology, and entertainment.)

Should all this international exchange of goods and services be celebrated, or is it cause for concern? Politicians and the public often question the desirability of international trade, arguing that the nation should produce goods for itself rather than buying them from foreigners. Industries around the world demand protection from foreign competition: Japanese farmers want to keep out American rice, American steelworkers want to keep out European steel. And these demands are often supported by public opinion.

Economists, however, have a very positive view of international trade. Why? Because they view it in terms of comparative advantage.

Figure 2-6 on the next page shows, with a simple example, how international trade can be interpreted in terms of comparative advantage. Although the example as constructed is hypothetical, it is based on an actual pattern of international trade: American exports of pork to Canada and Canadian exports of aircraft to the United States. Panels (a) and (b) illustrate hypothetical production possibility frontiers for the United States and Canada, with pork measured on the horizontal axis and aircraft measured on the vertical axis. The U.S. production possibility frontier is flatter than the Canadian frontier, implying that producing one more ton of pork costs a lot fewer aircraft in the United States than it does in Canada. This means that the United States has a comparative advantage in pork and Canada has a comparative advantage in aircraft.

Although the consumption points in Figure 2-6 are hypothetical, they illustrate a general principle: just like the example of Tom and Hank, the United States and Canada can both achieve mutual gains from trade. If the United States concentrates on producing pork and ships some of its output to Canada, while Canada concentrates on aircraft and ships some of its output to the United States, both countries can consume more than if they insisted on being self-sufficient.

An individual has an **absolute advantage** in an activity if he or she can do it better than other people. Having an absolute advantage is not the same thing as having a comparative advantage.

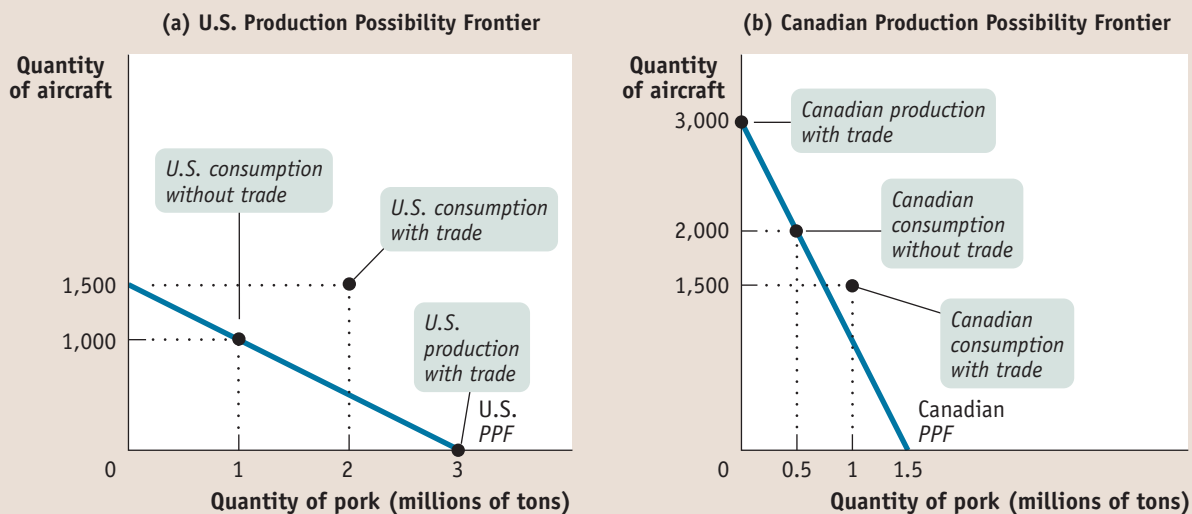
PITFALLS

MISUNDERSTANDING COMPARATIVE ADVANTAGE

Students do it, pundits do it, and politicians do it all the time: they confuse *comparative* advantage with *absolute* advantage. For example, back in the 1980s, when the U.S. economy seemed to be lagging behind that of Japan, one often heard commentators warn that if we didn't improve our productivity, we would soon have no comparative advantage in anything.

What those commentators meant was that we would have no *absolute* advantage in anything—that there might come a time when the Japanese were better at everything than we were. (It didn't turn out that way, but that's another story.) And they had the idea that in that case we would no longer be able to benefit from trade with Japan.

But just as Hank is able to benefit from trade with Tom (and vice versa) despite the fact that Tom is better at everything, nations can still gain from trade even if they are less productive in all industries than the countries they trade with.

FIGURE 2-6 Comparative Advantage and International Trade

In this hypothetical example, Canada and the United States produce only two goods: pork and aircraft. Aircraft are measured on the vertical axis and pork on the horizontal axis. Panel (a) shows the U.S. production possibility frontier. It is relatively flat, implying that the United States has a comparative advantage in

pork production. Panel (b) shows the Canadian production possibility frontier. It is relatively steep, implying that Canada has a comparative advantage in aircraft production. Just like two individuals, both countries gain from specialization and trade.

Moreover, these mutual gains don't depend on each country being better at producing one kind of good. Even if one country has, say, higher output per person-hour in both industries—that is, even if one country has an absolute advantage in both industries—there are still mutual gains from trade.



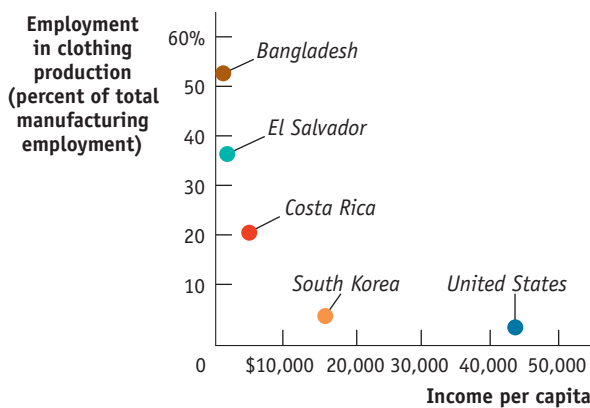
PAJAMA REPUBLICS

Poor countries tend to have low productivity in clothing manufacture, but even lower productivity in other industries (see the upcoming Economics in Action). As a result, they have a comparative advantage in clothing production, which actually dominates the industries of some very poor countries. An official from one such country once joked, "We are not a banana republic—we are a pajama republic."

This figure, which compares per capita income (the total income of the country divided by the size of the population) with the share of the clothing industry in manufacturing employment, shows just how strong this effect is.

According to a U.S. Department of Commerce assessment, Bangladesh's clothing industry has "low productivity, largely low literacy levels, frequent labor unrest, and outdated technology." Yet it devotes most of its manufacturing workforce to clothing, the sector in which it nonetheless has a comparative advantage because its productivity in nonclothing industries is even lower. The same assessment describes Costa Rica as having "relatively high productivity" in clothing—yet

a much smaller and declining fraction of Costa Rica's workforce is employed in clothing production. That's because productivity in nonclothing industries is somewhat higher in Costa Rica than in Bangladesh.



Source: World Bank, World Development Indicators; Nicita A. and M. Olarreaga "Trade, Production and Protection 1976–2004," *World Bank Economic Review* 21 no. 1 (2007): 165–171.

Transactions: The Circular-Flow Diagram

The little economy created by Tom and Hank on their island lacks many features of the modern American economy. For one thing, though millions of Americans are self-employed, most workers are employed by someone else, usually a company with hundreds or thousands of employees. Also, Tom and Hank engage only in the simplest of economic transactions, **barter**, in which an individual directly trades a good or service he or she has for a good or service he or she wants. In the modern economy, simple barter is rare: usually people trade goods or services for money—pieces of colored paper with no inherent value—and then trade those pieces of colored paper for the goods or services they want. That is, they sell goods or services and buy other goods or services.

And they both sell and buy a lot of different things. The U.S. economy is a vastly complex entity, with more than a hundred million workers employed by millions of companies, producing millions of different goods and services. Yet you can learn some very important things about the economy by considering the simple graphic shown in Figure 2-7, the **circular-flow diagram**. This diagram represents the transactions that take place in an economy by two kinds of flows around a circle: flows of physical things such as goods, services, labor, or raw materials in one direction, and flows of money that pay for these physical things in the opposite direction. In this case the physical flows are shown in yellow, the money flows in green.

The simplest circular-flow diagram illustrates an economy that contains only two kinds of “inhabitants”: **households** and **firms**. A household consists of either an individual or a group of people (usually, but not necessarily, a family) that share their income. A firm is an organization (usually, but not necessarily, a corporation) that produces goods and services for sale—and that employs members of households.

As you can see in Figure 2-7, there are two kinds of markets in this simple economy. On one side (here the left side) there are **markets for goods and services** in which households buy the goods and services they want from firms. This produces a flow of goods and services to households and a return flow of money to firms.

On the other side, there are **factor markets** in which firms buy the resources they need to produce goods and services. Recall from earlier in the chapter that the main factors of production are land, labor, capital, and human capital.

Trade takes the form of **barter** when people directly exchange goods or services that they have for goods or services that they want.

The **circular-flow diagram** represents the transactions in an economy by flows around a circle.

A **household** is a person or a group of people that share their income.

A **firm** is an organization that produces goods and services for sale.

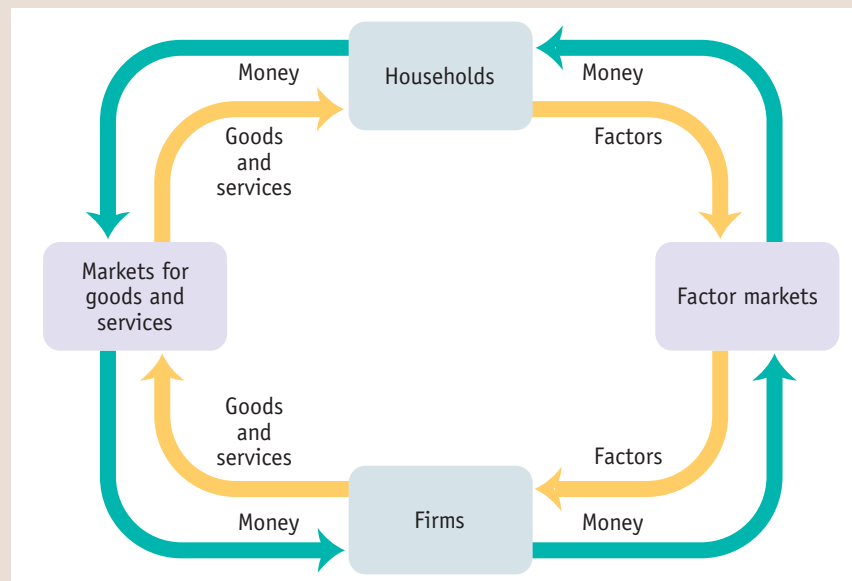
Firms sell goods and services that they produce to households in **markets for goods and services**.

Firms buy the resources they need to produce goods and services in **factor markets**.

FIGURE 2-7

The Circular-Flow Diagram

This diagram represents the flows of money and goods and services in the economy. In the markets for goods and services, households purchase goods and services from firms, generating a flow of money to the firms and a flow of goods and services to the households. The money flows back to households as firms purchase factors of production from the households in factor markets.



An economy's **income distribution** is the way in which total income is divided among the owners of the various factors of production.

The factor market most of us know best is the *labor market*, in which workers are paid for their time. Besides labor, we can think of households as owning and selling the other factors of production to firms. For example, when a corporation pays dividends to its stockholders, who are members of households, it is in effect paying them for the use of the machines and buildings that ultimately belong to those investors. In this case, the transactions are occurring in the *capital market*, the market in which capital is bought and sold. As we'll examine in detail later, factor markets ultimately determine an economy's **income distribution**, how the total income created in an economy is allocated between less skilled workers, highly skilled workers, and the owners of capital and land.

The circular-flow diagram ignores a number of real-world complications in the interests of simplicity. A few examples:

- In the real world, the distinction between firms and households isn't always that clear-cut. Consider a small, family-run business—a farm, a shop, a small hotel. Is this a firm or a household? A more complete picture would include a separate box for family businesses.
- Many of the sales firms make are not to households but to other firms; for example, steel companies sell mainly to other companies such as auto manufacturers, not to households. A more complete picture would include these flows of goods, services, and money within the business sector.
- The figure doesn't show the government, which in the real world diverts quite a lot of money out of the circular flow in the form of taxes but also injects a lot of money back into the flow in the form of spending.

Figure 2-7, in other words, is by no means a complete picture either of all the types of inhabitants of the real economy or of all the flows of money and physical items that take place among these inhabitants.

Despite its simplicity, the circular-flow diagram is a very useful aid to thinking about the economy.

►ECONOMICS IN ACTION



Rich Nation, Poor Nation

Try taking off your clothes—at a suitable time and in a suitable place, of course—and take a look at the labels inside that say where they were made. It's a very good bet that much, if not most, of your clothing was manufactured overseas, in a country that is much poorer than the United States—say, in El Salvador, Sri Lanka, or Bangladesh.

Why are these countries so much poorer than we are? The immediate reason is that their economies are much less *productive*—firms in these countries are just not able to produce as much from a given quantity of resources as comparable firms in the United States or other wealthy countries. Why countries differ so much in productivity is a deep question—indeed, one of the main questions that preoccupy economists. But in any case, the difference in productivity is a fact.

But if the economies of these countries are so much less productive than ours, how is it that they make so much of our clothing? Why don't we do it for ourselves?

The answer is “comparative advantage.” Just about every industry in Bangladesh is much less productive than the corresponding industry in the United States. But the productivity difference between rich and poor countries varies across goods; it is very large in the production of sophisticated goods like aircraft but not that large in the production of simpler goods like clothing. So Bangladesh's position with regard to clothing production is like Hank's position with respect to coconut-gathering: he's not as good at it as his fellow castaway, but it's the thing he does comparatively well.



Robert Nickelsberg/Getty Images

Although less productive than American workers, Bangladeshi workers have a comparative advantage in clothing production.

Bangladesh, though it is at an absolute disadvantage compared with the United States in almost everything, has a comparative advantage in clothing production. This means that both the United States and Bangladesh are able to consume more because they specialize in producing different things, with Bangladesh supplying our clothing and the United States supplying Bangladesh with more sophisticated goods. ▲

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▶ CHECK YOUR UNDERSTANDING 2-1

- True or false? Explain your answer.
 - An increase in the amount of resources available to Tom for use in producing coconuts and fish does not change his production possibility frontier.
 - A technological change that allows Tom to catch more fish for any amount of coconuts gathered results in a change in his production possibility frontier.
 - The production possibility frontier is useful because it illustrates how much of one good an economy must give up to get more of another good regardless of whether resources are being used efficiently.
- In Italy, an automobile can be produced by 8 workers in one day and a washing machine by 3 workers in one day. In the United States, an automobile can be produced by 6 workers in one day, and a washing machine by 2 workers in one day.
 - Which country has an absolute advantage in the production of automobiles? In washing machines?
 - Which country has a comparative advantage in the production of washing machines? In automobiles?
 - What pattern of specialization results in the greatest gains from trade between the two countries?
- Explain why Tom and Hank are willing to engage in a trade of 1 fish for 1.5 coconuts.
- Use the circular-flow diagram to explain how an increase in the amount of money spent by households results in an increase in the number of jobs in the economy. Describe in words what the circular-flow diagram predicts.

Solutions appear at back of book.

>> QUICK REVIEW

- Most economic **models** are “thought experiments” or simplified representations of reality, which rely on the **other things equal assumption**.
- An important economic model is the **production possibility frontier**, which illustrates the concepts of efficiency, opportunity cost, and economic growth.
- Comparative advantage** is a model that explains the source of gains from trade but is often confused with **absolute advantage**. Every person and every country has a comparative advantage in something, giving rise to gains from trade.
- In the simplest economies people **barter** rather than trade with money as in a modern economy. The **circular-flow diagram** illustrates transactions within the economy as flows of goods and services, **factors of production**, and money between **households** and **firms**. These transactions occur in **markets for goods and services** and **factor markets**. Ultimately, factor markets determine the economy’s **income distribution**, how total income is divided among the owners of the various factors of production.

Using Models

Economics, we have now learned, is mainly a matter of creating models that draw on a set of basic principles but add some more specific assumptions that allow the modeler to apply those principles to a particular situation. But what do economists actually *do* with their models?

Positive versus Normative Economics

Imagine that you are an economic adviser to the governor of your state. What kinds of questions might the governor ask you to answer?

Well, here are three possible questions:

- How much revenue will the tolls on the state turnpike yield next year?
- How much would that revenue increase if the toll were raised from \$1 to \$1.50?
- Should the toll be raised, bearing in mind that a toll increase will reduce traffic and air pollution near the road but will impose some financial hardship on frequent commuters?

There is a big difference between the first two questions and the third one. The first two are questions about facts. Your forecast of next year’s toll collection will be proved right or wrong when the numbers actually come in. Your estimate of the impact of a change in the toll is a little harder to check—revenue depends on other factors besides the toll, and it may be hard to disentangle the causes of any change in revenue. Still, in principle there is only one right answer.

Positive economics is the branch of economic analysis that describes the way the economy actually works.

Normative economics makes prescriptions about the way the economy should work.

A **forecast** is a simple prediction of the future.

But the question of whether tolls should be raised may not have a “right” answer—two people who agree on the effects of a higher toll could still disagree about whether raising the toll is a good idea. For example, someone who lives near the turnpike but doesn’t commute on it will care a lot about noise and air pollution but not so much about commuting costs. A regular commuter who doesn’t live near the turnpike will have the opposite priorities.

This example highlights a key distinction between two roles of economic analysis. Analysis that tries to answer questions about the way the world works, which have definite right and wrong answers, is known as **positive economics**. In contrast, analysis that involves saying how the world *should* work is known as **normative economics**. To put it another way, positive economics is about description, normative economics is about prescription.

Positive economics occupies most of the time and effort of the economics profession. And models play a crucial role in almost all positive economics. As we mentioned earlier, the U.S. government uses a computer model to assess proposed changes in national tax policy, and many state governments have similar models to assess the effects of their own tax policy.

It’s worth noting that there is a subtle but important difference between the first and second questions we imagined the governor asking. Question 1 asked for a simple prediction about next year’s revenue—a **forecast**. Question 2 was a “what if” question, asking how revenue would change if the tax law were to change. Economists are often called upon to answer both types of questions, but models are especially useful for answering “what if” questions.

The answers to such questions often serve as a guide to policy, but they are still predictions, not prescriptions. That is, they tell you what will happen if a policy is changed; they don’t tell you whether or not that result is good. Suppose that your economic model tells you that the governor’s proposed increase in highway tolls will raise property values in communities near the road but will hurt people who must use the turnpike to get to work. Does that make this proposed toll increase a good idea or a bad one? It depends on whom you ask. As we’ve just seen, someone who is very concerned with the communities near the road will support the increase, but someone who is very concerned with the welfare of drivers will feel differently. That’s a value judgment—it’s not a question of economic analysis.

Still, economists often do engage in normative economics and give policy advice. How can they do this when there may be no “right” answer?

One answer is that economists are also citizens, and we all have our opinions. But economic analysis can often be used to show that some policies are clearly better than others, regardless of anyone’s opinions.

Suppose that policies A and B achieve the same goal, but policy A makes everyone better off than policy B—or at least makes some people better off without making other people worse off. Then A is clearly more efficient than B. That’s not a value judgment: we’re talking about how best to achieve a goal, not about the goal itself.

For example, two different policies have been used to help low-income families obtain housing: rent control, which limits the rents landlords are allowed to charge, and rent subsidies, which provide families with additional money to pay rent. Almost all economists agree that subsidies are the more efficient policy. (In Chapter 5 we’ll see why this is so.) And so the great majority of economists, whatever their personal politics, favor subsidies over rent control.

When policies can be clearly ranked in this way, then economists generally agree. But it is no secret that economists sometimes disagree.

When and Why Economists Disagree

Economists have a reputation for arguing with each other. Where does this reputation come from?

One important answer is that media coverage tends to exaggerate the real differences in views among economists. If nearly all economists agree on an issue—for

example, the proposition that rent controls lead to housing shortages—reporters and editors are likely to conclude that there is no story worth covering, and so the professional consensus tends to go unreported. But when there is some issue on which prominent economists take opposing sides on the same issue—for example, whether cutting taxes right now would help the economy—that does make a good news story. So you hear much more about the areas of disagreement within economics than you do about the large areas of agreement.

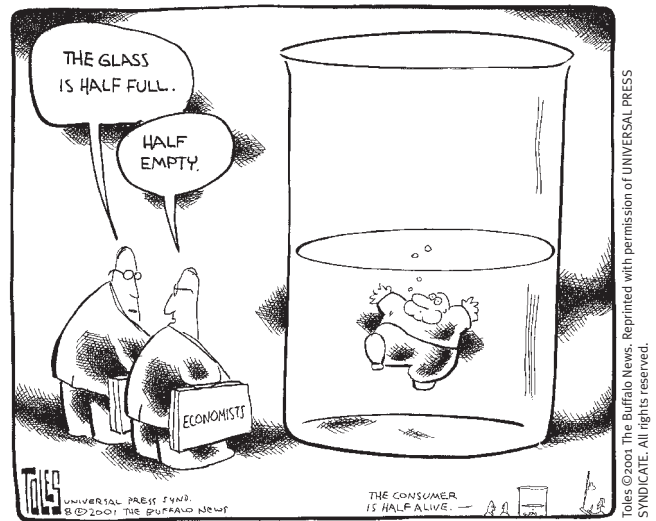
It is also worth remembering that economics is, unavoidably, often tied up in politics. On a number of issues powerful interest groups know what opinions they want to hear; they therefore have an incentive to find and promote economists who profess those opinions, giving these economists a prominence and visibility out of proportion to their support among their colleagues.

But although the appearance of disagreement among economists exceeds the reality, it remains true that economists often *do* disagree about important things. For example, some very respected economists argue vehemently that the U.S. government should replace the income tax with a *value-added tax* (a national sales tax, which is the main source of government revenue in many European countries). Other equally respected economists disagree. Why this difference of opinion?

One important source of differences is in values: as in any diverse group of individuals, reasonable people can differ. In comparison to an income tax, a value-added tax typically falls more heavily on people of modest means. So an economist who values a society with more social and income equality for its own sake will tend to oppose a value-added tax. An economist with different values will be less likely to oppose it.

A second important source of differences arises from economic modeling. Because economists base their conclusions on models, which are simplified representations of reality, two economists can legitimately disagree about which simplifications are appropriate—and therefore arrive at different conclusions.

Suppose that the U.S. government was considering introducing a value-added tax. Economist A may rely on a model that focuses on the administrative costs of tax systems—that is, the costs of monitoring, processing papers, collecting the tax, and so on. This economist might then point to the well-known high costs of administering a value-added tax and argue against the change. But economist B may think that the right way to approach the question is to ignore the administrative costs and focus on how the proposed law would change savings behavior. This economist might point to studies suggesting that value-added taxes promote higher consumer saving, a desirable result.



FOR INQUIRING MINDS

When Economists Agree

"If all the economists in the world were laid end to end, they still couldn't reach a conclusion." So goes one popular economist joke. But do economists really disagree that much?

Not according to a classic survey of members of the American Economic Association, reported in the May 1992 issue of the *American Economic Review*. The authors asked respondents to agree or disagree with a number of statements

about the economy; what they found was a high level of agreement among professional economists on many of the statements. At the top, with more than 90 percent of the economists agreeing, were "Tariffs and import quotas usually reduce general economic welfare" and "A ceiling on rents reduces the quantity and quality of housing available." What's striking about these two statements is that many noneconomists disagree: tariffs and import

quotas to keep out foreign-produced goods are favored by many voters, and proposals to do away with rent control in cities like New York and San Francisco have met fierce political opposition.

So is the stereotype of quarreling economists a myth? Not entirely: economists do disagree quite a lot on some issues, especially in macroeconomics. But there is a large area of common ground.

Because the economists have used different models—that is, made different simplifying assumptions—they arrive at different conclusions. And so the two economists may find themselves on different sides of the issue.

Most such disputes are eventually resolved by the accumulation of evidence showing which of the various models proposed by economists does a better job of fitting the facts. However, in economics, as in any science, it can take a long time before research settles important disputes—decades, in some cases. And since the economy is always changing, in ways that make old models invalid or raise new policy questions, there are always new issues on which economists disagree. The policy maker must then decide which economist to believe.

The important point is that economic analysis is a method, not a set of conclusions.

► **ECONOMICS IN ACTION**

Economists in Government

Many economists are mainly engaged in teaching and research. But quite a few economists have a more direct hand in events.

As described earlier in the chapter (For Inquiring Minds, “Models for Money”), economists play a significant role in the business world, especially in the financial industry. But the most striking involvement of economists in the “real” world is their extensive participation in government.

This shouldn’t be surprising: one of the most important functions of government is to make economic policy, and almost every government policy decision must take economic effects into consideration. So governments around the world employ economists in a variety of roles.

In the U.S. government, a key role is played by the Council of Economic Advisers, a branch of the Executive Office (that is, the staff of the President) whose sole purpose is to advise the White House on economic matters and to prepare the annual Economic Report of the President. Unlike most employees in government agencies, the majority of the economists at the Council are not long-term civil servants; instead, they are mainly professors on leave for one or two years from their universities. Many of the nation’s best-known economists have served on the Council of Economic Advisers at some point during their careers.

Economists also play an important role in many other parts of the U.S. government. Indeed, as the Bureau of Labor Statistics *Occupational Outlook Handbook* says, “Government employed 58 percent of economists in a wide range of government agencies.” Needless to say, the Bureau of Labor Statistics is itself a major employer of economists. And economists dominate the staff of the Federal Reserve, a government agency that controls the supply of money in the economy and is crucial to its operation.

It’s also worth noting that economists play an especially important role in two international organizations headquartered in Washington, D.C.: the International Monetary Fund, which provides advice and loans to countries experiencing economic difficulties, and the World Bank, which provides advice and loans to promote long-term economic development.

Do all these economists in government disagree with each other all the time? Are their positions largely dictated by political affiliation? The answer to both questions is no. Although there are important disputes over economic issues in government, and politics inevitably plays some role, there is broad agreement among economists on many issues, and most economists in government try very hard to assess issues as objectively as possible. ▲

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► **QUICK REVIEW**

- Economists do mostly **positive economics**, analysis of the way the world works, in which there are definite right and wrong answers and which involve making **forecasts**. But in **normative economics**, which makes prescriptions about how things ought to be, there are often no right answers and only value judgments.
- Economists do disagree—though not as much as legend has it—for two main reasons. One, they may disagree about which simplifications to make in a model. Two, economists may disagree—like everyone else—about values.

► CHECK YOUR UNDERSTANDING 2-2

- Which of the following statements is a positive statement? Which is a normative statement?
 - Society should take measures to prevent people from engaging in dangerous personal behavior.
 - People who engage in dangerous personal behavior impose higher costs on society through higher medical costs.
- True or false? Explain your answer.
 - Policy choice A and policy choice B attempt to achieve the same social goal. Policy choice A, however, results in a much less efficient use of resources than policy choice B. Therefore, economists are more likely to agree on choosing policy choice B.
 - When two economists disagree on the desirability of a policy, it's typically because one of them has made a mistake.
 - Policy makers can always use economics to figure out which goals a society should try to achieve.

Solutions appear at back of book.

►► A LOOK AHEAD...

This chapter has given you a first view of what it means to do economics, starting with the general idea of models as a way to make sense of a complicated world and then moving on to two simple introductory models.

To get a real sense of how economic analysis works, however, and to show just how useful such analysis can be, we need to move on to a more powerful model. In the next two chapters we will study the quintessential economic model, one that has an amazing ability to make sense of many policy issues, predict the effects of many forces, and change the way you look at the world. That model is known as “supply and demand.”]

SUMMARY

- Almost all economics is based on **models**, “thought experiments” or simplified versions of reality, many of which use mathematical tools such as graphs. An important assumption in economic models is the **other things equal assumption**, which allows analysis of the effect of a change in one factor by holding all other relevant factors unchanged.
- One important economic model is the **production possibility frontier**. It illustrates: *opportunity cost* (showing how much less of one good can be produced if more of the other good is produced); *efficiency* (an economy is efficient in production if it produces on the production possibility frontier and efficient in allocation if it produces the mix of goods and services that people want to consume); and *economic growth* (an outward shift of the production possibility frontier). There are two basic sources of growth: an increase in **factors of production**, resources such as land, labor, capital, and human capital, inputs that are not used up in production, and improved **technology**.
- Another important model is **comparative advantage**, which explains the source of gains from trade between individuals and countries. Everyone has a comparative advantage in something—some good or service in which that person has a lower opportunity cost than everyone else. But it is often confused with **absolute advantage**, an ability to produce a particular good or service better than anyone else. This confusion leads some to erroneously conclude that there are no gains from trade between people or countries.
- In the simplest economies people **barter**—trade goods and services for one another—rather than trade them for money, as in a modern economy. The **circular-flow diagram** represents transactions within the economy as flows of goods, services, and money between **households** and **firms**. These transactions occur in **markets for goods and services** and **factor markets**, markets for **factors of production**—land, labor, capital, and human capital. It is useful in understanding how spending, production, employment, income, and growth are related in the economy. Ultimately, factor markets determine the economy's **income distribution**, how an economy's total income is allocated to the owners of the factors of production.
- Economists use economic models for both **positive economics**, which describes how the economy works, and for **normative economics**, which prescribes how the economy *should* work. Positive economics often involves making **forecasts**. Economists can determine correct answers for positive questions, but typically not

for normative questions, which involve value judgments. The exceptions are when policies designed to achieve a certain prescription can be clearly ranked in terms of efficiency.

6. There are two main reasons economists disagree. One, they may disagree about which simplifications to make in a model. Two, economists may disagree—like everyone else—about values.

KEY TERMS

Model, p. 24	Absolute advantage, p. 33	Factor markets, p. 35
Other things equal assumption, p. 24	Barter, p. 35	Income distribution, p. 36
Production possibility frontier, p. 25	Circular-flow diagram, p. 35	Positive economics, p. 38
Factors of production, p. 29	Household, p. 35	Normative economics, p. 38
Technology, p. 29	Firm, p. 35	Forecast, p. 38
Comparative advantage, p. 31	Markets for goods and services, p. 35	

PROBLEMS

- Two important industries on the island of Bermuda are fishing and tourism. According to data from the World Resources Institute and the Bermuda Department of Statistics, in the year 2000 the 307 registered fishermen in Bermuda caught 286 metric tons of marine fish. And the 3,409 people employed by hotels produced 538,000 hotel stays (measured by the number of visitor arrivals). Suppose that this production point is efficient in production. Assume also that the opportunity cost of one additional metric ton of fish is 2,000 hotel stays and that this opportunity cost is constant (the opportunity cost does not change).
 - If all 307 registered fishermen were to be employed by hotels (in addition to the 3,409 people already working in hotels), how many hotel stays could Bermuda produce?
 - If all 3,409 hotel employees were to become fishermen (in addition to the 307 fishermen already working in the fishing industry), how many metric tons of fish could Bermuda produce?
 - Draw a production possibility frontier for Bermuda, with fish on the horizontal axis and hotel stays on the vertical axis, and label Bermuda's actual production point for the year 2000.
- Atlantis is a small, isolated island in the South Atlantic. The inhabitants grow potatoes and catch fish. The accompanying table shows the maximum annual output combinations of potatoes and fish that can be produced. Obviously, given their limited resources and available technology, as they use more of their resources for potato production, there are fewer resources available for catching fish.

Maximum annual output options	Quantity of potatoes (pounds)	Quantity of fish (pounds)
A	1,000	0
B	800	300
C	600	500
D	400	600
E	200	650
F	0	675

- Draw a production possibility frontier with potatoes on the horizontal axis and fish on the vertical axis illustrating these options, showing points A–F.
 - Can Atlantis produce 500 pounds of fish and 800 pounds of potatoes? Explain. Where would this point lie relative to the production possibility frontier?
 - What is the opportunity cost of increasing the annual output of potatoes from 600 to 800 pounds?
 - What is the opportunity cost of increasing the annual output of potatoes from 200 to 400 pounds?
 - Can you explain why the answers to parts c and d are not the same? What does this imply about the slope of the production possibility frontier?
- According to data from the U.S. Department of Agriculture's National Agricultural Statistics Service, 124 million acres of land in the United States were used for wheat or corn farming in 2004. Of those 124 million acres, farmers used 50 million acres to grow 2.158 billion bushels of wheat and 74 million acres of land to grow 11.807 billion bushels of corn. Suppose that U.S. wheat and corn farming is efficient in production. At that production point, the opportunity cost of producing one additional bushel of wheat is 1.7 fewer bushels of corn. However, farmers have increasing opportunity costs, so that additional bushels of wheat have an opportunity cost greater than 1.7 bushels of corn. For each of the following production points, decide whether that production point is (i) feasible and efficient in production, (ii) feasible but not efficient in production, (iii) not feasible, or (iv) unclear as to whether or not it is feasible.
 - Farmers use 40 million acres of land to produce 1.8 billion bushels of wheat, and they use 60 million acres of land to produce 9 billion bushels of corn. The remaining 24 million acres are left unused.
 - From their original production point, farmers transfer 40 million acres of land from corn to wheat production. They now produce 3.158 billion bushels of wheat and 10.107 billion bushels of corn.
 - Farmers reduce their production of wheat to 2 billion bushels and increase their production of corn to 12.044 billion bushels.

billion bushels. Along the production possibility frontier, the opportunity cost of going from 11.807 billion bushels of corn to 12.044 billion bushels of corn is 0.666 bushel of wheat per bushel of corn.

4. In the ancient country of Roma, only two goods, spaghetti and meatballs, are produced. There are two tribes in Roma, the Tivoli and the Frivoli. By themselves, the Tivoli each month can produce either 30 pounds of spaghetti and no meatballs, or 50 pounds of meatballs and no spaghetti, or any combination in between. The Frivoli, by themselves, each month can produce 40 pounds of spaghetti and no meatballs, or 30 pounds of meatballs and no spaghetti, or any combination in between.

a. Assume that all production possibility frontiers are straight lines. Draw one diagram showing the monthly production possibility frontier for the Tivoli and another showing the monthly production possibility frontier for the Frivoli. Show how you calculated them.

b. Which tribe has the comparative advantage in spaghetti production? In meatball production?

In A.D. 100 the Frivoli discover a new technique for making meatballs that doubles the quantity of meatballs they can produce each month.

c. Draw the new monthly production possibility frontier for the Frivoli.

d. After the innovation, which tribe now has an absolute advantage in producing meatballs? In producing spaghetti? Which has the comparative advantage in meatball production? In spaghetti production?

5. According to the U.S. Census Bureau, in July 2006 the United States exported aircraft worth \$1 billion to China and imported aircraft worth only \$19,000 from China. During the same month, however, the United States imported \$83 million worth of men's trousers, slacks, and jeans from China but exported only \$8,000 worth of trousers, slacks, and jeans to China. Using what you have learned about how trade is determined by comparative advantage, answer the following questions.

a. Which country has the comparative advantage in aircraft production? In production of trousers, slacks, and jeans?

b. Can you determine which country has the absolute advantage in aircraft production? In production of trousers, slacks, and jeans?

6. Peter Pundit, an economics reporter, states that the European Union (EU) is increasing its productivity very rapidly in all industries. He claims that this productivity advance is so rapid that output from the EU in these industries will soon exceed that of the United States and, as a result, the United States will no longer benefit from trade with the EU.

a. Do you think Peter Pundit is correct or not? If not, what do you think is the source of his mistake?

b. If the EU and the United States continue to trade, what do you think will characterize the goods that the EU exports to the United States and the goods that the United States exports to the EU?

7. You are in charge of allocating residents to your dormitory's baseball and basketball teams. You are down to the last four people, two of whom must be allocated to baseball and two to basketball. The accompanying table gives each person's batting average and free-throw average.

Name	Batting average	Free-throw average
Kelley	70%	60%
Jackie	50%	50%
Curt	10%	30%
Gerry	80%	70%

a. Explain how you would use the concept of comparative advantage to allocate the players. Begin by establishing each player's opportunity cost of free throws in terms of batting average.

b. Why is it likely that the other basketball players will be unhappy about this arrangement but the other baseball players will be satisfied? Nonetheless, why would an economist say that this is an efficient way to allocate players for your dormitory's sports teams?

8. The inhabitants of the fictional economy of Atlantis use money in the form of cowry shells. Draw a circular-flow diagram showing households and firms. Firms produce potatoes and fish, and households buy potatoes and fish. Households also provide the land and labor to firms. Identify where in the flows of cowry shells or physical things (goods and services, or resources) each of the following impacts would occur. Describe how this impact spreads around the circle.

a. A devastating hurricane floods many of the potato fields.

b. A very productive fishing season yields a very large number of fish caught.

c. The inhabitants of Atlantis discover Shakira and spend several days a month at dancing festivals.

9. An economist might say that colleges and universities "produce" education, using faculty members and students as inputs. According to this line of reasoning, education is then "consumed" by households. Construct a circular-flow diagram to represent the sector of the economy devoted to college education: colleges and universities represent firms, and households both consume education and provide faculty and students to universities. What are the relevant markets in this diagram? What is being bought and sold in each direction? What would happen in the diagram if the government decided to subsidize 50% of all college students' tuition?

10. Your dormitory roommate plays loud music most of the time; you, however, would prefer more peace and quiet. You suggest that she buy some earphones. She responds that although she would be happy to use earphones, she has many other things that she would prefer to spend her money on right now. You discuss this situation with a friend who is an economics major. The following exchange takes place:

He: How much would it cost to buy earphones?

You: \$15.

He: How much do you value having some peace and quiet for the rest of the semester?

You: \$30.

He: It is efficient for you to buy the earphones and give them to your roommate. You gain more than you lose; the benefit exceeds the cost. You should do that.

You: It just isn't fair that I have to pay for the earphones when I'm not the one making the noise.

- a. Which parts of this conversation contain positive statements and which parts contain normative statements?
 - b. Compose an argument supporting your viewpoint that your roommate should be the one to change her behavior. Similarly, compose an argument from the viewpoint of your roommate that you should be the one to buy the earphones. If your dormitory has a policy that gives residents the unlimited right to play music, whose argument is likely to win? If your dormitory has a rule that a person must stop playing music whenever a roommate complains, whose argument is likely to win?
11. A representative of the American clothing industry recently made the following statement: "Workers in Asia often work in sweatshop conditions earning only pennies an hour. American workers are more productive and as a result earn higher wages. In order to preserve the dignity of the American workplace, the government should enact legislation banning imports of low-wage Asian clothing."
- a. Which parts of this quote are positive statements? Which parts are normative statements?
 - b. Is the policy that is being advocated consistent with the preceding statements about the wages and productivities of American and Asian workers?
 - c. Would such a policy make some Americans better off without making any other Americans worse off? That is, would this policy be efficient from the viewpoint of all Americans?
 - d. Would low-wage Asian workers benefit from or be hurt by such a policy?
12. Are the following statements true or false? Explain your answers.
- a. "When people must pay higher taxes on their wage earnings, it reduces their incentive to work" is a positive statement.
 - b. "We should lower taxes to encourage more work" is a positive statement.
 - c. Economics cannot always be used to completely decide what society ought to do.
 - d. "The system of public education in this country generates greater benefits to society than the cost of running the system" is a normative statement.
 - e. All disagreements among economists are generated by the media.
13. Evaluate the following statement: "It is easier to build an economic model that accurately reflects events that have already occurred than to build an economic model to forecast future events." Do you think that this is true or not? Why? What does this imply about the difficulties of building good economic models?
14. Economists who work for the government are often called on to make policy recommendations. Why do you think it is important for the public to be able to differentiate normative statements from positive statements in these recommendations?
15. The mayor of Gotham City, worried about a potential epidemic of deadly influenza this winter, asks an economic adviser the following series of questions. Determine whether a question requires the economic adviser to make a positive assessment or a normative assessment.
- a. How much vaccine will be in stock in the city by the end of November?
 - b. If we offer to pay 10% more per dose to the pharmaceutical companies providing the vaccines, will they provide additional doses?
 - c. If there is a shortage of vaccine in the city, whom should we vaccinate first—the elderly or the very young? (Assume that a person from one group has an equal likelihood of dying from influenza as a person from the other group.)
 - d. If the city charges \$25 per shot, how many people will pay?
 - e. If the city charges \$25 per shot, it will make a profit of \$10 per shot, money that can go to pay for inoculating poor people. Should the city engage in such a scheme?
16. Assess the following statement: "If economists just had enough data, they could solve all policy questions in a way that maximizes the social good. There would be no need for divisive political debates, such as whether the government should provide free medical care for all."



>> Chapter 2 Appendix: Graphs in Economics

Getting the Picture

Whether you're reading about economics in the *Wall Street Journal* or in your economics textbook, you will see many graphs. Visual images can make it much easier to understand verbal descriptions, numerical information, or ideas. In economics, graphs are the type of visual image used to facilitate understanding. To fully understand the ideas and information being discussed, you need to be familiar with how to interpret these visual aids. This appendix explains how graphs are constructed and interpreted and how they are used in economics.

A quantity that can take on more than one value is called a **variable**.

Graphs, Variables, and Economic Models

One reason to attend college is that a bachelor's degree provides access to higher-paying jobs. Additional degrees, such as MBAs or law degrees, increase earnings even more. If you were to read an article about the relationship between educational attainment and income, you would probably see a graph showing the income levels for workers with different amounts of education. And this graph would depict the idea that, in general, more education increases income. This graph, like most of those in economics, would depict the relationship between two economic variables. A **variable** is a quantity that can take on more than one value, such as the number of years of education a person has, the price of a can of soda, or a household's income.

As you learned in this chapter, economic analysis relies heavily on *models*, simplified descriptions of real situations. Most economic models describe the relationship between two variables, simplified by holding constant other variables that may affect the relationship. For example, an economic model might describe the relationship between the price of a can of soda and the number of cans of soda that consumers will buy, assuming that everything else that affects consumers' purchases of soda stays constant. This type of model can be described mathematically or verbally, but illustrating the relationship in a graph makes it easier to understand. Next we show how graphs that depict economic models are constructed and interpreted.

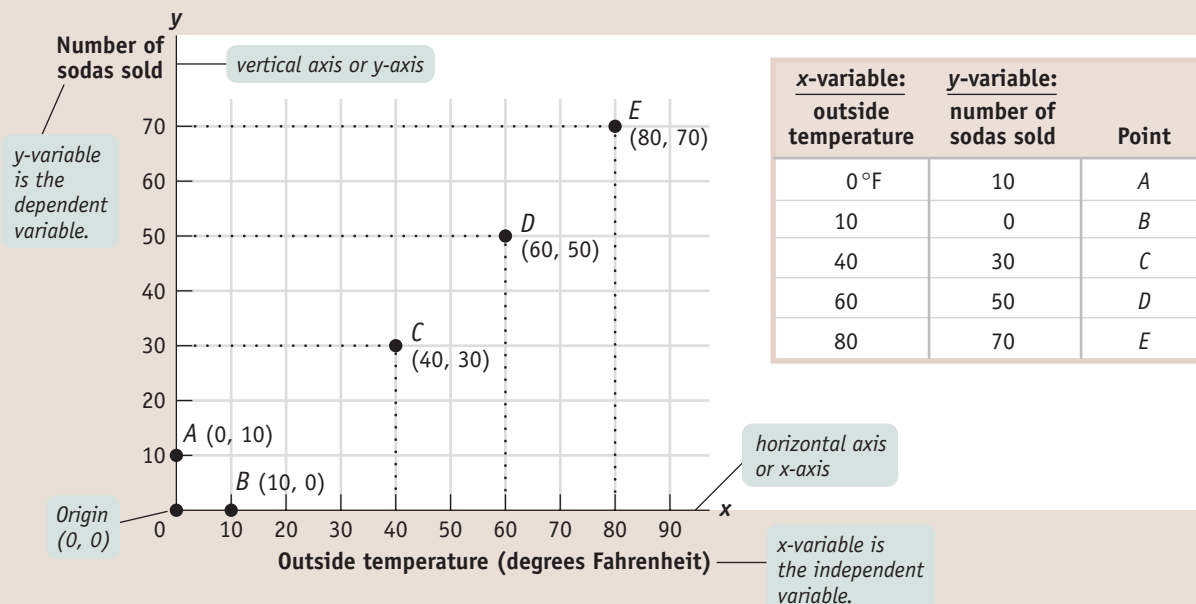
How Graphs Work

Most graphs in economics are based on a grid built around two perpendicular lines that show the values of two variables, helping you visualize the relationship between them. So a first step in understanding the use of such graphs is to see how this system works.

Two-Variable Graphs

Figure 2A-1 on the next page shows a typical two-variable graph. It illustrates the data in the accompanying table on outside temperature and the number of sodas a typical vendor can expect to sell at a baseball stadium during one game. The first column shows the values of outside temperature (the first variable) and the second column shows the values of the number of sodas sold (the second variable). Five combinations or pairs of the two variables are shown, each denoted by A through E in the third column.

Now let's turn to graphing the data in this table. In any two-variable graph, one variable is called the *x*-variable and the other is called the *y*-variable. Here we have made outside temperature the *x*-variable and number of sodas sold the *y*-variable. The

FIGURE 2A-1 Plotting Points on a Two-Variable Graph

The data from the table are plotted where outside temperature (the independent variable) is measured along the horizontal axis and number of sodas sold (the dependent variable) is measured along the vertical axis. Each of the five combinations of temperature and sodas sold is represented by a

point: A, B, C, D, and E. Each point in the graph is identified by a pair of values. For example, point C corresponds to the pair (40, 30)—an outside temperature of 40°F (the value of the x-variable) and 30 sodas sold (the value of the y-variable).

The line along which values of the x-variable are measured is called the **horizontal axis** or **x-axis**. The line along which values of the y-variable are measured is called the **vertical axis** or **y-axis**. The point where the axes of a two-variable graph meet is the **origin**.

A **causal relationship** exists between two variables when the value taken by one variable directly influences or determines the value taken by the other variable. In a causal relationship, the determining variable is called the **independent variable**; the variable it determines is called the **dependent variable**.

solid horizontal line in the graph is called the **horizontal axis** or **x-axis**, and values of the x-variable—outside temperature—are measured along it. Similarly, the solid vertical line in the graph is called the **vertical axis** or **y-axis**, and values of the y-variable—number of sodas sold—are measured along it. At the **origin**, the point where the two axes meet, each variable is equal to zero. As you move rightward from the origin along the x-axis, values of the x-variable are positive and increasing. As you move up from the origin along the y-axis, values of the y-variable are positive and increasing.

You can plot each of the five points A through E on this graph by using a pair of numbers—the values that the x-variable and the y-variable take on for a given point. In Figure 2A-1, at point C, the x-variable takes on the value 40 and the y-variable takes on the value 30. You plot point C by drawing a line straight up from 40 on the x-axis and a horizontal line across from 30 on the y-axis. We write point C as (40, 30). We write the origin as (0, 0).

Looking at point A and point B in Figure 2A-1, you can see that when one of the variables for a point has a value of zero, it will lie on one of the axes. If the value of the x-variable is zero, the point will lie on the vertical axis, like point A. If the value of the y-variable is zero, the point will lie on the horizontal axis, like point B.

Most graphs that depict relationships between two economic variables represent a **causal relationship**, a relationship in which the value taken by one variable directly influences or determines the value taken by the other variable. In a causal relationship, the determining variable is called the **independent variable**; the variable it determines is called the **dependent variable**. In our example of soda sales, the outside temperature is the independent variable. It directly influences the number of sodas that are sold, the dependent variable in this case.

By convention, we put the independent variable on the horizontal axis and the dependent variable on the vertical axis. Figure 2A-1 is constructed consistent with this convention; the independent variable (outside temperature) is on the horizontal axis and the dependent variable (number of sodas sold) is on the vertical axis. An important exception to this convention is in graphs showing the economic relationship between the price of a product and quantity of the product: although price is generally the independent variable that determines quantity, it is always measured on the vertical axis.

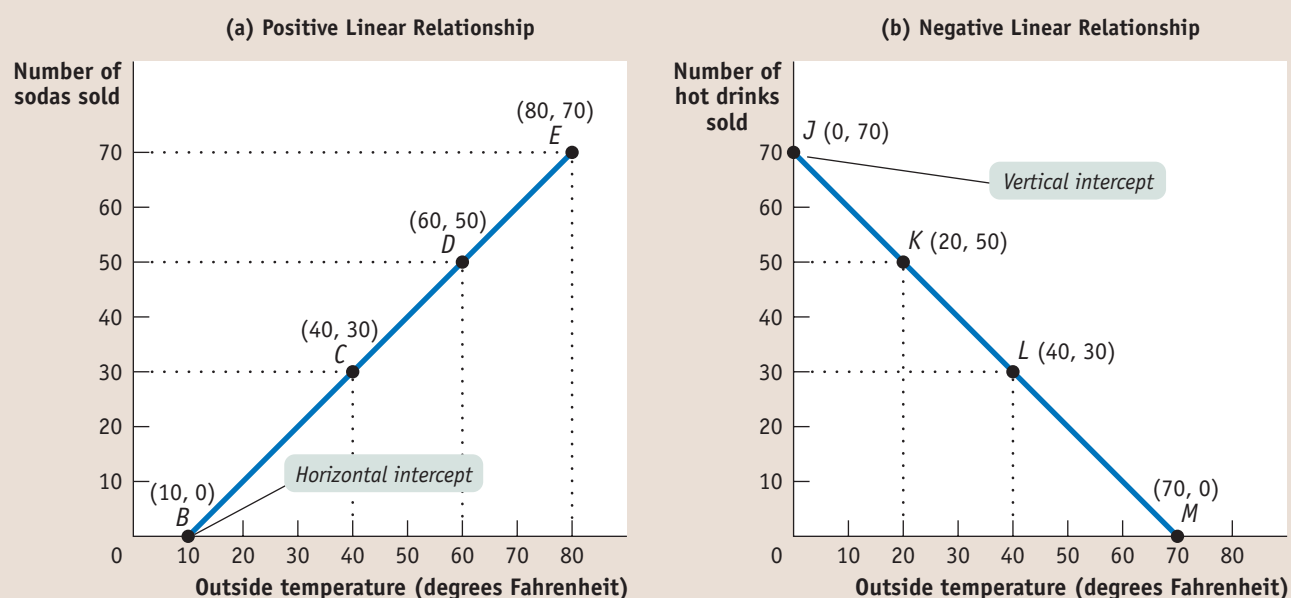
A **curve** is a line on a graph that depicts a relationship between two variables. It may be either a straight line or a curved line. If the curve is a straight line, the variables have a **linear relationship**. If the curve is not a straight line, the variables have a **nonlinear relationship**.

Curves on a Graph

Panel (a) of Figure 2A-2 contains some of the same information as Figure 2A-1, with a line drawn through the points B, C, D, and E. Such a line on a graph is called a **curve**, regardless of whether it is a straight line or a curved line. If the curve that shows the relationship between two variables is a straight line, or linear, the variables have a **linear relationship**. When the curve is not a straight line, or nonlinear, the variables have a **nonlinear relationship**.

A point on a curve indicates the value of the y-variable for a specific value of the x-variable. For example, point D indicates that at a temperature of 60°F, a vendor can expect to sell 50 sodas. The shape and orientation of a curve reveal the general nature of the relationship between the two variables. The upward tilt of the curve in panel (a) of Figure 2A-2 suggests that vendors can expect to sell more sodas at higher outside temperatures.

FIGURE 2A-2 Drawing Curves



The curve in panel (a) illustrates the relationship between the two variables, outside temperature and number of sodas sold. The two variables have a positive linear relationship: positive because the curve has an upward tilt, and linear because it is a straight line. It implies that an increase in the x-variable (outside temperature) leads to an increase in the y-variable (number of sodas sold). The curve in panel (b) is also a straight line, but it tilts downward. The two variables here, out-

side temperature and number of hot drinks sold, have a negative linear relationship: an increase in the x-variable (outside temperature) leads to a decrease in the y-variable (number of hot drinks sold). The curve in panel (a) has a horizontal intercept at point B, where it hits the horizontal axis. The curve in panel (b) has a vertical intercept at point J, where it hits the vertical axis, and a horizontal intercept at point M, where it hits the horizontal axis.

Two variables have a **positive relationship** when an increase in the value of one variable is associated with an increase in the value of the other variable. It is illustrated by a curve that slopes upward from left to right.

Two variables have a **negative relationship** when an increase in the value of one variable is associated with a decrease in the value of the other variable. It is illustrated by a curve that slopes downward from left to right.

The **horizontal intercept** of a curve is the point at which it hits the horizontal axis; it indicates the value of the x -variable when the value of the y -variable is zero.

The **vertical intercept** of a curve is the point at which it hits the vertical axis; it shows the value of the y -variable when the value of the x -variable is zero.

The **slope** of a line or curve is a measure of how steep it is. The slope of a line is measured by “rise over run”—the change in the y -variable between two points on the line divided by the change in the x -variable between those same two points.

When variables are related this way—that is, when an increase in one variable is associated with an increase in the other variable—the variables are said to have a **positive relationship**. It is illustrated by a curve that slopes upward from left to right. Because this curve is also linear, the relationship between outside temperature and number of sodas sold illustrated by the curve in panel (a) of Figure 2A-2 is a positive linear relationship.

When an increase in one variable is associated with a decrease in the other variable, the two variables are said to have a **negative relationship**. It is illustrated by a curve that slopes downward from left to right, like the curve in panel (b) of Figure 2A-2. Because this curve is also linear, the relationship it depicts is a negative linear relationship. Two variables that might have such a relationship are the outside temperature and the number of hot drinks a vendor can expect to sell at a baseball stadium.

Return for a moment to the curve in panel (a) of Figure 2A-2 and you can see that it hits the horizontal axis at point B. This point, known as the **horizontal intercept**, shows the value of the x -variable when the value of the y -variable is zero. In panel (b) of Figure 2A-2, the curve hits the vertical axis at point J. This point, called the **vertical intercept**, indicates the value of the y -variable when the value of the x -variable is zero.

A Key Concept: The Slope of a Curve

The **slope** of a line or curve is a measure of how steep it is and indicates how sensitive the y -variable is to a change in the x -variable. In our example of outside temperature and the number of cans of soda a vendor can expect to sell, the slope of the curve would indicate how many more cans of soda the vendor could expect to sell with each 1° increase in temperature. Interpreted this way, the slope gives meaningful information. Even without numbers for x and y , it is possible to arrive at important conclusions about the relationship between the two variables by examining the slope of a curve at various points.

The Slope of a Linear Curve

Along a linear curve the slope, or steepness, is measured by dividing the “rise” between two points on the curve by the “run” between those same two points. The rise is the amount that y changes, and the run is the amount that x changes. Here is the formula:

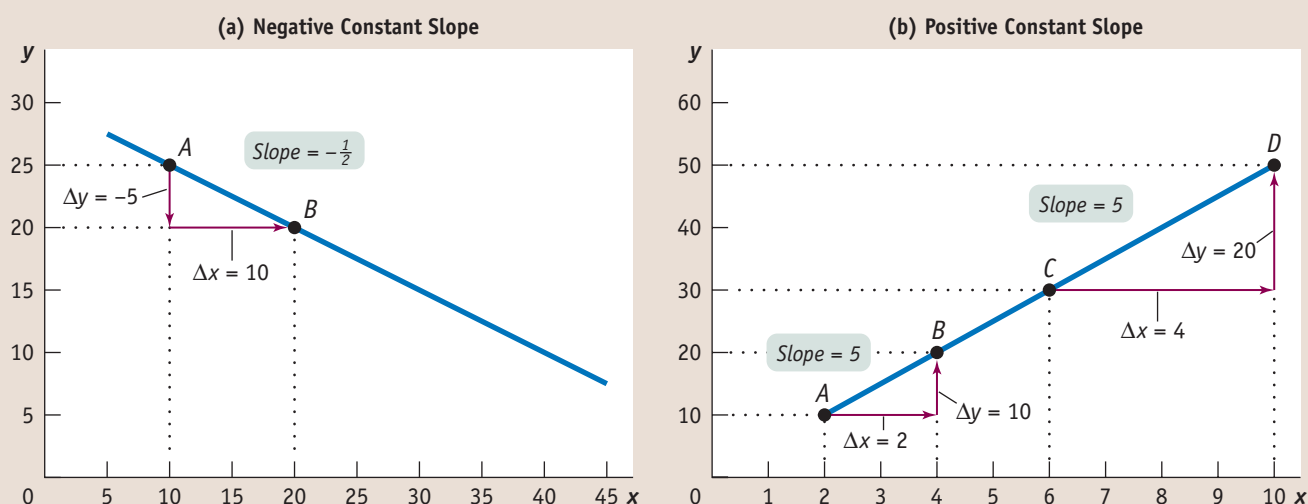
$$\frac{\text{Change in } y}{\text{Change in } x} = \frac{\Delta y}{\Delta x} = \text{Slope}$$

In the formula, the symbol Δ (the Greek uppercase delta) stands for “change in.” When a variable increases, the change in that variable is positive; when a variable decreases, the change in that variable is negative.

The slope of a curve is positive when the rise (the change in the y -variable) has the same sign as the run (the change in the x -variable). That’s because when two numbers have the same sign, the ratio of those two numbers is positive. The curve in panel (a) of Figure 2A-2 has a positive slope: along the curve, both the y -variable and the x -variable increase. The slope of a curve is negative when the rise and the run have different signs. That’s because when two numbers have different signs, the ratio of those two numbers is negative. The curve in panel (b) of Figure 2A-2 has a negative slope: along the curve, an increase in the x -variable is associated with a decrease in the y -variable.

Figure 2A-3 illustrates how to calculate the slope of a linear curve. Let’s focus first on panel (a). From point A to point B the value of the y -variable changes from 25 to 20 and the value of the x -variable changes from 10 to 20. So the slope of the line between these two points is:

$$\frac{\text{Change in } y}{\text{Change in } x} = \frac{\Delta y}{\Delta x} = \frac{-5}{10} = -\frac{1}{2} = -0.5$$

FIGURE 2A-3 Calculating the Slope

Panels (a) and (b) show two linear curves. Between points A and B on the curve in panel (a), the change in y (the rise) is -5 and the change in x (the run) is 10 . So the slope from A to B is $\frac{\Delta y}{\Delta x} = \frac{-5}{10} = -\frac{1}{2} = -0.5$, where the negative sign indicates that the curve is downward sloping. In panel (b), the curve has a slope from A to B of $\frac{\Delta y}{\Delta x} = \frac{10}{2} = 5$. The slope from C to D is

$\frac{\Delta y}{\Delta x} = \frac{20}{4} = 5$. The slope is positive, indicating that the curve is upward sloping. Furthermore, the slope between A and B is the same as the slope between C and D, making this a linear curve. The slope of a linear curve is constant: it is the same regardless of where it is calculated along the curve.

Because a straight line is equally steep at all points, the slope of a straight line is the same at all points. In other words, a straight line has a constant slope. You can check this by calculating the slope of the linear curve between points A and B and between points C and D in panel (b) of Figure 2A-3.

Between A and B:
$$\frac{\Delta y}{\Delta x} = \frac{10}{2} = 5$$

Between C and D:
$$\frac{\Delta y}{\Delta x} = \frac{20}{4} = 5$$

Horizontal and Vertical Curves and Their Slopes

When a curve is horizontal, the value of the y-variable along that curve never changes—it is constant. Everywhere along the curve, the change in y is zero. Now, zero divided by any number is zero. So, regardless of the value of the change in x, the slope of a horizontal curve is always zero.

If a curve is vertical, the value of the x-variable along the curve never changes—it is constant. Everywhere along the curve, the change in x is zero. This means that the slope of a vertical line is a ratio with zero in the denominator. A ratio with zero in the denominator is equal to infinity—that is, an infinitely large number. So the slope of a vertical line is equal to infinity.

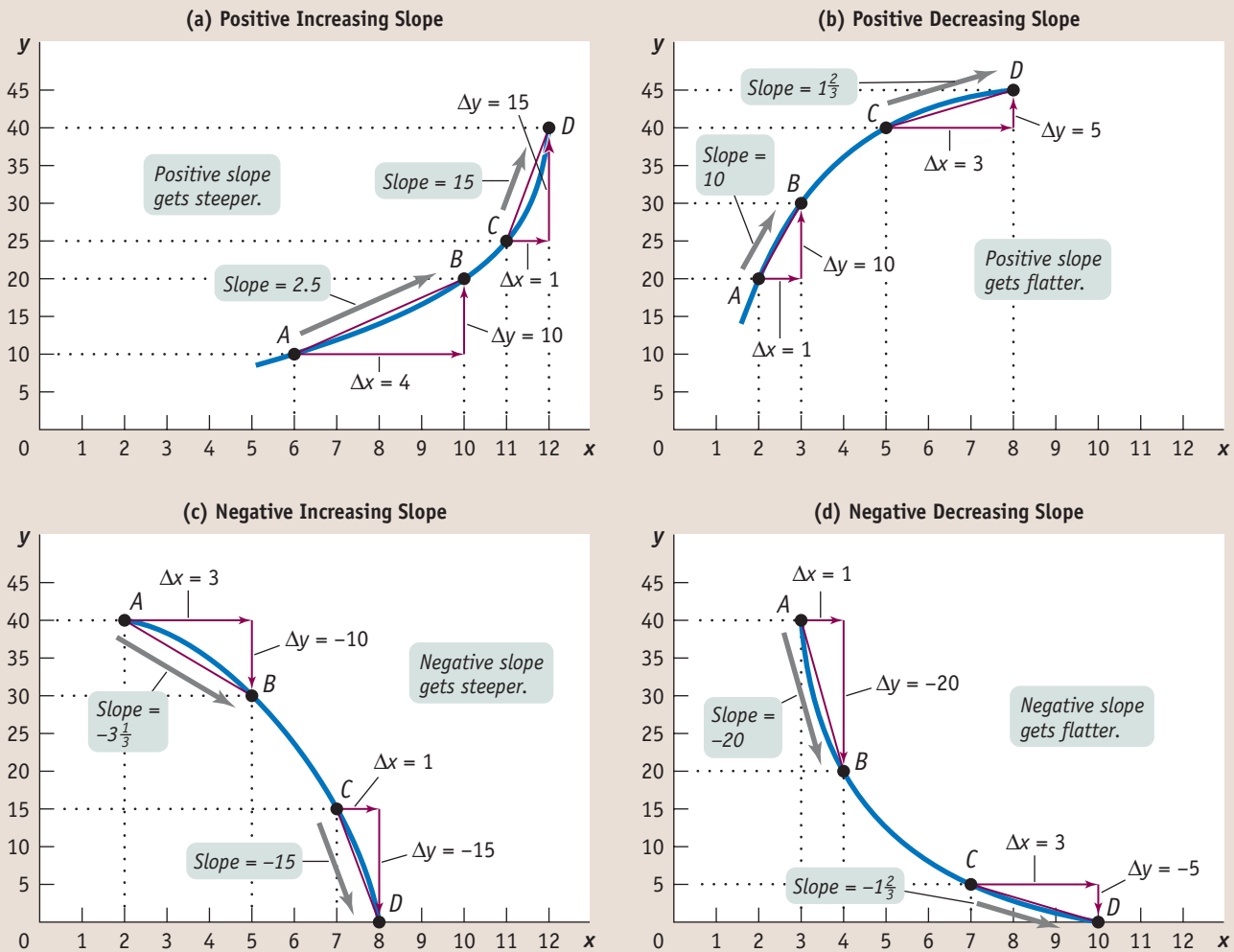
A vertical or a horizontal curve has a special implication: it means that the x-variable and the y-variable are unrelated. Two variables are unrelated when a change in one variable (the independent variable) has no effect on the other variable (the dependent variable). Or to put it a slightly different way, two variables are unrelated when the dependent variable is constant regardless of the value of the independent variable. If, as is usual, the y-variable is the dependent variable, the curve is horizontal. If the dependent variable is the x-variable, the curve is vertical.

A **nonlinear curve** is one in which the slope is not the same between every pair of points.

The Slope of a Nonlinear Curve

A **nonlinear curve** is one in which the slope changes as you move along it. Panels (a), (b), (c), and (d) of Figure 2A-4 show various nonlinear curves. Panels (a) and (b) show nonlinear curves whose slopes change as you move along them, but the slopes always remain positive. Although both curves tilt upward, the curve in panel

FIGURE 2A-4 Nonlinear Curves



In panel (a) the slope of the curve from A to B is $\frac{\Delta y}{\Delta x} = \frac{10}{4} = 2.5$, and from C to D it is $\frac{\Delta y}{\Delta x} = \frac{15}{1} = 15$. The slope is positive and increasing; it gets steeper as you move to the right. In panel (b) the slope of the curve from A to B is $\frac{\Delta y}{\Delta x} = \frac{10}{1} = 10$, and from C to D it is $\frac{\Delta y}{\Delta x} = \frac{5}{3} = 1\frac{2}{3}$. The slope is positive and decreasing; it gets flatter as you move to the right. In panel (c) the slope from A to B is $\frac{\Delta y}{\Delta x} = \frac{-10}{3} = -3\frac{1}{3}$, and from C to D it is $\frac{\Delta y}{\Delta x} = \frac{-15}{1} = -15$. The slope is negative and increasing;

it gets steeper as you move to the right. And in panel (d) the slope from A to B is $\frac{\Delta y}{\Delta x} = \frac{-20}{1} = -20$, and from C to D it is $\frac{\Delta y}{\Delta x} = \frac{-5}{3} = -1\frac{2}{3}$. The slope is negative and decreasing; it gets flatter as you move to the right. The slope in each case has been calculated by using the arc method—that is, by drawing a straight line connecting two points along a curve. The average slope between those two points is equal to the slope of the straight line between those two points.

(a) gets steeper as you move from left to right in contrast to the curve in panel (b), which gets flatter. A curve that is upward sloping and gets steeper, as in panel (a), is said to have *positive increasing* slope. A curve that is upward sloping but gets flatter, as in panel (b), is said to have *positive decreasing* slope.

When we calculate the slope along these nonlinear curves, we obtain different values for the slope at different points. How the slope changes along the curve determines the curve's shape. For example, in panel (a) of Figure 2A-4, the slope of the curve is a positive number that steadily increases as you move from left to right, whereas in panel (b), the slope is a positive number that steadily decreases.

The slopes of the curves in panels (c) and (d) are negative numbers. Economists often prefer to express a negative number as its **absolute value**, which is the value of the negative number without the minus sign. In general, we denote the absolute value of a number by two parallel bars around the number; for example, the absolute value of -4 is written as $|-4| = 4$. In panel (c), the absolute value of the slope steadily increases as you move from left to right. The curve therefore has *negative increasing* slope. And in panel (d), the absolute value of the slope of the curve steadily decreases along the curve. This curve therefore has *negative decreasing* slope.

Calculating the Slope Along a Nonlinear Curve

We've just seen that along a nonlinear curve, the value of the slope depends on where you are on that curve. So how do you calculate the slope of a nonlinear curve? We will focus on two methods: the *arc method* and the *point method*.

The Arc Method of Calculating the Slope An arc of a curve is some piece or segment of that curve. For example, panel (a) of Figure 2A-4 shows an arc consisting of the segment of the curve between points A and B. To calculate the slope along a nonlinear curve using the arc method, you draw a straight line between the two end-points of the arc. The slope of that straight line is a measure of the average slope of the curve between those two end-points. You can see from panel (a) of Figure 2A-4 that the straight line drawn between points A and B increases along the x -axis from 6 to 10 (so that $\Delta x = 4$) as it increases along the y -axis from 10 to 20 (so that $\Delta y = 10$). Therefore the slope of the straight line connecting points A and B is:

$$\frac{\Delta y}{\Delta x} = \frac{10}{4} = 2.5$$

This means that the average slope of the curve between points A and B is 2.5.

Now consider the arc on the same curve between points C and D. A straight line drawn through these two points increases along the x -axis from 11 to 12 ($\Delta x = 1$) as it increases along the y -axis from 25 to 40 ($\Delta y = 15$). So the average slope between points C and D is:

$$\frac{\Delta y}{\Delta x} = \frac{15}{1} = 15$$

Therefore the average slope between points C and D is larger than the average slope between points A and B. These calculations verify what we have already observed—that this upward-tilted curve gets steeper as you move from left to right and therefore has positive increasing slope.

The Point Method of Calculating the Slope The point method calculates the slope of a nonlinear curve at a specific point on that curve. Figure 2A-5 on the next page illustrates how to calculate the slope at point B on the curve. First, we draw a straight line that just touches the curve at point B. Such a line is called a **tangent line**: the fact that it just touches the curve at point B and does not touch the curve at any other point on the curve means that the straight line is *tangent* to the curve at point B. The slope of this tangent line is equal to the slope of the nonlinear curve at point B.

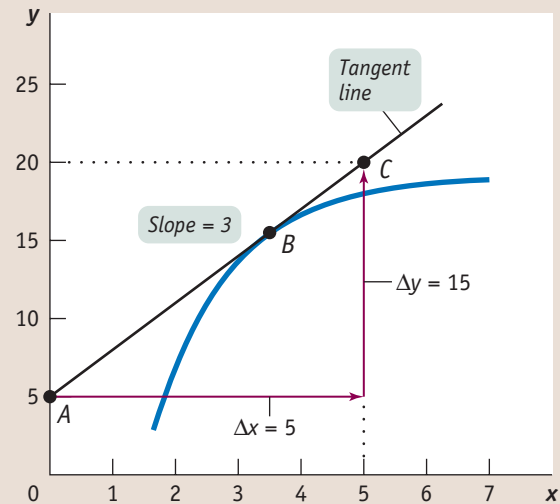
The **absolute value** of a negative number is the value of the negative number without the minus sign.

A **tangent line** is a straight line that just touches, or is tangent to, a nonlinear curve at a particular point. The slope of the tangent line is equal to the slope of the nonlinear curve at that point.

FIGURE 2A-5

Calculating the Slope Using the Point Method

Here a tangent line has been drawn, a line that just touches the curve at point *B*. The slope of this line is equal to the slope of the curve at point *B*. The slope of the tangent line, measuring from *A* to *C*, is $\frac{\Delta y}{\Delta x} = \frac{15}{5} = 3$.



You can see from Figure 2A-5 how the slope of the tangent line is calculated: from point *A* to point *C*, the change in *y* is 15 and the change in *x* is 5, generating a slope of:

$$\frac{\Delta y}{\Delta x} = \frac{15}{5} = 3$$

By the point method, the slope of the curve at point *B* is equal to 3.

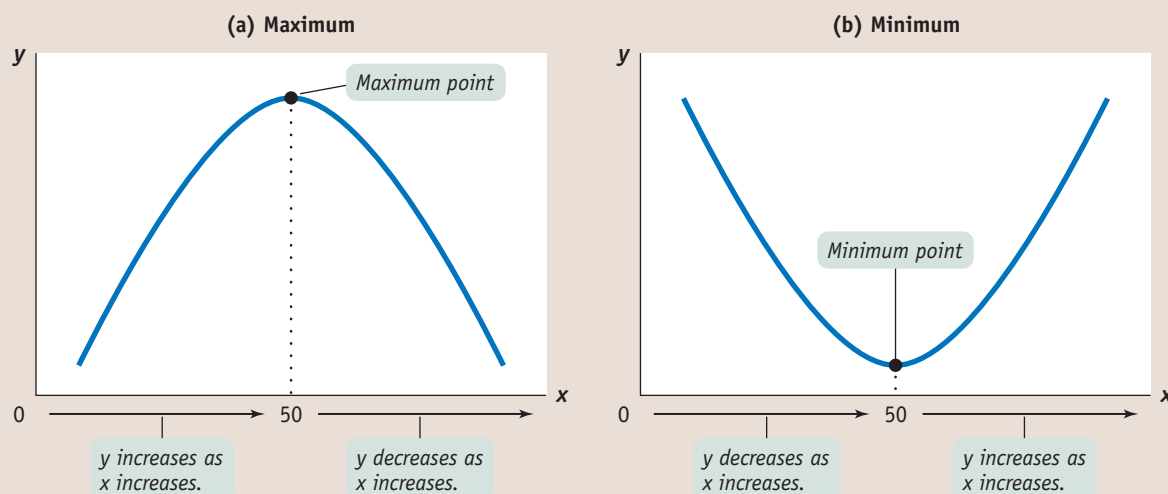
A natural question to ask at this point is how to determine which method to use—the arc method or the point method—in calculating the slope of a nonlinear curve. The answer depends on the curve itself and the data used to construct it. You use the arc method when you don't have enough information to be able to draw a smooth curve. For example, suppose that in panel (a) of Figure 2A-4 you have only the data represented by points *A*, *C*, and *D* and don't have the data represented by point *B* or any of the rest of the curve. Clearly, then, you can't use the point method to calculate the slope at point *B*; you would have to use the arc method to approximate the slope of the curve in this area by drawing a straight line between points *A* and *C*. But if you have sufficient data to draw the smooth curve shown in panel (a) of Figure 2A-4, then you could use the point method to calculate the slope at point *B*—and at every other point along the curve as well.

Maximum and Minimum Points

The slope of a nonlinear curve can change from positive to negative or vice versa. When the slope of a curve changes from positive to negative, it creates what is called a *maximum* point of the curve. When the slope of a curve changes from negative to positive, it creates a *minimum* point.

Panel (a) of Figure 2A-6 illustrates a curve in which the slope changes from positive to negative as you move from left to right. When *x* is between 0 and 50, the slope of the curve is positive. At *x* equal to 50, the curve attains its highest point—the largest value of *y* along the curve. This point is called the **maximum** of the curve. When *x* exceeds 50, the slope becomes negative as the curve turns downward. Many important curves in economics, such as the curve that represents how the profit of a firm changes as it produces more output, are hill-shaped like this.

A nonlinear curve may have a **maximum** point, the highest point along the curve. At the maximum, the slope of the curve changes from positive to negative.

FIGURE 2A-6 Maximum and Minimum Points

Panel (a) shows a curve with a maximum point, the point at which the slope changes from positive to negative.

Panel (b) shows a curve with a minimum point, the point at which the slope changes from negative to positive.

In contrast, the curve shown in panel (b) of Figure 2A-6 is U-shaped: it has a slope that changes from negative to positive. At x equal to 50, the curve reaches its lowest point—the smallest value of y along the curve. This point is called the **minimum** of the curve. Various important curves in economics, such as the curve that represents how the costs of some firms change as output increases, are U-shaped like this.

Calculating the Area Below or Above a Curve

Sometimes it is useful to be able to measure the size of the area below or above a curve. We will encounter one such case in Chapter 4. To keep things simple, we'll only calculate the area below or above a linear curve.

How large is the shaded area below the linear curve in panel (a) of Figure 2A-7 on the next page? First note that this area has the shape of a right triangle. A right triangle is a triangle that has two sides that make a right angle with each other. We will refer to one of these sides as the *height* of the triangle and the other side as the *base* of the triangle. For our purposes, it doesn't matter which of these two sides we refer to as the base and which as the height. Calculating the area of a right triangle is straightforward: multiply the height of the triangle by the base of the triangle, and divide the result by 2. The height of the triangle in panel (a) of Figure 2A-7 is $10 - 4 = 6$. And the base of the triangle is $3 - 0 = 3$. So the area of that triangle is

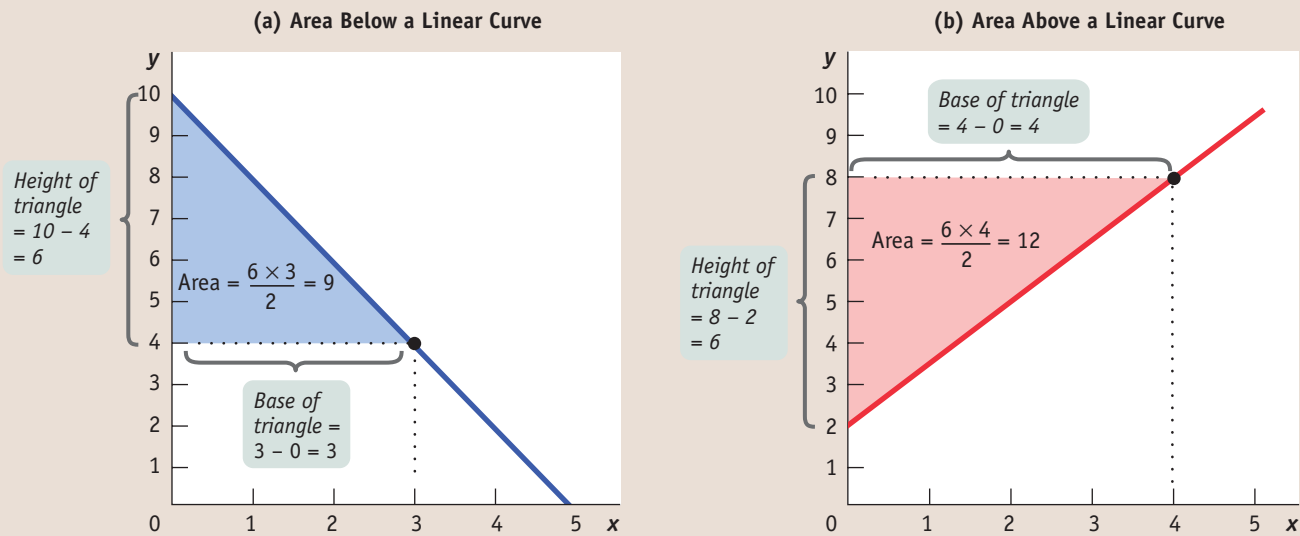
$$\frac{6 \times 3}{2} = 9$$

How about the shaded area above the linear curve in panel (b) of Figure 2A-7? We can use the same formula to calculate the area of this right triangle. The height of the triangle is $8 - 2 = 6$. And the base of the triangle is $4 - 0 = 4$. So the area of that triangle is

$$\frac{6 \times 4}{2} = 12$$

A nonlinear curve may have a **minimum** point, the lowest point along the curve. At the minimum, the slope of the curve changes from negative to positive.

FIGURE 2A-7 Calculating the Area Below and Above a Linear Curve



The area above or below a linear curve forms a right triangle. The area of a right triangle is calculated by multiplying the height of the triangle by the base of the

triangle, and dividing the result by 2. In panel (a) the area of the shaded triangle is $\frac{6 \times 3}{2} = 9$. In panel (b) the area of the shaded triangle is $\frac{6 \times 4}{2} = 12$.

Graphs That Depict Numerical Information

Graphs can also be used as a convenient way to summarize and display data without assuming some underlying causal relationship. Graphs that simply display numerical information are called *numerical graphs*. Here we will consider four types of numerical graphs: *time-series graphs*, *scatter diagrams*, *pie charts*, and *bar graphs*. These are widely used to display real, empirical data about different economic variables because they often help economists and policy makers identify patterns or trends in the economy. But as we will also see, you must be careful not to misinterpret or draw unwarranted conclusions from numerical graphs. That is, you must be aware of both the usefulness and the limitations of numerical graphs.

Types of Numerical Graphs

You have probably seen graphs in newspapers that show what has happened over time to economic variables such as the unemployment rate or stock prices. A **time-series graph** has successive dates on the horizontal axis and the values of a variable that occurred on those dates on the vertical axis. For example, Figure 2A-8 shows the unemployment rate in the United States from 1989 to late 2006. A line connecting the points that correspond to the unemployment rate for each month during those years gives a clear idea of the overall trend in unemployment over these years.

Figure 2A-9 is an example of a different kind of numerical graph. It represents information from a sample of 158 countries on average life expectancy and gross national product (GNP) per capita—a rough measure of a country's standard of living. Each point here indicates an average resident's life expectancy and the log of GNP per capita for a given country. (Economists have found that the log of GNP rather than the simple level of GNP is more closely tied to average life expectancy.)

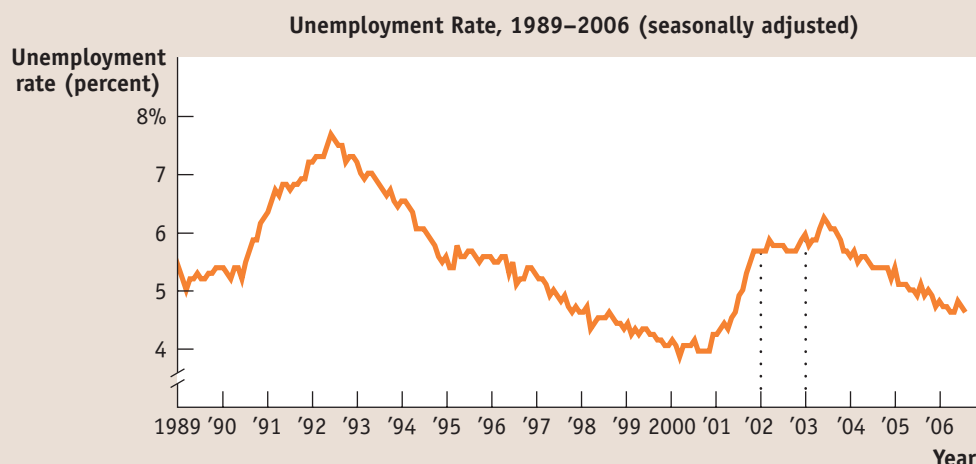
A **time-series graph** has dates on the horizontal axis and values of a variable that occurred on those dates on the vertical axis.

FIGURE 2A-8

Time-Series Graph

Time-series graphs show successive dates on the x-axis and values for a variable on the y-axis. This time-series graph shows the seasonally adjusted unemployment rate in the United States from 1989 to late 2006.

Source: Bureau of Labor Statistics.



The points lying in the upper right of the graph, which show combinations of high life expectancy and high log GNP per capita, represent economically advanced countries such as the United States. Points lying in the bottom left of the graph, which show combinations of low life expectancy and low log GNP per capita, represent economically less advanced countries such as Afghanistan and Sierra Leone. The pattern of points indicates that there is a positive relationship between life expectancy and log GNP per capita: on the whole, people live longer in countries with a higher standard of living. This type of graph is called a **scatter diagram**, a diagram in which each point corresponds to an actual observation of the x-variable and the y-variable. In scatter diagrams, a curve is typically fitted to the scatter of points; that is, a curve is drawn that approximates as closely as possible the general relationship between the variables. As you can see, the fitted curve in Figure 2A-9 is upward-sloping, indicating the underlying positive relationship between the two variables. Scatter diagrams are often used to show how a general relationship can be inferred from a set of data.

A **scatter diagram** shows points that correspond to actual observations of the x- and y-variables. A curve is usually fitted to the scatter of points.

FIGURE 2A-9

Scatter Diagram

In a scatter diagram, each point represents the corresponding values of the x- and y-variables for a given observation. Here, each point indicates the observed average life expectancy and the log of GNP per capita of a given country for a sample of 158 countries. The upward-sloping fitted line here is the best approximation of the general relationship between the two variables.

Source: Eduard Bos et al., *Health, Nutrition, and Population Indicators: A Statistical Handbook* (Washington, DC: World Bank, 1999).

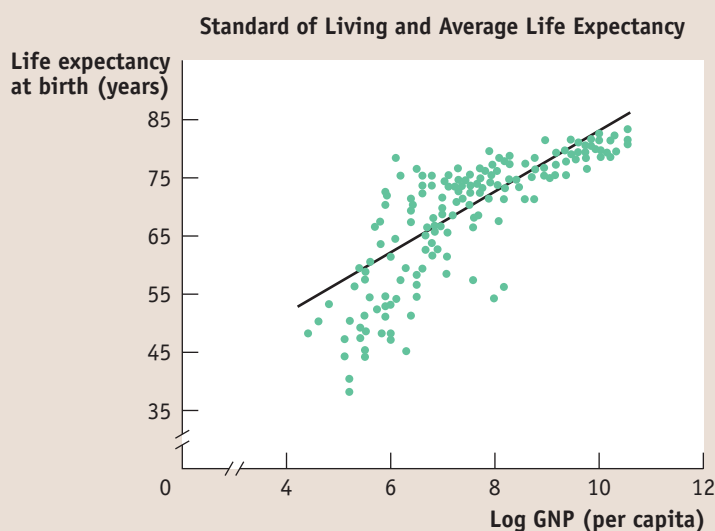


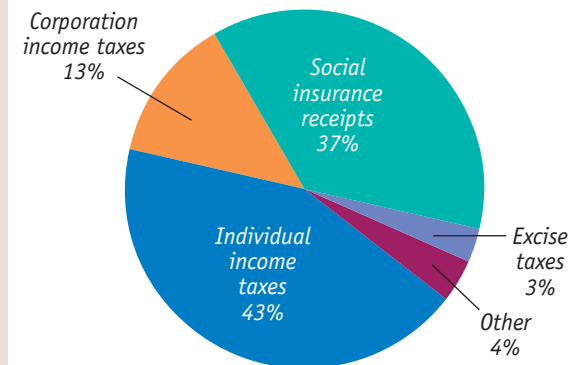
FIGURE 2A-10

Pie Chart

A pie chart shows the percentages of a total amount that can be attributed to various components. This pie chart shows the percentages of total federal revenues that come from each source.

Source: Office of Management and Budget.

Receipts by Source for U.S. Government Budget 2005
(total: \$2,153.9 billion)



A **pie chart** shows the share of a total amount that is accounted for by various components, usually expressed in percentages. For example, Figure 2A-10 is a pie chart that depicts the various sources of revenue for the U.S. government budget in 2005, expressed in percentages of the total revenue amount, \$2,153.9 billion. As you can see, social insurance receipts (the revenues collected to fund Social Security, Medicare, and unemployment insurance) accounted for 37% of total government revenue and individual income tax receipts accounted for 43%.

Bar graphs use bars of various heights or lengths to indicate values of a variable. In the bar graph in Figure 2A-11, the bars show the percent change in the number of unemployed workers in the United States from 2001 to 2002, separately for White, Black or African-American, and Asian workers. Exact values of the variable that is being measured may be written at the end of the bar, as in this figure. For instance, the number of unemployed Asian workers in the United States increased by 35% between 2001 and 2002. But even without the precise values, comparing the heights or lengths of the bars can give useful insight into the relative magnitudes of the different values of the variable.

A **pie chart** shows how some total is divided among its components, usually expressed in percentages.

A **bar graph** uses bars of varying height or length to show the comparative sizes of different observations of a variable.

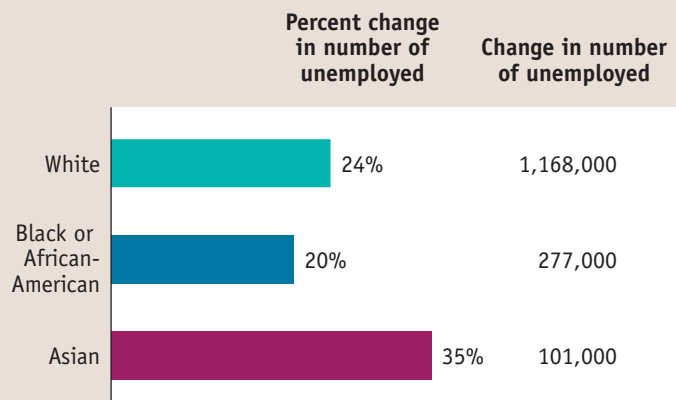
FIGURE 2A-11

Bar Graph

A bar graph measures a variable by using bars of various heights or lengths. This bar graph shows the percent change in the number of unemployed workers between 2001 and 2002, separately for White, Black or African-American, and Asian workers.

Source: Bureau of Labor Statistics.

Changes in the Number of Unemployed by Race (2001–2002)



Problems in Interpreting Numerical Graphs

Although the beginning of this appendix emphasized that graphs are visual images that make ideas or information easier to understand, graphs can be constructed (intentionally or unintentionally) in ways that are misleading and can lead to inaccurate conclusions. This section raises some issues that you should be aware of when you interpret graphs.

Features of Construction Before drawing any conclusions about what a numerical graph implies, you should pay attention to the scale, or size of increments, shown on the axes. Small increments tend to visually exaggerate changes in the variables, whereas large increments tend to visually diminish them. So the scale used in construction of a graph can influence your interpretation of the significance of the changes it illustrates—perhaps in an unwarranted way.

Take, for example, Figure 2A-12, which shows the unemployment rate in the United States in 2002 using a 0.1% scale. You can see that the unemployment rate rose from 5.6% at the beginning of 2002 to 6.0% by the end of the year. Here, the rise of 0.4% in the unemployment rate looks enormous and could lead a policy maker to conclude that it was a relatively significant event. But if you go back and reexamine Figure 2A-8, which shows the unemployment rate in the United States from 1989 to late 2006, you can see that this would be a misguided conclusion. Figure 2A-8 includes the same data shown in Figure 2A-12, but it is constructed with a 1% scale rather than a 0.1% scale. From it you can see that the rise of 0.4% in the unemployment rate during 2002 was, in fact, a relatively insignificant event, at least compared to the rise in unemployment during 1990 or during 2001. This comparison shows that if you are not careful to factor in the choice of scale in interpreting a graph, you can arrive at very different, and possibly misguided, conclusions.

Related to the choice of scale is the use of *truncation* in constructing a graph. An axis is **truncated** when part of the range is omitted. This is indicated by two slashes (//) in the axis near the origin. You can see that the vertical axis of Figure 2A-12 has been truncated—the range of values from 0 to 5.6 has been omitted and a // appears in the axis. Truncation saves space in the presentation of a graph and allows smaller increments to be used in constructing it. As a result, changes in the variable depicted on a graph that has been truncated appear larger compared to a graph that has not been truncated and that uses larger increments.

An axis is **truncated** when some of the values on the axis are omitted, usually to save space.

FIGURE 2A-12

Interpreting Graphs: The Effect of Scale

Some of the same data for the year 2002 used in Figure 2A-8 are represented here, except that here they are shown using 0.1% increments rather than 1% increments. As a result of this change in scale, the rise in the unemployment rate during 2002 looks much larger in this figure compared to Figure 2A-8.

Source: Bureau of Labor Statistics.



An **omitted variable** is an unobserved variable that, through its influence on other variables, creates the erroneous appearance of a direct causal relationship among those variables.

The error of **reverse causality** is committed when the true direction of causality between two variables is reversed.

You must also pay close attention to exactly what a graph is illustrating. For example, in Figure 2A-11, you should recognize that what is being shown here are percentage changes in the number of unemployed, not numerical changes. The unemployment rate for Asian workers increased by the highest percentage, 35% in this example. If you confused numerical changes with percentage changes, you would erroneously conclude that the greatest number of newly unemployed workers were Asian. But, in fact, a correct interpretation of Figure 2A-11 shows that the greatest number of newly unemployed workers were White: the total number of unemployed White workers grew by 1,168,000 workers, which is greater than the increase in the number of unemployed Asian workers, which is 101,000 in this example. Although there was a higher percentage increase in the number of unemployed Asian workers, the number of unemployed Asian workers in the United States in 2001 was much smaller than the number of unemployed White workers, leading to a smaller number of newly unemployed Asian workers than White workers.

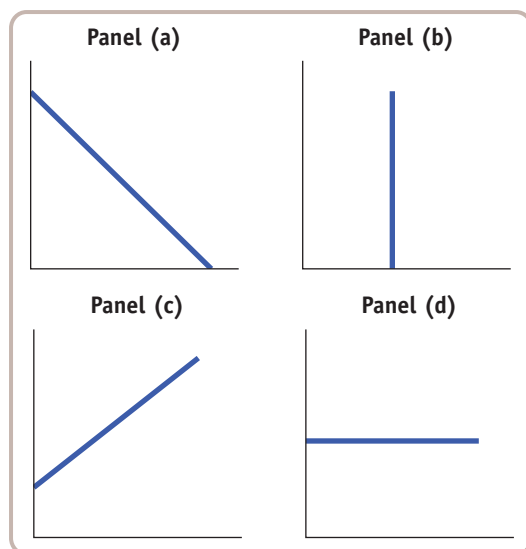
Omitted Variables From a scatter diagram that shows two variables moving either positively or negatively in relation to each other, it is easy to conclude that there is a causal relationship. But relationships between two variables are not always due to direct cause and effect. Quite possibly an observed relationship between two variables is due to the *unobserved* effect of a third variable on each of the other two variables. An unobserved variable that, through its influence on other variables, creates the erroneous appearance of a direct causal relationship among those variables is called an **omitted variable**. For example, in New England, a greater amount of snowfall during a given week will typically cause people to buy more snow shovels. It will also cause people to buy more de-icer fluid. But if you omitted the influence of the snowfall and simply plotted the number of snow shovels sold versus the number of bottles of de-icer fluid sold, you would produce a scatter diagram that showed an upward tilt in the pattern of points, indicating a positive relationship between snow shovels sold and de-icer fluid sold. To attribute a causal relationship between these two variables, however, is misguided; more snow shovels sold do not cause more de-icer fluid to be sold, or vice versa. They move together because they are both influenced by a third, determining, variable—the weekly snowfall, which is the omitted variable in this case. So before assuming that a pattern in a scatter diagram implies a cause-and-effect relationship, it is important to consider whether the pattern is instead the result of an omitted variable. Or to put it succinctly: correlation is not causation.

Reverse Causality Even when you are confident that there is no omitted variable and that there is a causal relationship between two variables shown in a numerical graph, you must also be careful that you don't make the mistake of **reverse causality**—coming to an erroneous conclusion about which is the dependent and which is the independent variable by reversing the true direction of causality between the two variables. For example, imagine a scatter diagram that depicts the grade point averages (GPAs) of 20 of your classmates on one axis and the number of hours that each of them spends studying on the other. A line fitted between the points will probably have a positive slope, showing a positive relationship between GPA and hours of studying. We could reasonably infer that hours spent studying is the independent variable and that GPA is the dependent variable. But you could make the error of reverse causality: you could infer that a high GPA causes a student to study more, whereas a low GPA causes a student to study less.

The significance of understanding how graphs can mislead or be incorrectly interpreted is not purely academic. Policy decisions, business decisions, and political arguments are often based on interpretation of the types of numerical graphs that we've just discussed. Problems of misleading features of construction, omitted variables, and reverse causality can lead to very important and undesirable consequences.

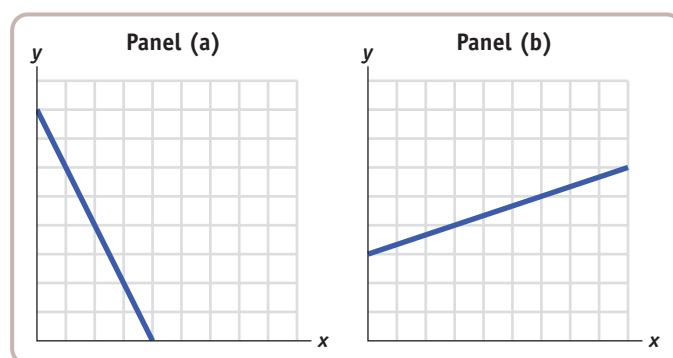
PROBLEMS

1. Study the four accompanying diagrams. Consider the following statements and indicate which diagram matches each statement. Which variable would appear on the horizontal axis and which on the vertical axis? In each of these statements, is the slope positive, negative, zero, or infinity?



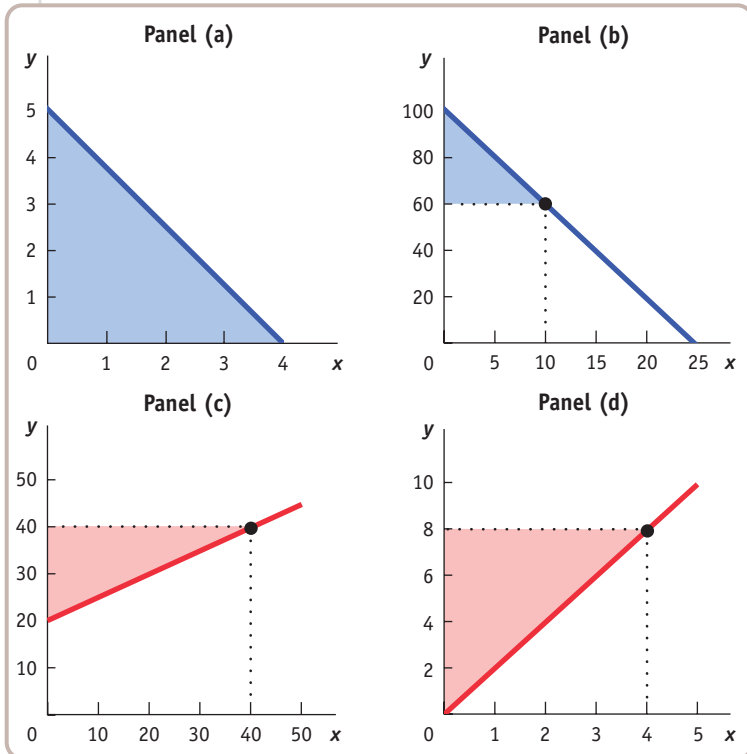
- If the price of movies increases, fewer consumers go to see movies.
 - More experienced workers typically have higher incomes than less experienced workers.
 - Whatever the temperature outside, Americans consume the same number of hot dogs per day.
 - Consumers buy more frozen yogurt when the price of ice cream goes up.
 - Research finds no relationship between the number of diet books purchased and the number of pounds lost by the average dieter.
 - Regardless of its price, Americans buy the same quantity of salt.
2. During the Reagan administration, economist Arthur Laffer argued in favor of lowering income tax rates in order to increase tax revenues. Like most economists, he believed that at tax rates above a certain level, tax revenue would fall because high taxes would discourage some people from working and that people would refuse to work at all if they received no income after paying taxes. This relationship between tax rates and tax revenue is graphically summarized in what is widely known as the Laffer curve. Plot the Laffer curve relationship assuming that it has the shape of a nonlinear curve. The following questions will help you construct the graph.
- Which is the independent variable? Which is the dependent variable? On which axis do you therefore measure the income tax rate? On which axis do you measure income tax revenue?

- What would tax revenue be at a 0% income tax rate?
 - The maximum possible income tax rate is 100%. What would tax revenue be at a 100% income tax rate?
 - Estimates now show that the maximum point on the Laffer curve is (approximately) at a tax rate of 80%. For tax rates less than 80%, how would you describe the relationship between the tax rate and tax revenue, and how is this relationship reflected in the slope? For tax rates higher than 80%, how would you describe the relationship between the tax rate and tax revenue, and how is this relationship reflected in the slope?
3. In the accompanying figures, the numbers on the axes have been lost. All you know is that the units shown on the vertical axis are the same as the units on the horizontal axis.



- In panel (a), what is the slope of the line? Show that the slope is constant along the line.
 - In panel (b), what is the slope of the line? Show that the slope is constant along the line.
4. Answer each of the following questions by drawing a schematic diagram.
- Taking measurements of the slope of a curve at three points farther and farther to the right along the horizontal axis, the slope of the curve changes from -0.3 , to -0.8 , to -2.5 , measured by the point method. Draw a schematic diagram of this curve. How would you describe the relationship illustrated in your diagram?
 - Taking measurements of the slope of a curve at five points farther and farther to the right along the horizontal axis, the slope of the curve changes from 1.5 , to 0.5 , to 0 , to -0.5 , to -1.5 , measured by the point method. Draw a schematic diagram of this curve. Does it have a maximum or a minimum?

5. For each of the accompanying diagrams, calculate the area of the shaded right triangle.



6. The base of a right triangle is 10, and its area is 20. What is the height of this right triangle?
7. The accompanying table shows the relationship between workers' hours of work per week and their hourly wage rate. Apart from the fact that they receive a different hourly wage rate and work different hours, these five workers are otherwise identical.

Name	Quantity of labor (hours per week)	Wage rate (per hour)
Athena	30	\$15
Boris	35	30
Curt	37	45
Diego	36	60
Emily	32	75

- Which variable is the independent variable? Which is the dependent variable?
- Draw a scatter diagram illustrating this relationship. Draw a (nonlinear) curve that connects the points. Put the hourly wage rate on the vertical axis.
- As the wage rate increases from \$15 to \$30, how does the number of hours worked respond according to the relationship depicted here? What is the average slope of the curve between Athena's and Boris's data points using the arc method?
- As the wage rate increases from \$60 to \$75, how does the number of hours worked respond according to the relationship depicted here? What is the average slope of the

curve between Diego's and Emily's data points using the arc method?

- Studies have found a relationship between a country's yearly rate of economic growth and the yearly rate of increase in airborne pollutants. It is believed that a higher rate of economic growth allows a country's residents to have more cars and travel more, thereby releasing more airborne pollutants.
 - Which variable is the independent variable? Which is the dependent variable?
 - Suppose that in the country of Sudland, when the yearly rate of economic growth fell from 3.0% to 1.5%, the yearly rate of increase in airborne pollutants fell from 6% to 5%. What is the average slope of a nonlinear curve between these points using the arc method?
 - Now suppose that when the yearly rate of economic growth rose from 3.5% to 4.5%, the yearly rate of increase in airborne pollutants rose from 5.5% to 7.5%. What is the average slope of a nonlinear curve between these two points using the arc method?
 - How would you describe the relationship between the two variables here?
- An insurance company has found that the severity of property damage in a fire is positively related to the number of firefighters arriving at the scene.
 - Draw a diagram that depicts this finding with number of firefighters on the horizontal axis and amount of property damage on the vertical axis. What is the argument made by this diagram? Suppose you reverse what is measured on the two axes. What is the argument made then?
 - In order to reduce its payouts to policyholders, should the insurance company therefore ask the city to send fewer firefighters to any fire?
- The accompanying table illustrates annual salaries and income tax owed by five individuals. Apart from the fact that they receive different salaries and owe different amounts of income tax, these five individuals are otherwise identical.

Name	Annual salary	Annual income tax owed
Susan	\$22,000	\$3,304
Eduardo	63,000	14,317
John	3,000	454
Camila	94,000	23,927
Peter	37,000	7,020

- If you were to plot these points on a graph, what would be the average slope of the curve between the points for Eduardo's and Camila's salaries and taxes using the arc method? How would you interpret this value for slope?
- What is the average slope of the curve between the points for John's and Susan's salaries and taxes using the arc method? How would you interpret that value for slope?
- What happens to the slope as salary increases? What does this relationship imply about how the level of income taxes affects a person's incentive to earn a higher salary?

>> Supply and Demand

WAKE UP AND DON'T SMELL THE COFFEE

FOR THOSE WHO NEED A CAPPUCINO, MOCHA latte, or frappuccino to get through the day, coffee drinking can become an expensive habit. And on October 6, 2006, the habit got a little more expensive. On that day Starbucks raised its drink prices for the first time in six years. The average price of coffee beverages at the world's leading chain of coffeehouses rose about 11 cents per cup.

Starbucks had kept its prices unchanged for six years. So what compelled them to finally raise their prices in the fall of 2006? Mainly the fact that the cost of a major ingredient—coffee beans—had gone up significantly. In fact, coffee bean prices doubled between 2002 and 2006.

Who decided to raise the prices of coffee beans? Nobody: prices went up because of events outside anyone's control. Specifically, the main cause of rising bean prices was a significant decline in the supply of coffee beans from the world's two leading coffee exporters: Brazil and Vietnam. (Yes, Vietnam: since the 1990s, a

country best known to Americans as a place we fought a war has become a coffee-growing giant.) In Brazil, the decline in supply was a delayed reaction to low prices earlier in the decade, which led coffee growers to cut back on planting. In Vietnam, the problem was weather: a prolonged drought sharply reduced coffee harvests.

And a lower supply of coffee beans from Vietnam or Brazil inevitably translates into a higher price of coffee on Main Street. It's just a matter of supply and demand.

What do we mean by that? Many people use “supply and demand” as a sort of catchphrase to mean “the laws of the marketplace at work.” To economists, however, the concept of supply and demand has a precise meaning: it is a *model of how a market behaves* that is extremely useful for understanding many—but not all—markets.

In this chapter, we lay out the pieces that make up the *supply and demand model*, put them together, and show how this model can be used to understand how many—but not all—markets behave.



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Jed Jacobsohn/Getty Images

Reduced coffee bean production in Vietnam inevitably translates into higher coffee prices at your local Starbucks.

WHAT YOU WILL LEARN IN THIS CHAPTER:

- What a **competitive market** is and how it is described by the **supply and demand model**
- The difference between **movements along a curve** and **shifts of a curve**
- **equilibrium price** and **equilibrium quantity**
- What the **demand curve** and **supply curve** are
- How the supply and demand curves determine a market's
- In the case of a **shortage** or **surplus**, how price moves the market back to equilibrium

Supply and Demand: A Model of a Competitive Market

Coffee bean sellers and coffee bean buyers constitute a market—a group of producers and consumers who exchange a good or service for payment. In this chapter, we'll focus on a particular type of market known as a *competitive market*. Roughly, a **competitive market** is a market in which there are many buyers and sellers of the same good or service. More precisely, the key feature of a competitive market is that no individual's actions have a noticeable effect on the price at which the good or service is sold. It's important to understand, however, that this is not an accurate description of every market. For example, it's not an accurate description of the market for cola beverages. That's because in the market for cola beverages, Coca-Cola and Pepsi account for such a large proportion of total sales that they are able to influence the price at which cola beverages are bought and sold. But it is an accurate description of the market for coffee beans. The global marketplace for coffee beans is so huge that even a coffee retailer as large as Starbucks accounts for only a tiny fraction of transactions, making it unable to influence the price at which coffee beans are bought and sold.

It's a little hard to explain why competitive markets are different from other markets until we've seen how a competitive market works. So let's take a rain check—we'll return to that issue at the end of this chapter. For now, let's just say that it's easier to model competitive markets than other markets. When taking an exam, it's always a good strategy to begin by answering the easier questions. In this book, we're going to do the same thing. So we will start with competitive markets.

When a market is competitive, its behavior is well described by the **supply and demand model**. Because many markets *are* competitive, the supply and demand model is a very useful one indeed.

There are five key elements in this model:

- The *demand curve*
- The *supply curve*
- The set of factors that cause the demand curve to shift and the set of factors that cause the supply curve to shift
- The *market equilibrium*, which includes the *equilibrium price* and *equilibrium quantity*
- The way the market equilibrium changes when the supply curve or demand curve shifts

To understand the supply and demand model, we will examine each of these elements.

A **competitive market** is a market in which there are many buyers and sellers of the same good or service, none of whom can influence the price at which the good or service is sold.

The **supply and demand model** is a model of how a competitive market works.

The Demand Curve

How many pounds of coffee beans do consumers around the world want to buy in a given year? You might at first think that we can answer this question by looking at the total number of cups of coffee drunk around the world each day and the amount of coffee beans it takes to brew a cup, then multiplying by 365. But that's not enough to answer the question, because how many pounds of coffee beans consumers want

to buy—and therefore how much coffee people want to drink—depends on the price of coffee beans. When the price of coffee rises, as it did in 2006, some people drink less of it, perhaps switching completely to other caffeinated beverages, such as tea or Coca-Cola. (Yes, there are people who drink Coke in the morning.) In general, the quantity of coffee beans, or of any good or service that people want to buy, depends on the price. The higher the price, the less of the good or service people want to purchase; alternatively, the lower the price, the more they want to purchase.

So the answer to the question “How many pounds of coffee beans do consumers want to buy?” depends on the price of coffee beans. If you don’t yet know what the price will be, you can start by making a table of how many pounds of coffee beans people would want to buy at a number of different prices. Such a table is known as a *demand schedule*. This, in turn, can be used to draw a *demand curve*, which is one of the key elements of the supply and demand model.

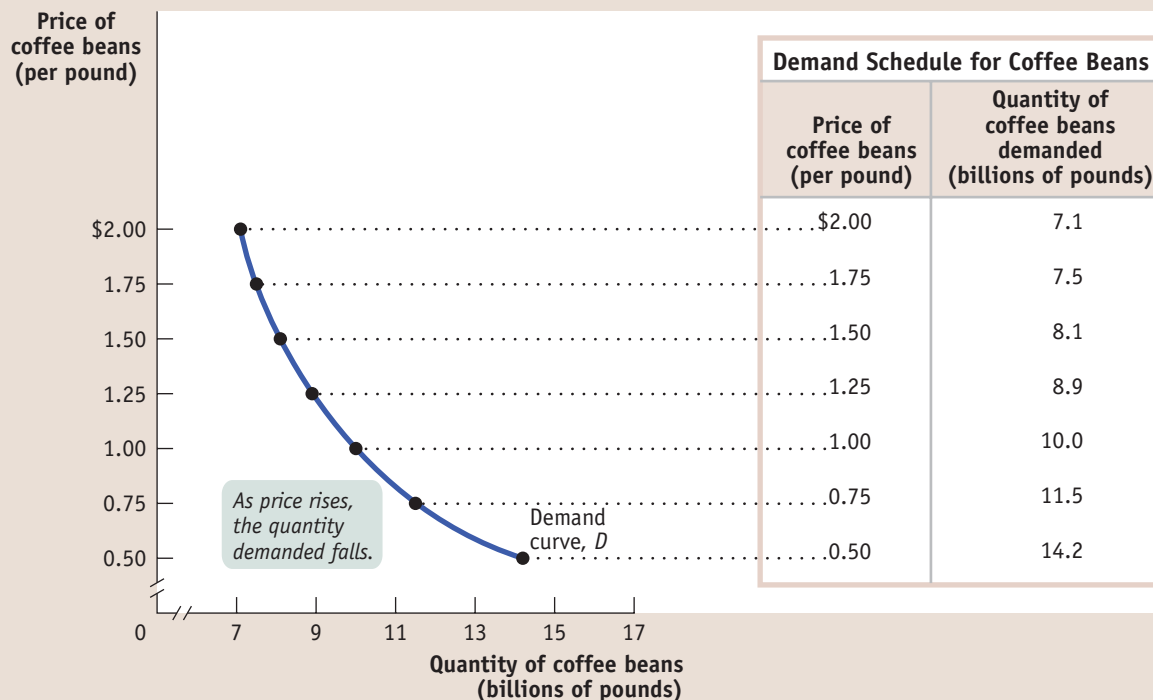
A **demand schedule** shows how much of a good or service consumers will want to buy at different prices.

The Demand Schedule and the Demand Curve

A **demand schedule** is a table showing how much of a good or service consumers will want to buy at different prices. At the right of Figure 3-1, we show a hypothetical demand schedule for coffee beans. It’s hypothetical in that it doesn’t use actual data on the world demand for coffee beans and it assumes that all coffee beans are of equal quality (with our apologies to coffee connoisseurs).

According to the table, if coffee beans cost \$1 a pound, consumers around the world will want to purchase 10 billion pounds of coffee beans over the course of a year. If the price is \$1.25 a pound, they will want to buy only 8.9 billion pounds; if

FIGURE 3-1 The Demand Schedule and the Demand Curve



The demand schedule for coffee beans yields the corresponding demand curve, which shows how much of a good or service consumers want to buy at any given price. The demand curve and the demand

schedule reflect the law of demand: As price rises, the quantity demanded falls. Similarly, a decrease in price raises the quantity demanded. As a result, the demand curve is downward sloping.

The **quantity demanded** is the actual amount of a good or service consumers are willing to buy at some specific price.

A **demand curve** is a graphical representation of the demand schedule. It shows the relationship between quantity demanded and price.

The **law of demand** says that a higher price for a good or service, other things equal, leads people to demand a smaller quantity of that good or service.

the price is only \$0.75 a pound, they will want to buy 11.5 billion pounds; and so on. So the higher the price, the fewer pounds of coffee beans consumers will want to purchase. In other words, as the price rises, the **quantity demanded** of coffee beans—the actual amount consumers are willing to buy at some specific price—falls.

The graph in Figure 3-1 is a visual representation of the information in the table. (You might want to review the discussion of graphs in economics in the appendix to Chapter 2.) The vertical axis shows the price of a pound of coffee beans and the horizontal axis shows the quantity of coffee beans. Each point on the graph corresponds to one of the entries in the table. The curve that connects these points is a **demand curve**. A demand curve is a graphical representation of the demand schedule, another way of showing the relationship between the quantity demanded and price.

Note that the demand curve shown in Figure 3-1 slopes downward. This reflects the general proposition that a higher price reduces the quantity demanded. For example, some people who drink two cups of coffee a day when beans are \$1 per pound will cut down to one cup when beans are \$2 per pound. Similarly, some who drink one cup when beans are \$1 a pound will drink tea instead if the price doubles to \$2 per pound and so on. In the real world, demand curves almost always *do* slope downward. (The exceptions are so rare that for practical purposes we can ignore them.) Generally, the proposition that a higher price for a good, *other things equal*, leads people to demand a smaller quantity of that good is so reliable that economists are willing to call it a “law”—the **law of demand**.

Shifts of the Demand Curve

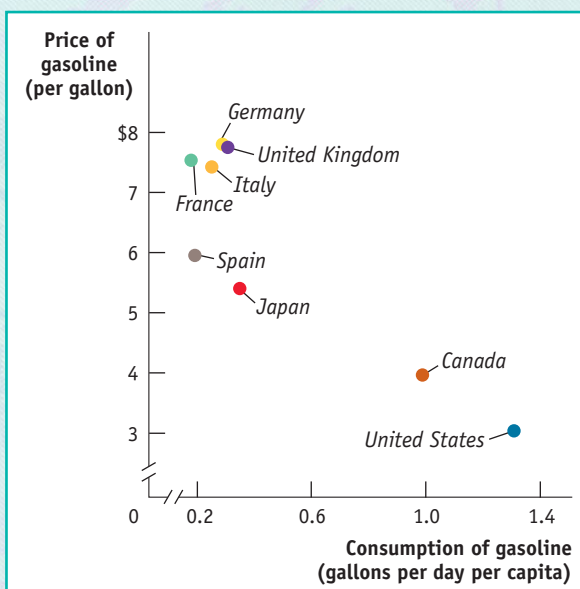
Even though coffee prices were a lot higher in 2006 than they had been in 2002, total world consumption of coffee was higher in 2006. How can we reconcile this fact with the law of demand, which says that a higher price reduces the quantity demanded, other things equal?



PAY MORE, PUMP LESS

For a real-world illustration of the law of demand, consider how gasoline consumption varies according to the prices consumers pay at the pump. Because of high taxes, gasoline and diesel fuel are more than twice as expensive in most European countries as in the United States. According to the law of demand, this should lead Europeans to buy less gasoline than Americans—and they do. As you can see from the figure, per person, Europeans consume less than half as much fuel as Americans, mainly because they drive smaller cars with better mileage.

Prices aren't the only factor affecting fuel consumption, but they're probably the main cause of the difference between European and American fuel consumption per person.



Source: U.S. Energy Information Administration, 2007.

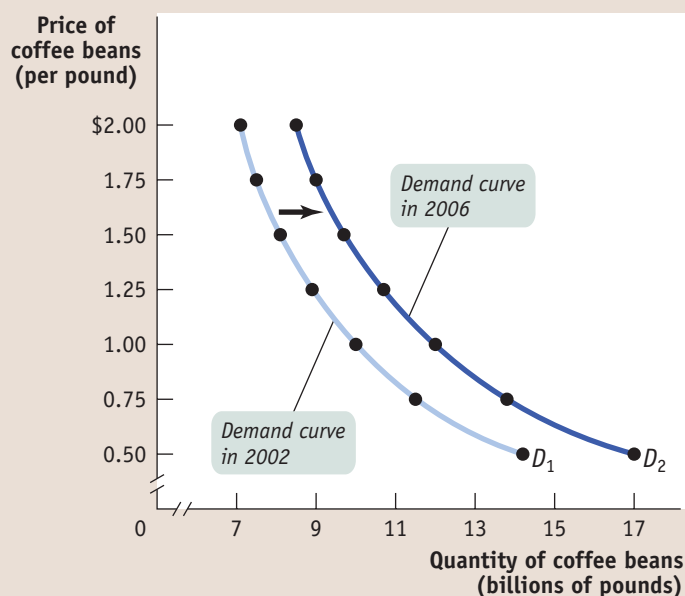
The answer lies in the crucial phrase *other things equal*. In this case, other things weren't equal: the world had changed between 2002 and 2006, in ways that increased the quantity of coffee demanded at any given price. For one thing, the world's population, and therefore the number of potential coffee drinkers, increased. In addition, the growing popularity of different types of coffee beverages, like lattes and cappuccinos, led to an increase in the quantity demanded at any given price. Figure 3-2 illustrates this phenomenon using the demand schedule and demand curve for coffee beans. (As before, the numbers in Figure 3-2 are hypothetical.)

The table in Figure 3-2 shows two demand schedules. The first is a demand schedule for 2002, the same one shown in Figure 3-1. The second is a demand schedule for 2006. It differs from the 2002 demand schedule due to factors such as a larger population and the greater popularity of lattes, factors that led to an increase in the quantity of coffee beans demanded at any given price. So at each price the 2006 schedule shows a larger quantity demanded than the 2002 schedule. For example, the quantity of coffee beans consumers wanted to buy at a price of \$1 per pound increased from 10 billion to 12 billion pounds per year, the quantity demanded at \$1.25 per pound went from 8.9 billion to 10.7 billion pounds, and so on.

What is clear from this example is that the changes that occurred between 2002 and 2006 generated a *new* demand schedule, one in which the quantity demanded was greater at any given price than in the original demand schedule. The two curves in Figure 3-2 show the same information graphically. As you can see, the demand schedule for 2006 corresponds to a new demand curve, D_2 , that is to the right of the demand curve for 2002, D_1 . This **shift of the demand curve** shows the change in the quantity demanded at any given price, represented by the change in position of the original demand curve D_1 to its new location at D_2 .

A **shift of the demand curve** is a change in the quantity demanded at any given price, represented by the change of the original demand curve to a new position, denoted by a new demand curve.

FIGURE 3-2 An Increase in Demand



Price of coffee beans (per pound)	Quantity of coffee beans demanded (billions of pounds)	
	in 2002	in 2006
\$2.00	7.1	8.5
1.75	7.5	9.0
1.50	8.1	9.7
1.25	8.9	10.7
1.00	10.0	12.0
0.75	11.5	13.8
0.50	14.2	17.0

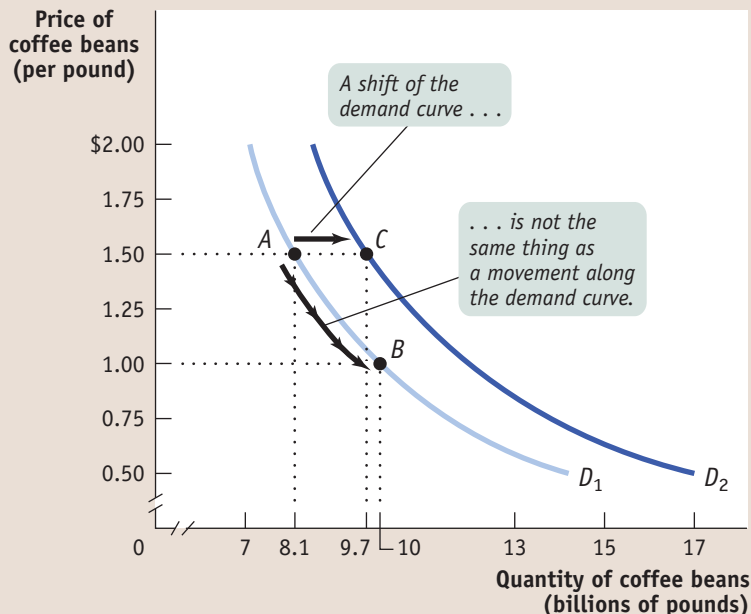
An increase in the population and other factors generate an increase in demand—a rise in the quantity demanded at any given price. This is represented by the two demand schedules—one showing demand in 2002,

before the rise in population, the other showing demand in 2006, after the rise in population—and their corresponding demand curves. The increase in demand shifts the demand curve to the right.

FIGURE 3-3

Movement Along the Demand Curve Versus Shift of the Demand Curve

The rise in quantity demanded when going from point A to point B reflects a movement along the demand curve: it is the result of a fall in the price of the good. The rise in quantity demanded when going from point A to point C reflects a shift of the demand curve: it is the result of a rise in the quantity demanded at any given price.



PITFALLS

DEMAND VERSUS QUANTITY DEMANDED

When economists say “an increase in demand,” they mean a rightward shift of the demand curve, and when they say “a decrease in demand,” they mean a leftward shift of the demand curve—that is, when they’re being careful. In ordinary speech most people, including professional economists, use the word *demand* casually. For example, an economist might say “the demand for air travel has doubled over the past 15 years, partly because of falling air fares” when he or she really means that the *quantity demanded* has doubled.

It’s OK to be a bit sloppy in ordinary conversation. But when you’re doing economic analysis, it’s important to make the distinction between changes in the quantity demanded, which involve movements along a demand curve, and shifts of the demand curve. Sometimes students end up writing something like this: “If demand increases, the price will go up, but that will lead to a fall in demand, which pushes the price down . . .” and then go around in circles. If you make a clear distinction between changes in *demand*, which mean shifts of the demand curve, and changes in *quantity demanded*, you can avoid a lot of confusion.

It’s crucial to make the distinction between such shifts of the demand curve and **movements along the demand curve**, changes in the quantity demanded of a good that result from a change in that good’s price. Figure 3-3 illustrates the difference.

The movement from point A to point B is a movement along the demand curve: the quantity demanded rises due to a fall in price as you move down D_1 . Here, a fall in the price of coffee beans from \$1.50 to \$1 per pound generates a rise in the quantity demanded from 8.1 billion to 10 billion pounds per year. But the quantity demanded can also rise when the price is unchanged if there is an *increase in demand*—a rightward shift of the demand curve. This is illustrated in Figure 3-3 by the shift of the demand curve from D_1 to D_2 . Holding the price constant at \$1.50 a pound, the quantity demanded rises from 8.1 billion pounds at point A on D_1 to 9.7 billion pounds at point C on D_2 .

When economists say “the demand for X increased” or “the demand for Y decreased,” they mean that the demand curve for X or Y shifted—*not* that the quantity demanded rose or fell because of a change in the price.

Understanding Shifts of the Demand Curve

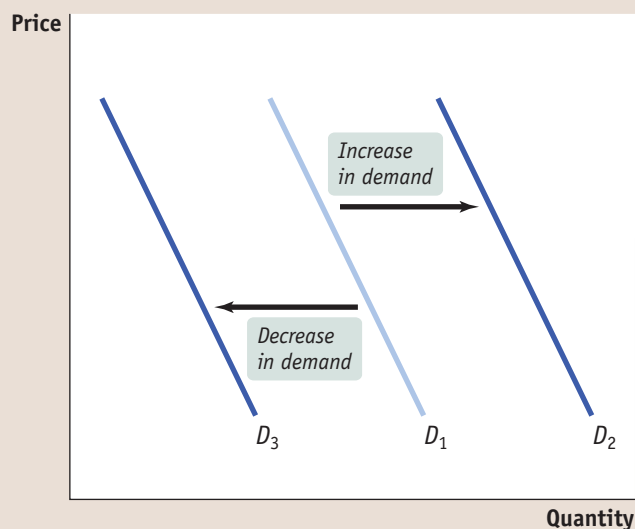
Figure 3-4 illustrates the two basic ways in which demand curves can shift. When economists talk about an “increase in demand,” they mean a *rightward* shift of the demand curve: at any given price, consumers demand a larger quantity of the good or service than before. This is shown by the rightward shift of the original demand curve D_1 to D_2 . And when economists talk about a “decrease in demand,” they mean a *leftward* shift of the demand curve: at any given price, consumers demand a smaller quantity of the good or service than before. This is shown by the leftward shift of the original demand curve D_1 to D_3 .

A **movement along the demand curve** is a change in the quantity demanded of a good that is the result of a change in that good’s price.

FIGURE 3-4

Shifts of the Demand Curve

Any event that increases demand shifts the demand curve to the right, reflecting a rise in the quantity demanded at any given price. Any event that decreases demand shifts the demand curve to the left, reflecting a fall in the quantity demanded at any given price.



What caused the demand curve for coffee beans to shift? We have already mentioned two reasons: changes in population and a change in the popularity of coffee beverages. If you think about it, you can come up with other things that would be likely to shift the demand curve for coffee beans. For example, suppose that the price of tea rises. This will induce some people who previously drank tea to drink coffee instead, increasing the demand for coffee beans.

Economists believe that there are five principal factors that shift the demand curve for a good or service:

- Changes in the prices of related goods or services
- Changes in income
- Changes in tastes
- Changes in expectations
- Changes in the number of consumers

Although this is not an exhaustive list, it contains the five most important factors that can shift demand curves. So when we say that the quantity of a good or service demanded falls as its price rises, *other things equal*, we are in fact stating that the factors that shift demand are remaining unchanged. Let's now explore, in more detail, how those factors shift the demand curve.

Changes in the Prices of Related Goods or Services While there's nothing quite like a good cup of coffee to start your day, a cup or two of strong tea isn't a bad alternative. Tea is what economists call a *substitute* for coffee. A pair of goods are **substitutes** if a rise in the price of one good (coffee) makes consumers more willing to buy the other good (tea). Substitutes are usually goods that in some way serve a similar function: concerts and theater plays, muffins and doughnuts, train rides and air flights. A rise in the price of the alternative good induces some consumers to purchase the original good *instead* of it, shifting demand for the original good to the right.

But sometimes a fall in the price of one good makes consumers *more* willing to buy another good. Such pairs of goods are known as **complements**. Complements are usually goods that in some sense are consumed together: computers and software, cappuccinos and croissants, cars and gasoline. Because consumers like to consume a good and its complement together, a change in the price of one of the goods will affect the demand for its complement. In particular, when the price of one good

Two goods are **substitutes** if a rise in the price of one of the goods leads to an increase in the demand for the other good.

Two goods are **complements** if a rise in the price of one good leads to a decrease in the demand for the other good.

When a rise in income increases the demand for a good—the normal case—it is a **normal good**.

When a rise in income decreases the demand for a good, it is an **inferior good**.

risks, the demand for its complement decreases, shifting the demand curve for the complement to the left. So the October 2006 rise in Starbucks' cappuccino prices is likely to have precipitated a leftward shift of the demand curve for croissants, as people consumed fewer cappuccinos and croissants. Likewise, when the price of one good falls, the quantity demanded of its complement rises, shifting the demand curve for the complement to the right. This means that if, for some reason, the price of cappuccinos falls, we should see a rightward shift of the demand curve for croissants as people consume more cappuccinos and croissants.

Changes in Income When individuals have more income, they are normally more likely to purchase a good at any given price. For example, if a family's income rises, it is more likely to take that summer trip to Disney World—and therefore also more likely to buy plane tickets. So a rise in consumer incomes will cause the demand curves for most goods to shift to the right.

Why do we say “most goods,” not “all goods”? Most goods are **normal goods**—the demand for them increases when consumer income rises. However, the demand for some products falls when income rises. Goods for which demand decreases when income rises are known as **inferior goods**. Usually an inferior good is one that is considered less desirable than more expensive alternatives—such as a bus ride versus a taxi ride. When they can afford to, people stop buying an inferior good and switch their consumption to the preferred, more expensive alternative. So when a good is inferior, a rise in income shifts the demand curve to the left. And, not surprisingly, a fall in income shifts the demand curve to the right.

One example of the distinction between normal and inferior goods that has drawn considerable attention in the business press is the difference between so-called casual-dining restaurants such as Applebee's or Olive Garden and fast-food chains such as McDonald's and KFC. When Americans' income rises, they tend to eat out more at casual-dining restaurants. However, some of this increased dining out comes at the expense of fast-food venues—to some extent, people visit McDonald's less once they can afford to move upscale. So casual dining is a normal good, while fast-food consumption appears to be an inferior good.

Changes in Tastes Why do people want what they want? Fortunately, we don't need to answer that question—we just need to acknowledge that people have certain preferences, or tastes, that determine what they choose to consume and that these tastes can change. Economists usually lump together changes in demand due to fads, beliefs, cultural shifts, and so on under the heading of changes in *tastes* or *preferences*.

For example, once upon a time men wore hats. Up until around World War II, a respectable man wasn't fully dressed unless he wore a dignified hat along with his suit. But the returning GIs adopted a more informal style, perhaps due to the rigors of the war. And President Eisenhower, who had been supreme commander of Allied Forces before becoming president, often went hatless. After World War II, it was clear that the demand curve for hats had shifted leftward, reflecting a decrease in the demand for hats.

We've already mentioned one way in which changing tastes played a role in the increase in the demand for coffee beans from 2002 to 2006: the increase in the popularity of coffee beverages such as lattes and cappuccinos. In addition, there was another route by which changing tastes increased worldwide demand for coffee beans: the switch by consumers in traditionally tea-drinking countries to coffee. “In 1999,” reported *Roast* magazine, “the ratio of Russian tea drinkers to coffee drinkers was five to one. In 2005, the ratio is roughly two to one.”

Economists have little to say about the forces that influence consumers' tastes. (Although marketers and advertisers have plenty to say about them!) However, a *change* in tastes has a predictable impact on demand. When tastes change in favor of a good, more people want to buy it at any given price, so the demand curve shifts to the right. When tastes change against a good, fewer people want to buy it at any given price, so the demand curve shifts to the left.

Changes in Expectations When consumers have some choice about when to make a purchase, current demand for a good is often affected by expectations about its future price. For example, savvy shoppers often wait for seasonal sales—say, buying next year’s holiday gifts during the post-holiday markdowns. In this case, expectations of a future drop in price lead to a decrease in demand today. Alternatively, expectations of a future rise in price are likely to cause an increase in demand today. For example, savvy shoppers, knowing that Starbucks was going to increase the price of its coffee beans on October 6, 2006, would stock up on Starbucks coffee beans before that date.

Expected changes in future income can also lead to changes in demand: if you expect your income to rise in the future, you will typically borrow today and increase your demand for certain goods; and if you expect your income to fall in the future, you are likely to save today and reduce your demand for some goods.

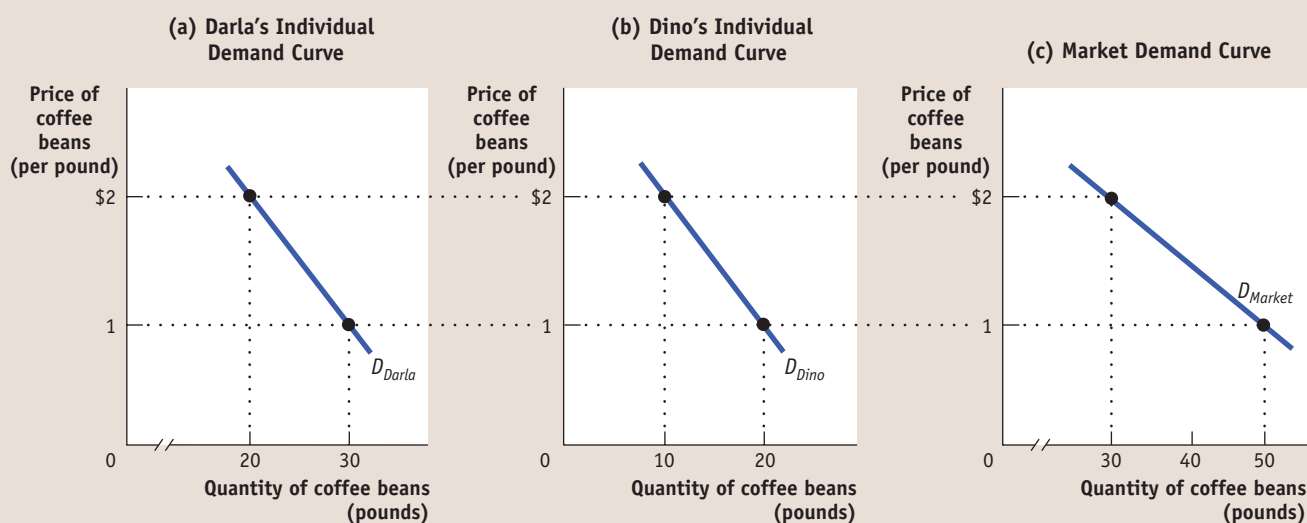
Changes in the Number of Consumers As we’ve already noted, one of the reasons for rising coffee demand between 2002 and 2006 was a growing world population. Because of population growth, overall demand for coffee would have risen even if each individual coffee-drinker’s demand for coffee had remained unchanged.

Let’s introduce a new concept: the **individual demand curve**, which shows the relationship between quantity demanded and price for an individual consumer. For example, suppose that Darla is a consumer of coffee beans and that panel (a) of Figure 3-5 shows how many pounds of coffee beans she will buy per year at any given price per pound. Then D_{Darla} is Darla’s individual demand curve.

The *market demand curve* shows how the combined quantity demanded by all consumers depends on the market price of that good. (Most of the time, when economists refer to the demand curve, they mean the market demand curve.) The market demand curve is the *horizontal sum* of the individual demand curves of all

An **individual demand curve** illustrates the relationship between quantity demanded and price for an individual consumer.

FIGURE 3-5 Individual Demand Curves and the Market Demand Curve



Darla and Dino are the only two consumers of coffee beans in the market. Panel (a) shows Darla’s individual demand curve: the number of pounds of coffee beans she will buy per year at any given price. Panel (b) shows Dino’s individual demand curve. Given that Darla and Dino are the only two consumers, the *market demand curve*, which shows the

quantity of coffee demanded by all consumers at any given price, is shown in panel (c). The market demand curve is the *horizontal sum* of the individual demand curves of all consumers. In this case, at any given price, the quantity demanded by the market is the sum of the quantities demanded by Darla and Dino.

TABLE 3-1

Factors That Shift Demand

Changes in the prices of related goods or services		
If A and B are substitutes . . .	. . . and the price of B rises, . . .	. . . demand for A increases.
	. . . and the price of B falls, . . .	. . . demand for A decreases.
If A and B are complements . . .	. . . and the price of B rises, . . .	. . . demand for A decreases.
	. . . and the price of B falls, . . .	. . . demand for A increases.
Changes in income		
If A is a normal good . . .	. . . and income rises, . . .	. . . demand for A increases.
	. . . and income falls, . . .	. . . demand for A decreases.
If A is an inferior good . . .	. . . and income rises, . . .	. . . demand for A decreases.
	. . . and income falls, . . .	. . . demand for A increases.
Changes in tastes		
	If tastes change in favor of A , . . .	. . . demand for A increases.
	If tastes change against A , . . .	. . . demand for A decreases.
Changes in expectations		
	If the price of A is expected to rise in the future, . . .	. . . demand for A increases today.
	If the price of A is expected to fall in the future, . . .	. . . demand for A decreases today.
If A is a normal good . . .	. . . and income is expected to rise in the future, . . .	. . . demand for A may increase today.
	. . . and income is expected to fall in the future, . . .	. . . demand for A may decrease today.
If A is an inferior good . . .	. . . and income is expected to rise in the future, . . .	. . . demand for A may decrease today.
	. . . and income is expected to fall in the future, . . .	. . . demand for A may increase today.
Changes in the number of consumers		
	If the number of consumers of A rises, . . .	. . . market demand for A increases.
	If the number of consumers of A falls, . . .	. . . market demand for A decreases.

consumers in that market. To see what we mean by the term *horizontal sum*, assume for a moment that there are only two consumers of coffee, Darla and Dino. Dino's individual demand curve, D_{Dino} , is shown in panel (b). Panel (c) shows the market demand curve. At any given price, the quantity demanded by the market is the sum of the quantities demanded by Darla and Dino. For example, at a price of \$2 per pound, Darla demands 20 pounds of coffee beans per year and Dino demands 10 pounds per year. So the quantity demanded by the market is 30 pounds per year.

Clearly, the quantity demanded by the market at any given price is larger with Dino present than it would be if Darla was the only consumer. The quantity demanded at any given price would be even larger if we added a third consumer, then a fourth, and so on. So an increase in the number of consumers leads to an increase in demand.

For an overview of the factors that shift demand, see Table 3-1.

►ECONOMICS IN ACTION

Beating the Traffic

All big cities have traffic problems, and many local authorities try to discourage driving in the crowded city center. If we think of an auto trip to the city center as a good that people consume, we can use the economics of demand to analyze anti-traffic policies.



One common strategy of local governments is to reduce the demand for auto trips by lowering the prices of substitutes. Many metropolitan areas subsidize bus and rail service, hoping to lure commuters out of their cars.

An alternative strategy is to raise the price of complements: several major U.S. cities impose high taxes on commercial parking garages, both to raise revenue and to discourage people from driving into the city. Short time limits on parking meters, combined with vigilant parking enforcement, is a related tactic.

However, few cities have been willing to adopt the politically controversial direct approach: reducing congestion by raising the price of driving. So it was a shock when, in 2003, London imposed a “congestion charge” on all cars entering the city center during business hours—currently £8 (about \$16) for drivers who pay on the same day they travel.

Compliance is monitored with automatic cameras that photograph license plates. People can either pay the charge in advance or pay it by midnight of the day they have driven. If they pay on the day after they have driven, the charge increases to £10 (about \$20). And if they don’t pay and are caught, a fine of £120 (about \$240) is imposed for each transgression. (A full description of the rules can be found at www.cclondon.com.)

Not surprisingly, the result of the new policy confirms the law of demand: three years after the charge was put in place, traffic in central London was about 10 percent lower than before the charge. In February 2007, the British government doubled the area of London covered by the congestion charge, and it suggested that it might institute congestion charging across the country by 2015. Several American and European municipalities, having seen the success of London’s congestion charge, have said that they are seriously considering adopting a congestion charge as well. ▲

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► CHECK YOUR UNDERSTANDING 3-1

1. Explain whether each of the following events represents (i) a *shift* of the demand curve or (ii) a *movement along* the demand curve.
 - a. A store owner finds that customers are willing to pay more for umbrellas on rainy days.
 - b. When XYZ Telecom, a long-distance telephone service provider, offered reduced rates on weekends, its volume of weekend calling increased sharply.
 - c. People buy more long-stem roses the week of Valentine’s Day, even though the prices are higher than at other times during the year.
 - d. The sharp rise in the price of gasoline leads many commuters to join carpools in order to reduce their gasoline purchases.

Solutions appear at back of book.

►► QUICK REVIEW

- The **supply and demand model** is a model of a **competitive market**—one in which there are many buyers and sellers of the same good or service.
- The **demand schedule** shows how the **quantity demanded** changes as the price changes. This relationship is illustrated by a **demand curve**.
- The **law of demand** asserts that demand curves normally slope downward—that is, a higher price reduces the quantity demanded.
- Increases or decreases in demand correspond to **shifts of the demand curve**. An increase in demand is a rightward shift: the quantity demanded rises for any given price. A decrease in demand is a leftward shift: the quantity demanded falls for any given price. A change in price results in a **movement along the demand curve**—a change in the quantity demanded.
- The five main factors that can shift the demand curve are changes in (1) the price of a related good, such as a **substitute** or a **complement**, (2) income, (3) tastes, (4) expectations, and (5) the number of consumers.
- The market demand curve is the horizontal sum of the **individual demand curves** of all consumers in the market.

The Supply Curve

Some parts of the world are especially well suited to growing coffee beans, which is why, as the lyrics of an old song put it, “There’s an awful lot of coffee in Brazil.” But even in Brazil, some land is better suited to growing coffee than other land. Whether Brazilian farmers restrict their coffee-growing to only the most ideal locations or expand it to less suitable land depends on the price they expect to get for their beans. Moreover, there are many other areas in the world where coffee beans could be grown—such as Madagascar and Vietnam. Whether farmers there actually grow coffee depends, again, on the price.

So just as the quantity of coffee beans that consumers want to buy depends on the price they have to pay, the quantity that producers are willing to produce and sell—the **quantity supplied**—depends on the price they are offered.

The Supply Schedule and the Supply Curve

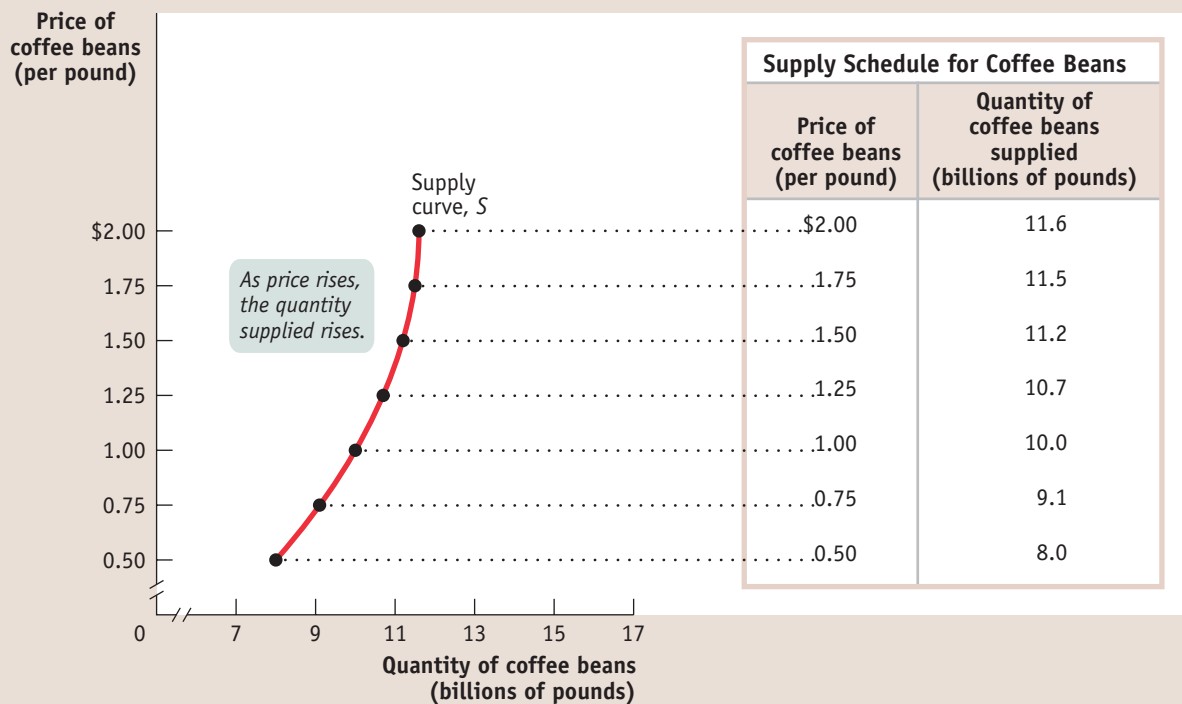
The table in Figure 3-6 on the next page shows how the quantity of coffee beans made available varies with the price—that is, it shows a hypothetical **supply schedule** for coffee beans.

The **quantity supplied** is the actual amount of a good or service producers are willing to sell at some specific price.

A **supply schedule** shows how much of a good or service producers will supply at different prices.

FIGURE 3-6

The Supply Schedule and the Supply Curve



The supply schedule for coffee beans is plotted to yield the corresponding supply curve, which shows how much of a good producers are willing to sell at any given price. The supply curve and the supply

schedule reflect the fact that supply curves are usually upward sloping: the quantity supplied rises when the price rises.

A supply schedule works the same way as the demand schedule shown in Figure 3-1: in this case, the table shows the quantity of coffee beans farmers are willing to sell at different prices. At a price of \$0.50 per pound, farmers are willing to sell only 8 billion pounds of coffee beans per year. At \$0.75 per pound, they're willing to sell 9.1 billion pounds. At \$1, they're willing to sell 10 billion pounds, and so on.

In the same way that a demand schedule can be represented graphically by a demand curve, a supply schedule can be represented by a **supply curve**, as shown in Figure 3-6. Each point on the curve represents an entry from the table.

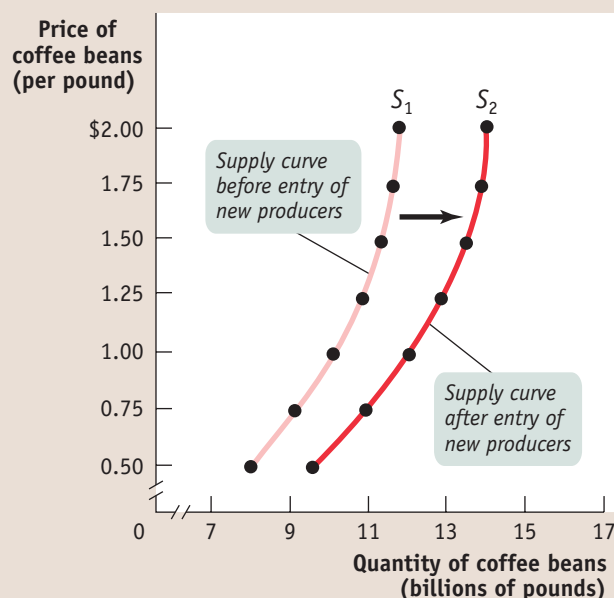
Suppose that the price of coffee beans rises from \$1 to \$1.25; we can see that the quantity of coffee beans farmers are willing to sell rises from 10 billion to 10.7 billion pounds. This is the normal situation for a supply curve, reflecting the general proposition that a higher price leads to a higher quantity supplied. So just as demand curves normally slope downward, supply curves normally slope upward: the higher the price being offered, the more of any good or service producers will be willing to sell.

Shifts of the Supply Curve

Compared to earlier trends, coffee beans were unusually cheap in the early years of the twenty-first century. One reason was the emergence of new coffee bean-producing countries, which began competing with the traditional sources in Latin

A **supply curve** shows the relationship between quantity supplied and price.

FIGURE 3-7 An Increase in Supply



Supply Schedules for Coffee Beans		
Price of coffee beans (per pound)	Quantity of coffee beans supplied (billions of pounds)	
	Before entry	After entry
\$2.00	11.6	13.9
1.75	11.5	13.8
1.50	11.2	13.4
1.25	10.7	12.8
1.00	10.0	12.0
0.75	9.1	10.9
0.50	8.0	9.6

The entry of Vietnam into the coffee bean business generated an increase in supply—a rise in the quantity supplied at any given price. This event is represented by the two supply schedules—one showing supply before

Vietnam's entry, the other showing supply after Vietnam came in—and their corresponding supply curves. The increase in supply shifts the supply curve to the right.

America. Vietnam, in particular, emerged as a big new source of coffee beans. Figure 3-7 illustrates this event in terms of the supply schedule and the supply curve for coffee beans.

The table in Figure 3-7 shows two supply schedules. The schedule before new producers such as Vietnam arrived on the scene is the same one as in Figure 3-6. The second schedule shows the supply of coffee beans *after* the entry of new producers. Just as a change in demand schedules leads to a shift of the demand curve, a change in supply schedules leads to a **shift of the supply curve**—a change in the quantity supplied at any given price. This is shown in Figure 3-7 by the shift of the supply curve before the entry of the new producers, S_1 , to its new position after the entry of the new producers, S_2 . Notice that S_2 lies to the right of S_1 , a reflection of the fact that quantity supplied increases at any given price.

As in the analysis of demand, it's crucial to draw a distinction between such shifts of the supply curve and **movements along the supply curve**—changes in the quantity supplied that result from a change in price. We can see this difference in Figure 3-8 on the next page. The movement from point A to point B is a movement along the supply curve: the quantity supplied rises along S_1 due to a rise in price. Here, a rise in price from \$1 to \$1.50 leads to a rise in the quantity supplied from 10 billion to 11.2 billion pounds of coffee beans. But the quantity supplied can also rise when the price is unchanged if there is an increase in supply—a rightward shift of the supply curve. This is shown by the rightward shift of the supply curve from S_1 to S_2 . Holding price constant at \$1, the quantity supplied rises from 10 billion pounds at point A on S_1 to 12 billion pounds at point C on S_2 .

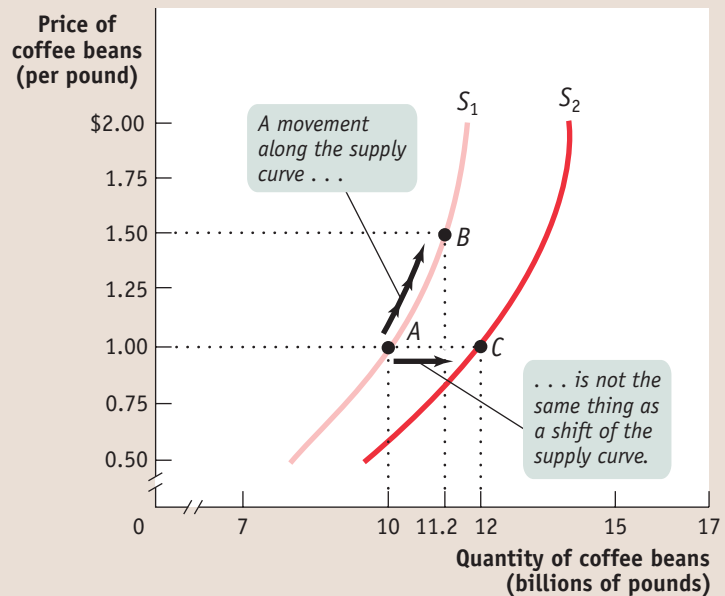
A **shift of the supply curve** is a change in the quantity supplied of a good or service at any given price. It is represented by the change of the original supply curve to a new position, denoted by a new supply curve.

A **movement along the supply curve** is a change in the quantity supplied of a good that is the result of a change in that good's price.

FIGURE 3-8

Movement Along the Supply Curve Versus Shift of the Supply Curve

The increase in quantity supplied when going from point *A* to point *B* reflects a movement along the supply curve: it is the result of a rise in the price of the good. The increase in quantity supplied when going from point *A* to point *C* reflects a shift of the supply curve: it is the result of an increase in the quantity supplied at any given price.



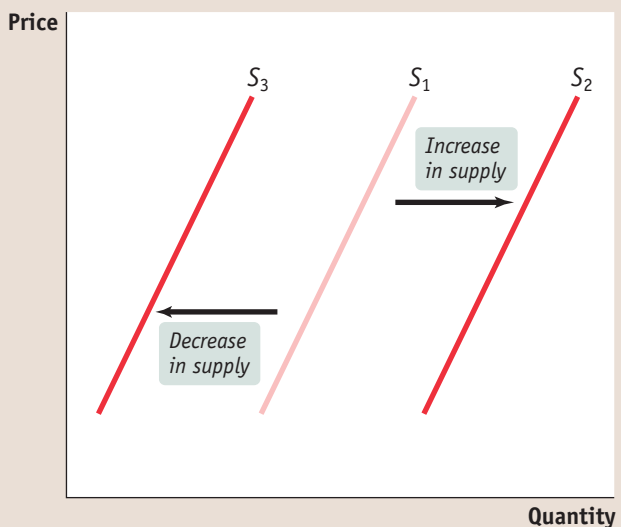
Understanding Shifts of the Supply Curve

Figure 3-9 illustrates the two basic ways in which supply curves can shift. When economists talk about an “increase in supply,” they mean a *rightward* shift of the supply curve: at any given price, producers supply a larger quantity of the good than before. This is shown in Figure 3-9 by the rightward shift of the original supply curve S_1 to S_2 . And when economists talk about a “decrease in supply,” they mean a *leftward* shift of the supply curve: at any given price, producers supply a smaller quantity of the good than before. This is represented by the leftward shift of S_1 to S_3 .

FIGURE 3-9

Shifts of the Supply Curve

Any event that increases supply shifts the supply curve to the right, reflecting a rise in the quantity supplied at any given price. Any event that decreases supply shifts the supply curve to the left, reflecting a fall in the quantity supplied at any given price.



Economists believe that shifts of the supply curve for a good or service are mainly the result of five factors (though, as in the case of demand, there are other possible causes):

- Changes in input prices
- Changes in the prices of related goods or services
- Changes in technology
- Changes in expectations
- Changes in the number of producers

An **input** is a good or service that is used to produce another good or service.

Changes in Input Prices To produce output, you need inputs. For example, to make vanilla ice cream, you need vanilla beans, cream, sugar, and so on. An **input** is any good or service that is used to produce another good or service. Inputs, like output, have prices. And an increase in the price of an input makes the production of the final good more costly for those who produce and sell it. So producers are less willing to supply the final good at any given price, and the supply curve shifts to the left. For example, newspaper publishers buy large quantities of newsprint (the paper on which newspapers are printed). When newsprint prices rose sharply in 1994–1995, the supply of newspapers fell: several newspapers went out of business and a number of new publishing ventures were canceled. Similarly, a fall in the price of an input makes the production of the final good less costly for sellers. They are more willing to supply the good at any given price, and the supply curve shifts to the right.

Changes in the Prices of Related Goods or Services A single producer often produces a mix of goods rather than a single product. For example, an oil refinery produces gasoline from crude oil, but it also produces heating oil and other products from the same raw material. When a producer sells several products, the quantity of any one good it is willing to supply at any given price depends on the prices of its other co-produced goods. This effect can run in either direction. An oil refiner will supply less gasoline at any given price when the price of heating oil rises, shifting the supply curve for gasoline to the left. But it will supply more gasoline at any given price when the price of heating oil falls, shifting the supply curve for gasoline to the right. This means that gasoline and other co-produced oil products are *substitutes in production* for refiners. In contrast, due to the nature of the production process, other goods can be *complements in production*. For example, producers of crude oil—oil-well drillers—often find that oil wells also produce natural gas as a by-product of oil extraction. The higher the price at which a driller can sell its natural gas, the more oil wells it will drill and the more oil it will supply at any given price for oil. As a result, natural gas is a complement in production for crude oil.

Changes in Technology When economists talk about “technology,” they don’t necessarily mean high technology—they mean all the methods people can use to turn inputs into useful goods and services. In that sense, the whole complex sequence of activities that turn corn from an Iowa farm into cornflakes on your breakfast table is technology. And when a better technology becomes available, reducing the cost of production—that is, letting a producer spend less on inputs yet produce the same output—supply increases, and the supply curve shifts to the right. For example, an improved strain of corn that is more resistant to disease makes farmers willing to supply more corn at any given price.

Changes in Expectations Just as changes in expectations can shift the demand curve, they can also shift the supply curve. When suppliers have some choice about when they put their good up for sale, changes in the expected future price of the good can lead a supplier to supply less or more of the good today. For example, consider the fact that gasoline and other oil products are often stored for significant periods of time at oil refineries before being sold to consumers. In fact, storage is normally part of producers’ business strategy. Knowing that the demand for gasoline

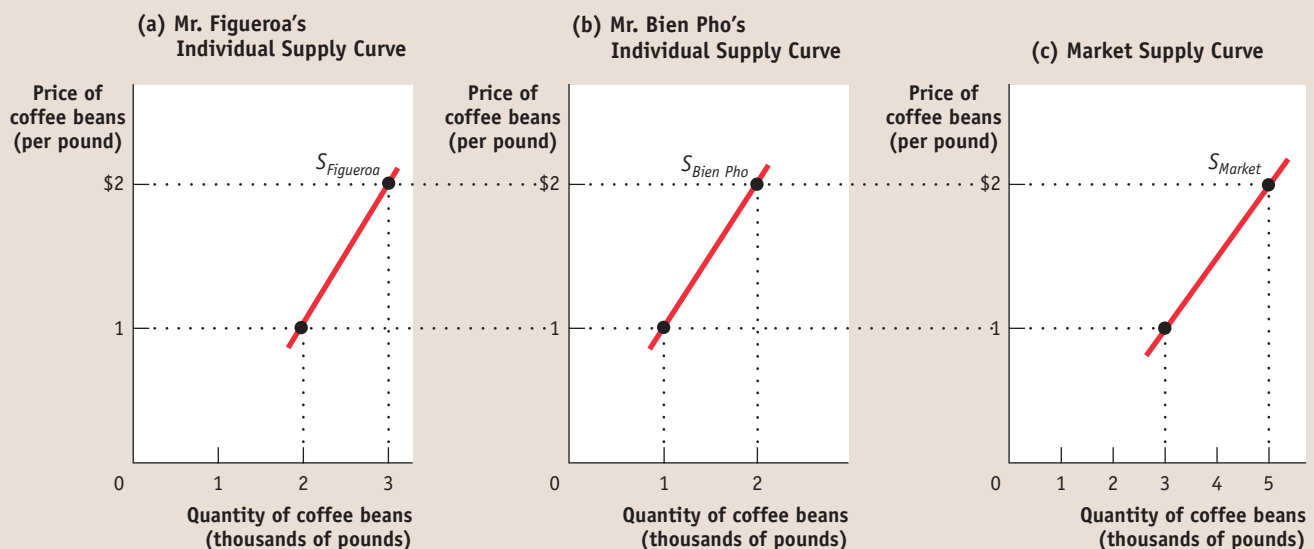
An **individual supply curve** illustrates the relationship between quantity supplied and price for an individual producer.

peaks in the summer, oil refiners normally store some of their gasoline produced during the spring for summer sale. Similarly, knowing that the demand for heating oil peaks in the winter, they normally store some of their heating oil produced during the fall for winter sale. In each case, there's a decision to be made between selling the product now versus storing it for later sale. Which choice a producer makes depends on a comparison of the current price versus the expected future price. This example illustrates how changes in expectations can alter supply: an increase in the anticipated future price of a good or service reduces supply today, a leftward shift of the supply curve. But a fall in the anticipated future price increases supply today, a rightward shift of the supply curve.

Changes in the Number of Producers Just as changes in the number of consumers affect the demand curve, changes in the number of producers affect the supply curve. Let's examine the **individual supply curve**, which shows the relationship between quantity supplied and price for an individual producer. For example, suppose that Mr. Figueroa is a Brazilian coffee farmer and that panel (a) of Figure 3-10 shows how many pounds of beans he will supply per year at any given price. Then S_{Figueroa} is his individual supply curve.

The **market supply curve** shows how the combined total quantity supplied by all individual producers in the market depends on the market price of that good. Just as the market demand curve is the horizontal sum of the individual demand curves of all consumers, the market supply curve is the horizontal sum of the individual supply curves of all producers. Assume for a moment that there are only two producers of coffee beans, Mr. Figueroa and Mr. Bien Pho, a Vietnamese coffee farmer. Mr. Bien Pho's individual supply curve is shown in panel (b). Panel (c) shows the market supply curve. At any given price, the quantity supplied to the market is the sum of the quantities supplied by Mr. Figueroa and Mr. Bien Pho. For example, at a price of \$2 per pound, Mr. Figueroa supplies 3,000 pounds of coffee beans per year and Mr. Bien Pho supplies 2,000 pounds per year, making the quantity supplied to the market 5,000 pounds.

FIGURE 3-10 The Individual Supply Curve and the Market Supply Curve



Panel (a) shows the individual supply curve for Mr. Figueroa, S_{Figueroa} , the quantity of coffee beans he will sell at any given price. Panel (b) shows the individual supply curve for Mr. Bien Pho, $S_{\text{Bien Pho}}$. The market supply curve, which

shows the quantity of coffee beans supplied by all producers at any given price, is shown in panel (c). The market supply curve is the horizontal sum of the individual supply curves of all producers.

TABLE 3-2**Factors That Shift Supply**

Changes in input prices		
	If the price of an input used to produce A rises, . . .	. . . supply of A decreases.
	If the price of an input used to produce A falls, . . .	. . . supply of A increases.
Changes in the prices of related goods or services		
If A and B are substitutes in production . . .	. . . and the price of B rises, . . .	. . . supply of A decreases.
	. . . and the price of B falls, . . .	. . . supply of A increases.
If A and B are complements in production . . .	. . . and the price of B rises, . . .	. . . supply of A increases.
	. . . and the price of B falls, . . .	. . . supply of A decreases.
Changes in technology		
	If the technology used to produce A improves, . . .	. . . supply of A increases.
Changes in expectations		
	If the price of A is expected to rise in the future, . . .	. . . supply of A decreases today.
	If the price of A is expected to fall in the future, . . .	. . . supply of A increases today.
Changes in the number of producers		
	If the number of producers of A rises, . . .	. . . market supply of A increases.
	If the number of producers of A falls, . . .	. . . market supply of A decreases.

Clearly, the quantity supplied to the market at any given price is larger with Mr. Bien Pho present than it would be if Mr. Figueroa was the only supplier. The quantity supplied at a given price would be even larger if we added a third producer, then a fourth, and so on. So an increase in the number of producers leads to an increase in supply and a rightward shift of the supply curve.

For an overview of the factors that shift supply, see Table 3-2.

►ECONOMICS IN ACTION

Only Creatures Small and Pampered

During the 1970s, British television featured a popular show titled *All Creatures Great and Small*. It chronicled the real life of James Herriot, a country veterinarian who tended to cows, pigs, sheep, horses, and the occasional house pet, often under arduous conditions, in rural England during the 1930s. The show made it clear that in those days the local vet was a critical member of farming communities, saving valuable farm animals and helping farmers survive financially. And it was also clear that Mr. Herriot considered his life's work well spent.

But that was then and this is now. According to a 2007 article in the *New York Times*, the United States has experienced a severe decline in the number of farm veterinarians over the past two decades. The source of the problem is competition. As the number of household pets has increased and the incomes of pet owners have grown, the demand for pet veterinarians has increased sharply. As a result, vets are being drawn away from the business of caring for farm animals into the more lucrative business of caring for pets. As one vet stated, she began her career caring for farm animals but changed her mind after “doing a C-section on a cow and it's 50 bucks. Do a C-section on a Chihuahua and you get \$300. It's the money. I hate to say that.”

How can we translate this into supply and demand curves? Farm veterinary services and pet veterinary services are like gasoline and fuel oil: they're related goods that are substitutes in production. A veterinarian typically specializes in one type of practice or the other, and that decision often depends on the going price for the service.

>> QUICK REVIEW

- The **supply schedule** shows how the **quantity supplied** depends on the price. The relationship between the two is illustrated by the **supply curve**.
- Supply curves are normally upward sloping: at a higher price, producers are willing to supply more of a good or service.
- A change in price results in a **movement along the supply curve** and a change in the quantity supplied.
- As with demand, increases or decreases in supply correspond to **shifts of the supply curve**. An increase in supply is a rightward shift: the quantity supplied rises for any given price. A decrease in supply is a leftward shift: the quantity supplied falls for any given price.
- The five main factors that can shift the supply curve are changes in (1) input prices, (2) prices of related goods or services, (3) technology, (4) expectations, and (5) number of producers.
- The market supply curve is the horizontal sum of the **individual supply curves** of all producers in the market.

America's growing pet population, combined with the increased willingness of doting owners to spend on their companions' care, has driven up the price of pet veterinary services. As a result, fewer and fewer veterinarians have gone into farm animal practice. So the supply curve of farm veterinarians has shifted leftward—fewer farm veterinarians are offering their services at any given price.

In the end, farmers understand that it is all a matter of dollars and cents—that they get fewer veterinarians because they are unwilling to pay more. As one farmer, who had recently lost an expensive cow due to the unavailability of a veterinarian, stated, “The fact that there’s nothing you can do, you accept it as a business expense now. You didn’t used to. If you have livestock, sooner or later you’re going to have deadstock.” (Although we should note that this farmer *could* have chosen to pay more for a vet who would have then saved his cow.) ▲

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> CHECK YOUR UNDERSTANDING 3-2

1. Explain whether each of the following events represents (i) a *shift* of the supply curve or (ii) a *movement along* the supply curve.
 - a. More homeowners put their houses up for sale during a real estate boom that causes house prices to rise.
 - b. Many strawberry farmers open temporary roadside stands during harvest season, even though prices are usually low at that time.
 - c. Immediately after the school year begins, fast-food chains must raise wages, which represent the price of labor, to attract workers.
 - d. Many construction workers temporarily move to areas that have suffered hurricane damage, lured by higher wages.
 - e. Since new technologies have made it possible to build larger cruise ships (which are cheaper to run per passenger), Caribbean cruise lines have offered more cabins, at lower prices, than before.

Solutions appear at back of book.

A competitive market is in equilibrium when price has moved to a level at which the quantity of a good or service demanded equals the quantity of that good or service supplied. The price at which this takes place is the **equilibrium price**, also referred to as the **market-clearing price**. The quantity of the good or service bought and sold at that price is the **equilibrium quantity**.

Supply, Demand, and Equilibrium

We have now covered the first three key elements in the supply and demand model: the demand curve, the supply curve, and the set of factors that shift each curve. The next step is to put these elements together to show how they can be used to predict the actual price at which the good is bought and sold, as well as the actual quantity transacted.

What determines the price at which a good or service is bought and sold? What determines the quantity transacted of the good or service? In Chapter 1 we learned the general principle that *markets move toward equilibrium*, a situation in which no individual would be better off taking a different action. In the case of a competitive market, we can be more specific: a competitive market is in equilibrium when the price has moved to a level at which the quantity of a good demanded equals the quantity of that good supplied. At that price, no individual seller could make herself better off by offering to sell either more or less of the good and no individual buyer could make himself better off by offering to buy more or less of the good. In other words, at the market equilibrium, price has moved to a level that exactly matches the quantity demanded by consumers to the quantity supplied by sellers.

The price that matches the quantity supplied and the quantity demanded is the **equilibrium price**; the quantity bought and sold at that price is the **equilibrium quantity**. The equilibrium price is also known as the **market-clearing price**: it is the price that “clears the market” by ensuring that every buyer willing to pay that price finds a seller willing to sell at that price, and vice versa. So how do we find the equilibrium price and quantity?

PITFALLS

BOUGHT AND SOLD?

We have been talking about the price at which a good or service is bought *and* sold, as if the two were the same. But shouldn't we make a distinction between the price received by sellers and the price paid by buyers? In principle, yes; but it is helpful at this point to sacrifice a bit of realism in the interest of simplicity—by assuming away the difference between the prices received by sellers and those paid by buyers. In reality, there is often a middleman—someone who brings buyers and sellers together—who buys from suppliers, then sells to consumers at a markup, for example, coffee

merchants who buy from coffee growers and sell to consumers. The growers generally receive less than those who eventually buy the coffee beans pay. No mystery there: that difference is how coffee merchants or any other middlemen make a living. In many markets, however, the difference between the buying and selling price is quite small. So it's not a bad approximation to think of the price paid by buyers as being the *same* as the price received by sellers. And that is what we assume in this chapter.



Finding the Equilibrium Price and Quantity

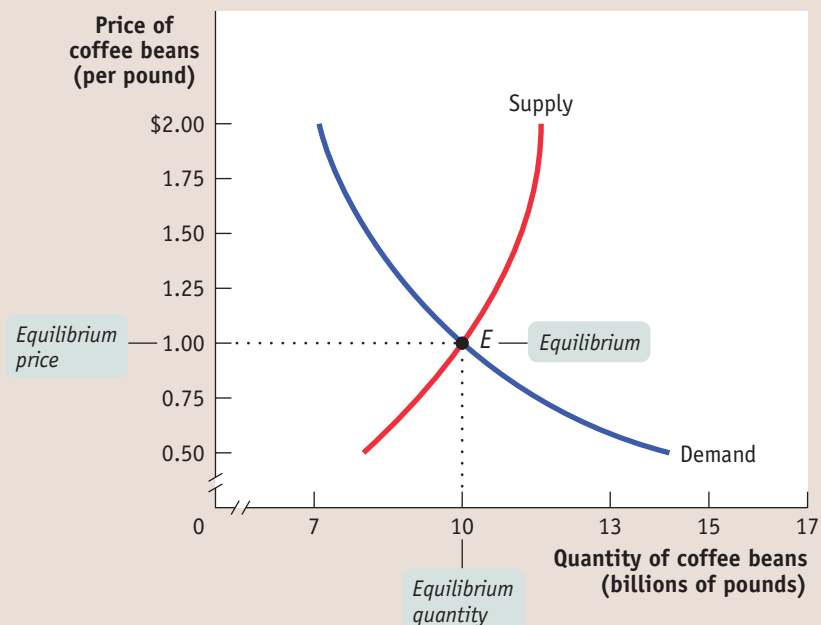
The easiest way to determine the equilibrium price and quantity in a market is by putting the supply curve and the demand curve on the same diagram. Since the supply curve shows the quantity supplied at any given price and the demand curve shows the quantity demanded at any given price, the price at which the two curves cross is the equilibrium price: the price at which quantity supplied equals quantity demanded.

Figure 3-11 combines the demand curve from Figure 3-1 and the supply curve from Figure 3-6. They *intersect* at point *E*, which is the equilibrium of this market; that is, \$1 is the equilibrium price and 10 billion pounds is the equilibrium quantity.

FIGURE 3-11

Market Equilibrium

Market equilibrium occurs at point *E*, where the supply curve and the demand curve intersect. In equilibrium, the quantity demanded is equal to the quantity supplied. In this market, the equilibrium price is \$1 per pound and the equilibrium quantity is 10 billion pounds per year.



There is a **surplus** of a good or service when the quantity supplied exceeds the quantity demanded. Surpluses occur when the price is above its equilibrium level.

Let's confirm that point *E* fits our definition of equilibrium. At a price of \$1 per pound, coffee bean producers are willing to sell 10 billion pounds a year and coffee bean consumers want to buy 10 billion pounds a year. So at the price of \$1 a pound, the quantity of coffee beans supplied equals the quantity demanded. Notice that at any other price the market would not clear: every willing buyer would not be able to find a willing seller, or vice versa. More specifically, if the price were more than \$1, the quantity supplied would exceed the quantity demanded; if the price were less than \$1, the quantity demanded would exceed the quantity supplied.

The model of supply and demand, then, predicts that given the demand and supply curves shown in Figure 3-11, 10 billion pounds of coffee beans would change hands at a price of \$1 per pound. But how can we be sure that the market will arrive at the equilibrium price? We begin by answering three simple questions:

1. Why do all sales and purchases in a market take place at the same price?
2. Why does the market price fall if it is above the equilibrium price?
3. Why does the market price rise if it is below the equilibrium price?

Why Do All Sales and Purchases in a Market Take Place at the Same Price?

There are some markets where the same good can sell for many different prices, depending on who is selling or who is buying. For example, have you ever bought a souvenir in a "tourist trap" and then seen the same item on sale somewhere else (perhaps even in the shop next door) for a lower price? Because tourists don't know which shops offer the best deals and don't have time for comparison shopping, sellers in tourist areas can charge different prices for the same good.

But in any market where the buyers and sellers have both been around for some time, sales and purchases tend to converge at a generally uniform price, so that we can safely talk about *the* market price. It's easy to see why. Suppose a seller offered a potential buyer a price noticeably above what the buyer knew other people to be paying. The buyer would clearly be better off shopping elsewhere—unless the seller was prepared to offer a better deal. Conversely, a seller would not be willing to sell for significantly less than the amount he knew most buyers were paying; he would be better off waiting to get a more reasonable customer. So in any well-established, ongoing market, all sellers receive and all buyers pay approximately the same price. This is what we call the *market price*.

Why Does the Market Price Fall If It Is Above the Equilibrium Price?

Suppose the supply and demand curves are as shown in Figure 3-11 but the market price is above the equilibrium level of \$1—say, \$1.50. This situation is illustrated in Figure 3-12. Why can't the price stay there?

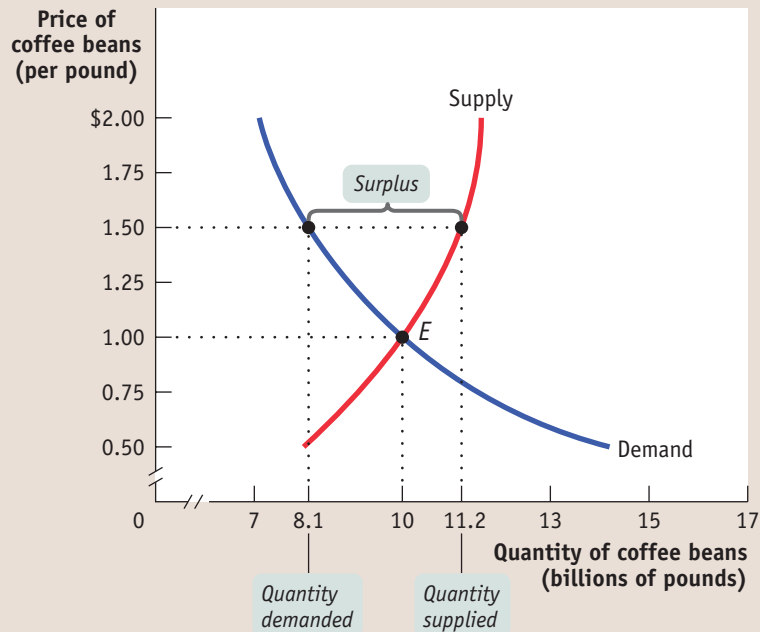
As the figure shows, at a price of \$1.50 there would be more coffee beans available than consumers wanted to buy: 11.2 billion pounds, versus 8.1 billion pounds. The difference of 3.1 billion pounds is the **surplus**—also known as the *excess supply*—of coffee beans at \$1.50.

This surplus means that some coffee producers are frustrated: at the current price, they cannot find consumers who want to buy their coffee beans. The surplus offers an incentive for those frustrated would-be sellers to offer a lower price in order to poach business from other producers and entice more consumers to buy. The result of this price cutting will be to push the prevailing price down until it reaches the equilibrium price. So the price of a good will fall whenever there is a surplus—that is, whenever the market price is above its equilibrium level.

FIGURE 3-12

Price Above Its Equilibrium Level Creates a Surplus

The market price of \$1.50 is above the equilibrium price of \$1. This creates a surplus: at a price of \$1.50, producers would like to sell 11.2 billion pounds but consumers want to buy only 8.1 billion pounds, so there is a surplus of 3.1 billion pounds. This surplus will push the price down until it reaches the equilibrium price of \$1.



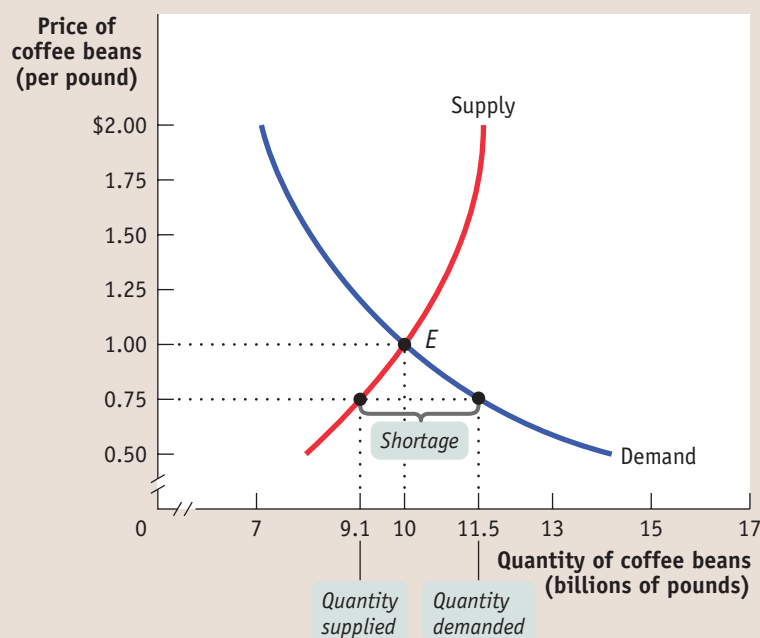
Why Does the Market Price Rise if It Is Below the Equilibrium Price?

Now suppose the price is below its equilibrium level—say, at \$0.75 per pound, as shown in Figure 3-13. In this case, the quantity demanded, 11.5 billion pounds, exceeds the quantity supplied, 9.1 billion pounds, implying that there are would-be

FIGURE 3-13

Price Below Its Equilibrium Level Creates a Shortage

The market price of \$0.75 is below the equilibrium price of \$1. This creates a shortage: consumers want to buy 11.5 billion pounds, but only 9.1 billion pounds are for sale, so there is a shortage of 2.4 billion pounds. This shortage will push the price up until it reaches the equilibrium price of \$1.



There is a **shortage** of a good or service when the quantity demanded exceeds the quantity supplied. Shortages occur when the price is below its equilibrium level.

buyers who cannot find coffee beans: there is a **shortage**, also known as an *excess demand*, of 2.4 billion pounds.

When there is a shortage, there are frustrated would-be buyers—people who want to purchase coffee beans but cannot find willing sellers at the current price. In this situation, either buyers will offer more than the prevailing price or sellers will realize that they can charge higher prices. Either way, the result is to drive up the prevailing price. This bidding up of prices happens whenever there are shortages—and there will be shortages whenever the price is below its equilibrium level. So the market price will always rise if it is below the equilibrium level.

Using Equilibrium to Describe Markets

We have now seen that a market tends to have a single price, the equilibrium price. If the market price is above the equilibrium level, the ensuing surplus leads buyers and sellers to take actions that lower the price. And if the market price is below the equilibrium level, the ensuing shortage leads buyers and sellers to take actions that raise the price. So the market price always *moves toward* the equilibrium price, the price at which there is neither surplus nor shortage.

►ECONOMICS IN ACTION

The Price of Admission

The market equilibrium, so the theory goes, is pretty egalitarian because the equilibrium price applies to everyone. That is, all buyers pay the same price—the equilibrium price—and all sellers receive that same price. But is this realistic?

The market for concert tickets is an example that seems to contradict the theory—there's one price at the box office, and there's another price (typically much higher) for the same event on Internet sites where people who already have tickets resell them, such as StubHub.com or eBay. For example, compare the box office price for a recent Justin Timberlake concert in Miami, Florida, to the StubHub.com price for seats in the same location: \$88.50 versus \$155.

Puzzling as this may seem, there is no contradiction once we take opportunity costs and tastes into account. For major events, buying tickets from the box office means waiting in very long lines. Ticket buyers who use Internet resellers have decided that the opportunity cost of their time is too high to spend waiting in line. And for those major events with online box offices selling tickets at face value, tickets often sell out within minutes. In this case, some people who want to go to the concert badly but have missed out on the opportunity to buy cheaper tickets from the online box office are willing to pay the higher Internet reseller price.

Not only that, perusing the StubHub.com website you can see that markets really do move to equilibrium. You'll notice that the prices quoted by different sellers for seats close to one another are also very close: \$184.99 versus \$185 for seats on the main floor of the Justin Timberlake concert. As the competitive market model predicts, units of the same good end up selling for the same price. And prices move in response to demand and supply. According to an article in the *New York Times*, tickets on StubHub.com can sell for less than the face value for events with little appeal, while prices can skyrocket for events that are in high demand. (The article quotes a price of \$3,530 for a recent Madonna concert.) Even StubHub.com's chief executive says his site is "the embodiment of supply-and-demand economics."

So the theory of competitive markets isn't just speculation. If you want to experience it for yourself, try buying tickets to a concert. ▲

►►QUICK REVIEW

- Price in a competitive market moves to the **equilibrium price**, or **market-clearing price**, where the quantity supplied is equal to the quantity demanded. This quantity is the **equilibrium quantity**.
- All sales and purchases in a market take place at the same price. If the price is above its equilibrium level, there is a **surplus** that drives the price down. If the price is below its equilibrium level, there is a **shortage** that drives the price up.

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► CHECK YOUR UNDERSTANDING 3-3

1. In the following three situations, the market is initially in equilibrium. After each event described below, does a surplus or shortage exist at the original equilibrium price? What will happen to the equilibrium price as a result?
 - a. 2005 was a very good year for California wine-grape growers, who produced a bumper crop.
 - b. After a hurricane, Florida hoteliers often find that many people cancel their upcoming vacations, leaving them with empty hotel rooms.
 - c. After a heavy snowfall, many people want to buy secondhand snowblowers at the local tool shop.

Solutions appear at back of book.

Changes in Supply and Demand

The emergence of Vietnam as a major coffee-producing country came as a surprise, but the subsequent fall in the price of coffee beans was no surprise at all. Suddenly the quantity of coffee beans available at any given price rose—that is, there was an increase in supply. Predictably, an increase in supply lowers the equilibrium price.

The entry of Vietnamese producers into the coffee bean business was an example of an event that shifted the supply curve for a good without having much effect on the demand curve. There are many such events. There are also events that shift the demand curve without shifting the supply curve. For example, a medical report that chocolate is good for you increases the demand for chocolate but does not affect the supply. That is, events often shift either the supply curve or the demand curve, but not both; it is therefore useful to ask what happens in each case.

We have seen that when a curve shifts, the equilibrium price and quantity change. We will now concentrate on exactly how the shift of a curve alters the equilibrium price and quantity.

What Happens When the Demand Curve Shifts

Coffee and tea are substitutes: if the price of tea rises, the demand for coffee will increase, and if the price of tea falls, the demand for coffee will decrease. But how does the price of tea affect the *market equilibrium* for coffee?

Figure 3-14 on the next page shows the effect of a rise in the price of tea on the market for coffee. The rise in the price of tea increases the demand for coffee. Point E_1 shows the equilibrium corresponding to the original demand curve, with P_1 the equilibrium price and Q_1 the equilibrium quantity bought and sold.

An increase in demand is indicated by a *rightward* shift of the demand curve from D_1 to D_2 . At the original market price P_1 , this market is no longer in equilibrium: a shortage occurs because the quantity demanded exceeds the quantity supplied. So the price of coffee rises and generates an increase in the quantity supplied, an upward *movement along the supply curve*. A new equilibrium is established at point E_2 , with a higher equilibrium price, P_2 , and higher equilibrium quantity, Q_2 . This sequence of events reflects a general principle: *When demand for a good or service increases, the equilibrium price and the equilibrium quantity of the good or service both rise.*

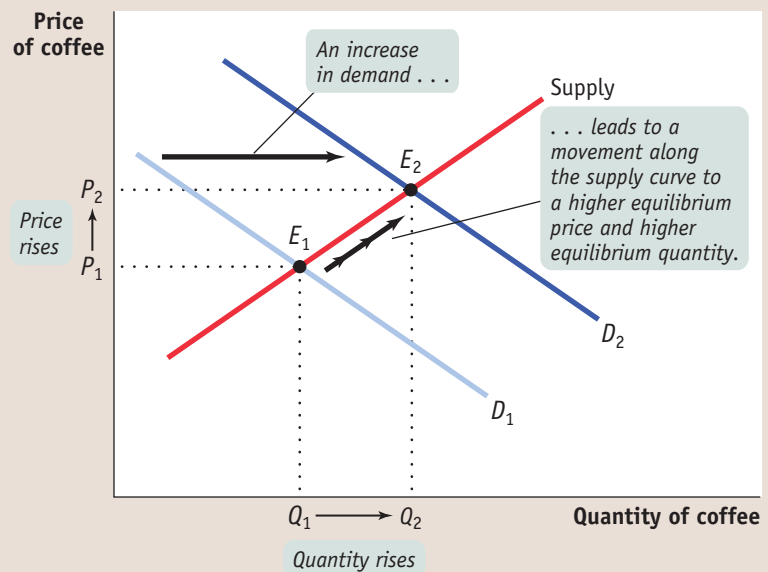
What would happen in the reverse case, a fall in the price of tea? A fall in the price of tea reduces the demand for coffee, shifting the demand curve to the *left*. At the original price, a surplus occurs as quantity supplied exceeds quantity demanded. The price falls and leads to a decrease in the quantity supplied, resulting in a lower equilibrium price and a lower equilibrium quantity. This illustrates another general principle: *When demand for a good or service decreases, the equilibrium price and the equilibrium quantity of the good or service both fall.*

To summarize how a market responds to a change in demand: *An increase in demand leads to a rise in both the equilibrium price and the equilibrium quantity. A decrease in demand leads to a fall in both the equilibrium price and the equilibrium quantity.*

FIGURE 3-14

Equilibrium and Shifts of the Demand Curve

The original equilibrium in the market for coffee is at E_1 , at the intersection of the supply curve and the original demand curve, D_1 . A rise in the price of tea, a substitute, shifts the demand curve rightward to D_2 . A shortage exists at the original price, P_1 , causing both the price and quantity supplied to rise, a movement along the supply curve. A new equilibrium is reached at E_2 , with a higher equilibrium price, P_2 , and a higher equilibrium quantity, Q_2 . When demand for a good or service increases, the equilibrium price and the equilibrium quantity of the good or service both rise.



What Happens When the Supply Curve Shifts

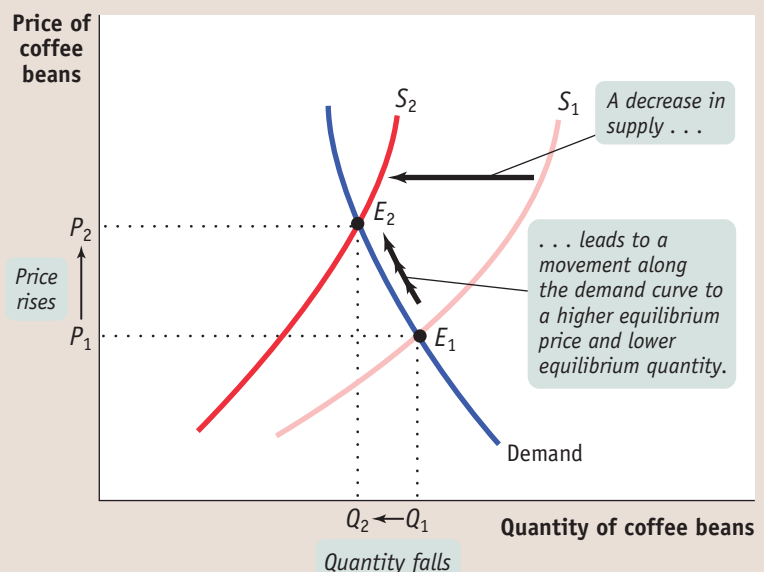
In the real world, it is a bit easier to predict changes in supply than changes in demand. Physical factors that affect supply, like the availability of inputs, are easier to get a handle on than the fickle tastes that affect demand. Still, with supply as with demand, what we can best predict are the *effects* of shifts of the supply curve.

As we mentioned in this chapter's opening story, a prolonged drought in Vietnam sharply reduced its supply of coffee beans. Figure 3-15 shows how this shift affected the market equilibrium. The original equilibrium is at E_1 , the point of intersection of the original supply curve, S_1 , and the demand curve, with an equilibrium price P_1 and

FIGURE 3-15

Equilibrium and Shifts of the Supply Curve

The original equilibrium in the market for coffee beans is at E_1 . A drought causes a fall in the supply of coffee beans and shifts the supply curve leftward from S_1 to S_2 . A new equilibrium is established at E_2 , with a higher equilibrium price, P_2 , and a lower equilibrium quantity, Q_2 .



equilibrium quantity Q_1 . As a result of the drought, supply falls and S_1 shifts *leftward* to S_2 . At the original price P_1 , a shortage of coffee beans now exists and the market is no longer in equilibrium. The shortage causes a rise in price and a fall in quantity demanded, an upward movement along the demand curve. The new equilibrium is at E_2 , with an equilibrium price P_2 , and an equilibrium quantity Q_2 . In the new equilibrium E_2 , the price is higher and the equilibrium quantity lower than before. This may be stated as a general principle: *When supply of a good or service decreases, the equilibrium price of the good or service rises and the equilibrium quantity of the good or service falls.*

What happens to the market when supply increases? An increase in supply leads to a *rightward* shift of the supply curve. At the original price, a surplus now exists; as a result, the equilibrium price falls and the quantity demanded rises. This describes what happened to the market for coffee beans when Vietnam entered the field. We can formulate a general principle: *When supply of a good or service increases, the equilibrium price of the good or service falls and the equilibrium quantity of the good or service rises.*

To summarize how a market responds to a change in supply: *An increase in supply leads to a fall in the equilibrium price and a rise in the equilibrium quantity. A decrease in supply leads to a rise in the equilibrium price and a fall in the equilibrium quantity.*

PITFALLS

WHICH CURVE IS IT, ANYWAY?

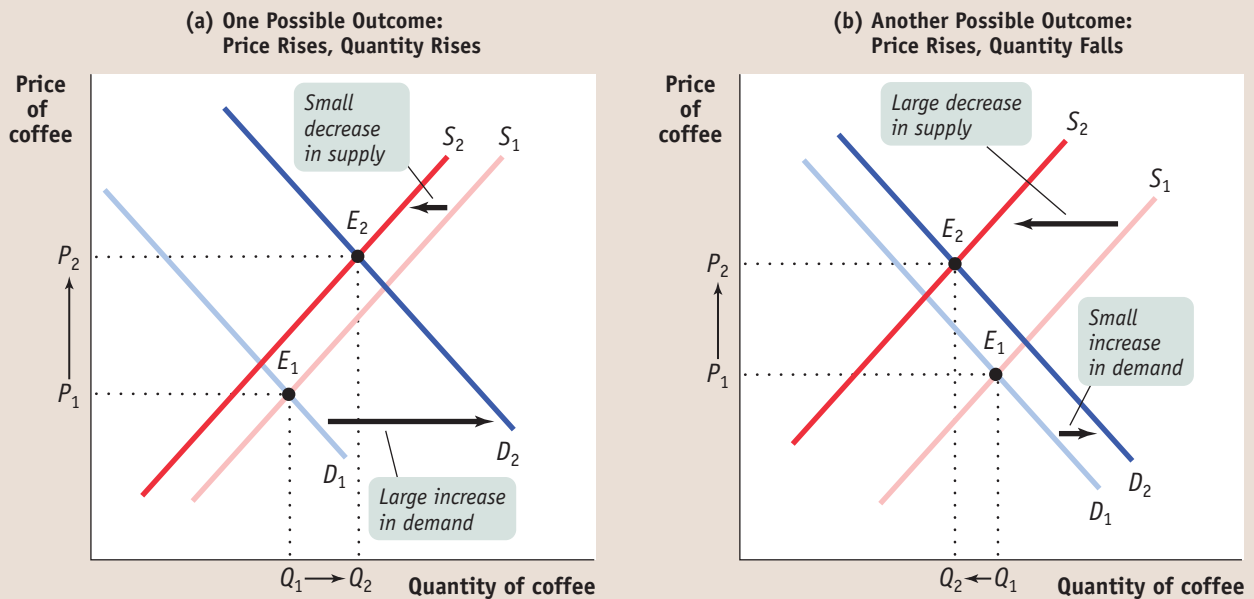
When the price of some good or service changes, in general, we can say that this reflects a change in either supply or demand. But it is easy to get confused about which one. A helpful clue is the direction of change in the quantity. If the quantity sold changes in the *same* direction as the price—for example, if both the price and the quantity rise—this suggests that the demand curve has shifted. If the price and the quantity move in *opposite* directions, the likely cause is a shift of the supply curve.

Simultaneous Shifts of Supply and Demand Curves

Finally, it sometimes happens that events shift *both* the demand and supply curves at the same time. This is not unusual; in real life, supply curves and demand curves for many goods and services typically shift quite often because the economic environment continually changes. Figure 3-16 illustrates two examples of simultaneous shifts. In both panels there is an increase in demand—that is, a rightward shift of the demand curve, from D_1 to D_2 —say, for example, representing the increase in the demand for

FIGURE 3-16

Simultaneous Shifts of the Demand and Supply Curves



In panel (a) there is a simultaneous rightward shift of the demand curve and leftward shift of the supply curve. Here the increase in demand is relatively larger than the decrease in supply, so the equilibrium price and equilibrium quantity both rise. In panel (b) there is also a

simultaneous rightward shift of the demand curve and leftward shift of the supply curve. Here the decrease in supply is relatively larger than the increase in demand, so the equilibrium price rises and the equilibrium quantity falls.

coffee due to changing tastes. Notice that the rightward shift in panel (a) is larger than the one in panel (b): we can suppose that panel (a) represents a year in which many more people than usual choose to drink double lattes and panel (b) represents a normal year. Both panels also show a decrease in supply—that is, a leftward shift of the supply curve from S_1 to S_2 . Also notice that the leftward shift in panel (b) is relatively larger than the one in panel (a): we can suppose that panel (b) represents the effect of a particularly extreme drought in Vietnam and panel (a) represents the effect of a much less severe weather event.

In both cases, the equilibrium price rises from P_1 to P_2 , as the equilibrium moves from E_1 to E_2 . But what happens to the equilibrium quantity, the quantity of coffee bought and sold? In panel (a) the increase in demand is large relative to the decrease in supply, and the equilibrium quantity rises as a result. In panel (b), the decrease in supply is large relative to the increase in demand, and the equilibrium quantity falls as a result. That is, when demand increases and supply decreases, the actual quantity bought and sold can go either way, depending on *how much* the demand and supply curves have shifted.

In general, when supply and demand shift in opposite directions, we can't predict what the ultimate effect will be on the quantity bought and sold. What we can say is that a curve that shifts a disproportionately greater distance than the other curve will have a disproportionately greater effect on the quantity bought and sold. That said,



FOR INQUIRING MINDS

Tribulations on the Runway

You probably don't spend much time worrying about the trials and tribulations of fashion models. Most of them don't lead glamorous lives; in fact, except for a lucky few, life as a fashion model today can be very trying and not very lucrative. And it's all because of supply and demand.

Consider the case of Bianca Gomez, a willowy 18-year-old from Los Angeles, with green eyes, honey-colored hair, and flawless skin, whose experience was detailed in a 2007 article in the *Wall Street Journal*. Bianca began modeling while still in high school, earning about \$30,000 in modeling fees during her senior year. Having attracted the interest of some top designers in New York, she moved there after graduation, hoping to land jobs in leading fashion houses and photo-shoots for leading fashion magazines.

But once in New York, Bianca entered the global market for fashion models. And it wasn't very pretty. Due to the ease of transmitting photos over the Internet and the relatively low cost of international travel, top fashion centers such as New York and Milan, Italy, are now deluged with beautiful young women from all over the world, eagerly trying to make it as models.



Bianca Gomez on the runway before intense global competition got her thinking about switching careers.

Carlo Busscemi/WireImage

Although Russians, other Eastern Europeans, and Brazilians are particularly numerous, some hail from places such as Kazakhstan and Mozambique. As one designer said, "There are so many models now. . . . There are just thousands every year."

Returning to our (less glamorous) economic model of supply and demand, the influx of aspiring fashion models from around the world can be represented by a

rightward shift of the supply curve in the market for fashion models, which would by itself tend to lower the price paid to models. And that wasn't the only change in the market. Unfortunately for Bianca and others like her, the tastes of many of those who hire models have changed as well. Over the past few years, fashion magazines have come to prefer using celebrities such as Angelina Jolie on their pages rather than anonymous models, believing that their readers connect better with a familiar face. This amounts to a leftward shift of the demand curve for models—again reducing the equilibrium price paid to models.

This was borne out in Bianca's experiences. After paying her rent, her transportation, all her modeling expenses, and 20% of her earnings to her modeling agency (which markets her to prospective clients and books her jobs), Bianca found that she was barely breaking even. Sometimes she even had to dip into savings from her high school years. To save money, she ate macaroni and hot dogs; she traveled to auditions, often four or five in one day, by subway. As the *Wall Street Journal* reported, Bianca was seriously considering quitting modeling altogether.

- When demand increases and supply decreases, the equilibrium price rises but the change in the equilibrium quantity is ambiguous.
- When demand decreases and supply increases, the equilibrium price falls but the change in the equilibrium quantity is ambiguous.

- When both demand and supply increase, the equilibrium quantity increases but the change in equilibrium price is ambiguous.
- When both demand and supply decrease, the equilibrium quantity decreases but the change in equilibrium price is ambiguous.

The increase in the price of corn was good news in Iowa, where farmers began planting more corn than ever before. But it was bad news for Mexican consumers, who found themselves paying more for their tortillas. ▲

- Changes in the equilibrium price and quantity in a market result from shifts of the supply curve, the demand curve, or both.
- An increase in demand increases both the equilibrium price and the equilibrium quantity. A decrease in demand pushes both the equilibrium price and the equilibrium quantity down.
- An increase in supply drives the equilibrium price down but increases the equilibrium quantity. A decrease in supply raises the equilibrium price but reduces the equilibrium quantity.
- Often the fluctuations in markets involve shifts of both the supply and demand curves. When they shift in the same direction, the change in equilibrium quantity is predictable but the change in equilibrium price is not. When they move in opposite directions, the change in equilibrium price is predictable but the change in equilibrium quantity is not. When there are simultaneous shifts of the demand and supply curves, the curve that shifts the greater distance has a greater effect on the change in equilibrium price and quantity.

2. Periodically, a computer chip maker like Intel introduces a new chip that is faster than the previous one. In response, demand for computers using the earlier chip decreases as customers put off purchases in anticipation of machines containing the new chip. Simultaneously, computer makers increase their production of computers containing the earlier chip in order to clear out their stocks of those chips.

Draw two diagrams of the market for computers containing the earlier chip: (a) one in which the equilibrium quantity falls in response to these events and (b) one in which the equilibrium quantity rises. What happens to the equilibrium price in each diagram?

Solutions appear at back of book.

Competitive Markets—And Others

Early in this chapter, we defined a competitive market and explained that the supply and demand framework is a model of competitive markets. But we took a rain check on the question of why it matters whether or not a market is competitive. Now that we've seen how the supply and demand model works, we can offer some explanation.

To understand why competitive markets are different from other markets, compare the problems facing two individuals: a wheat farmer who must decide whether to grow more wheat, and the president of a giant aluminum company—say, Alcoa—who must decide whether to produce more aluminum.

For the wheat farmer, the question is simply whether the extra wheat can be sold at a price high enough to justify the extra production cost. The farmer need not worry about whether producing more wheat will affect the price of the wheat he or she was already planning to grow. That's because the wheat market is competitive. There are thousands of wheat farmers, and no one farmer's decision will have much impact on the market price.

For the Alcoa executive, things are not that simple because the aluminum market is *not* competitive. There are only a few big players, including Alcoa, and each of them is well aware that its actions *do* have a noticeable impact on the market price. This adds a whole new level of complexity to the decisions producers have to make. Alcoa can't decide whether or not to produce more aluminum just by asking whether the additional product will sell for more than it costs to make. The company also has to ask whether producing more aluminum will drive down the market price and reduce its *profit*, its net gain from producing and selling its output.

When a market is competitive, individuals can base decisions on less complicated analyses than those used in a noncompetitive market. This in turn means that it's easier for economists to build a model of a competitive market than of a noncompetitive market.

Don't take this to mean that economic analysis has nothing to say about noncompetitive markets. On the contrary, economists can offer some very important insights into how other kinds of markets work. But those insights require other models, which we will learn about later in this text. In the next chapter, we will focus on how competitive markets benefit producers and consumers.

>> A LOOK AHEAD...

We've now developed a model that explains how markets arrive at prices and why markets "work" in the sense that buyers can almost always find sellers, and vice versa.

But what we haven't yet explained is what motivates buyers and sellers to participate in markets. In the next chapter, we'll study how a competitive market allocates gains—and potentially losses—to buyers and sellers. And we'll discover a surprisingly strong result: under certain conditions, a competitive market maximizes the total gains to buyers from consuming and to sellers from producing.]

SUMMARY

1. The **supply and demand model** illustrates how a **competitive market**, one with many buyers and sellers, none of whom can influence the market price, works.
2. The **demand schedule** shows the **quantity demanded** at each price and is represented graphically by a **demand curve**. The **law of demand** says that demand curves slope downward; that is, a higher price for a good or service leads people to demand a smaller quantity, other things equal.
3. A **movement along the demand curve** occurs when a price change leads to a change in the quantity demanded. When economists talk of increasing or decreasing demand, they mean **shifts of the demand curve**—a change in the quantity demanded at any given price. An increase in demand causes a rightward shift of the demand curve. A decrease in demand causes a leftward shift.
4. There are five main factors that shift the demand curve:
 - A change in the prices of related goods or services, such as **substitutes** or **complements**
 - A change in income: when income rises, the demand for **normal goods** increases and the demand for **inferior goods** decreases.
 - A change in tastes
 - A change in expectations
 - A change in the number of consumers
5. The market demand curve for a good or service is the horizontal sum of the **individual demand curves** of all consumers in the market.
6. The **supply schedule** shows the **quantity supplied** at each price and is represented graphically by a **supply curve**. Supply curves usually slope upward.
7. A **movement along the supply curve** occurs when a price change leads to a change in the quantity supplied. When economists talk of increasing or decreasing supply, they mean **shifts of the supply curve**—a change in the quantity supplied at any given price. An increase in supply causes a rightward shift of the supply curve. A decrease in supply causes a leftward shift.
8. There are five main factors that shift the supply curve:
 - A change in **input** prices
 - A change in the prices of related goods and services
 - A change in technology
 - A change in expectations
 - A change in the number of producers
9. The market supply curve for a good or service is the horizontal sum of the **individual supply curves** of all producers in the market.
10. The supply and demand model is based on the principle that the price in a market moves to its **equilibrium price**, or **market-clearing price**, the price at which the quantity demanded is equal to the quantity supplied. This quantity is the **equilibrium quantity**. When the price is above its market-clearing level, there is a **surplus** that pushes the price down. When the price is below its market-clearing level, there is a **shortage** that pushes the price up.
11. An increase in demand increases both the equilibrium price and the equilibrium quantity; a decrease in demand has the opposite effect. An increase in supply reduces the equilibrium price and increases the equilibrium quantity; a decrease in supply has the opposite effect.
12. Shifts of the demand curve and the supply curve can happen simultaneously. When they shift in opposite directions, the change in equilibrium price is predictable but the change in equilibrium quantity is not. When they shift in the same direction, the change in equilibrium quantity is predictable but the change in equilibrium price is not. In general, the curve that shifts the greater distance has a greater effect on the changes in equilibrium price and quantity.

KEY TERMS

Competitive market, p. 62
 Supply and demand model, p. 62
 Demand schedule, p. 63
 Quantity demanded, p. 64
 Demand curve, p. 64
 Law of demand, p. 64
 Shift of the demand curve, p. 65
 Movement along the demand curve, p. 66
 Substitutes, p. 67

Complements, p. 67
 Normal good, p. 68
 Inferior good, p. 68
 Individual demand curve, p. 69
 Quantity supplied, p. 71
 Supply schedule, p. 71
 Supply curve, p. 72
 Shift of the supply curve, p. 73
 Movement along the supply curve, p. 73

Input, p. 75
 Individual supply curve, p. 76
 Equilibrium price, p. 78
 Equilibrium quantity, p. 78
 Market-clearing price, p. 78
 Surplus, p. 80
 Shortage, p. 82

PROBLEMS

1. A survey indicated that chocolate is Americans' favorite ice cream flavor. For each of the following, indicate the possible effects on demand, supply, or both as well as equilibrium price and quantity of chocolate ice cream.
 - a. A severe drought in the Midwest causes dairy farmers to reduce the number of milk-producing cattle in their herds by a third. These dairy farmers supply cream that is used to manufacture chocolate ice cream.
 - b. A new report by the American Medical Association reveals that chocolate does, in fact, have significant health benefits.
 - c. The discovery of cheaper synthetic vanilla flavoring lowers the price of vanilla ice cream.
 - d. New technology for mixing and freezing ice cream lowers manufacturers' costs of producing chocolate ice cream.
2. In a supply and demand diagram, draw the shift of the demand curve for hamburgers in your hometown due to the following events. In each case show the effect on equilibrium price and quantity.
 - a. The price of tacos increases.
 - b. All hamburger sellers raise the price of their french fries.
 - c. Income falls in town. Assume that hamburgers are a normal good for most people.
 - d. Income falls in town. Assume that hamburgers are an inferior good for most people.
 - e. Hot dog stands cut the price of hot dogs.
3. The market for many goods changes in predictable ways according to the time of year, in response to events such as holidays, vacation times, seasonal changes in production, and so on. Using supply and demand, explain the change in price in each of the following cases. Note that supply and demand may shift simultaneously.
 - a. Lobster prices usually fall during the summer peak lobster harvest season, despite the fact that people like to eat lobster during the summer more than at any other time of year.
 - b. The price of a Christmas tree is lower after Christmas than before but fewer trees are sold.
 - c. The price of a round-trip ticket to Paris on Air France falls by more than \$200 after the end of school vacation in September. This happens despite the fact that generally worsening weather increases the cost of operating flights to Paris, and Air France therefore reduces the number of flights to Paris at any given price.
4. Show in a diagram the effect on the demand curve, the supply curve, the equilibrium price, and the equilibrium quantity of each of the following events.
 - a. The market for newspapers in your town
 - Case 1: The salaries of journalists go up.
 - Case 2: There is a big news event in your town, which is reported in the newspapers.
 - b. The market for St. Louis Rams cotton T-shirts
 - Case 1: The Rams win the Super Bowl.
 - Case 2: The price of cotton increases.

c. The market for bagels

- Case 1: People realize how fattening bagels are.
- Case 2: People have less time to make themselves a cooked breakfast.

d. The market for the Krugman and Wells economics textbook

- Case 1: Your professor makes it required reading for all of his or her students.
- Case 2: Printing costs for textbooks are lowered by the use of synthetic paper.

5. The U.S. Department of Agriculture reported that in 1997 each person in the United States consumed an average of 41 gallons of soft drinks (nondiet) at an average price of \$2 per gallon. Assume that, at a price of \$1.50 per gallon, each individual consumer would demand 50 gallons of soft drinks. The U.S. population in 1997 was 267 million. From this information about the individual demand schedule, calculate the market demand schedule for soft drinks for the prices of \$1.50 and \$2 per gallon.

6. Suppose that the supply schedule of Maine lobsters is as follows:

Price of lobster (per pound)	Quantity of lobster supplied (pounds)
\$25	800
20	700
15	600
10	500
5	400

Suppose that Maine lobsters can be sold only in the United States. The U.S. demand schedule for Maine lobsters is as follows:

Price of lobster (per pound)	Quantity of lobster demanded (pounds)
\$25	200
20	400
15	600
10	800
5	1,000

- a. Draw the demand curve and the supply curve for Maine lobsters. What are the equilibrium price and quantity of lobsters?

Now suppose that Maine lobsters can be sold in France. The French demand schedule for Maine lobsters is as follows:

Price of lobster (per pound)	Quantity of lobster demanded (pounds)
\$25	100
20	300
15	500
10	700
5	900

- b. What is the demand schedule for Maine lobsters now that French consumers can also buy them? Draw a supply and demand diagram that illustrates the new equilibrium price and quantity of lobsters. What will happen to the price at which fishermen can sell lobster? What will happen to the price paid by U.S. consumers? What will happen to the quantity consumed by U.S. consumers?
7. Find the flaws in reasoning in the following statements, paying particular attention to the distinction between shifts of and movements along the supply and demand curves. Draw a diagram to illustrate what actually happens in each situation.
- a. “A technological innovation that lowers the cost of producing a good might seem at first to result in a reduction in the price of the good to consumers. But a fall in price will increase demand for the good, and higher demand will send the price up again. It is not certain, therefore, that an innovation will really reduce price in the end.”
- b. “A study shows that eating a clove of garlic a day can help prevent heart disease, causing many consumers to demand more garlic. This increase in demand results in a rise in the price of garlic. Consumers, seeing that the price of garlic has gone up, reduce their demand for garlic. This causes the demand for garlic to decrease and the price of garlic to fall. Therefore, the ultimate effect of the study on the price of garlic is uncertain.”
8. The following table shows a demand schedule for a normal good.

Price	Quantity demanded
\$23	70
21	90
19	110
17	130

- a. Do you think that the increase in quantity demanded (say, from 90 to 110 in the table) when price decreases (from \$21 to \$19) is due to a rise in consumers' income? Explain clearly (and briefly) why or why not.
- b. Now suppose that the good is an inferior good. Would the demand schedule still be valid for an inferior good?
- c. Lastly, assume you do not know whether the good is normal or inferior. Devise an experiment that would allow you to determine which one it was. Explain.
9. According to the *New York Times* (November 18, 2006), the number of car producers in China is increasing rapidly. The newspaper reports that “China has more car brands now than the United States. . . . But while car sales have climbed 38 percent in the first three quarters of this year, automakers have increased their output even faster, causing fierce competition and a slow erosion in prices.” At the same time, Chinese consumers' incomes have risen. Assume that cars are a normal good. Use a diagram of the supply and demand curves for cars in China to explain what has happened in the Chinese car market.
10. Aaron Hank is a star hitter for the Bay City baseball team. He is close to breaking the major league record for home runs hit during one season, and it is widely anticipated that in the next game he will break that record. As a result, tickets for the team's next game have been a hot commodity. But today it is announced that, due to a knee injury, he will not in fact play in the team's next game. Assume that season ticket-holders are able to resell their tickets if they wish. Use supply and demand diagrams to explain the following.
- a. Show the case in which this announcement results in a lower equilibrium price and a lower equilibrium quantity than before the announcement.
- b. Show the case in which this announcement results in a lower equilibrium price and a higher equilibrium quantity than before the announcement.
- c. What accounts for whether case a or case b occurs?
- d. Suppose that a scalper had secretly learned before the announcement that Aaron Hank would not play in the next game. What actions do you think he would take?
11. In *Rolling Stone* magazine, several fans and rock stars, including Pearl Jam, were bemoaning the high price of concert tickets. One superstar argued, “It just isn't worth \$75 to see me play. No one should have to pay that much to go to a concert.” Assume this star sold out arenas around the country at an average ticket price of \$75.
- a. How would you evaluate the arguments that ticket prices are too high?
- b. Suppose that due to this star's protests, ticket prices were lowered to \$50. In what sense is this price too low? Draw a diagram using supply and demand curves to support your argument.
- c. Suppose Pearl Jam really wanted to bring down ticket prices. Since the band controls the supply of its services, what do you recommend they do? Explain using a supply and demand diagram.
- d. Suppose the band's next CD was a total dud. Do you think they would still have to worry about ticket prices being too high? Why or why not? Draw a supply and demand diagram to support your argument.
- e. Suppose the group announced their next tour was going to be their last. What effect would this likely have on the demand for and price of tickets? Illustrate with a supply and demand diagram.
12. The accompanying table gives the annual U.S. demand and supply schedules for pickup trucks.

Price of truck	Quantity of trucks demanded (millions)	Quantity of trucks supplied (millions)
\$20,000	20	14
25,000	18	15
30,000	16	16
35,000	14	17
40,000	12	18

- a. Plot the demand and supply curves using these schedules. Indicate the equilibrium price and quantity on your diagram.
 - b. Suppose the tires used on pickup trucks are found to be defective. What would you expect to happen in the market for pickup trucks? Show this on your diagram.
 - c. Suppose that the U.S. Department of Transportation imposes costly regulations on manufacturers that cause them to reduce supply by one-third at any given price. Calculate and plot the new supply schedule and indicate the new equilibrium price and quantity on your diagram.
13. After several years of decline, the market for handmade acoustic guitars is making a comeback. These guitars are usually made in small workshops employing relatively few highly skilled luthiers. Assess the impact on the equilibrium price and quantity of handmade acoustic guitars as a result of each of the following events. In your answers indicate which curve(s) shift(s) and in which direction.
- a. Environmentalists succeed in having the use of Brazilian rosewood banned in the United States, forcing luthiers to seek out alternative, more costly woods.
 - b. A foreign producer reengineers the guitar-making process and floods the market with identical guitars.
 - c. Music featuring handmade acoustic guitars makes a comeback as audiences tire of heavy metal and grunge music.
 - d. The country goes into a deep recession and the income of the average American falls sharply.
14. *Demand twistors:* Sketch and explain the demand relationship in each of the following statements.
- a. I would never buy a Britney Spears CD! You couldn't even give me one for nothing.
 - b. I generally buy a bit more coffee as the price falls. But once the price falls to \$2 per pound, I'll buy out the entire stock of the supermarket.
 - c. I spend more on orange juice even as the price rises. (Does this mean that I must be violating the law of demand?)
 - d. Due to a tuition rise, most students at a college find themselves with less disposable income. Almost all of them eat more frequently at the school cafeteria and less often at restaurants, even though prices at the cafeteria have risen, too. (This one requires that you draw both the demand and the supply curves for school cafeteria meals.)
15. Will Shakespeare is a struggling playwright in sixteenth-century London. As the price he receives for writing a play increases, he is willing to write more plays. For the following situations, use a diagram to illustrate how each event affects the equilibrium price and quantity in the market for Shakespeare's plays.
- a. The playwright Christopher Marlowe, Shakespeare's chief rival, is killed in a bar brawl.
 - b. The bubonic plague, a deadly infectious disease, breaks out in London.
 - c. To celebrate the defeat of the Spanish Armada, Queen Elizabeth declares several weeks of festivities, which involves commissioning new plays.
16. The small town of Middling experiences a sudden doubling of the birth rate. After three years, the birth rate returns to normal. Use a diagram to illustrate the effect of these events on the following.
- a. The market for an hour of babysitting services in Middling today
 - b. The market for an hour of babysitting services 14 years into the future, after the birth rate has returned to normal, by which time children born today are old enough to work as babysitters
 - c. The market for an hour of babysitting services 30 years into the future, when children born today are likely to be having children of their own
17. Use a diagram to illustrate how each of the following events affects the equilibrium price and quantity of pizza.
- a. The price of mozzarella cheese rises.
 - b. The health hazards of hamburgers are widely publicized.
 - c. The price of tomato sauce falls.
 - d. The incomes of consumers rise and pizza is an inferior good.
 - e. Consumers expect the price of pizza to fall next week.
18. Although he was a prolific artist, Pablo Picasso painted only 1,000 canvases during his "Blue Period." Picasso is now dead, and all of his Blue Period works are currently on display in museums and private galleries throughout Europe and the United States.
- a. Draw a supply curve for Picasso Blue Period works. Why is this supply curve different from ones you have seen?
 - b. Given the supply curve from part a, the price of a Picasso Blue Period work will be entirely dependent on what factor(s)? Draw a diagram showing how the equilibrium price of such a work is determined.
 - c. Suppose rich art collectors decide that it is essential to acquire Picasso Blue Period art for their collections. Show the impact of this on the market for these paintings.
19. Draw the appropriate curve in each of the following cases. Is it like or unlike the curves you have seen so far? Explain.
- a. The demand for cardiac bypass surgery, given that the government pays the full cost for any patient
 - b. The demand for elective cosmetic plastic surgery, given that the patient pays the full cost
 - c. The supply of reproductions of Rembrandt paintings



>> Consumer and Producer Surplus

MAKING GAINS BY THE BOOK

THERE IS A LIVELY MARKET IN SECOND-HAND college textbooks. At the end of each term, some students who took a course decide that the money they can make by selling their used books is worth more to them than keeping the books. And some students who are taking the course next term prefer to buy a somewhat battered but less expensive used textbook rather than pay full price for a new one.

Textbook publishers and authors are not happy about these transactions, because they cut into sales of new books. But both the students who sell used books and those who buy them clearly benefit from the existence of the market. That is why many college bookstores facilitate their trade, buying used textbooks and selling them alongside the new books.

But can we put a number on what used textbook buyers and sellers gain from these transactions? Can we answer the question, “*How much* do the buyers and sellers of textbooks gain from the existence of the used-book market?”

Yes, we can. In this chapter we will see how to measure benefits, such as those to buyers of used textbooks,

from being able to purchase a good—known as *consumer surplus*. And we will see that there is a corresponding measure, *producer surplus*, of the benefits sellers receive from being able to sell a good.

The concepts of consumer surplus and producer surplus are extremely useful for analyzing a wide variety of economic issues. They let us calculate how much benefit producers and consumers receive from the existence of a

market. They also allow us to calculate how the welfare of consumers and producers is affected by changes in market prices. Such calculations play a crucial role in evaluating many economic policies.

What information do we need to calculate consumer and producer surplus? Surprisingly, all we need are the demand and supply curves for a good.

That is, the supply and demand model isn’t just a model of how a competitive market works—it’s also a model of how much consumers and producers gain from participating in that market. So our first step will be to learn how consumer and producer surplus can be derived from the demand and supply curves. We will then see how these concepts can be applied to actual economic issues.



David Young-Wolff/PhotoEdit

How much am I willing to pay for that used textbook?

WHAT YOU WILL LEARN IN THIS CHAPTER:

- The meaning of **consumer surplus** and its relationship to the demand curve
- The meaning of **producer surplus** and its relationship to the supply curve
- The meaning and importance of **total surplus** and how it can be used both to measure the gains from trade and to illustrate why markets work so well
- The critical importance of **property rights** and prices as **economic signals** to the smooth functioning of a market
- Why markets typically lead to efficient outcomes and why markets sometimes fail

Consumer Surplus and the Demand Curve

The market in used textbooks is a big business in terms of dollars and cents—approximately \$1.9 billion in 2004–2005. More importantly for us, it is a convenient starting point for developing the concepts of consumer and producer surplus. We'll use the concepts of consumer and producer surplus to understand exactly how buyers and sellers benefit from a competitive market and how big those benefits are. In addition, these concepts play important roles in analyzing what happens when competitive markets don't work well or there is interference in the market.

So let's begin by looking at the market for used textbooks, starting with the buyers. The key point, as we'll see in a minute, is that the demand curve is derived from their tastes or preferences—and that those same preferences also determine how much they gain from the opportunity to buy used books.

Willingness to Pay and the Demand Curve

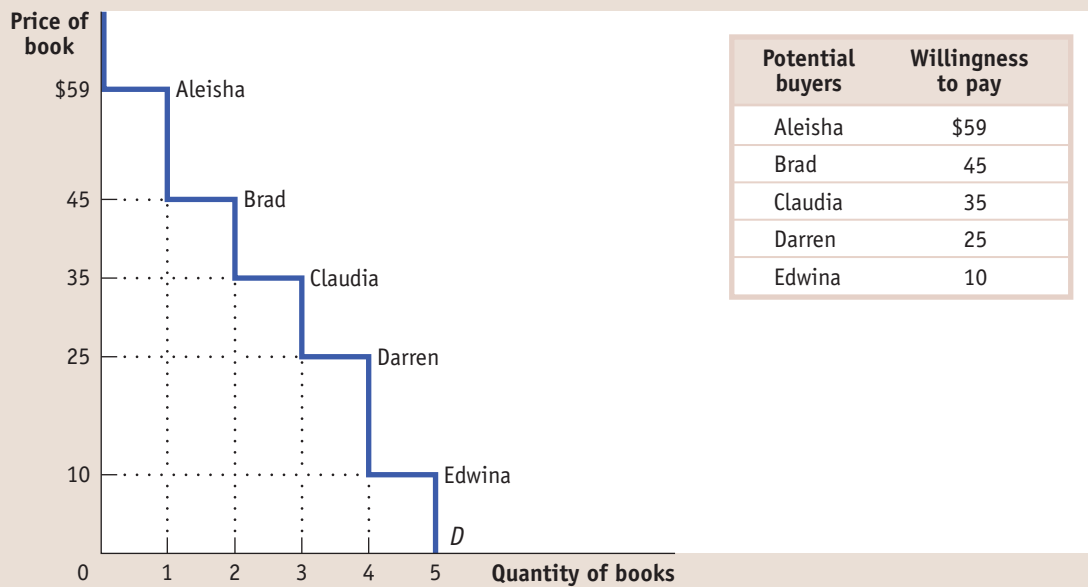
A used book is not as good as a new book—it will be battered and coffee-stained, may include someone else's highlighting, and may not be completely up to date. How much this bothers you depends on your preferences. Some potential buyers would prefer to buy the used book even if it is only slightly cheaper than a new one, while others would buy the used book only if it is considerably cheaper. Let's define a potential buyer's **willingness to pay** as the maximum price at which he or she would buy a good, in this case a used textbook. An individual won't buy the good if it costs more than this amount but is eager to do so if it costs less. If the price is just equal to an individual's willingness to pay, he or she is indifferent between buying and not buying. For the sake of simplicity, we'll assume that the individual buys the good in this case.

The table in Figure 4-1 shows five potential buyers of a used book that costs \$100 new, listed in order of their willingness to pay. At one extreme is Aleisha, who will buy a second-hand book even if the price is as high as \$59. Brad is less willing to have a used book and will buy one only if the price is \$45 or less. Claudia is willing to pay only \$35 and Darren, only \$25. And Edwina, who really doesn't like the idea of a used book, will buy one only if it costs no more than \$10.

How many of these five students will actually buy a used book? It depends on the price. If the price of a used book is \$55, only Aleisha buys one; if the price is \$40, Aleisha and Brad both buy used books, and so on. So the information in the table can be used to construct the *demand schedule* for used textbooks.

As we saw in Chapter 3, we can use this demand schedule to derive the market demand curve shown in Figure 4-1. Because we are considering only a small number of consumers, this curve doesn't look like the smooth demand curves of Chapter 3, where markets contained hundreds or thousands of consumers. This demand curve is step-shaped, with alternating horizontal and vertical segments. Each horizontal segment—each step—corresponds to one potential buyer's willingness to pay. However, we'll see shortly that for the analysis of consumer surplus it doesn't matter whether the demand curve is step-shaped, as in this figure, or whether there are many consumers, making the curve smooth.

A consumer's **willingness to pay** for a good is the maximum price at which he or she would buy that good.

FIGURE 4-1 The Demand Curve for Used Textbooks

With only five potential consumers in this market, the demand curve is step-shaped. Each step represents one consumer, and its height indicates that consumer's willingness to pay—the maximum price at which each will buy a used textbook—as indicated in the table. Aleisha has the highest willingness to pay at \$59, Brad has the next

highest at \$45, and so on down to Edwina with the lowest willingness to pay at \$10. At a price of \$59, the quantity demanded is one (Aleisha); at a price of \$45, the quantity demanded is two (Aleisha and Brad); and so on until you reach a price of \$10, at which all five students are willing to purchase a book.

Willingness to Pay and Consumer Surplus

Suppose that the campus bookstore makes used textbooks available at a price of \$30. In that case Aleisha, Brad, and Claudia will buy books. Do they gain from their purchases, and if so, how much?

The answer, shown in Table 4-1, is that each student who purchases a book does achieve a net gain but that the amount of the gain differs among students.

Aleisha would have been willing to pay \$59, so her net gain is $\$59 - \$30 = \$29$. Brad would have been willing to pay \$45, so his net gain is $\$45 - \$30 = \$15$. Claudia would have been willing to pay \$35, so her net gain is $\$35 - \$30 = \$5$. Darren and Edwina, however, won't be willing to buy a used book at a price of \$30, so they neither gain nor lose.

TABLE 4-1
Consumer Surplus When the Price of a Used Textbook Is \$30

Potential buyer	Willingness to pay	Price paid	Individual consumer surplus = Willingness to pay – Price paid
Aleisha	\$59	\$30	\$29
Brad	45	30	15
Claudia	35	30	5
Darren	25	—	—
Edwina	10	—	—
All buyers	Total consumer surplus = \$49		

Individual consumer surplus is the net gain to an individual buyer from the purchase of a good. It is equal to the difference between the buyer's willingness to pay and the price paid.

Total consumer surplus is the sum of the individual consumer surpluses of all the buyers of a good in a market.

The term **consumer surplus** is often used to refer to both individual and to total consumer surplus.

The net gain that a buyer achieves from the purchase of a good is called that buyer's **individual consumer surplus**. What we learn from this example is that whenever a buyer pays a price less than his or her willingness to pay, the buyer achieves some individual consumer surplus.

The sum of the individual consumer surpluses achieved by all the buyers of a good is known as the **total consumer surplus** achieved in the market. In Table 4-1, the total consumer surplus is the sum of the individual consumer surpluses achieved by Aleisha, Brad, and Claudia: $\$29 + \$15 + \$5 = \49 .

Economists often use the term **consumer surplus** to refer to both individual and total consumer surplus. We will follow this practice; it will always be clear in context whether we are referring to the consumer surplus achieved by an individual or by all buyers.

Total consumer surplus can be represented graphically. Figure 4-2 reproduces the demand curve from Figure 4-1. Each step in that demand curve is one book wide and represents one consumer. For example, the height of Aleisha's step is \$59, her willingness to pay. This step forms the top of a rectangle, with \$30—the price she actually pays for a book—forming the bottom. The area of Aleisha's rectangle, $(\$59 - \$30) \times 1 = \$29$, is her consumer surplus from purchasing one book at \$30. So the individual consumer surplus Aleisha gains is the *area of the dark blue rectangle* shown in Figure 4-2.

In addition to Aleisha, Brad and Claudia will also each buy a book when the price is \$30. Like Aleisha, they benefit from their purchases, though not as much, because they each have a lower willingness to pay. Figure 4-2 also shows the consumer surplus gained by Brad and Claudia; again, this can be measured by the areas of the appropriate rectangles. Darren and Edwina, because they do not buy books at a price of \$30, receive no consumer surplus.

The total consumer surplus achieved in this market is just the sum of the individual consumer surpluses received by Aleisha, Brad, and Claudia. So total consumer surplus is equal to the combined area of the three rectangles—the entire shaded area in Figure 4-2. Another way to say this is that total consumer surplus is equal to the area below the demand curve but above the price.

FIGURE 4-2

Consumer Surplus in the Used-Textbook Market

At a price of \$30, Aleisha, Brad, and Claudia each buy a book but Darren and Edwina do not. Aleisha, Brad, and Claudia get individual consumer surpluses equal to the difference between their willingness to pay and the price, illustrated by the areas of the shaded rectangles. Both Darren and Edwina have a willingness to pay less than \$30, so they are unwilling to buy a book in this market; they receive zero consumer surplus. The total consumer surplus is given by the entire shaded area—the sum of the individual consumer surpluses of Aleisha, Brad, and Claudia—equal to $\$29 + \$15 + \$5 = \49 .

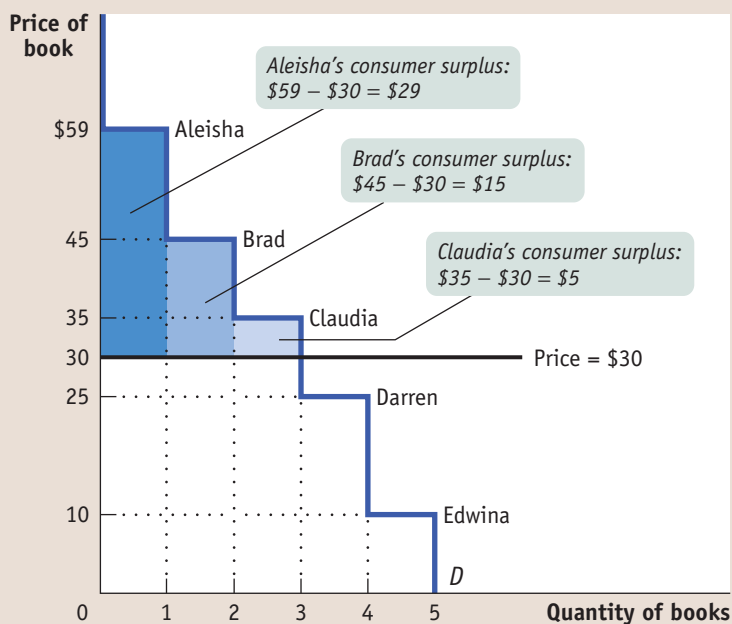
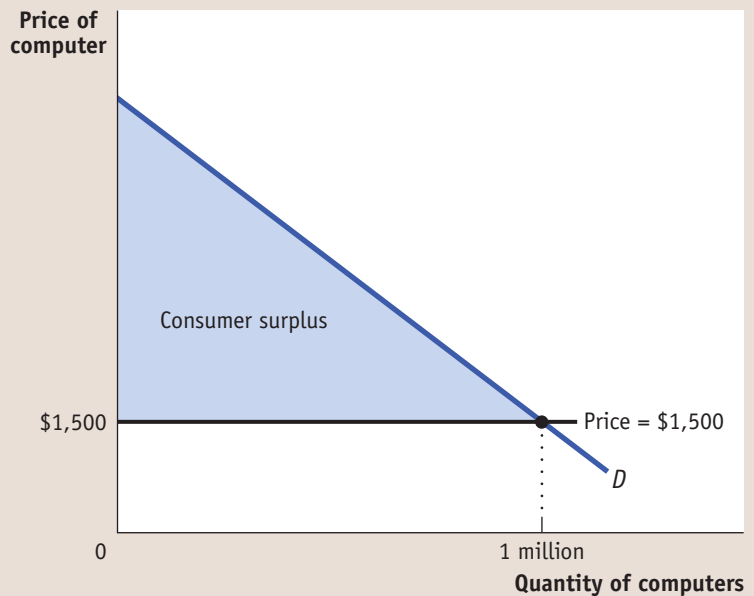


FIGURE 4-3

Consumer Surplus

The demand curve for computers is smooth because there are many potential buyers. At a price of \$1,500, 1 million computers are demanded. The consumer surplus at this price is equal to the shaded area: the area below the demand curve but above the price. This is the total net gain to consumers generated from buying and consuming computers when the price is \$1,500.



This illustrates the following general principle: *The total consumer surplus generated by purchases of a good at a given price is equal to the area below the demand curve but above that price.* The same principle applies regardless of the number of consumers.

When we consider large markets, this graphical representation becomes extremely helpful. Consider, for example, the sales of personal computers to millions of potential buyers. Each potential buyer has a maximum price that he or she is willing to pay. With so many potential buyers, the demand curve will be smooth, like the one shown in Figure 4-3.

Suppose that at a price of \$1,500, a total of 1 million computers are purchased. How much do consumers gain from being able to buy those 1 million computers? We could answer that question by calculating the individual consumer surplus of each buyer and then adding these numbers up to arrive at a total. But it is much easier just to look at Figure 4-3 and use the fact that total consumer surplus is equal to the shaded area. As in our original example, consumer surplus is equal to the area below the demand curve but above the price. (You can refresh your memory on how to calculate the area of a right triangle by turning to the appendix to Chapter 2.)

How Changing Prices Affect Consumer Surplus

It is often important to know how much consumer surplus *changes* when the price changes. For example, we may want to know how much consumers are hurt if a frost in Florida drives up orange prices or how much consumers gain if the introduction of fish farming makes salmon steaks less expensive. The same approach we have used to derive consumer surplus can be used to answer questions about how changes in prices affect consumers.

Let's return to the example of the market for used textbooks. Suppose that the bookstore decided to sell used textbooks for \$20 instead of \$30. How much would this fall in price increase consumer surplus?

The answer is illustrated in Figure 4-4 on the next page. As shown in the figure, there are two parts to the increase in consumer surplus. The first part, shaded dark blue, is the gain of those who would have bought books even at the higher price of \$30.

Each of the students who would have bought books at \$30—Aleisha, Brad, and Claudia—now pays \$10 less, and therefore each gains \$10 in consumer surplus from the fall in price to \$20. So the dark blue area represents the $10 \times 3 = \$30$ increase in consumer surplus to those three buyers. The second part, shaded light blue, is the gain to those who would not have bought a book at \$30 but are willing to pay more than \$20. In this case that gain goes to Darren, who would not have bought a book at \$30 but does buy one at \$20. He gains \$5—the difference between his willingness to pay of \$25 and the new price of \$20. So the light blue area represents a further \$5 gain in consumer surplus. The total increase in consumer surplus is the sum of the shaded areas, \$35. Likewise, a rise in price from \$20 to \$30 would decrease consumer surplus by an amount equal to the sum of the shaded areas.

Figure 4-4 illustrates that when the price of a good falls, the area under the demand curve but above the price—which we have seen is equal to total consumer surplus—increases. Figure 4-5 shows the same result for the case of a smooth demand curve, the demand for personal computers. Here we assume that the price of computers falls from \$5,000 to \$1,500, leading to an increase in the quantity demanded from 200,000 to 1 million units. As in the used-textbook example, we divide the gain in consumer surplus into two parts. The dark blue rectangle in Figure 4-5 corresponds to the dark blue area in Figure 4-4: it is the gain to the 200,000 people who would have bought computers even at the higher price of \$5,000. As a result of the price reduction, each receives additional surplus of \$3,500. The light blue triangle in Figure 4-5 corresponds to the light blue area in Figure 4-4: it is the gain to people who would not have bought the good at the higher price but are willing to do so at a price of \$1,500. For example, the light blue triangle includes the gain to someone who would have been willing to pay \$2,000 for a computer and therefore gains \$500 in consumer surplus when it is possible to buy a computer for only \$1,500. As before, the total gain in consumer surplus is the sum of the shaded areas, the increase in the area under the demand curve but above the price.

FIGURE 4-4

Consumer Surplus and a Fall in the Price of Used Textbooks

There are two parts to the increase in consumer surplus generated by a fall in price from \$30 to \$20. The first is given by the dark blue rectangle: each person who would have bought at the original price of \$30—Aleisha, Brad, and Claudia—receives an increase in consumer surplus equal to the total reduction in price, \$10. So the area of the dark blue rectangle corresponds to an amount equal to $3 \times \$10 = \30 . The second part is given by the light blue area: the increase in consumer surplus for those who would *not* have bought at the original price of \$30 but who buy at the new price of \$20—namely, Darren. Darren's willingness to pay is \$25, so he now receives consumer surplus of \$5. The total increase in consumer surplus is $3 \times \$10 + \$5 = \$35$, represented by the sum of the shaded areas. Likewise, a rise in price from \$20 to \$30 would decrease consumer surplus by an amount equal to the sum of the shaded areas.

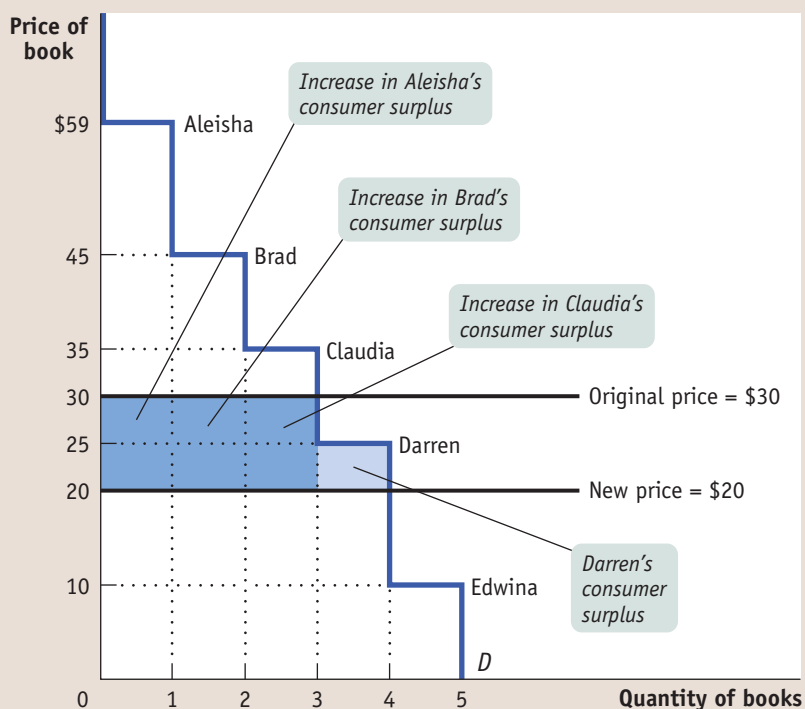
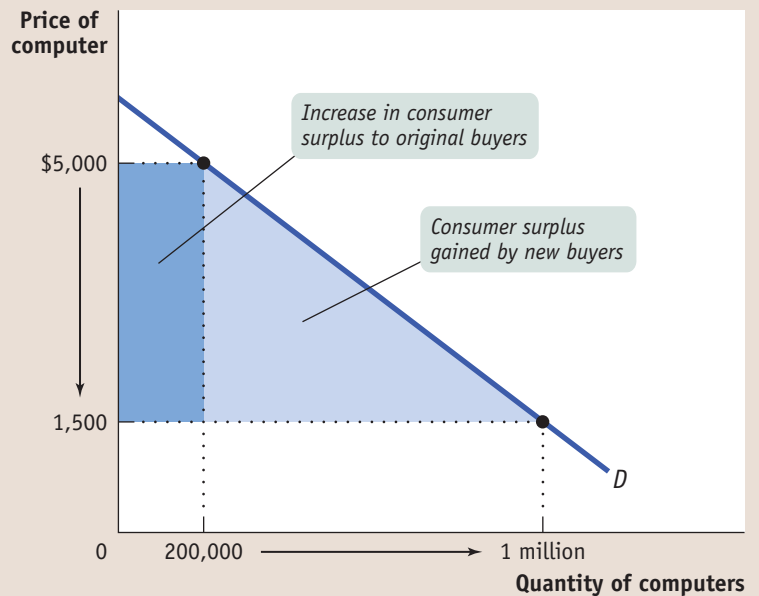


FIGURE 4-5

A Fall in the Price Increases Consumer Surplus

A fall in the price of a computer from \$5,000 to \$1,500 leads to an increase in the quantity demanded and an increase in consumer surplus. The change in total consumer surplus is given by the sum of the shaded areas: the total area below the demand curve and between the old and new prices. Here, the dark blue area represents the increase in consumer surplus for the 200,000 consumers who would have bought a computer at the original price of \$5,000; they each receive an increase in consumer surplus of \$3,500. The light blue area represents the increase in consumer surplus for those willing to buy at a price equal to or greater than \$1,500 but less than \$5,000. Similarly, a rise in the price of a computer from \$1,500 to \$5,000 generates a decrease in consumer surplus equal to the sum of the two shaded areas.



What would happen if the price of a good were to rise instead of fall? We would do the same analysis in reverse. Suppose, for example, that for some reason the price of computers rises from \$1,500 to \$5,000. This would lead to a fall in consumer surplus, equal to the sum of the shaded areas in Figure 4-5. This loss consists of two parts. The dark blue rectangle represents the loss to consumers who would still buy a computer, even at a price of \$5,000. The light blue triangle represents the loss to consumers who decide not to buy a computer at the higher price.

FOR INQUIRING MINDS

A Matter of Life and Death

Each year, about 4,000 people in the United States die while waiting for a kidney transplant. In 2007, some 70,000 more were wait-listed. Since the number of those in need of a kidney far exceeds availability, what is the best way to allocate available organs? A market isn't feasible. For understandable reasons, the sale of human body parts is illegal in this country. So the task of establishing a protocol for these situations has fallen to the nonprofit group United Network for Organ Sharing (UNOS).

Under current UNOS guidelines, a donated kidney goes to the person who has been waiting the longest. According to this system, an available kidney would go to a 75-year-old who has been waiting for 2 years instead of to a 25-year-old who has been

waiting 6 months, even though the 25-year-old will likely live longer and benefit from the transplanted organ for a longer period of time.

To address this issue, UNOS is devising a new set of guidelines based on a concept it calls "net benefit." According to these new guidelines, kidneys would be allocated on the basis of who will receive the greatest net benefit, where net benefit is measured as the expected increase in lifespan from the transplant. And age is by far the biggest predictor of how long someone will live after a transplant. For example, a typical 25-year-old diabetic will gain an extra 8.7 years of life from a transplant, but a typical 55-year-old diabetic will gain only 3.6 extra years. Under the current system,

based on waiting times, transplants lead to about 44,000 extra years of life for recipients; under the new system, that number would jump to 55,000 extra years. The share of kidneys going to those in their 20s would triple; the share going to those 60 and older would be halved.

What does this have to do with consumer surplus? As you may have guessed, the UNOS concept of "net benefit" is a lot like individual consumer surplus—the individual consumer surplus generated from getting a new kidney. In essence, UNOS has devised a system that allocates donated kidneys according to who gets the greatest individual consumer surplus. In terms of results, then, its proposed "net benefit" system operates a lot like a competitive market.

► ECONOMICS IN ACTION

When Money Isn't Enough

The key insight we get from the concept of consumer surplus is that purchases yield a net benefit to the consumer, because the consumer typically pays a price less than his or her willingness to pay for the good. Another way to say this is that the right to buy a good at the going price is a valuable thing in itself.

Most of the time we don't think about the value associated with the right to buy a good. In a market economy, we take it for granted that we can buy whatever we want, as long as we are willing to pay the market price. But that hasn't always been true. For example, during World War II the demands of wartime production created shortages of consumer goods when these goods were sold at pre-war prices. Rather than allow prices to rise, government officials created a system of rationing many goods. To buy sugar, meat, coffee, gasoline, and many other goods, you not only had to pay cash; you also had to present stamps or coupons from special books issued to each family by the government. These pieces of paper, which represented the right to buy goods at the government-regulated price, quickly became valuable commodities in themselves. As a result, illegal markets in meat stamps and gasoline coupons sprang into existence. Moreover, criminals began stealing coupons and even counterfeiting stamps.

The funny thing was that even if you had bought a gasoline coupon on the illegal market, you still had to pay to purchase gasoline. So what you were buying on the illegal market was not the good but *the right to buy the good* at the government-regulated price. That is, people who bought ration coupons on the illegal market were paying for the right to get some consumer surplus. ▲

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► QUICK REVIEW

- The demand curve for a good is determined by each potential consumer's **willingness to pay**.
- **Individual consumer surplus** is the net gain an individual consumer gets from buying a good.
- The **total consumer surplus** in a given market is equal to the area under the market demand curve but above the price.
- A fall in the price of a good increases **consumer surplus** through two channels: a gain to consumers who would have bought at the original price and a gain to consumers who are persuaded to buy by the lower price. A rise in the price of a good reduces consumer surplus in a similar fashion.

► CHECK YOUR UNDERSTANDING 4-1

1. Consider the market for cheese-stuffed jalapeno peppers. There are two consumers, Casey and Josey, and their willingness to pay for each pepper is given in the accompanying table. (Neither

Quantity of peppers	Casey's willingness to pay	Josey's willingness to pay
1st pepper	\$0.90	\$0.80
2nd pepper	0.70	0.60
3rd pepper	0.50	0.40
4th pepper	0.30	0.30

is willing to consume more than 4 peppers at any price.) Use the table (i) to construct the demand schedule for peppers for prices of \$0.00, \$0.10, and so on, up to \$0.90, and (ii) to calculate the total consumer surplus when the price of a pepper is \$0.40.

Solutions appear at back of book.

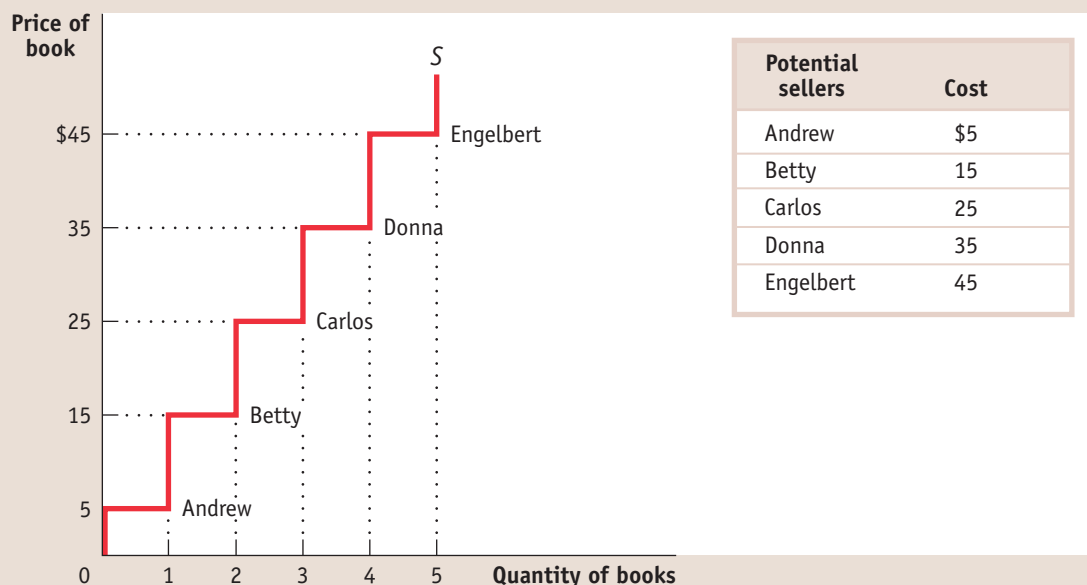
Producer Surplus and the Supply Curve

Just as some buyers of a good would have been willing to pay more for their purchase than the price they actually pay, some sellers of a good would have been willing to sell it for less than the price they actually receive. We can therefore carry out an analysis of producer surplus and the supply curve that is almost exactly parallel to that of consumer surplus and the demand curve.

Cost and Producer Surplus

Consider a group of students who are potential sellers of used textbooks. Because they have different preferences, the various potential sellers differ in the price at which they are willing to sell their books. The table in Figure 4-6 shows the prices at which several different students would be willing to sell. Andrew is willing to sell the book as long as he can get at least \$5; Betty won't sell unless she can get at least \$15; Carlos, unless he can get \$25; Donna, unless she can get \$35; Engelbert, unless he can get \$45.

FIGURE 4-6 The Supply Curve for Used Textbooks



The supply curve illustrates sellers' cost, the lowest price at which a potential seller is willing to sell the good, and the quantity supplied at that price. Each of the five students has one book to sell and each has a different cost, as indicated in the

accompanying table. At a price of \$5 the quantity supplied is one (Andrew), at \$15 it is two (Andrew and Betty), and so on until you reach \$45, the price at which all five students are willing to sell.

The lowest price at which a potential seller is willing to sell has a special name in economics: it is called the seller's **cost**. So Andrew's cost is \$5, Betty's is \$15, and so on.

Using the term *cost*, which people normally associate with the monetary cost of producing a good, may sound a little strange when applied to sellers of used textbooks. The students don't have to manufacture the books, so it doesn't cost the student who sells a book anything to make that book available for sale, does it?

Yes, it does. A student who sells a book won't have it later, as part of his or her personal collection. So there is an *opportunity cost* to selling a textbook, even if the owner has completed the course for which it was required. And remember that one of the basic principles of economics is that the true measure of the cost of doing something is always its opportunity cost. That is, the real cost of something is what you must give up to get it.

So it is good economics to talk of the minimum price at which someone will sell a good as the "cost" of selling that good, even if he or she doesn't spend any money to make the good available for sale. Of course, in most real-world markets the sellers are also those who produce the good and therefore *do* spend money to make the good available for sale. In this case the cost of making the good available for sale *includes* monetary costs, but it may also include other opportunity costs.

Getting back to the example, suppose that Andrew sells his book for \$30. Clearly he has gained from the transaction: he would have been willing to sell for only \$5, so he has gained \$25. This net gain, the difference between the price he actually gets and his cost—the minimum price at which he would have been willing to sell—is known as his **individual producer surplus**.

Just as we derived the demand curve from the willingness to pay of different consumers, we can derive the supply curve from the cost of different producers. The step-shaped curve in Figure 4-6 shows the supply curve implied by the costs shown in the accompanying table. At a price less than \$5, none of the students are willing to sell; at a price between \$5 and \$15, only Andrew is willing to sell, and so on.

A seller's **cost** is the lowest price at which he or she is willing to sell a good.

Individual producer surplus is the net gain to an individual seller from selling a good. It is equal to the difference between the price received and the seller's cost.

Total producer surplus in a market is the sum of the individual producer surpluses of all the sellers of a good in a market. Economists use the term **producer surplus** to refer both to individual and to total producer surplus.

TABLE 4-2

Producer Surplus When the Price of a Used Textbook Is \$30

Potential seller	Cost	Price received	Individual producer surplus = Price received – Cost
Andrew	\$5	\$30	\$25
Betty	15	30	15
Carlos	25	30	5
Donna	35	—	—
Engelbert	45	—	—
All sellers			Total producer surplus = \$45

As in the case of consumer surplus, we can add the individual producer surpluses of sellers to calculate the **total producer surplus**, the total net gain to all sellers in the market. Economists use the term **producer surplus** to refer to either total or individual producer surplus. Table 4-2 shows the net gain to each of the students who would sell a used book at a price of \$30: \$25 for Andrew, \$15 for Betty, and \$5 for Carlos. The total producer surplus is $\$25 + \$15 + \$5 = \45 .

As with consumer surplus, the producer surplus gained by those who sell books can be represented graphically. Figure 4-7 reproduces the supply curve from Figure 4-6. Each step in that supply curve is one book wide and represents one seller. The height of Andrew's step is \$5, his cost. This forms the bottom of a rectangle, with \$30, the price he actually receives for his book, forming the top. The area of this rectangle, $(\$30 - \$5) \times 1 = \$25$, is his producer surplus. So the producer surplus Andrew gains from selling his book is the *area of the dark red rectangle* shown in the figure.

Let's assume that the campus bookstore is willing to buy all the used copies of this book that students are willing to sell at a price of \$30. Then, in addition to Andrew, Betty and Carlos will also sell their books. They will also benefit from their sales, though not as much as Andrew, because they have higher costs. Andrew, as we have

FIGURE 4-7

Producer Surplus in the Used-Textbook Market

At a price of \$30, Andrew, Betty, and Carlos each sell a book but Donna and Engelbert do not. Andrew, Betty, and Carlos get individual producer surpluses equal to the difference between the price and their cost, illustrated here by the shaded rectangles. Donna and Engelbert each have a cost that is greater than the price of \$30, so they are unwilling to sell a book and so receive zero producer surplus. The total producer surplus is given by the entire shaded area, the sum of the individual producer surpluses of Andrew, Betty, and Carlos, equal to $\$25 + \$15 + \$5 = \45 .

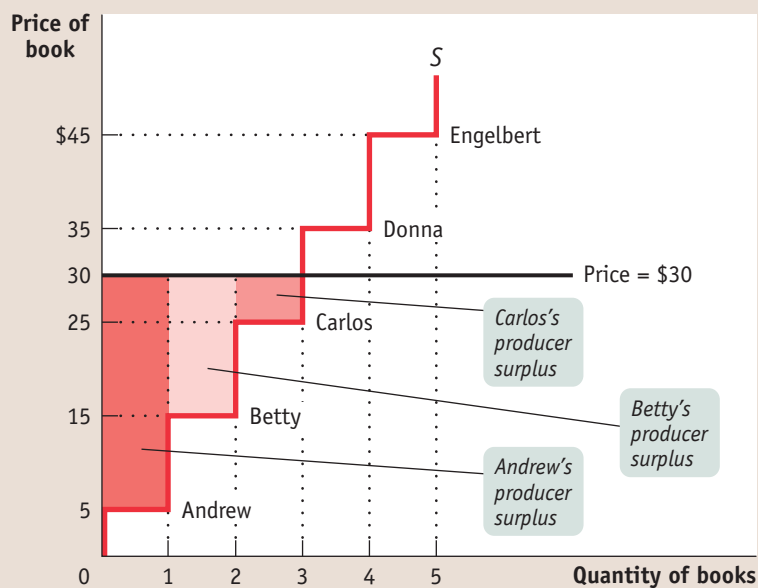
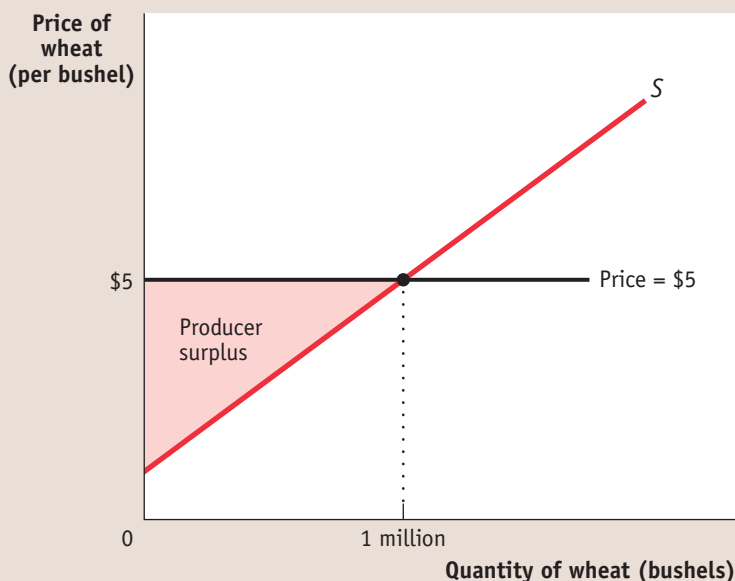


FIGURE 4-8

Producer Surplus

Here is the supply curve for wheat. At a price of \$5 per bushel, farmers supply 1 million bushels. The producer surplus at this price is equal to the shaded area: the area above the supply curve but below the price. This is the total gain to producers—farmers in this case—from supplying their product when the price is \$5.



seen, gains \$25. Betty gains a smaller amount: since her cost is \$15, she gains only \$15. Carlos gains even less, only \$5.

Again, as with consumer surplus, we have a general rule for determining the total producer surplus from sales of a good: *The total producer surplus from sales of a good at a given price is the area above the supply curve but below that price.*

This rule applies both to examples like the one shown in Figure 4-7, where there are a small number of producers and a step-shaped supply curve, and to more realistic examples, where there are many producers and the supply curve is more or less smooth.

Consider, for example, the supply of wheat. Figure 4-8 shows how producer surplus depends on the price per bushel. Suppose that, as shown in the figure, the price is \$5 per bushel and farmers supply 1 million bushels. What is the benefit to the farmers from selling their wheat at a price of \$5? Their producer surplus is equal to the shaded area in the figure—the area above the supply curve but below the price of \$5 per bushel.

How Changing Prices Affect Producer Surplus

As in the case of consumer surplus, a change in price alters producer surplus. However, although a fall in price increases consumer surplus, it reduces producer surplus. Similarly, a rise in price reduces consumer surplus but increases producer surplus.

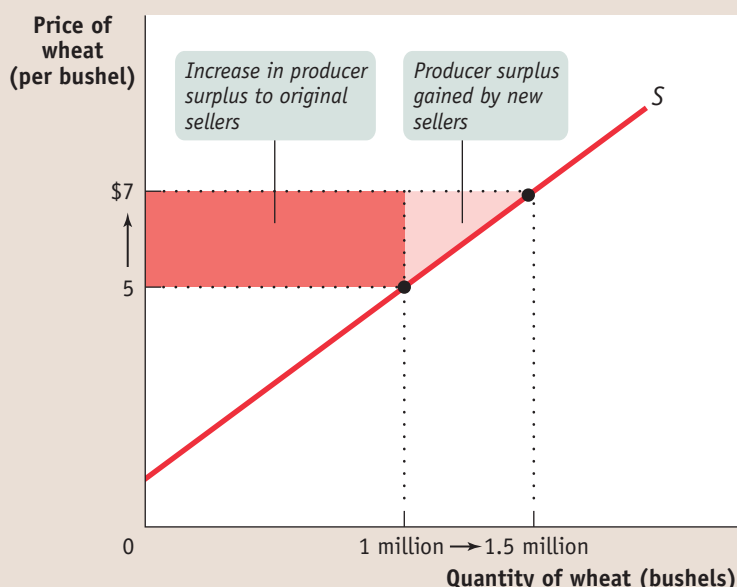
To see this, let's first consider a rise in the price of the good. Producers of the good will experience an increase in producer surplus, though not all producers gain the same amount. Some producers would have produced the good even at the original price; they will gain the entire price increase on every unit they produce. Other producers will enter the market because of the higher price; they will gain only the difference between the new price and their cost.

Figure 4-9 on the next page is the supply counterpart of Figure 4-5. It shows the effect on producer surplus of a rise in the price of wheat from \$5 to \$7 per bushel. The increase in producer surplus is the sum of the shaded areas, which consists of two parts. First, there is a dark red rectangle corresponding to the gains to those farmers who would have supplied wheat even at the original \$5 price. Second, there is an additional light red

FIGURE 4-9

A Rise in the Price Increases Producer Surplus

A rise in the price of wheat from \$5 to \$7 leads to an increase in the quantity supplied and an increase in producer surplus. The change in total producer surplus is given by the sum of the shaded areas: the total area above the supply curve but between the old and new prices. The dark red area represents the gain to the farmers who would have supplied 1 million bushels at the original price of \$5; they each receive an increase in producer surplus of \$2 for each of those bushels. The triangular light red area represents the increase in producer surplus achieved by the farmers who supply the additional 500,000 bushels because of the higher price. Similarly, a fall in the price of wheat generates a reduction in producer surplus equal to the sum of the shaded areas.



triangle that corresponds to the gains to those farmers who would not have supplied wheat at the original price but are drawn into the market by the higher price.

If the price were to fall from \$7 to \$5 per bushel, the story would run in reverse. The sum of the shaded areas would now be the decline in producer surplus, the decrease in the area above the supply curve but below the price. The loss would consist of two parts, the loss to farmers who would still grow wheat at a price of \$5 (the dark red rectangle) and the loss to farmers who decide to no longer grow wheat because of the lower price (the light red triangle).

►ECONOMICS IN ACTION

When the Corn Is High

The average value of farmland in Iowa hit a record high in 2006. A lot of people, it seems, wanted to be Iowa farmers. And there was no mystery why: it was all about the ethanol.

Let's explain: ethanol—the same kind of alcohol that's in beer and other alcoholic drinks—can also fuel automobiles. And in recent years government policy, at both the federal and state levels, has encouraged the use of gasoline that contains a percentage of ethanol. There are a couple of reasons for this policy, including some benefits in fighting air pollution and the hope that using more ethanol will reduce U.S. dependence on imported oil.

But where is the ethanol to come from? Ethanol advocates look to the example of Brazil, which has shifted much of its fuel consumption from gasoline to ethanol. Brazil gets its ethanol by fermenting sugarcane, then distilling out the alcohol. The United States can't follow the same strategy: we don't grow enough sugarcane to satisfy our own sweet teeth, let alone run our cars. But we do produce an awful lot of corn. And corn can also be turned into ethanol.

One result of the shift to ethanol fuel has been a rise in the demand for corn, leading to a surge in corn prices, which rose from \$1.85 a bushel in late 2005 to about \$4 a bushel in early 2007. And there's no place like Iowa for growing corn. Iowa farmers gained from high prices both because they could sell the corn they would have

grown even at lower prices for more money, and because they could shift land away from other crops—especially soybeans—to corn.

What does this have to do with the price of land? A person who buys a farm in Iowa buys the producer surplus that farm generates. And higher prices for corn, which raise the producer surplus of Iowa farmers, make Iowa farmland more valuable. According to the U.S. Department of Agriculture, Iowa farmland went from an average of \$1,800 per acre in 2000 to \$2,930 per acre in 2006, a 63% increase. ▲

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► CHECK YOUR UNDERSTANDING 4-2

1. Consider the market for cheese-stuffed jalapeno peppers. There are two producers, Cara and Jamie, and their costs of producing each pepper are given in the accompanying table. (Neither is willing to produce more than 4 peppers at any price.) Use the table (i) to construct the supply schedule for peppers for prices of \$0.00, \$0.10, and so on, up to \$0.90, and (ii) to calculate the total producer surplus when the price of a pepper is \$0.70.

Quantity of peppers	Cara's cost	Jamie's cost
1st pepper	\$0.10	\$0.30
2nd pepper	0.10	0.50
3rd pepper	0.40	0.70
4th pepper	0.60	0.90

Solutions appear at back of book.

►► QUICK REVIEW

- The supply curve for a good is determined by the **cost** of each seller.
- The difference between the price and cost is the seller's **individual producer surplus**.
- The **total producer surplus** is equal to the area above the market supply curve but below the price.
- When the price of a good rises, **producer surplus** increases through two channels: the gains of those who would have supplied the good at the original price and the gains of those who are induced to supply the good by the higher price. A fall in the price of a good similarly leads to a fall in producer surplus.

Consumer Surplus, Producer Surplus, and the Gains from Trade

One of the 12 core principles of economics we introduced in Chapter 1 is that markets are a remarkably effective way to organize economic activity: they generally make society as well off as possible given the available resources. The concepts of consumer surplus and producer surplus can help us deepen our understanding of why this is so.

The Gains from Trade

Let's return to the market in used textbooks, but now consider a much bigger market—say, one at a large state university. There are many potential buyers and sellers, so the market is competitive. Let's line up incoming students who are potential buyers of a book in order of their willingness to pay, so that the entering student with the highest willingness to pay is potential buyer number 1, the student with the next highest willingness to pay is number 2, and so on. Then we can use their willingness to pay to derive a demand curve like the one in Figure 4-10 on the next page. Similarly, we can line up outgoing students, who are potential sellers of the book, in order of their cost, starting with the student with the lowest cost, then the student with the next lowest cost, and so on, to derive a supply curve like the one shown in the same figure.

As we have drawn the curves, the market reaches equilibrium at a price of \$30 per book, and 1,000 books are bought and sold at that price. The two shaded triangles show the consumer surplus (blue) and the producer surplus (red) generated by this market. The sum of consumer and producer surplus is known as the **total surplus** generated in a market.

The striking thing about this picture is that both consumers and producers gain—that is, both consumers and producers are better off because there is a market in this good. But this should come as no surprise—it illustrates another core principle of economics: *There are gains from trade*. These gains from trade are the reason everyone is better off participating in a market economy than they would be if each individual tried to be self-sufficient.

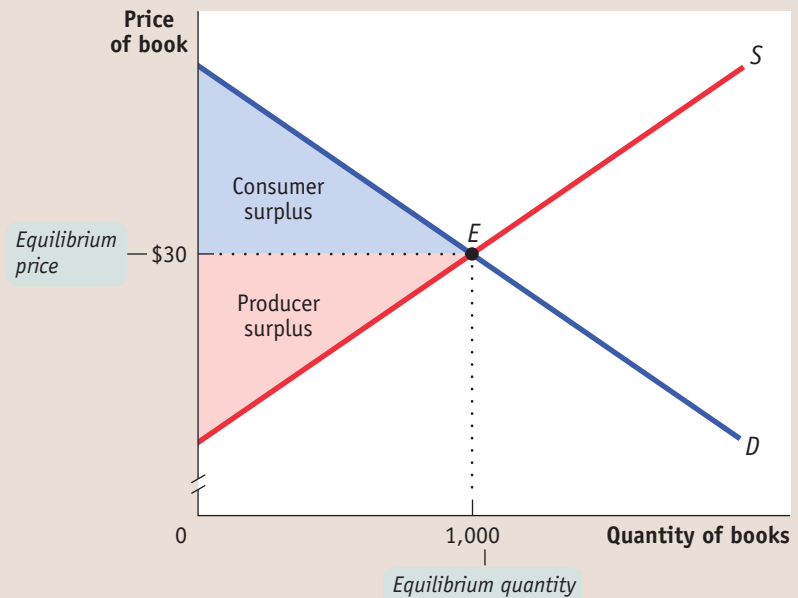
But are we as well off as we could be? This brings us to the question of the efficiency of markets.

The **total surplus** generated in a market is the total net gain to consumers and producers from trading in the market. It is the sum of the producer and the consumer surplus.

FIGURE 4-10

Total Surplus

In the market for used textbooks, the equilibrium price is \$30 and the equilibrium quantity is 1,000 books. Consumer surplus is given by the blue area, the area below the demand curve but above the price. Producer surplus is given by the red area, the area above the supply curve but below the price. The sum of the blue and the red areas is total surplus, the total benefit to society from the production and consumption of the good.

**The Efficiency of Markets**

Markets produce gains from trade, but in Chapter 1 we made an even bigger claim: that markets are usually *efficient*. That is, we claimed that once the market has produced its gains from trade, there is no way to make some people better off without making other people worse off, except under some well-defined conditions.

The analysis of consumer and producer surplus helps us understand why markets are usually efficient. To gain more intuition into why this is so, consider the fact that market equilibrium is just *one* way of deciding who consumes the good and who sells the good. There are other possible ways of making that decision. Consider, for example, the case of kidney transplants, discussed earlier in *For Inquiring Minds*. There you learned that available kidneys currently go to the people who have been waiting the longest, rather than to those most likely to benefit from the organ for longer. To address this inefficiency, a new set of guidelines is being devised to determine eligibility for a kidney transplant based on “net benefit,” a concept an awful lot like consumer surplus: kidneys would be allocated largely on the basis of who will benefit from them the most.

Similarly, imagine a committee charged with improving on the market equilibrium by deciding who gets and who gives up a used textbook. The committee’s ultimate goal: to bypass the market outcome and come up with another arrangement that would produce higher total surplus.

Let’s consider the three ways in which the committee might try to increase the total surplus:

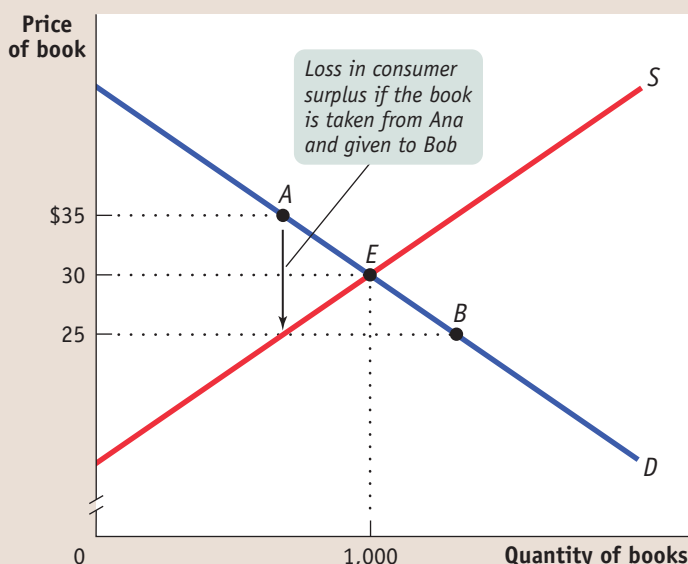
1. Reallocate consumption among consumers
2. Reallocate sales among sellers
3. Change the quantity traded

Reallocate Consumption Among Consumers The committee might try to increase total surplus by selling books to different consumers. Figure 4-11 shows why this will result in lower surplus compared to the market equilibrium outcome. Points A and B show the positions on the demand curve of two potential buyers of used books, Ana and Bob. As we can see from the figure, Ana is willing to pay \$35 for a book, but

FIGURE 4-11

Reallocating Consumption Lowers Consumer Surplus

Ana (point *A*) has a willingness to pay of \$35. Bob (point *B*) has a willingness to pay of only \$25. At the market equilibrium price of \$30, Ana purchases a book but Bob does not. If we rearrange consumption by taking a book from Ana and giving it to Bob, consumer surplus declines by \$10 and, as a result, total surplus declines by \$10. The market equilibrium generates the highest possible consumer surplus by ensuring that those who consume the good are those who most value it.



Bob is willing to pay only \$25. Since the market equilibrium price is \$30, under the market outcome Ana gets a book and Bob does not.

Now suppose the committee reallocates consumption. This would mean taking the book away from Ana and giving it to Bob. Since the book is worth \$35 to Ana but only \$25 to Bob, this change *reduces total consumer surplus* by $\$35 - \$25 = \$10$. Moreover, this result doesn't depend on which two students we pick. Every student who buys a book in the market equilibrium has a willingness to pay of \$30 or more, and every student who doesn't buy a book has a willingness to pay of less than \$30. So reallocating the good among consumers always means taking a book away from a student who values it more and giving it to one who values it less. This necessarily reduces total consumer surplus.

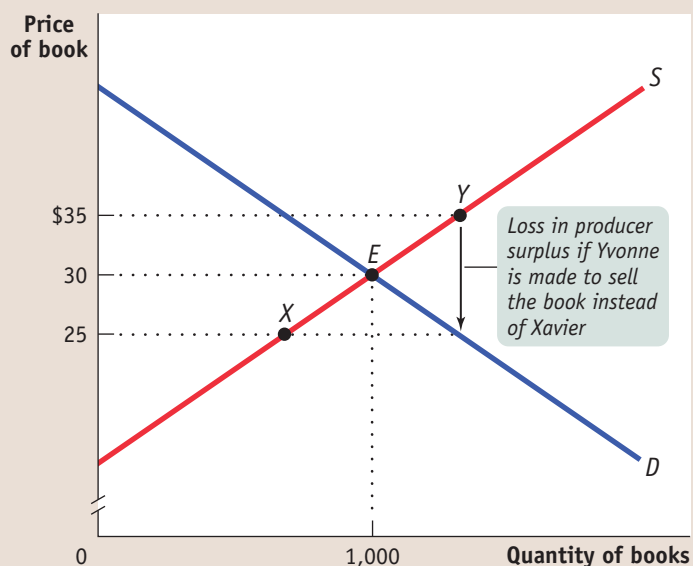
Reallocate Sales Among Sellers The committee might try to increase total surplus by altering who sells their books, taking sales away from sellers who would have sold their books in the market equilibrium and instead compelling those who would not have sold their books in the market equilibrium to sell them. Figure 4-12 on the next page shows why this will result in lower surplus. Here points *X* and *Y* show the positions on the supply curve of Xavier, who has a cost of \$25, and Yvonne, who has a cost of \$35. At the equilibrium market price of \$30, Xavier would sell his book but Yvonne would not sell hers. If the committee reallocated sales, forcing Xavier to keep his book and Yvonne to sell hers, total producer surplus would be reduced by $\$35 - \$25 = \$10$. Again, it doesn't matter which two students we choose. Any student who sells a book in the market equilibrium has a lower cost than any student who keeps a book. So reallocating sales among sellers necessarily increases total cost and reduces total producer surplus.

Change the Quantity Traded The committee might try to increase total surplus by compelling students to trade either more books or fewer books than the market equilibrium quantity. Figure 4-13 on the next page shows why this will result in lower surplus. It shows all four students: potential buyers Ana and Bob, and potential sellers Xavier and Yvonne. To reduce sales, the committee will have to prevent a transaction that would have occurred in the market equilibrium—that is, prevent Xavier from selling to Ana. Since Ana is willing to pay \$35 and Xavier's cost is \$25, preventing this transaction reduces total surplus by $\$35 - \$25 = \$10$. Once again, this result doesn't depend on which two students we pick: any student who would have sold the book in the market equilibrium has a cost of \$30 or less, and any student who would

FIGURE 4-12

Reallocating Sales Lowers Producer Surplus

Yvonne (point *Y*) has a cost of \$35, \$10 more than Xavier (point *X*), who has a cost of \$25. At the market equilibrium price of \$30, Xavier sells a book but Yvonne does not. If we rearrange sales by preventing Xavier from selling his book and compelling Yvonne to sell hers, producer surplus declines by \$10 and, as a result, total surplus declines by \$10. The market equilibrium generates the highest possible producer surplus by assuring that those who sell the good are those who most value the right to sell it.



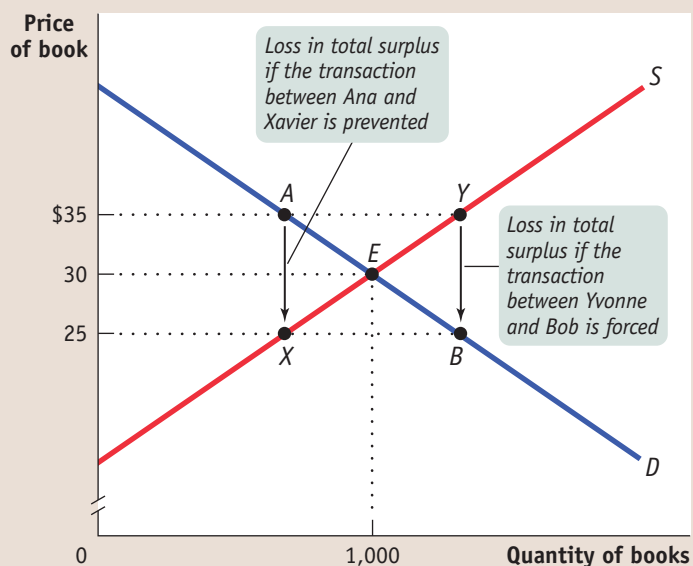
have purchased the book in the market equilibrium has a willingness to pay of \$30 or more. So preventing any sale that would have occurred in the market equilibrium necessarily reduces total surplus.

Finally, the committee might try to increase sales by forcing Yvonne, who would not have sold her book in the market equilibrium, to sell it to someone like Bob, who would not have bought a book in the market equilibrium. Because Yvonne's cost is \$35, but Bob is only willing to pay \$25, this transaction reduces total surplus by \$10. And once again it doesn't matter which two students we pick—anyone who wouldn't have bought the book has a willingness to pay of less than \$30, and anyone who wouldn't have sold has a cost of more than \$30.

FIGURE 4-13

Changing the Quantity Lowers Total Surplus

If Xavier (point *X*) were prevented from selling his book to someone like Ana (point *A*), total surplus would fall by \$10, the difference between Ana's willingness to pay (\$35) and Xavier's cost (\$25). This means that total surplus falls whenever fewer than 1,000 books—the equilibrium quantity—are transacted. Likewise, if Yvonne (point *Y*) were compelled to sell her book to someone like Bob (point *B*), total surplus would also fall by \$10, the difference between Yvonne's cost (\$35) and Bob's willingness to pay (\$25). This means that total surplus falls whenever more than 1,000 books are transacted. These two examples show that at market equilibrium, all mutually beneficial transactions—and only mutually beneficial transactions—occur.



The key point to remember is that once this market is in equilibrium, there is no way to increase the gains from trade. Any other outcome reduces total surplus. (This is why UNOS is trying, with its new guidelines based on “net benefit,” to reproduce the allocation of donated kidneys that would occur if there were a market for the organs.) We can summarize our results by stating that an efficient market performs four important functions:

1. It allocates consumption of the good to the potential buyers who most value it, as indicated by the fact that they have the highest willingness to pay.
2. It allocates sales to the potential sellers who most value the right to sell the good, as indicated by the fact that they have the lowest cost.
3. It ensures that every consumer who makes a purchase values the good more than every seller who makes a sale, so that all transactions are mutually beneficial.
4. It ensures that every potential buyer who doesn’t make a purchase values the good less than every potential seller who doesn’t make a sale, so that no mutually beneficial transactions are missed.

There are three caveats, however. First, although a market may be efficient, it isn’t necessarily *fair*. In fact, fairness, or *equity*, is often in conflict with efficiency. We’ll discuss this next.

The second caveat is that markets sometimes *fail*. As we mentioned in Chapter 1, under some well-defined conditions, markets can fail to deliver efficiency. When this occurs, markets no longer maximize total surplus. We provide a brief overview of why markets fail at the end of this chapter, reserving a more detailed analysis for later chapters.

Third, even when the market equilibrium maximizes total surplus, this does not mean that it results in the best outcome for every *individual* consumer and producer. Other things equal, each buyer would like to pay a lower price and each seller would like to receive a higher price. So if the government were to intervene in the market—say, by lowering the price below the equilibrium price to make consumers happy or by raising the price above the equilibrium price to make producers happy—the outcome would no longer be efficient. Although some people would be happier, society as a whole would be worse off because total surplus would be lower.

Equity and Efficiency

For many patients who need kidney transplants, the proposed UNOS guidelines, covered earlier, will be unwelcome news. Those who had waited years for a transplant will no doubt find these guidelines, which give precedence to younger patients, . . . well . . . unfair. And the guidelines raise other questions about fairness: Why limit potential transplant recipients to Americans? Why include younger patients with other chronic diseases? Why not give precedence to those who have made recognized contributions to society? And so on.

The point is that efficiency is about *how to achieve goals, not what those goals should be*. For example, UNOS decided that its goal is to maximize the life span of kidney recipients. Some might have argued for a different goal, and efficiency does not address which goal is the best. *What efficiency does address is the best way to achieve a goal once it has been determined*—in this case, using the UNOS concept of “net benefit.”

It’s easy to get carried away with the idea that markets are always right and that economic policies that interfere with efficiency are bad. But that would be misguided because there is another factor to consider: society cares about equity, or what’s “fair.” As we discussed in Chapter 1, there is often a trade-off between equity and efficiency: policies that promote equity often come at the cost of decreased efficiency, and policies that promote efficiency often result in decreased equity. So it’s important to realize that a society’s choice to sacrifice some efficiency for the sake of equity, however it defines equity, is a valid one. And it’s important to understand that fairness, unlike efficiency, can be very hard to define. Fairness is a concept about which well-intentioned people often disagree.



Maximizing total surplus at your local hardware store.

Photodisc/Getty Images

► ECONOMICS IN ACTION

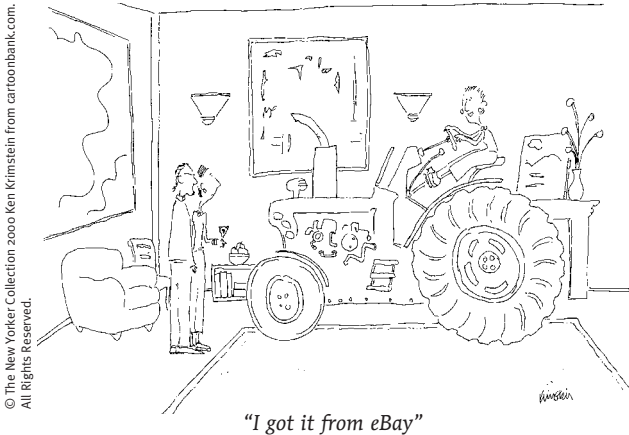
eBay and eEfficiency

Garage sales are an old American tradition: they are a way for people to sell items they don't want to others who have some use for them, to the benefit of both parties. But many potentially beneficial trades are missed. For all Mr. Smith knows, there is someone 1,000 miles away who would really love that 1930s gramophone he has in the basement; for all Ms. Jones knows, there is someone 1,000 miles away who has that 1930s gramophone she has always wanted. When garage sales are the only means by which buyers and sellers meet, there is no way for people like Mr. Smith and Ms. Jones to find each other.

Enter eBay, the online auction service. eBay was founded in 1995 by Pierre Omidyar, a programmer whose fiancée was a collector of Pez candy dispensers and wanted a way to find potential sellers. The company, which says that its mission is “to help practically anyone trade practically anything on earth,” provides a way for would-be buyers and would-be sellers of unique or used items to find each other, even if they

don't live in the same neighborhood or even the same city.

The potential gains from trade were evidently large: by late 2007, eBay had 83.2 million active users, and in 2007, \$60 billion in goods were bought and sold using the service. The Omidyars now possess a large collection of Pez dispensers. They are also billionaires. ▲



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► QUICK REVIEW

- **Total surplus** measures the gains from trade in a market.
- Markets are efficient except under some well-defined conditions. We can demonstrate the efficiency of a market by considering what happens to total surplus if we start from the equilibrium and reallocate consumption, reallocate sales, or change the quantity traded. Any outcome other than the market equilibrium reduces total surplus, which means that the market equilibrium is efficient.
- Because society cares about equity, government intervention in a market that reduces efficiency while increasing equity can be justified.

► CHECK YOUR UNDERSTANDING 4-3

1. Using the tables in Check Your Understanding 4-1 and 4-2, find the equilibrium price and quantity in the market for cheese-stuffed jalapeno peppers. What is total surplus in the equilibrium in this market, and who receives it?
2. Show how each of the following three actions reduces total surplus:
 - a. Having Josey consume one less pepper, and Casey one more pepper, than in the market equilibrium
 - b. Having Cara produce one less pepper, and Jamie one more pepper, than in the market equilibrium
 - c. Having Josey consume one less pepper, and Cara produce one less pepper, than in the market equilibrium
3. Suppose UNOS alters its guidelines for the allocation of donated kidneys, no longer relying solely on the concept of “net benefit” but also giving preference to patients with small children. If “total surplus” in this case is defined to be the total life span of kidney recipients, is this new guideline likely to reduce, increase, or leave total surplus unchanged? How might you justify this new guideline?

Solutions appear at back of book.

A Market Economy

As we learned earlier in the book, in a market economy decisions about production and consumption are made via markets. In fact, the economy as a whole is made up of many *interrelated markets*. Up until now, to learn how markets work we've been examining a single market—the market for used textbooks. But in reality, consumers and producers do not make decisions in isolated markets. For example, a student's decision in the market for used textbooks might be affected by how much interest must be paid on a student loan; thus, the decision in the used textbook market would be influenced by what is going on in the market for money.

We know that an efficient market equilibrium maximizes total surplus—the gains to buyers and sellers in that market. Is there a comparable result for an economy as a whole, an economy composed of a vast number of individual markets? The answer is yes, but with qualifications. When each and every market in the economy maximizes total surplus, then the economy as a whole is efficient. This is a very important result: just as it is impossible to make someone better off without making other people worse off in a single market when it is efficient, it is impossible to improve upon the outcome of a market economy when each and every market in that economy is efficient. However, it is important to realize that this is a *theoretical* result: it is virtually impossible to find an economy in which every market is efficient. For now, let's examine why markets and market economies typically work so well. Once we understand why, we can then briefly address why markets sometimes get it wrong.

Why Markets Typically Work So Well

Economists have written volumes about why markets are an effective way to organize an economy. In the end, well-functioning markets owe their effectiveness to two powerful features: *property rights* and the role of prices as *economic signals*.

By **property rights** we mean a system in which valuable items in the economy have specific owners who can dispose of them as they choose. In a system of property rights, by purchasing a good you receive “ownership rights”: the right to use and dispose of the good as you see fit. Property rights are what make the mutually beneficial transactions in the used-textbook market, or any market, possible.

To see why property rights are crucial, imagine that students do not have full property rights in their textbooks and are prohibited from reselling them when the semester ends. This restriction on property rights would prevent many mutually beneficial transactions. Some students would be stuck with textbooks they will never reread when they would be much happier receiving some cash instead. Other students would be forced to pay full price for brand-new books when they would be happier getting slightly battered copies at a lower price.

Once a system of well-defined property rights is in place, the second necessary feature of well-functioning markets—prices as economic signals—can operate. An **economic signal** is any piece of information that helps people make better economic decisions. There are thousands of signals that businesses watch in the real world. For example, business forecasters say that sales of cardboard boxes are a good early indicator of changes in industrial production: if businesses are buying lots of cardboard boxes, you can be sure that they will soon increase their production.

But prices are far and away the most important signals in a market economy, because they convey essential information about other people's costs and their willingness to pay. If the equilibrium price of used books is \$30, this in effect tells everyone both that there are consumers willing to pay \$30 and up and that there are potential sellers with a cost of \$30 or less. The signal given by the market price ensures that total surplus is maximized by telling people whether to buy books, sell books, or do nothing at all. Each potential seller with a cost of \$30 or less learns from the market price that it's a good idea to sell her book; if she has a higher cost, it's a good idea to keep it. Likewise, each consumer willing to pay \$30 or more learns from the market price that it's a good idea to buy a book; if he is unwilling to pay \$30, then it's a good idea not to buy a book.

This example shows that the market price “signals” to consumers with a willingness to pay equal to or more than the market price that they should buy the good, just as it signals to producers with a cost equal to or less than the market price that they should sell the good. And since, in equilibrium, the quantity demanded equals the quantity supplied, all willing consumers will find willing sellers.

Prices can sometimes fail as economic signals. Sometimes a price is not an accurate indicator of how desirable a good is. When there is uncertainty about the quality of a good, price alone may not be an accurate indicator of the value of the good. For example, you can't infer from the price alone whether a used car is good or a

Property rights are the rights of owners of valuable items, whether resources or goods, to dispose of those items as they choose.

An **economic signal** is any piece of information that helps people make better economic decisions.

A market or an economy is **inefficient** if there are missed opportunities: some people could be made better off without making other people worse off.

Market failure occurs when a market fails to be efficient.

“lemon.” In fact, a well-known problem in economics is “the market for lemons,” a market in which prices don’t work well as economic signals. (We’ll learn about the market for lemons in Chapter 21.)

A Few Words of Caution

As we’ve seen, markets are an amazingly effective way to organize economic activity. But as we’ve noted, markets can sometimes get it wrong. We first learned about this in Chapter 1 in our fifth principle of interaction: *When markets don’t achieve efficiency, government intervention can improve society’s welfare.* When markets are **inefficient**, there are missed opportunities—ways in which production or consumption can be rearranged that would make some people better off without making other people worse off. In other words, there are gains from trade that go unrealized: total surplus could be increased. And when a market or markets are inefficient, the economy in which they are embedded is also inefficient.

Markets can be rendered inefficient for a number of reasons. Two of the most important are a lack of property rights and inaccuracy of prices as economic signals. When a market is inefficient, we have what is known as **market failure**. We will examine various types of market failure in later chapters; for now, let’s review the three main ways in which markets sometimes fall short of efficiency.

First, markets can fail when, in an attempt to capture more surplus, one party prevents mutually beneficial trades from occurring. This situation arises, for instance, when a market contains only a single seller of a good, known as a *monopolist*. In this case, the assumption we have relied on in supply and demand analysis—that no individual buyer or seller can have a noticeable effect on the market price—is no longer valid; the monopolist can determine the market price. As we’ll see in Chapter 14, this gives rise to inefficiency as a monopolist manipulates the market price in order to increase profits, thereby preventing mutually beneficial trades from occurring.

Second, actions of individuals sometimes have side effects on the welfare of others that markets don’t take into account. In economics, these side effects are known as *externalities*, and the best-known example is pollution. We can think of the problem of pollution as a problem of incomplete property rights; for example, existing property rights don’t guarantee a right to ownership of clean air. We’ll see in Chapter 17 that pollution and other externalities also give rise to inefficiency.

Third, markets for some goods fail because these goods, by their very nature, are unsuited for efficient management by markets. In Chapter 21, we will analyze goods that fall into this category because of problems of *private information*—information about a good that some people possess but others don’t. The seller of a used car that is a “lemon” may have information that is unknown to potential buyers. In cases like this where there is private information, prices don’t always accurately reflect true value. In Chapter 18, we will encounter other types of goods that fall into the category of being unsuited for efficient management by markets—*public goods*, *common resources*, and *artificially scarce goods*. Markets for these goods fail because of problems in limiting people’s access to and consumption of the good; examples are fish in the sea and trees in the Amazonian rainforest. In these instances, markets generally fail due to incomplete property rights.

But even with these caveats, it’s remarkable how well markets work at maximizing the gains from trade.

►ECONOMICS IN ACTION

A Great Leap—Backward

Economies in which a central planner, rather than markets, makes consumption and production decisions are known as *planned economies*. Russia (formerly part of the U.S.S.R.), many Eastern European countries, and several Southeast Asian countries once had planned economies, and countries such as India and Brazil once had significant parts of their economies under central planning. China still does today.



Planned economies are notorious for their inefficiency, and what is probably the most compelling example of that is the so-called Great Leap Forward, an ambitious economic plan instituted in China during the late 1950s by its leader Mao Zedong. Its intention was to speed up the country's industrialization. Key to this plan was a shift from urban to rural manufacturing: farming villages were supposed to start producing heavy industrial goods such as steel.

Unfortunately, the plan backfired. Diverting farmers from their usual work led to a sharp fall in food production. Meanwhile, because raw materials for steel, such as coal and iron ore, were sent to ill-equipped and inexperienced rural producers rather than to urban factories, industrial output declined as well. The plan, in short, led to a fall in the production of everything in China.

Because China was a very poor country to start with, the results were catastrophic. The famine that followed is estimated to have reduced China's population by as much as 30 million. ▲

>> QUICK REVIEW

- In a market economy, markets are interrelated. When each and every market in an economy is efficient, the economy as a whole is efficient. But in the real world, some markets in a market economy will almost certainly fail to be efficient.
- A system of **property rights** and the operation of prices as **economic signals** are two key factors that enable a market to be efficient. But under conditions in which property rights are incomplete or prices give inaccurate economic signals, markets can fail.
- Under certain conditions, **market failure** occurs and the market is **inefficient**: gains to trade are unrealized. The three principal ways in which markets fail are the prevention of mutually beneficial transactions caused by one party's attempt to capture more surplus, side effects that aren't properly accounted for, and problems in the nature of the goods themselves.

> CHECK YOUR UNDERSTANDING 4-4

1. In some states that are rich in natural resources, such as oil, the law separates the right to above-ground use of the land from the right to drill below ground (called "mineral rights"). Someone who owns both the above-ground rights and the mineral rights can sell the two rights separately. Explain how this division of the property rights enhances efficiency compared to a situation in which the two rights must always be sold together.
2. Suppose that in the market for used textbooks the equilibrium price is \$30, but it is mistakenly announced that the equilibrium price is \$300. How does this affect the efficiency of the market? Be specific.
3. What is wrong with the following statement? "Markets are always the best way to organize economic activity. Any policies that interfere with markets reduce society's welfare."

Solutions appear at back of book.

[>> A LOOK AHEAD...

We have now seen how to measure the gains producers and consumers receive by trading in a market, and we've also seen that, subject to certain caveats, a market equilibrium maximizes these gains. Nonetheless, governments sometimes object to the equilibrium price or equilibrium quantity arising from an efficient market, and they intervene to change the result. In the next chapter, we'll describe the usually unpleasant consequences of attempts to tell efficient markets what to do.]

SUMMARY

1. The **willingness to pay** of each individual consumer determines the demand curve. When price is less than or equal to the willingness to pay, the potential consumer purchases the good. The difference between willingness to pay and price is the net gain to the consumer, the **individual consumer surplus**.
2. **Total consumer surplus** in a market, the sum of all individual consumer surpluses in a market, is equal to the area below the market demand curve but above the price. A rise in the price of a good reduces consumer surplus; a fall in the price increases consumer surplus. The term **consumer surplus** is often used to refer to both individual and total consumer surplus.
3. The **cost** of each potential producer, the lowest price at which he or she is willing to supply a unit of that good, determines the supply curve. If the price of a good is above a producer's cost, a sale generates a net gain to the producer, known as the **individual producer surplus**.
4. **Total producer surplus** in a market, the sum of the individual producer surpluses in a market, is equal to the area above the market supply curve but below the price. A rise in the price of a good increases producer surplus; a fall in the price reduces producer surplus. The term **producer surplus** is often used to refer to both individual and total producer surplus.

5. **Total surplus**, the total gain to society from the production and consumption of a good, is the sum of consumer and producer surplus.
6. Usually, markets are efficient and achieve the maximum total surplus. Any possible reallocation of consumption or sales, or change in the quantity bought and sold, reduces total surplus. However, society also cares about equity. So government intervention in a market that reduces efficiency but increases equity can be a valid choice by society.
7. An economy composed of efficient markets is also efficient, although this is virtually impossible to achieve in reality. The keys to the efficiency of a market economy are **property rights** and the operation of prices as **economic signals**. Under certain conditions, **market failure** occurs, making a market **inefficient**. Three principal sources of market failure are: attempts to capture more surplus that create inefficiencies, side effects of some transactions, and problems in the nature of the good.

KEY TERMS

Willingness to pay, p. 94
 Individual consumer surplus, p. 96
 Total consumer surplus, p. 96
 Consumer surplus, p. 96
 Cost, p. 101

Individual producer surplus, p. 101
 Total producer surplus, p. 102
 Producer surplus, p. 102
 Total surplus, p. 105
 Property rights, p. 111

Economic signal, p. 111
 Inefficient, p. 112
 Market failure, p. 112

PROBLEMS

1. Determine the amount of consumer surplus generated in each of the following situations.
 - a. Leon goes to the clothing store to buy a new T-shirt, for which he is willing to pay up to \$10. He picks out one he likes with a price tag of exactly \$10. When he is paying for it, he learns that the T-shirt has been discounted by 50%.
 - b. Alberto goes to the CD store hoping to find a used copy of *Nirvana's Greatest Hits* for up to \$10. The store has one copy selling for \$10, which he purchases.
 - c. After soccer practice, Stacey is willing to pay \$2 for a bottle of mineral water. The 7-Eleven sells mineral water for \$2.25 per bottle, so she declines to purchase it.
2. Determine the amount of producer surplus generated in each of the following situations.
 - a. Gordon lists his old Lionel electric trains on eBay. He sets a minimum acceptable price, known as his *reserve price*, of \$75. After five days of bidding, the final high bid is exactly \$75. He accepts the bid.
 - b. So-Hee advertises her car for sale in the used-car section of the student newspaper for \$2,000, but she is willing to sell the car for any price higher than \$1,500. The best offer she gets is \$1,200, which she declines.
 - c. Sanjay likes his job so much that he would be willing to do it for free. However, his annual salary is \$80,000.
3. There are six potential consumers of computer games, each willing to buy only one game. Consumer 1 is willing to pay \$40 for a computer game, consumer 2 is willing to pay \$35, consumer 3 is willing to pay \$30, consumer 4 is willing to pay \$25, consumer 5 is willing to pay \$20, and consumer 6 is willing to pay \$15.
 - a. Suppose the market price is \$29. What is the total consumer surplus?
 - b. The market price decreases to \$19. What is the total consumer surplus now?
 - c. When the price fell from \$29 to \$19, how much did each consumer's individual consumer surplus change? How does total consumer surplus change?
4. a. In an auction, potential buyers compete for a good by submitting bids. Adam Galinsky, a social psychologist at Northwestern University, compared eBay auctions in which the same good was sold. He found that, on average, the higher the number of bidders, the higher the sales price. For example, in two auctions of identical iPods, the one with the higher number of bidders brought a higher selling price. According to Galinsky, this explains why smart sellers on eBay set absurdly low opening prices (the lowest price that the seller will accept), such as 1 cent for a new iPod. Use the concepts of consumer and producer surplus to explain Galinsky's reasoning.
 - b. You are considering selling your vintage 1969 convertible Volkswagen Beetle. If the car is in good condition, it is worth a lot; if it is in poor condition, it is useful only as scrap. Assume that your car is in excellent condition but that it costs a potential buyer \$500 for an inspection to learn the car's condition. Use what you learned in part a to explain whether or not you should pay for an inspection and share the results with all interested buyers.
5. According to the Bureau of Transportation Statistics, due to an increase in demand, the average domestic airline fare increased from \$367.17 in the fourth quarter of 2005 to \$381.99 in the first quarter of 2006, an increase of \$14.82.

The number of passenger tickets sold in the fourth quarter of 2005 was 178.1 million. Over the same period, the airlines' costs remained roughly the same: the price of jet fuel averaged around \$1.85 per gallon in both quarters (Source: Energy Information Administration), and airline pilots' salaries remained roughly the same (according to the Bureau of Labor Statistics, they averaged \$135,040 per year in 2005).

Can you determine precisely by how much producer surplus has increased as a result of the \$14.82 increase in the average fare? If you cannot be precise, can you determine whether it will be less than, or more than, a specific amount?

6. Hollywood screenwriters negotiate a new agreement with movie producers stipulating that they will receive 10% of the revenue from every video rental of a movie they authored. They have no such agreement for movies shown on pay-per-view television.
 - a. When the new writers' agreement comes into effect, what will happen in the market for video rentals—that is, will supply or demand shift, and how? As a result, how will consumer surplus in the market for video rentals change? Illustrate with a diagram. Do you think the writers' agreement will be popular with consumers who rent videos?
 - b. Consumers consider video rentals and pay-per-view movies substitutable to some extent. When the new writers' agreement comes into effect, what will happen in the market for pay-per-view movies—that is, will supply or demand shift, and how? As a result, how will producer surplus in the market for pay-per-view movies change? Illustrate with a diagram. Do you think the writers' agreement will be popular with cable television companies that show pay-per-view movies?
7. The accompanying table shows the supply and demand schedules for used copies of the first edition of this textbook. The supply schedule is derived from offers at amazon.com. The demand schedule is hypothetical.

Price of book	Quantity of books demanded	Quantity of books supplied
\$60	30	0
65	27	3
70	25	7
75	20	7
80	17	8
85	15	15
90	12	16
95	9	17
100	8	29
105	2	31
110	0	34

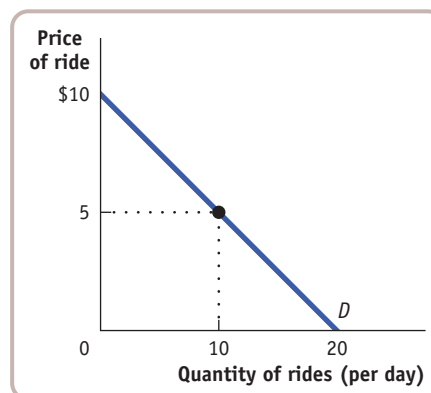
- a. Calculate consumer and producer surplus at the equilibrium in this market.

b. Now the second edition of this textbook becomes available. As a result, the willingness to pay of each potential buyer for a second-hand copy of the first edition falls by \$20. In a table, show the new demand schedule and again calculate consumer and producer surplus at the new equilibrium.

8. On Thursday nights, a local restaurant has a pasta special. Ari likes the restaurant's pasta, and his willingness to pay for each serving is shown in the accompanying table.

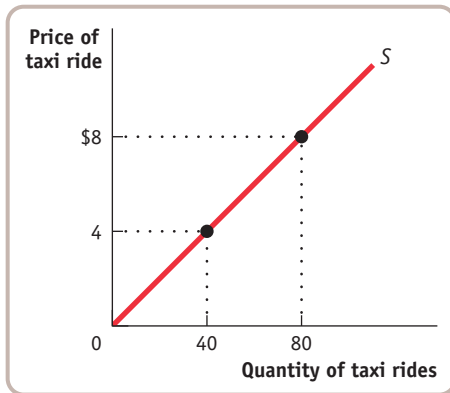
Quantity of pasta (servings)	Willingness to pay for pasta (per serving)
1	\$10
2	8
3	6
4	4
5	2
6	0

- a. If the price of a serving of pasta is \$4, how many servings will Ari buy? How much consumer surplus does he receive?
- b. The following week, Ari is back at the restaurant again, but now the price of a serving of pasta is \$6. By how much does his consumer surplus decrease compared to the previous week?
- c. One week later, he goes to the restaurant again. He discovers that the restaurant is offering an "all-you-can-eat" special for \$25. How much pasta will Ari eat, and how much consumer surplus does he receive now?
- d. Suppose you own the restaurant and Ari is a "typical" customer. What is the highest price you can charge for the "all-you-can-eat" special and still attract customers?
9. You are the manager of Fun World, a small amusement park. The accompanying diagram shows the demand curve of a typical customer at Fun World.



- a. Suppose that the price of each ride is \$5. At that price, how much consumer surplus does an individual consumer get? (Recall that the area of a right triangle is $\frac{1}{2} \times \text{the height of the triangle} \times \text{the base of the triangle}$.)

- b. Suppose that Fun World considers charging an admission fee, even though it maintains the price of each ride at \$5. What is the maximum admission fee it could charge? (Assume that all potential customers have enough money to pay the fee.)
- c. Suppose that Fun World lowered the price of each ride to zero. How much consumer surplus does an individual consumer get? What is the maximum admission fee Fun World could charge?
10. The accompanying diagram illustrates a taxi driver's individual supply curve (assume that each taxi ride is the same distance).



- a. Suppose the city sets the price of taxi rides at \$4 per ride, and at \$4 the taxi driver is able to sell as many taxi rides as he desires. What is this taxi driver's producer surplus? (Recall that the area of a right triangle is $\frac{1}{2} \times \text{the height of the triangle} \times \text{the base of the triangle}$.)
- b. Suppose that the city keeps the price of a taxi ride set at \$4, but it decides to charge taxi drivers a "licensing fee."

What is the maximum licensing fee the city could extract from this taxi driver?

- c. Suppose that the city allowed the price of taxi rides to increase to \$8 per ride. Again assume that, at this price, the taxi driver sells as many rides as he is willing to offer. How much producer surplus does an individual taxi driver now get? What is the maximum licensing fee the city could charge this taxi driver?
11. On November 18, 2006, the *New York Times* reported that "The Universal Music Group, the world's largest music company, filed a copyright infringement lawsuit yesterday against MySpace, the popular social networking Web site, for allowing users to upload and download songs and music videos. . . . In court papers, Universal noted that unauthorized copies of music and video from one of its biggest acts, U2, were easily available on the site, as is material from an unreleased album by the rap star Jay-Z." Allowing Internet users to download music and video for free limits Universal's right to dispose of the music and video as it chooses; in particular, it limits Universal's right to give access to its music only to those who have paid for it. In other words, it limits Universal's property rights.
- a. If everyone were to obtain music and video content for free from websites such as MySpace, instead of paying Universal, what would Universal's producer surplus be from music sales? What are the implications for Universal's incentive to produce music and video content in the future?
- b. If Universal loses the lawsuit and music can be freely downloaded from the Internet, what do you think will happen to mutually beneficial transactions (the producing and buying of music) in the future?



>> The Market Strikes Back

BIG CITY, NOT-SO-BRIGHT IDEAS

NEW YORK CITY IS A PLACE WHERE YOU CAN find almost anything—that is, almost anything, except a taxicab when you need one or a decent apartment at a rent you can afford. You might think that New York’s notorious shortages of cabs and apartments are the inevitable price of big-city living. However, they are largely the product of government policies—specifically, of government policies that have, one way or another, tried to prevail over the market forces of supply and demand.

In Chapter 3, we learned the principle that a market moves to equilibrium—that the market price rises or falls to the level at which the quantity of a good that people are willing to supply is equal to the quantity that other people demand. In Chapter 4, we learned that markets are typically efficient: at equilibrium a market typically maximizes the gains from trade—that is, the sum of consumer and producer surplus. We also learned in Chapter 4 that government intervention in a market can sometimes be justified on the grounds of equity or when the market itself is inefficient. But it’s important to note that governments also frequently intervene in markets without these justifications, often to please powerful interests.

Whenever a government tries to dictate either a market price or a market quantity that’s different from the equilibrium price or quantity, the market strikes back in

predictable ways. Our ability to predict what will happen when governments try to defy supply and demand shows the power and usefulness of supply and demand analysis itself.

The shortages of apartments and taxicabs in New York are particular examples that illuminate what happens when the logic of the market is defied. New York’s housing shortage is the result of *rent control*, a law that pre-

vents landlords from raising rents except when specifically given permission. Rent control was introduced during World War II to protect the interests of tenants, and it still remains in force. Many other American cities have had rent control at one time or another, but with the notable exceptions of New York and San



PNI Ltd./Picture Quest

New York City: an empty taxi is hard to find.

Francisco, these controls have largely been done away with. Similarly, New York’s limited supply of taxis is the result of a licensing system introduced in the 1930s. New York taxi licenses are known as “medallions,” and only taxis with medallions are allowed to pick up passengers. Although this system was originally intended to protect the interests of both drivers and customers, it has generated a shortage of taxis in the city. The number of medallions remained fixed for nearly 60 years, with no significant increase until 2004.

In this chapter, we begin by examining what happens when governments try to control prices in a competitive

market, keeping the price in a market either below its equilibrium level—a *price ceiling* such as rent control—or above it—a *price floor* such as the minimum wage paid to

workers in many countries. We then turn to schemes such as taxi medallions that attempt to dictate the quantity of a good bought and sold.

WHAT YOU WILL LEARN IN THIS CHAPTER:

- The meaning of **price controls** and **quantity controls**, two kinds of government intervention in markets
- How price and quantity controls create problems and can make a market inefficient
- What **deadweight loss** is
- Why the predictable side effects of intervention in markets often lead economists to be skeptical of its usefulness
- Who benefits and who loses from market interventions, and why they are used despite their well-known problems

Why Governments Control Prices

You learned in Chapter 3 that a market moves to equilibrium—that is, the market price moves to the level at which the quantity supplied equals the quantity demanded. But this equilibrium price does not necessarily please either buyers or sellers.

After all, buyers would always like to pay less if they could, and sometimes they can make a strong moral or political case that they should pay lower prices. For example, what if the equilibrium between supply and demand for apartments in a major city leads to rental rates that an average working person can't afford? In that case, a government might well be under pressure to impose limits on the rents landlords can charge.

Sellers, however, would always like to get more money for what they sell, and sometimes they can make a strong moral or political case that they should receive higher prices. For example, consider the labor market: the price for an hour of a worker's time is the wage rate. What if the equilibrium between supply and demand for less skilled workers leads to wage rates that yield an income below the poverty level? In that case, a government might well be pressured to require employers to pay a rate no lower than some specified minimum wage.

In other words, there is often a strong political demand for governments to intervene in markets. And powerful interests can make a compelling case that a market intervention favoring them is “fair.” When a government intervenes to regulate prices, we say that it imposes **price controls**. These controls typically take the form either of an upper limit, a **price ceiling**, or a lower limit, a **price floor**.

Unfortunately, it's not that easy to tell a market what to do. As we will now see, when a government tries to legislate prices—whether it legislates them *down* by imposing a price ceiling or *up* by imposing a price floor—there are certain predictable and unpleasant side effects.

We make an important assumption in this chapter: the markets in question are efficient before price controls are imposed. As we noted in Chapter 4, markets can sometimes be inefficient—for example, a market dominated by a monopolist, a single seller who has the power to influence the market price. When markets are inefficient, price controls don't necessarily cause problems and can potentially move the market closer to efficiency. In practice, however, price controls often *are* imposed on efficient markets—like the New York apartment market. And so the analysis in this chapter applies to many important real-world situations.

Price controls are legal restrictions on how high or low a market price may go. They can take two forms: a **price ceiling**, a maximum price sellers are allowed to charge for a good or service, or a **price floor**, a minimum price buyers are required to pay for a good or service.

Price Ceilings

Aside from rent control, there are not many price ceilings in the United States today. But at times they have been widespread. Price ceilings are typically imposed during crises—wars, harvest failures, natural disasters—because these events often lead to sudden price increases that hurt many people but produce big gains for a lucky few.

The U.S. government imposed ceilings on many prices during World War II: the war sharply increased demand for raw materials, such as aluminum and steel, and price controls prevented those with access to these raw materials from earning huge profits. Price controls on oil were imposed in 1973, when an embargo by Arab oil-exporting countries seemed likely to generate huge profits for U.S. oil companies. Price controls were imposed on California's wholesale electricity market in 2001, when a shortage created big profits for a few power-generating companies but led to higher electricity bills for consumers.

Rent control in New York is, believe it or not, a legacy of World War II: it was imposed because wartime production produced an economic boom, which increased demand for apartments at a time when the labor and raw materials that might have been used to build them were being used to win the war instead. Although most price controls were removed soon after the war ended, New York's rent limits were retained and gradually extended to buildings not previously covered, leading to some very strange situations.

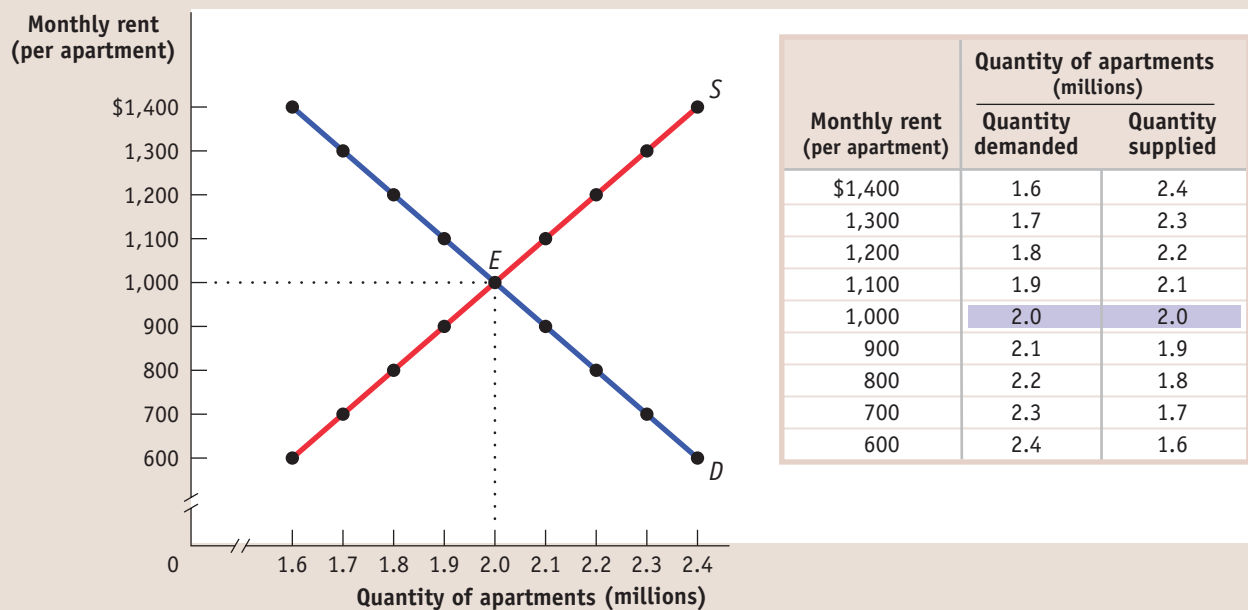
You can rent a one-bedroom apartment in Manhattan on fairly short notice—if you are able and willing to pay several thousand dollars a month and live in a less-than-desirable area. Yet some people pay only a small fraction of this for comparable apartments, and others pay hardly more for bigger apartments in better locations.

Aside from producing great deals for some renters, however, what are the broader consequences of New York's rent-control system? To answer this question, we turn to the model we developed in Chapter 3: the supply and demand model.

Modeling a Price Ceiling

To see what can go wrong when a government imposes a price ceiling on an efficient market, consider Figure 5-1, which shows a simplified model of the market for apartments in New York. For the sake of simplicity, we imagine that all apartments are

FIGURE 5-1 The Market for Apartments in the Absence of Government Controls

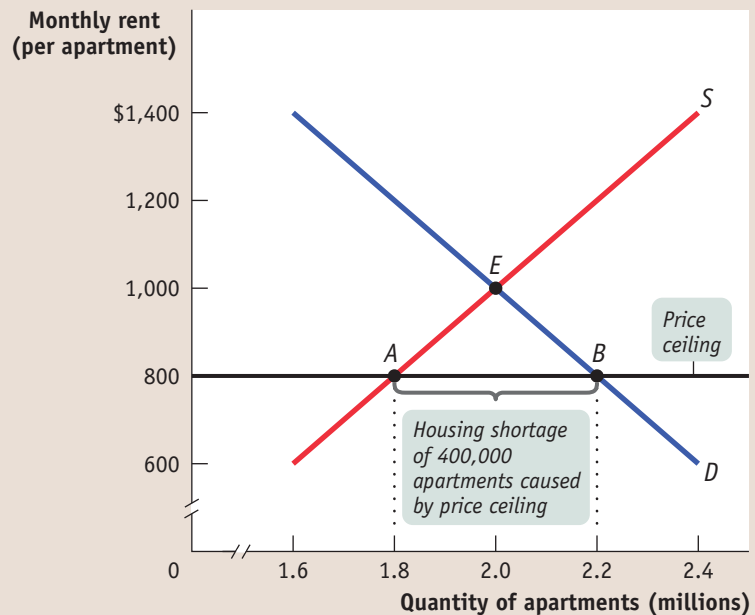


Without government intervention, the market for apartments reaches equilibrium at point E with a market rent of \$1,000 per month and 2 million apartments rented.

FIGURE 5-2

The Effects of a Price Ceiling

The black horizontal line represents the government-imposed price ceiling on rents of \$800 per month. This price ceiling reduces the quantity of apartments supplied to 1.8 million, point A, and increases the quantity demanded to 2.2 million, point B. This creates a persistent shortage of 400,000 units: 400,000 people who want apartments at the legal rent of \$800 but cannot get them.



exactly the same and so would rent for the same price in an unregulated market. The table in the figure shows the demand and supply schedules; the demand and supply curves are shown on the left. We show the quantity of apartments on the horizontal axis and the monthly rent per apartment on the vertical axis. You can see that in an unregulated market the equilibrium would be at point E: 2 million apartments would be rented for \$1,000 each per month.

Now suppose that the government imposes a price ceiling, limiting rents to a price below the equilibrium price—say, no more than \$800.

Figure 5-2 shows the effect of the price ceiling, represented by the line at \$800. At the enforced rental rate of \$800, landlords have less incentive to offer apartments, so they won't be willing to supply as many as they would at the equilibrium rate of \$1,000. They will choose point A on the supply curve, offering only 1.8 million apartments for rent, 200,000 fewer than in the unregulated market. At the same time, more people will want to rent apartments at a price of \$800 than at the equilibrium price of \$1,000; as shown at point B on the demand curve, at a monthly rent of \$800 the quantity of apartments demanded rises to 2.2 million, 200,000 more than in the unregulated market and 400,000 more than are actually available at the price of \$800. So there is now a persistent shortage of rental housing: at that price, 400,000 more people want to rent than are able to find apartments.

Do price ceilings always cause shortages? No. If a price ceiling is set above the equilibrium price, it won't have any effect. Suppose that the equilibrium rental rate on apartments is \$1,000 per month and the city government sets a ceiling of \$1,200. Who cares? In this case, the price ceiling won't be binding—it won't actually constrain market behavior—and it will have no effect.

How a Price Ceiling Causes Inefficiency

The housing shortage shown in Figure 5-2 is not merely annoying: like any shortage induced by price controls, it can be seriously harmful because it leads to inefficiency. In other words, there are gains from trade that go unrealized. Rent control, like all price ceilings, creates inefficiency in at least four distinct ways. It reduces the quantity of

apartments rented below the efficient level; it typically leads to misallocation of apartments among would-be renters; it leads to wasted time and effort as people search for apartments; and it leads landlords to maintain apartments in inefficiently low quality or condition. In addition to inefficiency, price ceilings give rise to illegal behavior as people try to circumvent them.

Inefficiently Low Quantity In Chapter 4 we learned that the market equilibrium of an efficient market leads to the “right” quantity of a good or service being bought and sold—that is, the quantity that maximizes the sum of producer and consumer surplus. Because rent controls reduce the number of apartments supplied, they reduce the number of apartments rented, too. Figure 5-3 shows the implications for total surplus. Recall that total surplus is the sum of the area above the supply curve and below the demand curve. If the only effect of rent control was to reduce the number of apartments available, it would cause a loss of surplus equal to the area of the shaded triangle in the figure. The area represented by that triangle has a special name in economics, **deadweight loss**: the lost surplus associated with the transactions that no longer occur due to the market intervention. In this example, the deadweight loss is the lost surplus associated with the apartment rentals that no longer occur due to the price ceiling, a loss that is experienced by both disappointed renters and frustrated landlords. Economists often call triangles like the one in Figure 5-3 a *deadweight-loss triangle*.

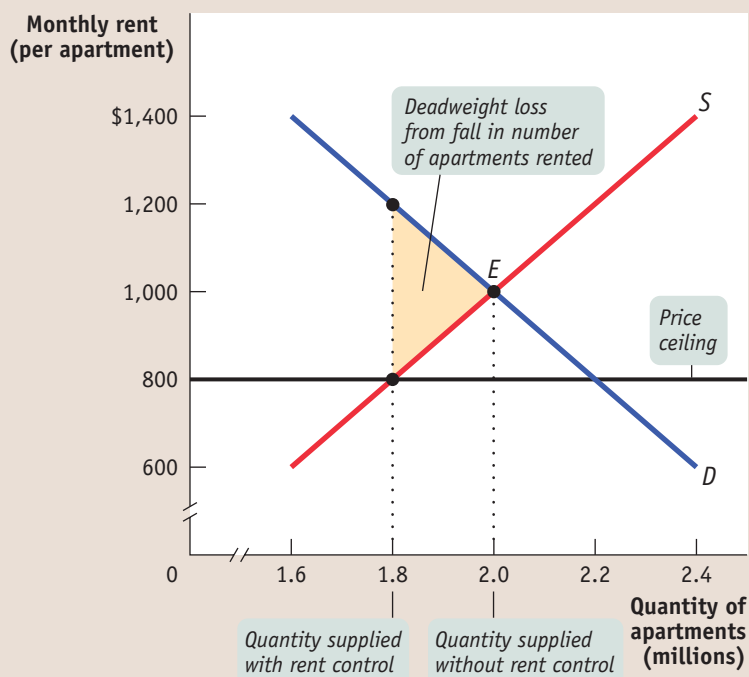
Deadweight loss is a key concept in economics, one that we will encounter whenever an action or a policy leads to a reduction in the quantity transacted below the efficient market equilibrium quantity. It is important to realize that deadweight loss is a *loss to society*—it is a reduction in total surplus, a loss in surplus that accrues to no one as a gain. It is not the same as a loss in surplus to one person that then accrues as a gain to someone else, what an economist would call a *transfer of surplus* from one person to another. For an example of how a price ceiling leads to a transfer of surplus between renters and landlords and the deadweight loss that arises, see For Inquiring Minds on the next page.

Deadweight loss is the loss in total surplus that occurs whenever an action or a policy reduces the quantity transacted below the efficient market equilibrium quantity.

FIGURE 5-3

A Price Ceiling Causes Inefficiently Low Quantity

A price ceiling reduces the quantity supplied below the market equilibrium quantity, leading to a deadweight loss. The area of the shaded triangle corresponds to the amount of total surplus lost due to inefficiently low quantity transacted.



FOR INQUIRING MINDS

Winners, Losers, and Rent Control

Price controls create winners and losers: some people benefit from the policy but others are made worse off.

In New York City, some of the biggest beneficiaries of rent control are affluent tenants who have lived for decades in choice apartments that would now command very high rents. These winners include celebrities like the pop singer Cyndi Lauper, who in 2005 was paying only \$989 a month for an apartment that would have been worth \$3,750 if unregulated. There is also the classic case of the actress Mia Farrow's apartment, which, when it lost its rent-control status, rose from the bargain rate of \$2,900 per month to \$8,000. Ironically, in cases like these, the losers are the working-class renters the system was intended to help.

We can use the concepts of consumer and producer surplus, which you learned about in Chapter 4, to evaluate graphically the winners and the losers from rent control. Panel (a) of Figure 5-4 shows the con-

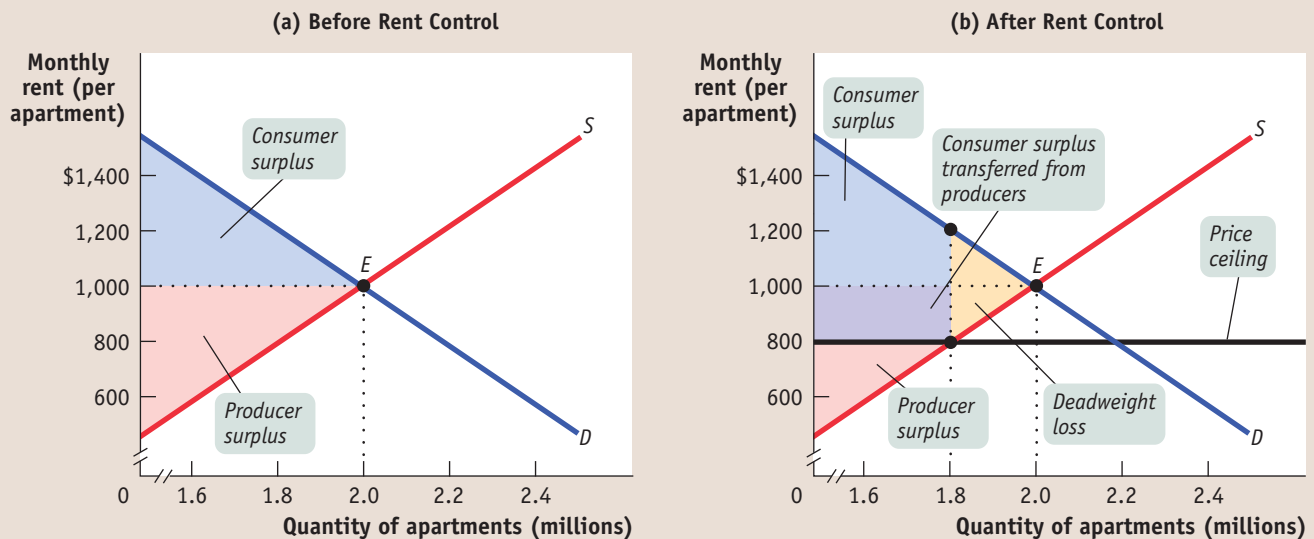
sumer surplus and producer surplus in the equilibrium of the unregulated market for apartments—before rent control. Recall that the consumer surplus, represented by the area below the demand curve and above the price, is the total net gain to consumers in the market equilibrium. Likewise, producer surplus, represented by the area above the supply curve and below the price, is the total net gain to producers in the market equilibrium.

Panel (b) of this figure shows the consumer and producer surplus in the market after the price ceiling of \$800 has been imposed. As you can see, for those consumers who can still obtain apartments under rent control, consumer surplus has increased. These renters are clearly winners: those who obtain an apartment at \$800, paying \$200 less than the unregulated market price. These people receive a direct transfer of surplus from landlords in the form of lower rent. But not all renters win:

there are fewer apartments to rent now than if the market had remained unregulated, making it hard, if not impossible, for some to find a place to call home. Without direct calculation of the surpluses gained and lost, it is generally unclear whether renters as a whole are made better or worse off by rent control. What we can say is that the greater the deadweight loss—the larger the reduction in the quantity of apartments rented—the more likely it is that renters as a whole lose.

However, we can say unambiguously that landlords are worse off: producer surplus has clearly decreased. Landlords who continue to rent out their apartments get \$200 a month less in rent, and others withdraw their apartments from the market altogether. The deadweight-loss triangle, shaded yellow in panel (b), represents the value lost to both renters and landlords from rentals that essentially vanish thanks to rent control.

FIGURE 5-4 Winners and Losers from Rent Control



Panel (a) shows the consumer surplus and producer surplus in the equilibrium of the unregulated market for apartments—before rent control. Panel (b) shows the consumer and producer surplus in the market after a price

ceiling of \$800 has been imposed. As you can see, for those consumers who can still obtain apartments under rent control, consumer surplus has increased but producer surplus and total surplus have decreased.

Deadweight loss is not the only type of inefficiency that arises from a price ceiling. The types of inefficiency created by rent control go beyond reducing the quantity of apartments available. These additional inefficiencies—inefficient allocation to consumers, wasted resources, and inefficiently low quality—lead to a loss of surplus over and above the deadweight loss.

Inefficient Allocation to Consumers Rent control doesn't just lead to too few apartments being available. It can also lead to misallocation of the apartments that are available: people who badly need a place to live may not be able to find an apartment, while some apartments may be occupied by people with much less urgent needs.

In the case shown in Figure 5-2, 2.2 million people would like to rent an apartment at \$800 per month, but only 1.8 million apartments are available. Of those 2.2 million who are seeking an apartment, some want an apartment badly and are willing to pay a high price to get one. Others have a less urgent need and are only willing to pay a low price, perhaps because they have alternative housing. An efficient allocation of apartments would reflect these differences: people who really want an apartment will get one and people who aren't all that anxious to find an apartment won't. In an inefficient distribution of apartments, the opposite will happen: some people who are not especially anxious to find an apartment will get one and others who are very anxious to find an apartment won't. Because people usually get apartments through luck or personal connections under rent control, it generally results in an **inefficient allocation to consumers** of the few apartments available.

To see the inefficiency involved, consider the plight of the Lees, a family with young children who have no alternative housing and would be willing to pay up to \$1,500 for an apartment—but are unable to find one. Also consider George, a retiree who lives most of the year in Florida but still has a lease on the New York apartment he moved into 40 years ago. George pays \$800 per month for this apartment, but if the rent were even slightly more—say, \$850—he would give it up and stay with his children when he is in New York.

This allocation of apartments—George has one and the Lees do not—is a missed opportunity: there is a way to make the Lees and George both better off at no additional cost. The Lees would be happy to pay George, say, \$1,200 a month to sublease his apartment, which he would happily accept since the apartment is worth no more than \$849 a month to him. George would prefer the money he gets from the Lees to keeping his apartment; the Lees would prefer to have the apartment rather than the money. So both would be made better off by this transaction—and nobody else would be made worse off.

Generally, if people who really want apartments could sublease them from people who are less eager to live there, both those who gain apartments and those who trade their occupancy for money would be better off. However, subletting is illegal under rent control because it would occur at prices above the price ceiling. The fact that subletting is illegal doesn't mean it never happens. In fact, chasing down illegal subletting is a major business for New York private investigators. A 2007 report in the *New York Times* described how private investigators use hidden cameras and other tricks to prove that the legal tenants in rent-controlled apartments actually live in the suburbs, or even in other states, and have sublet their apartments at two or three times the controlled rent. This subletting is a kind of illegal activity, which we will discuss shortly. For now, just notice that landlords' pursuit of illegal subletting surely discourages the practice, so there isn't enough subletting to eliminate the inefficient allocation of apartments.

Wasted Resources Another reason a price ceiling causes inefficiency is that it leads to **wasted resources**: people expend money, effort, and time to cope with the shortages caused by the price ceiling. Back in 1979, U.S. price controls on gasoline led to shortages that forced millions of Americans to spend hours each week waiting in lines

Price ceilings often lead to inefficiency in the form of **inefficient allocation to consumers**: people who want the good badly and are willing to pay a high price don't get it, and those who care relatively little about the good and are only willing to pay a low price do get it.

Price ceilings typically lead to inefficiency in the form of **wasted resources**: people expend money, effort, and time to cope with the shortages caused by the price ceiling.

Price ceilings often lead to inefficiency in that the goods being offered are of **inefficiently low quality**: sellers offer low-quality goods at a low price even though buyers would prefer a higher quality at a higher price.

at gas stations. The opportunity cost of the time spent in gas lines—the wages not earned, the leisure time not enjoyed—constituted wasted resources from the point of view of consumers and of the economy as a whole. Because of rent control, the Lees will spend all their spare time for several months searching for an apartment, time they would rather have spent working or in family activities. That is, there is an opportunity cost to the Lees' prolonged search for an apartment—the leisure or income they had to forgo. If the market for apartments worked freely, the Lees would quickly find an apartment at the equilibrium rent of \$1,000, leaving them time to earn more or to enjoy themselves—an outcome that would make them better off without making anyone else worse off. Again, rent control creates missed opportunities.

Inefficiently Low Quality Yet another way a price ceiling causes inefficiency is by causing goods to be of inefficiently low quality. **Inefficiently low quality** means that sellers offer low-quality goods at a low price even though buyers would rather have higher quality and are willing to pay a higher price for it.

Again, consider rent control. Landlords have no incentive to provide better conditions because they cannot raise rents to cover their repair costs but are able to find tenants easily. In many cases, tenants would be willing to pay much more for improved conditions than it would cost for the landlord to provide them—for example, the upgrade of an antiquated electrical system that cannot safely run air conditioners or computers. But

FOR INQUIRING MINDS

Rent Control, Mumbai Style

How far would you go to keep a rent-controlled apartment? Some tenants in the city of Mumbai, India, went very far indeed. According to a *Wall Street Journal* article, in May 2006 three people were killed when four floors in a rent-controlled apartment building in Mumbai collapsed. Despite demands by the city government to vacate the deteriorated building, 58 other tenants refused to leave. They stayed put even after having their electricity and water shut off, being locked out of their apartments, and surviving a police raid on the building. Tenants camped out on the building's veranda, vowing not to give up.

Not all of these tenants were desperately poor and lacking other options. One rent-controlled tenant is the owner of a thriving textile business who was paying a total of \$8.50 a month for a spacious two-bedroom apartment. (Luxury apartments in Mumbai can go for thousands of dollars a month.)

Although it's a world away, the dynamics of rent control in Mumbai are a lot like those in New York (although Mumbai has clearly had a much more extreme experience). Rent control began in Mumbai in 1947, to address a critical shortage of



In Mumbai, rent control has led to a steep deterioration in housing quality.

housing caused by a flood of refugees fleeing conflict between Hindus and Muslims. Clearly intended to be a temporary measure, it was so popular politically that it has been extended 20 times and now applies to about 60% of the buildings in the city's center. Tenants pass apartments on to their heirs or sell the right to occupy

to other tenants. Despite the fact that land prices in Mumbai surged more than 30% in 2005, landlords of rent-controlled buildings have suffered financially, with the result that across the city prime buildings have been abandoned to decay, even though half of the city's 12 million residents live in slums because of a lack of new housing.



any additional payment for such improvements would be legally considered a rent increase, which is prohibited. Indeed, rent-controlled apartments are notoriously badly maintained, rarely painted, subject to frequent electrical and plumbing problems, sometimes even hazardous to inhabit. As one former manager of Manhattan buildings described: “At unregulated apartments we’d do most things that the tenants requested. But on the rent-regulated units, we did absolutely only what the law required. . . . We had a perverse incentive to make those tenants unhappy. With regulated apartments, the ultimate objective is to get people out of the building.”

This whole situation is a missed opportunity—some tenants would be happy to pay for better conditions, and landlords would be happy to provide them for payment. But such an exchange would occur only if the market were allowed to operate freely.

Black Markets And that leads us to a last aspect of price ceilings: the incentive they provide for illegal activities, specifically the emergence of **black markets**. We have already described one kind of black market activity—illegal subletting by tenants. But it does not stop there. Clearly, there is a temptation for a landlord to say to a potential tenant, “Look, you can have the place if you slip me an extra few hundred in cash each month”—and for the tenant to agree, if he or she is one of those people who would be willing to pay much more than the maximum legal rent.

What’s wrong with black markets? In general, it’s a bad thing if people break *any* law, because it encourages disrespect for the law in general. Worse yet, in this case illegal activity worsens the position of those who try to be honest. If the Lees are scrupulous about upholding the rent-control law but other people—who may need an apartment less than the Lees—are willing to bribe landlords, the Lees may *never* find an apartment.

So Why Are There Price Ceilings?

We have seen three common results of price ceilings:

- A persistent shortage of the good
- Inefficiency arising from this persistent shortage in the form of inefficiently low quantity (deadweight loss), inefficient allocation of the good to consumers, resources wasted in searching for the good, and the inefficiently low quality of the good offered for sale
- The emergence of illegal, black market activity

Given these unpleasant consequences, why do governments still sometimes impose price ceilings? Why does rent control, in particular, persist in New York?

One answer is that although price ceilings may have adverse effects, they do benefit some people. In practice, New York’s rent-control rules—which are more complex than our simple model—hurt most residents but give a small minority of renters much cheaper housing than they would get in an unregulated market. And those who benefit from the controls are typically better organized and more vocal than those who are harmed by them.

Also, when price ceilings have been in effect for a long time, buyers may not have a realistic idea of what would happen without them. In our previous example, the rental rate in an unregulated market (Figure 5-1) would be only 25% higher than in the regulated market (Figure 5-2): \$1,000 instead of \$800. But how would renters know that? Indeed, they might have heard about black market transactions at much higher prices—the Lees or some other family paying George \$1,200 or more—and would not realize that these black market prices are much higher than the price that would prevail in a fully unregulated market.

A last answer is that government officials often do not understand supply and demand analysis! It is a great mistake to suppose that economic policies in the real world are always sensible or well informed.

A **black market** is a market in which goods or services are bought and sold illegally—either because it is illegal to sell them at all or because the prices charged are legally prohibited by a price ceiling.



►ECONOMICS IN ACTION

Hard Shopping in Caracas

Supermarket shopping in Caracas, Venezuela, reported the *New York Times* in February 2007, “is a bizarre experience. Shelves are fully stocked with Scotch whiskey, Argentine wines and imported cheeses like brie and Camembert, but basic staples like black beans and desirable cuts of beef like sirloin are often absent.” Why? Because of price controls.

Since 1998, Venezuela has been governed by Hugo Chavez, a populist president who has routinely denounced the nation's economic elite and pursued policies favoring the poor and working classes. Among those policies were price controls on basic foods such as beans, sugar, beef, and chicken, intended to hold down the cost of living. These policies led to sporadic shortages beginning in 2003, but the shortages became much more severe in 2006. On one side, generous government policies led to higher spending by consumers and sharply rising prices for goods that weren't subject to price controls. The result was a big increase in demand for price-controlled goods. On the other side, a sharp decline in the value of Venezuela's currency led to a fall in imports of foreign food. The result was empty shelves in the nation's food stores.

The Venezuelan government responded by accusing food producers, wholesalers, and grocers of profiteering, threatening to seize control of supermarkets if they didn't make more food available. Yet even Mercal, a government-owned grocery chain, had empty shelves.

The government also instituted rationing, restricting shoppers' purchases of sugar to two large bags. Predictably, reported the *Times*, "a black market in sugar has developed among street vendors."

All in all, food shortages in Venezuela offer a textbook example both of why governments sometimes think price ceilings would be a good idea and of why they're usually wrong. ▲

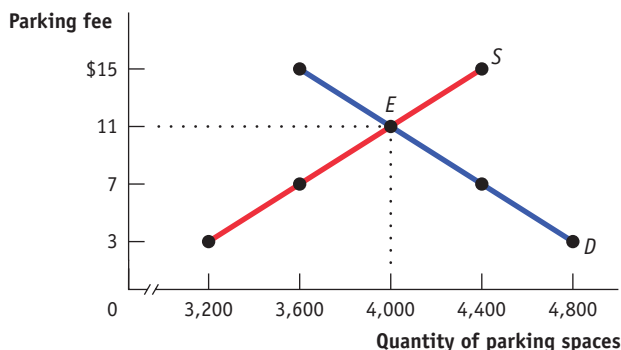


►► QUICK REVIEW

- **Price controls** take the form of either legal maximum prices—**price ceilings**—or legal minimum prices—**price floors**.
- A price ceiling below the equilibrium price benefits successful buyers but causes predictable adverse effects such as persistent shortages, which lead to four types of inefficiencies: **deadweight loss**, **inefficient allocation to consumers**, **wasted resources**, and **inefficiently low quality**.
- A deadweight loss is a loss of total surplus that occurs whenever a policy or action reduces the quantity transacted below the efficient market equilibrium level.
- Price ceilings also lead to **black markets**, as buyers and sellers attempt to evade the price controls.

► CHECK YOUR UNDERSTANDING 5-1

1. On game days, homeowners near Middletown University's stadium used to rent parking spaces in their driveways to fans at a going rate of \$11. A new town ordinance now sets a maximum parking fee of \$7. Use the accompanying supply and demand diagram to explain how each of the following corresponds to a price-ceiling concept.



- Some homeowners now think it's not worth the hassle to rent out spaces.
 - Some fans who used to carpool to the game now drive alone.
 - Some fans can't find parking and leave without seeing the game.
- Explain how each of the following adverse effects arises from the price ceiling.
- Some fans now arrive several hours early to find parking.
 - Friends of homeowners near the stadium regularly attend games, even if they aren't big fans. But some serious fans have given up because of the parking situation.
 - Some homeowners rent spaces for more than \$7 but pretend that the buyers are nonpaying friends or family.

2. True or false? Explain your answer. A price ceiling below the equilibrium price of an otherwise efficient market does the following:
 - a. Increases quantity supplied
 - b. Makes some people who want to consume the good worse off
 - c. Makes all producers worse off
3. Which of the following create deadweight loss? Which do not and are simply a transfer of surplus from one person to another? Explain your answer.

- You have been evicted from your rent-controlled apartment after the landlord discovered your pet boa constrictor. The apartment is quickly rented to someone else at the same price. You and the new renter do not necessarily have the same willingness to pay for the apartment.
- In a contest, you won a ticket to a jazz concert. But you can't go to the concert because of an exam, and the terms of the contest do not allow you to sell the ticket or give it to someone else. Would your answer to this question change if you could not sell the ticket but could give it to someone else?
- Your school's dean of students, who is a proponent of a low-fat diet, decrees that ice cream can no longer be served on campus.
- Your ice cream cone falls on the ground and your dog eats it. (Take the liberty of counting your dog as a member of society, and that, if he could, your dog would be willing to pay the same amount for the ice cream cone as you.)

Solutions appear at back of book.

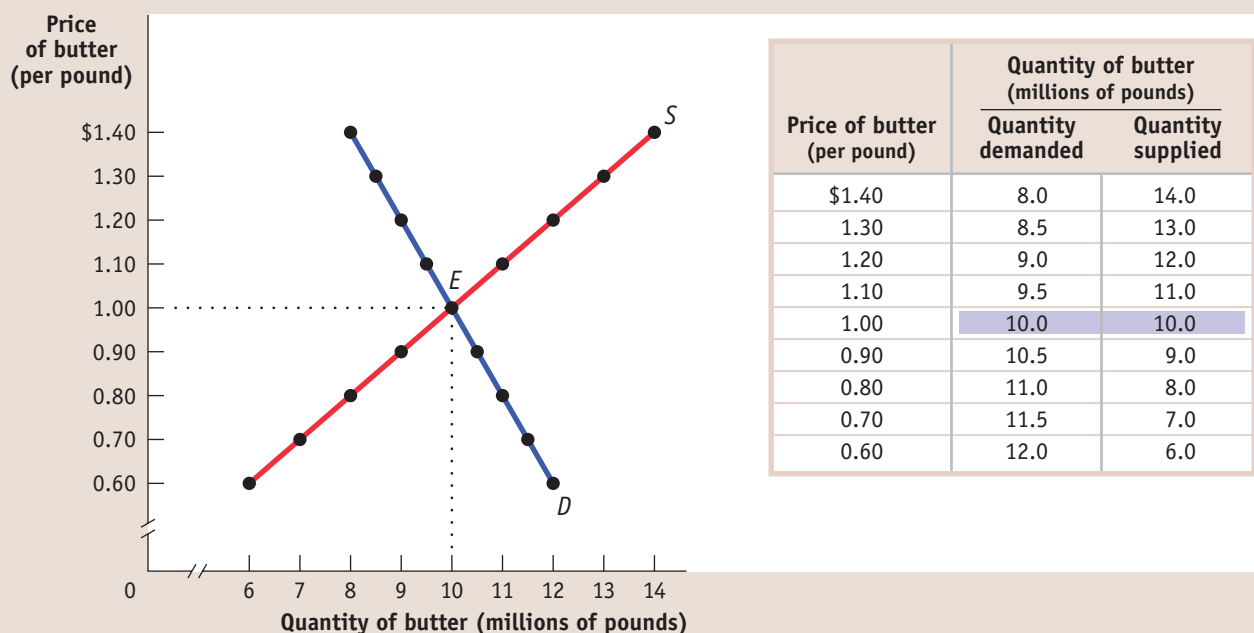
The **minimum wage** is a legal floor on the wage rate, which is the market price of labor.

Price Floors

Sometimes governments intervene to push market prices up instead of down. *Price floors* have been widely legislated for agricultural products, such as wheat and milk, as a way to support the incomes of farmers. Historically, there were also price floors on such services as trucking and air travel, although these were phased out by the U.S. government in the 1970s. If you have ever worked in a fast-food restaurant, you are likely to have encountered a price floor: governments in the United States and many other countries maintain a lower limit on the hourly wage rate of a worker's labor—that is, a floor on the price of labor—called the **minimum wage**.

Just like price ceilings, price floors are intended to help some people but generate predictable and undesirable side effects. Figure 5-5 shows hypothetical supply and demand curves for butter. Left to itself, the market would move to equilibrium at

FIGURE 5-5 The Market for Butter in the Absence of Government Controls

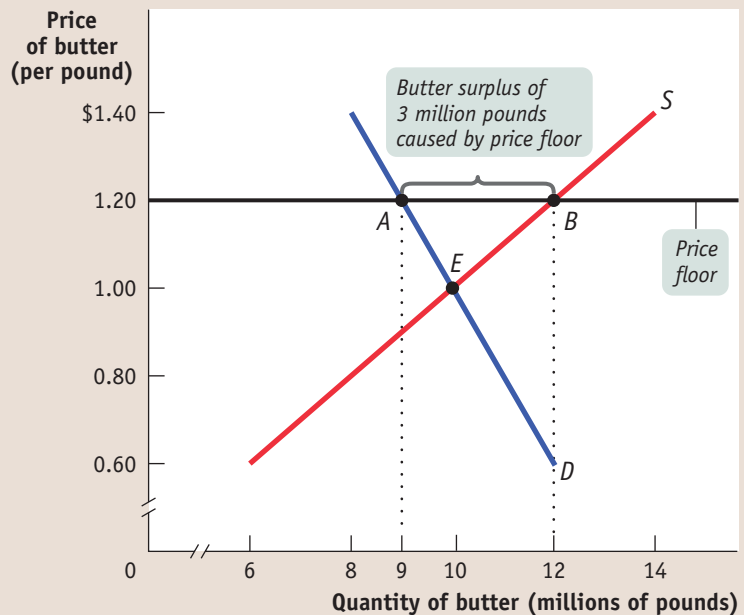


Without government intervention, the market for butter reaches equilibrium at a price of \$1 per pound with 10 million pounds of butter bought and sold.

FIGURE 5-6

The Effects of a Price Floor

The dark horizontal line represents the government-imposed price floor of \$1.20 per pound of butter. The quantity of butter demanded falls to 9 million pounds, and the quantity supplied rises to 12 million pounds, generating a persistent surplus of 3 million pounds of butter.



point E, with 10 million pounds of butter bought and sold at a price of \$1 per pound.

Now suppose that the government, in order to help dairy farmers, imposes a price floor on butter of \$1.20 per pound. Its effects are shown in Figure 5-6, where the line at \$1.20 represents the price floor. At a price of \$1.20 per pound, producers would want to supply 12 million pounds (point B on the supply curve) but consumers would want to buy only 9 million pounds (point A on the demand curve). So the price floor leads to a persistent surplus of 3 million pounds of butter.

Does a price floor always lead to an unwanted surplus? No. Just as in the case of a price ceiling, the floor may not be binding—that is, it may be irrelevant. If the equilibrium price of butter is \$1 per pound but the floor is set at only \$0.80, the floor has no effect.

But suppose that a price floor is binding: what happens to the unwanted surplus? The answer depends on government policy. In the case of agricultural price floors, governments buy up unwanted surplus. As a result, the U.S. government has at times found itself warehousing thousands of tons of butter, cheese, and other farm products. (The European Commission, which administers price floors for a number of European countries, once found itself the owner of a so-called butter mountain, equal in weight to the entire population of Austria.) The government then has to find a way to dispose of these unwanted goods.

Some countries pay exporters to sell products at a loss overseas; this is standard procedure for the European Union. The United States gives surplus food away to schools, which use the products in school lunches (see *For Inquiring Minds* on the next page). In some cases, governments have actually destroyed the surplus production. To avoid the problem of dealing with the unwanted surplus, the U.S. government typically pays farmers not to produce the products at all.

When the government is not prepared to purchase the unwanted surplus, a price floor means that would-be sellers cannot find buyers. This is what happens when there is a price floor on the wage rate paid for an hour of labor, the *minimum wage*: when the minimum wage is above the equilibrium wage rate, some people who are willing to work—that is, sell labor—cannot find buyers—that is, employers—willing to give them jobs.

FOR INQUIRING MINDS

Price Floors and School Lunches

When you were in grade school, did your school offer free or very cheap lunches? If so, you were probably a beneficiary of price floors.

Where did all the cheap food come from? During the 1930s, when the U.S. economy was going through the Great Depression, a prolonged economic slump, prices were low and farmers were suffering severely. In an effort to help rural Americans, the U.S. government imposed price floors on a number of agricultural products. The system of agricultural price floors—officially called price support programs—continues to this day. Among the products subject to price support are sugar and various dairy products; at times grains, beef, and pork have also had a minimum price.

The big problem with any attempt to impose a price floor is that it creates a surplus. To some extent the U.S. Department of Agriculture has tried to head off surpluses by taking steps to reduce supply; for example, by paying farmers *not* to grow crops. As a last resort, however, the U.S. government has been willing to buy up the surplus, taking the excess supply off the market.

But then what? The government has to find a way to get rid of the agricultural products it has bought. It can't just sell them: that would depress market prices, forcing the government to buy the stuff right back. So it has to give it away in ways that don't depress market prices. One of the ways it does this is by giving surplus food, free, to school lunch programs.

These gifts are known as “bonus foods.” Along with financial aid, bonus foods are what allow many school districts to provide free or very cheap lunches to their students. Is this a story with a happy ending?

Not really. Nutritionists, concerned about growing child obesity in the United States, place part of the blame on those bonus foods. Schools get whatever the government has too much of—and that has tended to include a lot of dairy products, beef, and corn, and not much in the way of fresh vegetables or fruit. As a result, school lunches that make extensive use of bonus foods tend to be very high in fat and calories. So this is a case in which there is such a thing as a free lunch—but this lunch may be bad for your health.

How a Price Floor Causes Inefficiency

The persistent surplus that results from a price floor creates missed opportunities—inefficiencies—that resemble those created by the shortage that results from a price ceiling. These include deadweight loss from inefficiently low quantity, inefficient allocation of sales among sellers, wasted resources, inefficiently high quality, and the temptation to break the law by selling below the legal price.

Inefficiently Low Quantity Because a price floor raises the price of a good to consumers, it reduces the quantity of that good demanded; because sellers can't sell more units of a good than buyers are willing to buy, a price floor reduces the quantity of a good bought and sold below the market equilibrium quantity and leads to a deadweight loss. Notice that this is the *same* effect as a price ceiling. You might be tempted to think that a price floor and a price ceiling have opposite effects, but both have the effect of reducing the quantity of a good bought and sold (see Pitfalls to the right).

Since the equilibrium of an efficient market maximizes the sum of consumer and producer surplus, a price floor that reduces the quantity below the equilibrium quantity reduces total surplus. Figure 5-7 on the next page shows the implications for total surplus of a price floor on the price of butter. Total surplus is the sum of the area above the supply curve and below the demand curve. By reducing the quantity of butter sold, a price floor causes a deadweight loss equal to the area of the shaded triangle in the figure. As in the case of a price ceiling, however, deadweight loss is only one of the forms of inefficiency that the price control creates.

PITFALLS

CEILINGS, FLOORS, AND QUANTITIES

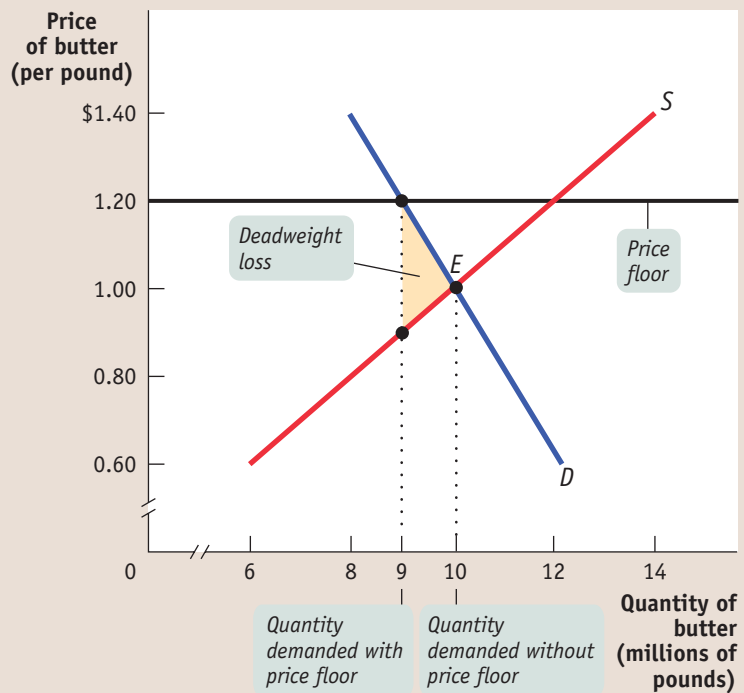
A price ceiling pushes the price of a good *down*. A price floor pushes the price of a good *up*. So it's easy to assume that the effects of a price floor are the opposite of the effects of a price ceiling. In particular, if a price ceiling reduces the quantity of a good bought and sold, doesn't a price floor increase the quantity?

No, it doesn't. In fact, both floors and ceilings reduce the quantity bought and sold. Why? When the quantity of a good supplied isn't equal to the quantity demanded, the actual quantity sold is determined by the “short side” of the market—whichever quantity is less. If sellers don't want to sell as much as buyers want to buy, it's the sellers who determine the actual quantity sold, because buyers can't force unwilling sellers to sell. If buyers don't want to buy as much as sellers want to sell, it's the buyers who determine the actual quantity sold, because sellers can't force unwilling buyers to buy.

FIGURE 5-7

A Price Floor Causes Inefficiently Low Quantity

A price floor reduces the quantity demanded below the market equilibrium quantity and leads to a deadweight loss.



Inefficient Allocation of Sales Among Sellers Like a price ceiling, a price floor can lead to *inefficient allocation*—but in this case **inefficient allocation of sales among sellers** rather than inefficient allocation to consumers.

An episode from the Belgian movie *Rosetta*, a realistic fictional story, illustrates the problem of inefficient allocation of selling opportunities quite well. Like many European countries, Belgium has a high minimum wage, and jobs for young people are scarce. At one point Rosetta, a young woman who is very anxious to work, loses her job at a fast-food stand because the owner of the stand replaces her with his son—a very reluctant worker. Rosetta would be willing to work for less money, and with the money he would save, the owner could give his son an allowance and let him do something else. But to hire Rosetta for less than the minimum wage would be illegal.

Wasted Resources Also like a price ceiling, a price floor generates inefficiency by *wasting resources*. The most graphic examples involve government purchases of the unwanted surpluses of agricultural products caused by price floors. The surplus production is sometimes destroyed, which is pure waste; in other cases the stored produce goes, as officials euphemistically put it, “out of condition” and must be thrown away.

Price floors also lead to wasted time and effort. Consider the minimum wage. Would-be workers who spend many hours searching for jobs, or waiting in line in the hope of getting jobs, play the same role in the case of price floors as hapless families searching for apartments in the case of price ceilings.

Inefficiently High Quality Again like price ceilings, price floors lead to inefficiency in the quality of goods produced.

We saw that when there is a price ceiling, suppliers produce products that are of inefficiently low quality: buyers prefer higher-quality products and are willing to pay for them, but sellers refuse to improve the quality of their products because the price ceiling prevents their being compensated for doing so. This same logic applies to price floors, but in reverse: suppliers offer goods of **inefficiently high quality**.

How can this be? Isn't high quality a good thing? Yes, but only if it is worth the cost. Suppose that suppliers spend a lot to make goods of very high quality but that this quality isn't worth much to consumers, who would rather receive the money spent on that quality in the form of a lower price. This represents a missed opportunity: suppliers and buyers could make a mutually beneficial deal in which buyers got goods of lower quality for a much lower price.

Price floors lead to **inefficient allocation of sales among sellers**: those who would be willing to sell the good at the lowest price are not always those who actually manage to sell it.

Price floors often lead to inefficiency in that goods of **inefficiently high quality** are offered: sellers offer high-quality goods at a high price, even though buyers would prefer a lower quality at a lower price.

A good example of the inefficiency of excessive quality comes from the days when transatlantic airfares were set artificially high by international treaty. Forbidden to compete for customers by offering lower ticket prices, airlines instead offered expensive services, like lavish in-flight meals that went largely uneaten. At one point the regulators tried to restrict this practice by defining maximum service standards—for example, that snack service should consist of no more than a sandwich. One airline then introduced what it called a “Scandinavian Sandwich,” a towering affair that forced the convening of another conference to define *sandwich*. All of this was wasteful, especially considering that what passengers really wanted was less food and lower airfares.

Since the deregulation of U.S. airlines in the 1970s, American passengers have experienced a large decrease in ticket prices accompanied by a decrease in the quality of in-flight service—smaller seats, lower-quality food, and so on. Everyone complains about the service—but thanks to lower fares, the number of people flying on U.S. carriers has grown several hundred percent since airline deregulation.

Illegal Activity Finally, like price ceilings, price floors provide incentives for illegal activity. For example, in countries where the minimum wage is far above the equilibrium wage rate, workers desperate for jobs sometimes agree to work off the books for employers who conceal their employment from the government—or bribe the government inspectors. This practice, known in Europe as “black labor,” is especially common in Southern European countries such as Italy and Spain (see Economics in Action on the next page).

So Why Are There Price Floors?

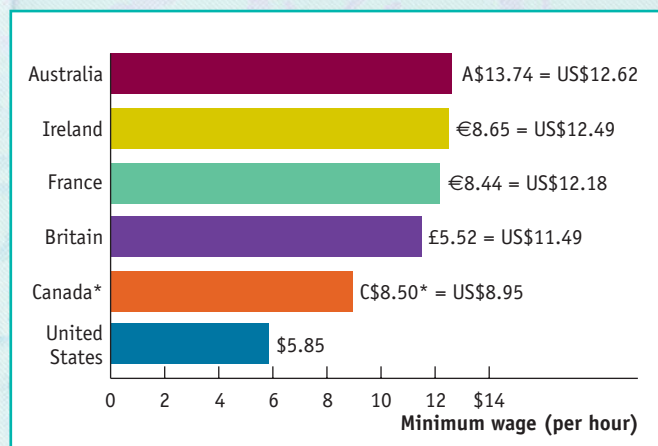
To sum up, a price floor creates various negative side effects:

- A persistent surplus of the good
- Inefficiency arising from the persistent surplus in the form of inefficiently low quantity (deadweight loss), inefficient allocation of sales among sellers, wasted resources, and an inefficiently high level of quality offered by suppliers
- The temptation to engage in illegal activity, particularly bribery and corruption of government officials



CHECK OUT OUR LOW, LOW WAGES!

The minimum wage rate in the United States, as you can see in this graph, is actually quite low compared with other rich countries. Since minimum wages are set in national currency—the British minimum wage is set in British pounds, the French minimum wage is set in euros, and so on—the comparison depends on the exchange rate on any given day. As of November 1, 2007, Australia had a minimum wage about twice as high as the U.S. rate, with Ireland and France not far behind. You can see one effect of this difference in the supermarket checkout line. In the United States there is usually someone to bag your groceries—someone typically paid the minimum wage or at best slightly more. In Europe, where hiring a bagger is a lot more expensive, you’re almost always expected to do the bagging yourself.



Source: Department of Enterprise, Trade and Employment (Ireland); Ministère du Travail, des Relations Sociales et de la Solidarité (France); Australian Fair Pay Commission (Australia); Department for Business, Enterprise and Regulatory Reform (Britain); Human Resources and Social Development Canada (Canada); Department of Labor (U.S.); Federal Reserve Bank of St. Louis (exchange rates as of 11/1/2007).

*The Canadian minimum wage varies by province from C\$7.25 to C\$8.50.

So why do governments impose price floors when they have so many negative side effects? The reasons are similar to those for imposing price ceilings. Government officials often disregard warnings about the consequences of price floors either because they believe that the relevant market is poorly described by the supply and demand model or, more often, because they do not understand the model. Above all, just as price ceilings are often imposed because they benefit some influential buyers of a good, price floors are often imposed because they benefit some influential sellers.

►ECONOMICS IN ACTION



“Black Labor” in Southern Europe

The best-known example of a price floor is the minimum wage. Most economists believe, however, that the minimum wage has relatively little effect on the job market in the United States, mainly because the floor is set so low. In 1968, the U.S. minimum wage was 53% of the average wage of blue-collar workers; by 2005, it had fallen to about 32%.

The situation is different, however, in many European countries, where minimum wages have been set much higher than in the United States. This has happened despite the fact that workers in most European countries are somewhat less productive than their American counterparts, which means that the equilibrium wage in Europe—the wage that would clear the labor market—is probably lower in Europe than in the United States. Moreover, European countries often require employers to pay for health and retirement benefits, which are more extensive and so more costly than comparable American benefits. These mandated benefits make the actual cost of employing a European worker considerably more than the worker’s paycheck.

The result is that in Europe the price floor on labor is definitely binding: the minimum wage is well above the wage rate that would make the quantity of labor supplied by workers equal to the quantity of labor demanded by employers.

The persistent surplus that results from this price floor appears in the form of high unemployment—millions of workers, especially young workers, seek jobs but cannot find them. In countries where the enforcement of labor laws is lax, however, there is a second, entirely predictable result: widespread evasion of the law. In both Italy and Spain, officials believe there are hundreds of thousands, if not millions, of workers who are employed by companies that pay them less than the legal minimum, fail to provide the required health and retirement benefits, or both. In many cases the jobs are simply unreported: Spanish economists estimate that about a third of the country’s reported unemployed are in the black labor market—working at unreported jobs. In fact, Spaniards waiting to collect checks from the unemployment office have been known to complain about the long lines that keep them from getting back to work!

Employers in these countries have also found legal ways to evade the wage floor. For example, Italy’s labor regulations apply only to companies with 15 or more workers. This gives a big cost advantage to small Italian firms, many of which remain small in order to avoid paying higher wages and benefits. And sure enough, in some Italian industries there is an astonishing proliferation of tiny companies. For example, one of Italy’s most successful industries is the manufacture of fine woolen cloth, centered in the Prato region. The average textile firm in that region employs only four workers! ▲

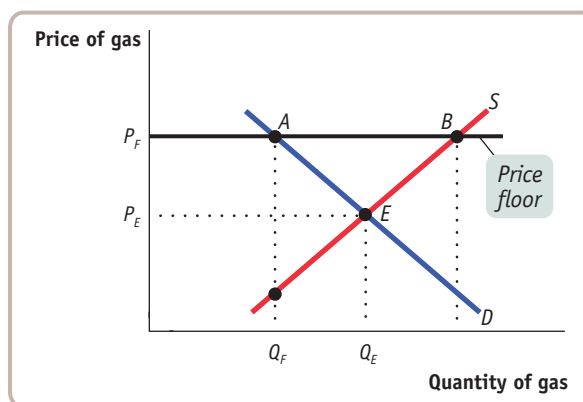
►► QUICK REVIEW

- The most familiar price floor is the **minimum wage**. Price floors are also commonly imposed on agricultural goods.
- A price floor above the equilibrium price benefits successful sellers but causes predictable adverse effects such as a persistent surplus, which leads to four kinds of inefficiencies: deadweight loss from inefficiently low quantities, **inefficient allocation of sales among sellers**, wasted resources, and **inefficiently high quality**.
- Price floors encourage illegal activity, such as workers who work off the books, often leading to official corruption.

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► CHECK YOUR UNDERSTANDING 5-2

1. The state legislature mandates a price floor for gasoline of P_F per gallon. Assess the following statements and illustrate your answer using the figure provided.
 - a. Proponents of the law claim it will increase the income of gas station owners. Opponents claim it will hurt gas station owners because they will lose customers.
 - b. Proponents claim consumers will be better off because gas stations will provide better service. Opponents claim consumers will be generally worse off because they prefer to buy gas at cheaper prices.
 - c. Proponents claim that they are helping gas station owners without hurting anyone else. Opponents claim that consumers are hurt and will end up doing things like buying gas in a nearby state or on the black market.



Solutions appear at back of book.

Controlling Quantities

In the 1930s, New York City instituted a system of licensing for taxicabs: only taxis with a “medallion” were allowed to pick up passengers. Because this system was intended to assure quality, medallion owners were supposed to maintain certain standards, including safety and cleanliness. A total of 11,787 medallions were issued, with taxi owners paying \$10 for each medallion.

In 1995, there were still only 11,787 licensed taxicabs in New York, even though the city had meanwhile become the financial capital of the world, a place where hundreds of thousands of people in a hurry tried to hail a cab every day. (An additional 400 medallions were issued in 1995, and after several rounds of sales of additional medallions, today there are 13,089 medallions.)

The result of this restriction on the number of taxis was that a New York City taxi medallion became very valuable: if you wanted to operate a taxi in New York, you had to lease a medallion from someone else or buy one for a going price of several hundred thousand dollars.

It turns out that this story is not unique; other cities introduced similar medallion systems in the 1930s and, like New York, have issued few new medallions since. In San Francisco and Boston, as in New York, taxi medallions trade for six-figure prices.

A taxi medallion system is a form of **quantity control**, or **quota**, by which the government regulates the quantity of a good that can be bought and sold rather than the price at which it is transacted. The total amount of the good that can be transacted under the quantity control is called the **quota limit**. Typically, the government limits quantity in a market by issuing **licenses**; only people with a license can legally supply the good. A taxi medallion is just such a license. The government of New York City limits the number of taxi rides that can be sold by limiting the number of taxis to only those who hold medallions. There are many other cases of quantity controls, ranging from limits on how much foreign currency (for instance, British pounds or Mexican pesos) people are allowed to buy to the quantity of clams New Jersey fishing boats are allowed to catch. Notice, by the way, that although there are price controls on both sides of the equilibrium price—price ceilings and price floors—in the real world, quantity controls always set an upper, not a lower, limit on quantities. After all, nobody can be forced to buy or sell more than they want to!

A **quantity control**, or **quota**, is an upper limit on the quantity of some good that can be bought or sold. The total amount of the good that can be legally transacted is the **quota limit**.

A **license** gives its owner the right to supply a good.

The **demand price** of a given quantity is the price at which consumers will demand that quantity.

Some attempts to control quantities are undertaken for good economic reasons, some for bad ones. In many cases, as we will see, quantity controls introduced to address a temporary problem become politically hard to remove later because the beneficiaries don't want them abolished, even after the original reason for their existence is long gone. But whatever the reasons for such controls, they have certain predictable—and usually undesirable—economic consequences.

The Anatomy of Quantity Controls

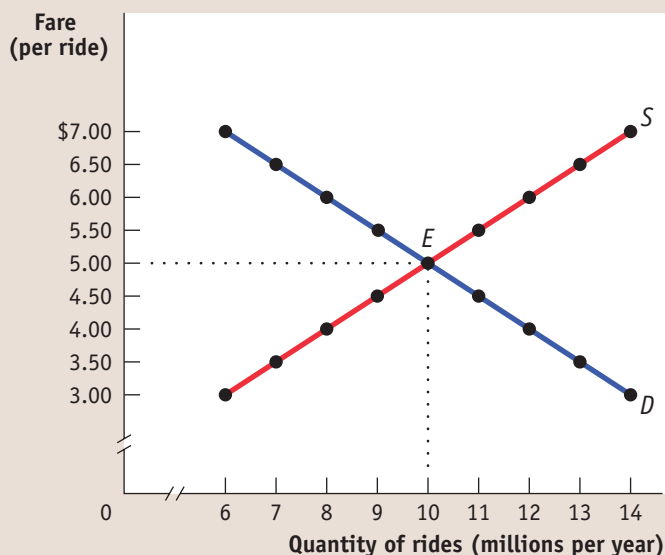
To understand why a New York taxi medallion is worth so much money, we consider a simplified version of the market for taxi rides, shown in Figure 5-8. Just as we assumed in the analysis of rent control that all apartments are the same, we now suppose that all taxi rides are the same—ignoring the real-world complication that some taxi rides are longer, and so more expensive, than others. The table in the figure shows supply and demand schedules. The equilibrium—indicated by point *E* in the figure and by the shaded entries in the table—is a fare of \$5 per ride, with 10 million rides taken per year. (You'll see in a minute why we present the equilibrium this way.)

The New York medallion system limits the number of taxis, but each taxi driver can offer as many rides as he or she can manage. (Now you know why New York taxi drivers are so aggressive!) To simplify our analysis, however, we will assume that a medallion system limits the number of taxi rides that can legally be given to 8 million per year.

Until now, we have derived the demand curve by answering questions of the form: “How many taxi rides will passengers want to take if the price is \$5 per ride?” But it is possible to reverse the question and ask instead: “At what price will consumers want to buy 10 million rides per year?” The price at which consumers want to buy a given quantity—in this case, 10 million rides at \$5 per ride—is the **demand price** of that quantity. You can see from the demand schedule in Figure 5-8 that the demand price of 6 million rides is \$7 per ride, the demand price of 7 million rides is \$6.50 per ride, and so on.

FIGURE 5-8

The Market for Taxi Rides in the Absence of Government Controls



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
\$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

Without government intervention, the market reaches equilibrium with 10 million rides taken per year at a fare of \$5 per ride.

Similarly, the supply curve represents the answer to questions of the form: “How many taxi rides would taxi drivers supply at a price of \$5 each?” But we can also reverse this question to ask: “At what price will suppliers be willing to supply 10 million rides per year?” The price at which suppliers will supply a given quantity—in this case, 10 million rides at \$5 per ride—is the **supply price** of that quantity. We can see from the supply schedule in Figure 5-8 that the supply price of 6 million rides is \$3 per ride, the supply price of 7 million rides is \$3.50 per ride, and so on.

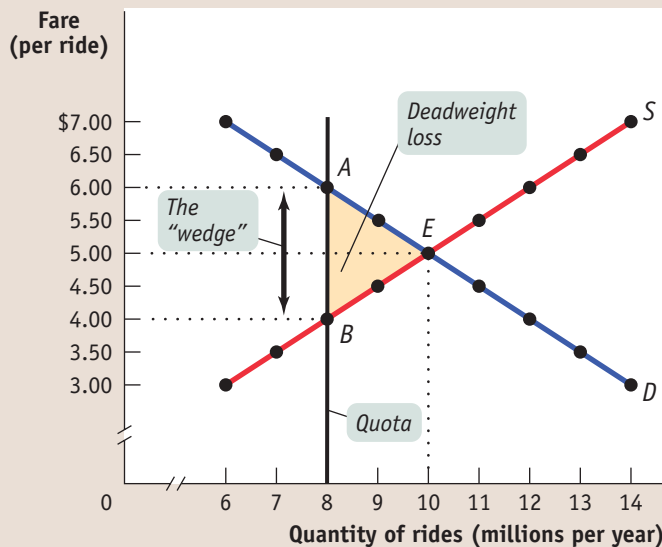
Now we are ready to analyze a quota. We have assumed that the city government limits the quantity of taxi rides to 8 million per year. Medallions, each of which carries the right to provide a certain number of taxi rides per year, are made available to selected people in such a way that a total of 8 million rides will be provided. Medallion holders may then either drive their own taxis or rent their medallions to others for a fee.

Figure 5-9 shows the resulting market for taxi rides, with the black vertical line at 8 million rides per year representing the quota limit. Because the quantity of rides is limited to 8 million, consumers must be at point A on the demand curve, corresponding to the shaded entry in the demand schedule: the demand price of 8 million rides is \$6 per ride. Meanwhile, taxi drivers must be at point B on the supply curve, corresponding to the shaded entry in the supply schedule: the supply price of 8 million rides is \$4 per ride.

But how can the price received by taxi drivers be \$4 when the price paid by taxi riders is \$6? The answer is that in addition to the market in taxi rides, there is also a market in medallions. Medallion-holders may not always want to drive their taxis: they may be ill or on vacation. Those who do not want to drive their own taxis will sell the right to use the medallion to someone else. So we need to consider two sets of transactions here, and so two prices: (1) the transactions in taxi rides and the price

The **supply price** of a given quantity is the price at which producers will supply that quantity.

FIGURE 5-9 Effect of a Quota on the Market for Taxi Rides



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
\$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

The table shows the demand price and the supply price corresponding to each quantity: the price at which that quantity would be demanded and supplied, respectively. The city government imposes a quota of 8 million rides by selling licenses for only 8 million rides, represented by the black vertical line. The price paid by consumers rises to \$6 per ride, the demand price of 8 million rides, shown by point A. The supply price of 8 million rides is only \$4

per ride, shown by point B. The difference between these two prices is the quota rent per ride, the earnings that accrue to the owner of a license. The quota rent drives a wedge between the demand price and the supply price. And since the quota discourages mutually beneficial transactions, it creates a deadweight loss equal to the shaded triangle.

A quantity control, or quota, drives a **wedge** between the demand price and the supply price of a good; that is, the price paid by buyers ends up being higher than that received by sellers. The difference between the demand and supply price at the quota limit is the **quota rent**, the earnings that accrue to the license-holder from ownership of the right to sell the good. It is equal to the market price of the license when the licenses are traded.

at which these will occur, and (2) the transactions in medallions and the price at which these will occur. It turns out that since we are looking at two markets, the \$4 and \$6 prices will both be right.

To see how this all works, consider two imaginary New York taxi drivers, Sunil and Harriet. Sunil has a medallion but can't use it because he's recovering from a severely sprained wrist. So he's looking to rent his medallion out to someone else. Harriet doesn't have a medallion but would like to rent one. Furthermore, at any point in time there are many other people like Harriet who would like to rent a medallion. Suppose Sunil agrees to rent his medallion to Harriet. To make things simple, assume that any driver can give only one ride per day and that Sunil is renting his medallion to Harriet for one day. What rental price will they agree on?

To answer this question, we need to look at the transactions from the viewpoints of both drivers. Once she has the medallion, Harriet knows she can make \$6 per day—the demand price of a ride under the quota. And she is willing to rent the medallion only if she makes at least \$4 per day—the supply price of a ride under the quota. So Sunil cannot demand a rent of more than \$2—the difference between \$6 and \$4. And if Harriet offered Sunil less than \$2—say, \$1.50—there would be other eager drivers willing to offer him more, up to \$2. So, in order to get the medallion, Harriet must offer Sunil at least \$2. Since the rent can be no more than \$2 and no less than \$2, it must be exactly \$2.

It is no coincidence that \$2 is exactly the difference between \$6, the demand price of 8 million rides, and \$4, the supply price of 8 million rides. In every case in which the supply of a good is legally restricted, there is a **wedge** between the demand price of the quantity transacted and the supply price of the quantity transacted. This wedge, illustrated by the double-headed arrow in Figure 5-9, has a special name: the **quota rent**. It is the earnings that accrue to the license-holder from ownership of a valuable commodity, the license. In the case of Sunil and Harriet, the quota rent of \$2 goes to Sunil because he owns the license, and the remaining \$4 from the total fare of \$6 goes to Harriet.

So Figure 5-9 also illustrates the quota rent in the market for New York taxi rides. The quota limits the quantity of rides to 8 million per year, a quantity at which the demand price of \$6 exceeds the supply price of \$4. The wedge between these two prices, \$2, is the quota rent that results from the restrictions placed on the quantity of taxi rides in this market.

But wait a second. What if Sunil doesn't rent out his medallion? What if he uses it himself? Doesn't this mean that he gets a price of \$6? No, not really. Even if Sunil doesn't rent out his medallion, he could have rented it out, which means that the medallion has an *opportunity cost* of \$2: if Sunil decides to use his own medallion and drive his own taxi rather than renting his medallion to Harriet, the \$2 represents his opportunity cost of not renting out his medallion. That is, the \$2 quota rent is now the rental income he forgoes by driving his own taxi. In effect, Sunil is in two businesses—the taxi-driving business and the medallion-renting business. He makes \$4 per ride from driving his taxi and \$2 per ride from renting out his medallion. It doesn't make any difference that in this particular case he has rented his medallion to himself! So regardless of whether the medallion owner uses the medallion himself or herself, or rents it to others, it is a valuable asset. And this is represented in the going price for a New York City taxi medallion: in February 2008, it was around \$429,000.

Notice, by the way, that quotas—like price ceilings and price floors—don't always have a real effect. If the quota were set at 12 million rides—that is, above the equilibrium quantity in an unregulated market—it would have no effect because it would not be binding.

The Costs of Quantity Controls

Like price controls, quantity controls can have some predictable and undesirable side effects. The first is the by-now-familiar problem of inefficiency due to missed opportunities: quantity controls create deadweight loss by preventing mutually beneficial transactions from occurring, transactions that would benefit both buyers and sellers.

Looking back at Figure 5-9, you can see that starting at the quota limit of 8 million rides, New Yorkers would be willing to pay at least \$5.50 per ride for an additional 1 million rides and that taxi drivers would be willing to provide those rides as long as they got at least \$4.50 per ride. These are rides that would have taken place if there were no quota limit. The same is true for the next 1 million rides: New Yorkers would be willing to pay at least \$5 per ride when the quantity of rides is increased from 9 to 10 million, and taxi drivers would be willing to provide those rides as long as they got at least \$5 per ride. Again, these rides would have occurred without the quota limit. Only when the market has reached the unregulated market equilibrium quantity of 10 million rides are there no “missed-opportunity rides”—the quota limit of 8 million rides has caused 2 million “missed-opportunity rides.” Generally, *as long as the demand price of a given quantity exceeds the supply price, there is a deadweight loss*. A buyer would be willing to buy the good at a price that the seller would be willing to accept, but such a transaction does not occur because it is forbidden by the quota. The deadweight loss arising from the 2 million in missed-opportunity rides is represented by the shaded triangle in Figure 5-9.

And because there are transactions that people would like to make but are not allowed to, quantity controls generate an incentive to evade them or even to break the law. New York’s taxi industry again provides clear examples. Taxi regulation applies only to those drivers who are hailed by passengers on the street. A car service that makes prearranged pickups does not need a medallion. As a result, such hired cars provide much of the service that might otherwise be provided by taxis, as in other cities. In addition, there are substantial numbers of unlicensed cabs that simply defy the law by picking up passengers without a medallion. Because these cabs are illegal, their drivers are completely unregulated, and they generate a disproportionately large share of traffic accidents in New York City.

In fact, in 2004 the hardships caused by the limited number of New York taxis led city leaders to authorize an increase in the number of licensed taxis. In a series of sales, the city sold almost 1,000 new medallions, to bring the total number up to the current 13,089 medallions—a move that certainly cheered New York riders. But those who already owned medallions were less happy with the increase; they understood that the nearly 1,000 new taxis would reduce or eliminate the shortage of taxis. As a result, taxi drivers anticipated a decline in their revenues as they would no longer always be assured of finding willing customers. And, in turn, the value of a medallion would fall. So to placate the medallion owners, city officials also raised taxi fares: by 25% in 2004, and again—by a smaller percentage—in 2006. Although taxis are now easier to find, a ride now costs more—and that price increase slightly diminished the newfound cheer of New York taxi riders.

In sum, quantity controls typically create the following undesirable side effects:

- Deadweight loss because some mutually beneficial transactions don’t occur
- Incentives for illegal activities

►ECONOMICS IN ACTION

The Clams of New Jersey

Forget the refineries along the Jersey Turnpike; one industry that New Jersey *really* dominates is clam fishing. In 2005 the Garden State supplied 71% of the country’s surf clams, whose tongues are used in fried-clam dinners, and 92% of the quahogs, which are used to make clam chowder.

In the 1980s, however, excessive fishing threatened to wipe out New Jersey’s clam beds. To save the resource, the U.S. government introduced a clam quota, which sets an overall limit on the number of bushels of clams that may be caught and allocates licenses to owners of fishing boats based on their historical catches.

>> QUICK REVIEW

- > **Quantity controls**, or **quotas**, are government-imposed limits on how much of a good may be bought or sold. The quantity allowed for sale is the **quota limit**. The government then issues a **license**—the right to sell a given quantity of a good under the quota.
- > When the quota limit is smaller than the equilibrium quantity in an unregulated market, the **demand price** is higher than the **supply price**—there is a **wedge** between them at the quota limit.
- > This wedge is the **quota rent**, the earnings that accrue to the license-holder from ownership of the right to sell the good—whether by actually supplying the good or by renting the license to someone else. The market price of a license equals the quota rent.
- > Like price controls, quantity controls create deadweight loss and encourage illegal activity.

Notice, by the way, that this is an example of a quota that is probably justified by broader economic and environmental considerations—unlike the New York taxicab quota, which has long since lost any economic rationale. Still, whatever its rationale, the New Jersey clam quota works the same way as any other quota.

Once the quota system was established, many boat owners stopped fishing for clams. They realized that rather than operate a boat part time, it was more profitable to sell or rent their licenses to someone else, who could then assemble enough licenses to operate a boat full time. Today, there are about 50 New Jersey boats fishing for clams; the license required to operate one is worth more than the boat itself. ▲

> CHECK YOUR UNDERSTANDING 5-3

1. Suppose that the supply and demand for taxi rides is given by Figure 5-8 but the quota is set at 6 million rides instead of 8 million. Find the following and indicate them on Figure 5-8.
 - a. The price of a ride
 - b. The quota rent
 - c. The deadweight loss
 - d. Suppose the quota limit on taxi rides is increased to 9 million. What happens to the quota rent? To the deadweight loss?
2. Assume that the quota limit is 8 million rides. Suppose demand decreases due to a decline in tourism. What is the smallest parallel leftward shift in demand that would result in the quota no longer having an effect on the market? Illustrate your answer using Figure 5-8.

Solutions appear at back of book.

>> A LOOK AHEAD...

It's important to remember that the supply and demand model isn't a static model, limited to describing a market at only one point in time. Instead, it can also be used to understand how markets change over time in response to events. To understand the relationship between an event and the magnitude of its effect on a market, we now turn to the concept that's the subject of the next chapter, elasticity.]

SUMMARY

1. Even when a market is efficient, governments often intervene to pursue greater fairness or to please a powerful interest group. Interventions can take the form of **price controls** or quantity controls, both of which generate predictable and undesirable side effects consisting of various forms of inefficiency and illegal activity.
2. A **price ceiling**, a maximum market price below the equilibrium price, benefits successful buyers but creates persistent shortages. Because the price is maintained below the equilibrium price, the quantity demanded is increased and the quantity supplied is decreased compared to the equilibrium quantity. This leads to predictable problems: inefficiencies in the form of **deadweight loss** from inefficiently low quantity, **inefficient allocation to consumers**, **wasted resources**, and **inefficiently low quality**. It also encourages illegal activity as people turn to **black markets** to get the good. Because of these problems, price ceilings have generally lost favor as an economic policy tool. But some governments continue to impose them either because they don't understand the effects or because the price ceilings benefit some influential group.
3. A **price floor**, a minimum market price above the equilibrium price, benefits successful sellers but creates persistent surplus. Because the price is maintained above the equilibrium price, the quantity demanded is decreased and the quantity supplied is increased compared to the equilibrium quantity. This leads to predictable problems: inefficiencies in the form of deadweight loss from inefficiently low quantity, **inefficient allocation of sales among sellers**, wasted resources, and **inefficiently high quality**. It also encourages illegal activity and black markets. The most well known kind of price floor is the **minimum wage**, but price floors are also commonly applied to agricultural products.
4. **Quantity controls**, or **quotas**, limit the quantity of a good that can be bought or sold. The quantity allowed for sale is the **quota limit**. The government issues **licenses** to individuals, the right to sell a given quantity of the good. The owner of a license earns a **quota rent**, earnings that accrue from ownership of the right to sell the good. It is equal to the difference between the **demand price** at the quota limit, what consumers are willing to pay for that

quantity, and the **supply price** at the quota limit, what suppliers are willing to accept for that quantity. Economists say that a quota drives a **wedge** between the

demand price and the supply price; this wedge is equal to the quota rent. Quantity controls lead to deadweight loss in addition to encouraging illegal activity.

KEY TERMS

Price controls, p. 118	Black markets, p. 125	Quota limit, p. 133
Price ceiling, p. 118	Minimum wage, p. 127	License, p. 133
Price floor, p. 118	Inefficient allocation of sales among sellers, p. 130	Demand price, p. 134
Deadweight loss, p. 121	Inefficiently high quality, p. 130	Supply price, p. 135
Inefficient allocation to consumers, p. 123	Quantity control, p. 133	Wedge, p. 136
Wasted resources, p. 123	Quota, p. 133	Quota rent, p. 136
Inefficiently low quality, p. 124		

PROBLEMS

- Suppose it is decided that rent control in New York City will be abolished and that market rents will now prevail. Assume that all rental units are identical and so are offered at the same rent. To address the plight of residents who may be unable to pay the market rent, an income supplement will be paid to all low-income households equal to the difference between the old controlled rent and the new market rent.
 - Use a diagram to show the effect on the rental market of the elimination of rent control. What will happen to the quality and quantity of rental housing supplied?
 - Use a second diagram to show the additional effect of the income-supplement policy on the market. What effect does it have on the market rent and quantity of rental housing supplied in comparison to your answers to part a?
 - Are tenants better or worse off as a result of these policies? Are landlords better or worse off? Is society as a whole better or worse off?
 - From a political standpoint, why do you think cities have been more likely to resort to rent control rather than a policy of income supplements to help low-income people pay for housing?
- In order to ingratiate himself with voters, the mayor of Gotham City decides to lower the price of taxi rides. Assume, for simplicity, that all taxi rides are the same distance and therefore cost the same. The accompanying table shows the demand and supply schedules for taxi rides.
 - Assume that there are no restrictions on the number of taxi rides that can be supplied (there is no medallion system). Find the equilibrium price and quantity.
 - Suppose that the mayor sets a price ceiling at \$5.50. How large is the shortage of rides? Illustrate with a diagram. Who loses and who benefits from this policy?
 - Suppose that the stock market crashes and, as a result, people in Gotham City are poorer. This reduces the quantity of taxi rides demanded by 6 million rides per year at any given price. What effect will the mayor's new policy have now? Illustrate with a diagram.
 - Suppose that the stock market rises and the demand for taxi rides returns to normal (that is, returns to the demand schedule given in the table). The mayor now decides to ingratiate himself with taxi drivers. He announces a policy in which operating licenses are given to existing taxi drivers; the number of licenses is restricted such that only 10 million rides per year can be given. Illustrate the effect of this policy on the market, and indicate the resulting price and quantity transacted. What is the quota rent per ride?
- In the late eighteenth century, the price of bread in New York City was controlled, set at a predetermined price above the market price.
 - Draw a diagram showing the effect of the policy. Did the policy act as a price ceiling or a price floor?
 - What kinds of inefficiencies were likely to have arisen when the controlled price of bread was above the market price? Explain in detail.

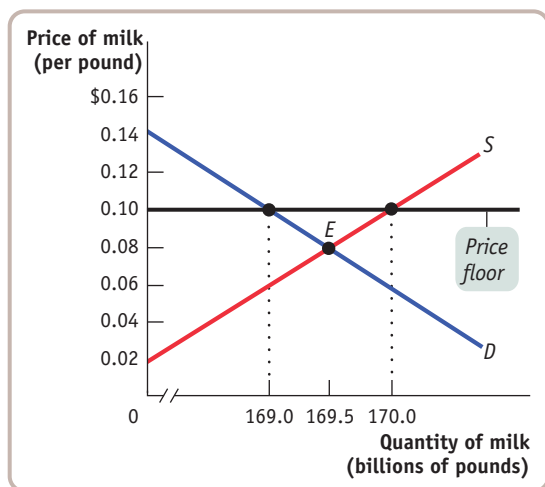
Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
\$7.00	10	12
6.50	11	11
6.00	12	10
5.50	13	9
5.00	14	8
4.50	15	7

One year during this period, a poor wheat harvest caused a leftward shift in the supply of bread and therefore an increase in its market price. New York bakers found that the controlled price of bread in New York was below the market price.

- Draw a diagram showing the effect of the price control on the market for bread during this one-year period. Did the policy act as a price ceiling or a price floor?

d. What kinds of inefficiencies do you think occurred during this period? Explain in detail.

4. The U.S. Department of Agriculture (USDA) administers the price floor for milk, set at \$0.10 per pound of milk. (The price floor is officially set at \$9.90 per hundredweight of milk. One hundredweight is 100 pounds.) At that price, according to data from the USDA, the quantity of milk produced in 2003 by U.S. producers was 170 billion pounds, and the quantity demanded was 169 billion pounds. To support the price of milk at the price floor, the USDA had to buy up 1 billion pounds of milk. The accompanying diagram shows supply and demand curves illustrating the market for milk.



- a. In the absence of a price floor, how much consumer surplus is created? How much producer surplus? What is the total surplus?
- b. With the price floor at \$0.10 per pound of milk, consumers buy 169 billion pounds of milk. How much consumer surplus is created now?
- c. With the price floor at \$0.10 per pound of milk, producers sell 170 billion pounds of milk (some to consumers and some to the USDA). How much producer surplus is created now?
- d. How much money does the USDA spend on buying up surplus milk?
- e. Taxes must be collected to pay for the purchases of surplus milk by the USDA. As a result, total surplus (producer plus consumer) is reduced by the amount the USDA spent on buying surplus milk. Using your answers for parts b–d, what is the total surplus when there is a price floor? How does this compare to the total surplus without a price floor from part a?
5. The accompanying table shows hypothetical demand and supply schedules for milk per year. The U.S. government decides that the incomes of dairy farmers should be maintained at a level that allows the traditional family dairy farm to survive. So it implements a price floor of \$1 per pint by buying surplus milk until the market price is \$1 per pint.

Price of milk (per pint)	Quantity of milk (millions of pints per year)	
	Quantity demanded	Quantity supplied
\$1.20	550	850
1.10	600	800
1.00	650	750
0.90	700	700
0.80	750	650

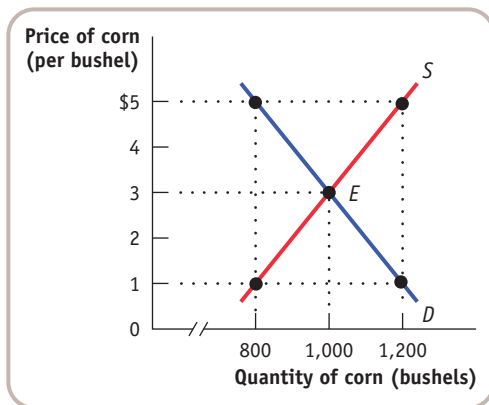
- a. In a diagram, show the deadweight loss from the inefficiently low quantity bought and sold.
- b. How much surplus milk will be produced as a result of this policy?
- c. What will be the cost to the government of this policy?
- d. Since milk is an important source of protein and calcium, the government decides to provide the surplus milk it purchases to elementary schools at a price of only \$0.60 per pint. Assume that schools will buy any amount of milk available at this low price. But parents now reduce their purchases of milk at any price by 50 million pints per year because they know their children are getting milk at school. How much will the dairy program now cost the government?
- e. Explain how inefficiencies in the form of inefficient allocation to sellers and wasted resources arise from this policy.
6. As noted in the text, European governments tend to make greater use of price controls than does the U.S. government. For example, the French government sets minimum starting yearly wages for new hires who have completed *le bac*, certification roughly equivalent to a high school diploma. The demand schedule for new hires with *le bac* and the supply schedule for similarly credentialed new job seekers are given in the accompanying table. The price here—given in euros, the currency used in France—is the same as the yearly wage.

Wage (per year)	Quantity demanded (new job offers per year)	Quantity supplied (new job seekers per year)
€45,000	200,000	325,000
40,000	220,000	320,000
35,000	250,000	310,000
30,000	290,000	290,000
25,000	370,000	200,000

- a. In the absence of government interference, what are the equilibrium wage and number of graduates hired per year? Illustrate with a diagram. Will there be anyone seeking a job at the equilibrium wage who is unable to find one—that is, will there be anyone who is involuntarily unemployed?
- b. Suppose the French government sets a minimum yearly wage of €35,000. Is there any involuntary unemployment?

at this wage? If so, how much? Illustrate with a diagram. What if the minimum wage is set at €40,000? Also illustrate with a diagram.

- c. Given your answer to part b and the information in the table, what do you think is the relationship between the level of involuntary unemployment and the level of the minimum wage? Who benefits from such a policy? Who loses? What is the missed opportunity here?
7. Until recently, the standard number of hours worked per week for a full-time job in France was 39 hours, just as in the United States. But in response to social unrest over high levels of involuntary unemployment, the French government instituted a 35-hour workweek—a worker could not work more than 35 hours per week even if both the worker and employer wanted it. The motivation behind this policy was that if current employees worked fewer hours, employers would be forced to hire more new workers. Assume that it is costly for employers to train new workers. French employers were greatly opposed to this policy and threatened to move their operations to neighboring countries that did not have such employment restrictions. Can you explain their attitude? Give an example of both an inefficiency and an illegal activity that are likely to arise from this policy.
8. For the last 70 years the U.S. government has used price supports to provide income assistance to American farmers. To implement these price supports, at times the government has used price floors, which it maintains by buying up the surplus farm products. At other times, it has used target prices, a policy by which the government gives the farmer an amount equal to the difference between the market price and the target price for each unit sold. Consider the market for corn depicted in the accompanying diagram.



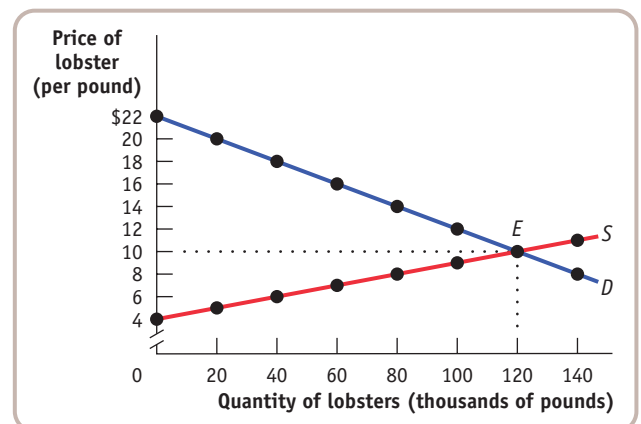
- a. If the government sets a price floor of \$5 per bushel, how many bushels of corn are produced? How many are purchased by consumers? By the government? How much does the program cost the government? How much revenue do corn farmers receive?
- b. Suppose the government sets a target price of \$5 per bushel for any quantity supplied up to 1,000 bushels. How many bushels of corn are purchased by consumers and at what price? By the government? How much does the

program cost the government? How much revenue do corn farmers receive?

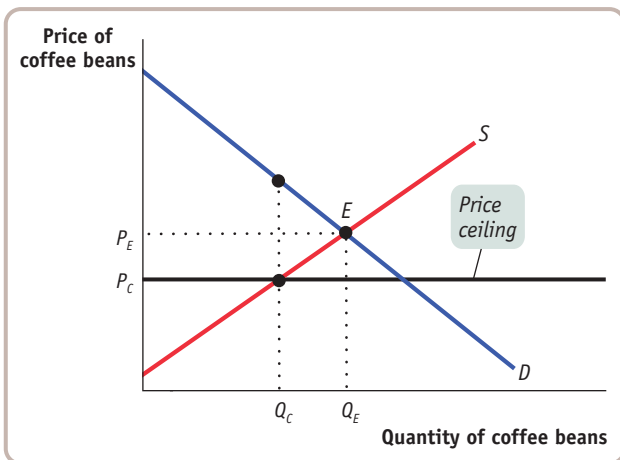
- c. Which of these programs (in parts a and b) costs corn consumers more? Which program costs the government more? Explain.
- d. Is one of these policies less inefficient than the other? Explain.
9. The waters off the North Atlantic coast were once teeming with fish. Now, due to overfishing by the commercial fishing industry, the stocks of fish are seriously depleted. In 1991, the National Marine Fishery Service of the U.S. government implemented a quota to allow fish stocks to recover. The quota limited the amount of swordfish caught per year by all U.S.-licensed fishing boats to 7 million pounds. As soon as the U.S. fishing fleet had met the quota limit, the swordfish catch was closed down for the rest of the year. The accompanying table gives the hypothetical demand and supply schedules for swordfish caught in the United States per year.

Price of swordfish (per pound)	Quantity of swordfish (millions of pounds per year)	
	Quantity demanded	Quantity supplied
\$20	6	15
18	7	13
16	8	11
14	9	9
12	10	7

- a. Use a diagram to show the effect of the quota on the market for swordfish in 1991. In your diagram, illustrate the deadweight loss from inefficiently low quantity.
- b. How do you think fishermen will change how they fish in response to this policy?
10. In Maine, you must have a license to harvest lobster commercially; these licenses are issued yearly. The state of Maine is concerned about the dwindling supplies of lobsters found off its coast. The state fishery department has decided to place a yearly quota of 80,000 pounds of lobsters harvested in all Maine waters. It has also decided to give licenses this year only to those fishermen who had licenses last year. The accompanying diagram shows the demand and supply curves for Maine lobsters.



- a. In the absence of government restrictions, what are the equilibrium price and quantity?
 - b. What is the *demand price* at which consumers wish to purchase 80,000 pounds of lobsters?
 - c. What is the *supply price* at which suppliers are willing to supply 80,000 pounds of lobsters?
 - d. What is the *quota rent* per pound of lobster when 80,000 pounds are sold? Illustrate the quota rent and the deadweight loss on the diagram.
 - e. Explain a transaction that benefits both buyer and seller but is prevented by the quota restriction.
11. The Venezuelan government has imposed a price ceiling on the retail price of roasted coffee beans. The accompanying diagram shows the market for coffee beans. In the absence of price controls, the equilibrium is at point E , with an equilibrium price of P_E and an equilibrium quantity bought and sold of Q_E .

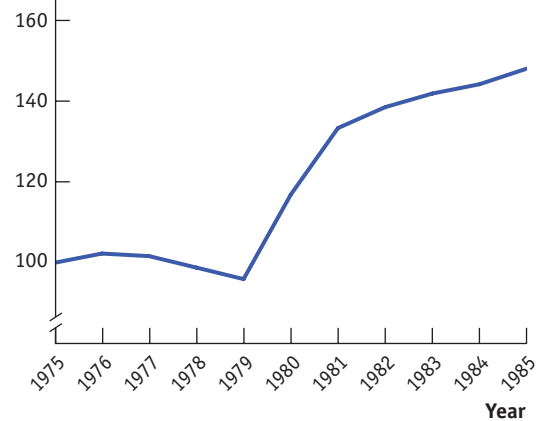


- a. Show the consumer and producer surplus before the introduction of the price ceiling.
- After the introduction of the price ceiling, the price falls to P_C and the quantity bought and sold falls to Q_C .
- b. Show the consumer surplus after the introduction of the price ceiling (assuming that the consumers with the highest willingness to pay get to buy the available coffee beans; that is, assuming that there is no inefficient allocation to consumers).
 - c. Show the producer surplus after the introduction of the price ceiling (assuming that the producers with the lowest cost get to sell their coffee beans; that is, assuming that there is no inefficient allocation of sales among producers).

- d. Using the diagram, show how much of what was producer surplus before the introduction of the price ceiling has been transferred to consumers as a result of the price ceiling?
- e. Using the diagram, show how much of what was total surplus before the introduction of the price ceiling has been lost? That is, how great is the deadweight loss?

12. The accompanying diagram shows data from the U.S. Bureau of Labor Statistics on the average price of an airline ticket in the United States from 1975 until 1985, adjusted to eliminate the effect of *inflation* (the general increase in the prices of all goods over time). In 1978, the United States Airline Deregulation Act removed the price floor on airline fares, and it also allowed the airlines greater flexibility to offer new routes.

Price of airline ticket (index: 1975 = 100)



Source: U.S. Bureau of Labor Statistics.

- a. Looking at the data on airline ticket prices in the diagram, do you think the price floor that existed before 1978 was binding or nonbinding? That is, do you think it was set above or below the equilibrium price? Draw a supply and demand diagram, showing where the price floor that existed before 1978 was in relation to the equilibrium price.
- b. Most economists agree that the average airline ticket price per mile traveled actually *fell* as a result of the Airline Deregulation Act. How might you reconcile that view with what you see in the diagram?



>> Elasticity

MORE PRECIOUS THAN A FLU SHOT

PANIC WAS THE ONLY WORD TO DESCRIBE THE situation at hospitals, clinics, and nursing homes across America in October 2004. Early that month, Chiron Corporation, one of only two suppliers of flu vaccine for the entire U.S. market, announced that contamination problems would force the closure of its manufacturing plant. With that closure, the U.S. supply of vaccine for the 2004–2005 flu season was suddenly cut in half, from 100 million to 50 million doses. Because making flu vaccine is a costly and time-consuming process, no more doses could be made to replace Chiron's lost output. And since every country jealously guards its supply of flu vaccine for its own citizens, none could be obtained from other countries.

If you've ever had a real case of the flu, you know just how unpleasant an experience it is. And it can be worse than unpleasant: every year the flu kills around 36,000 Americans and sends another 200,000 to the hospital. Victims are most commonly children, seniors, or those with compromised immune systems. In a normal flu season, this part of the population, along with health care workers, are immunized first.

But the flu vaccine shortfall of 2004 upended those plans. As news of it spread, there was a rush to get the

shots. People lined up in the middle of the night at the few locations that had somehow obtained the vaccine and were offering it at a reasonable price: the crowds included seniors with oxygen tanks, parents with sleeping children, and others in wheelchairs. Meanwhile, some pharmaceutical distributors—the companies that obtain vaccine from manufacturers and then distribute it to hospitals and pharmacies—detected a profit-making opportunity in the frenzy. One company, Med-Stat, which normally charged \$8.50 for a dose, began charging \$90, more than 10 times the normal price. A survey of pharmacists found that price-gouging was fairly widespread.

Although most people refused or were unable to pay such a high price for the vaccine, many others undoubtedly did. Med-Stat judged, correctly, that consumers of the vaccine were relatively *unresponsive* to price; that is, the large increase in the price of the vaccine left the quantity demanded by consumers relatively unchanged.

Clearly, the demand for flu vaccine is unusual

in this respect. For many, getting vaccinated meant the difference between life and death. Let's consider a very different and less urgent scenario. Suppose, for example, that the supply of a particular type of breakfast cereal was halved due to manufacturing problems. It would be extremely unlikely, if not impossible, to find



A shortage of flu vaccine created panic during the flu season of 2004.

a consumer willing to pay 10 times the original price for a box of this particular cereal. In other words, consumers of breakfast cereal are much more responsive to price than consumers of flu vaccine. But how do we define *responsiveness*?

Economists measure responsiveness of consumers to price with a particular number, called the *price elasticity*

of demand. In this chapter we will show how the price elasticity of demand is calculated and why it is the best measure of how the quantity demanded responds to changes in price. We will then see that the price elasticity of demand is only one of a family of related concepts, including the *income elasticity of demand* and the *price elasticity of supply*.

WHAT YOU WILL LEARN IN THIS CHAPTER:

- The definition of **elasticity**, a measure of responsiveness to changes in prices or incomes
- The importance of the **price elasticity of demand**, which measures the responsiveness of the quantity demanded to changes in price
- The meaning and importance of the **income elasticity of demand**, a measure of the responsiveness of demand to changes in income
- How the **cross-price elasticity of demand** measures the responsiveness of demand for one good to changes in the price of another good.
- The significance of the **price elasticity of supply**, which measures the responsiveness of the quantity supplied to changes in price
- The factors that influence the size of these various elasticities

Defining and Measuring Elasticity

In order for Flunomics, a hypothetical flu vaccine distributor, to know whether it could raise its revenue by significantly raising the price of its flu vaccine during the 2004 flu vaccine panic, it would have to know the *price elasticity of demand* for flu vaccinations.

Calculating the Price Elasticity of Demand

Figure 6-1 shows a hypothetical demand curve for flu vaccinations. At a price of \$20 per vaccination, consumers would demand 10 million vaccinations per year (point A); at a price of \$21, the quantity demanded would fall to 9.9 million vaccinations per year (point B).

Figure 6-1, then, tells us the change in the quantity demanded for a particular change in the price. But how can we turn this into a measure of price responsiveness? The answer is to calculate the *price elasticity of demand*.

The **price elasticity of demand** compares the *percent change in quantity demanded* to the *percent change in price* as we move along the demand curve. As we'll see later in this chapter, the reason economists use percent changes is to get a measure that doesn't depend on the units in which a good is measured (say, a child-size dose versus an adult-size dose of vaccine). But before we get to that, let's look at how elasticity is calculated.

To calculate the price elasticity of demand, we first calculate the *percent change in the quantity demanded* and the corresponding *percent change in the price* as we move along the demand curve. These are defined as follows:

$$(6-1) \quad \% \text{ change in quantity demanded} = \frac{\text{Change in quantity demanded}}{\text{Initial quantity demanded}} \times 100$$

and

$$(6-2) \quad \% \text{ change in price} = \frac{\text{Change in price}}{\text{Initial price}} \times 100$$

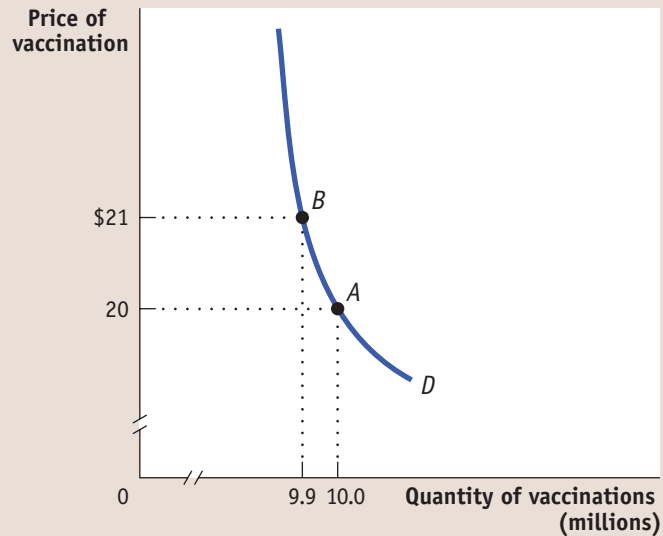
In Figure 6-1, we see that when the price rises from \$20 to \$21, the quantity demanded falls from 10 million to 9.9 million vaccinations, yielding a change in

The **price elasticity of demand** is the ratio of the percent change in the quantity demanded to the percent change in the price as we move along the demand curve (dropping the minus sign).

FIGURE 6-1

The Demand for Vaccinations

At a price of \$20 per vaccination, the quantity of vaccinations demanded is 10 million per year (point A). When price rises to \$21 per vaccination, the quantity demanded falls to 9.9 million vaccinations per year (point B).



the quantity demanded of 0.1 million vaccinations. So the percent change in the quantity demanded is

$$\% \text{ change in quantity demanded} = \frac{-0.1 \text{ million vaccinations}}{10 \text{ million vaccinations}} \times 100 = -1\%$$

The initial price is \$20 and the change in the price is \$1, so the percent change in price is

$$\% \text{ change in price} = \frac{\$1}{\$20} \times 100 = 5\%$$

To calculate the price elasticity of demand, we find the ratio of the percent change in the quantity demanded to the percent change in the price:

$$(6-3) \text{ Price elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$

In Figure 6-1, the price elasticity of demand is therefore

$$\text{Price elasticity of demand} = \frac{1\%}{5\%} = 0.2$$

The *law of demand* says that demand curves are downward sloping, so price and quantity demanded always move in opposite directions. In other words, a positive percent change in price (a rise in price) leads to a negative percent change in the quantity demanded; a negative percent change in price (a fall in price) leads to a positive percent change in the quantity demanded. This means that the price elasticity of demand is, in strictly mathematical terms, a negative number. However, it is inconvenient to repeatedly write a minus sign. So when economists talk about the price elasticity of demand, they usually drop the minus sign and report the absolute value of the price elasticity of demand. In this case, for example, economists would usually say “the price elasticity of demand is 0.2,” taking it for granted that you understand they mean *minus* 0.2. We follow this convention here.

The larger the price elasticity of demand, the more responsive the quantity demanded is to the price. When the price elasticity of demand is large—when consumers change their quantity demanded by a large percentage compared with the percent change in the price—economists say that demand is highly elastic.

The **midpoint method** is a technique for calculating the percent change. In this approach, we calculate changes in a variable compared with the average, or midpoint, of the starting and final values.

As we'll see shortly, a price elasticity of 0.2 indicates a small response of quantity demanded to price. That is, the quantity demanded will fall by a relatively small amount when price rises. This is what economists call *inelastic* demand. And inelastic demand was exactly what Flunomics needed for its strategy to increase revenue by raising the price of its flu vaccines.

An Alternative Way to Calculate Elasticities: the Midpoint Method

Price elasticity of demand compares the *percent change in quantity demanded* with the *percent change in price*. When we look at some other elasticities, which we will do shortly, we'll see why it is important to focus on percent changes. But at this point we need to discuss a technical issue that arises when you calculate percent changes in variables and how economists deal with it.

The best way to understand the issue is with a real example. Suppose you were trying to estimate the price elasticity of demand for gasoline by comparing gasoline prices and consumption in different countries. Because of high taxes, gasoline usually costs about three times as much per gallon in Europe as it does in the United States. So what is the percent difference between American and European gas prices?

Well, it depends on which way you measure it. Because the price of gasoline in Europe is approximately three times higher than in the United States, it is 200 percent higher. Because the price of gasoline in the United States is one-third as high as in Europe, it is 66.7 percent lower.

This is a nuisance: we'd like to have a percent measure of the difference in prices that doesn't depend on which way you measure it. A good way to avoid computing different elasticities for rising and falling prices is to use the *midpoint method*.

The **midpoint method** replaces the usual definition of the percent change in a variable, X , with a slightly different definition:

$$(6-4) \quad \% \text{ change in } X = \frac{\text{Change in } X}{\text{Average value of } X} \times 100$$

where the average value of X is defined as

$$\text{Average value of } X = \frac{\text{Starting value of } X + \text{Final value of } X}{2}$$

When calculating the price elasticity of demand using the midpoint method, both the percent change in the price and the percent change in the quantity demanded are found using this method. To see how this method works, suppose you have the following data for some good:

	Price	Quantity demanded
Situation A	\$0.90	1,100
Situation B	\$1.10	900

To calculate the percent change in quantity going from situation A to situation B, we compare the change in the quantity demanded—a fall of 200 units—with the *average* of the quantity demanded in the two situations. So we calculate

$$\% \text{ change in quantity demanded} = \frac{-200}{(1,100 + 900)/2} \times 100 = \frac{-200}{1,000} \times 100 = -20\%$$

In the same way, we calculate

$$\% \text{ change in price} = \frac{\$0.20}{(\$0.90 + \$1.10)/2} \times 100 = \frac{\$0.20}{\$1.00} \times 100 = 20\%$$

So in this case we would calculate the price elasticity of demand to be

$$\text{Price elasticity of demand} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}} = \frac{20\%}{20\%} = 1$$

again dropping the minus sign.

The important point is that we would get the same result, a price elasticity of demand of 1, whether we go up the demand curve from situation A to situation B or down from situation B to situation A.

To arrive at a more general formula for price elasticity of demand, suppose that we have data for two points on a demand curve. At point 1 the quantity demanded and price are (Q_1, P_1) ; at point 2 they are (Q_2, P_2) . Then the formula for calculating the price elasticity of demand is:

$$(6-5) \text{ Price elasticity of demand} = \frac{\frac{Q_2 - Q_1}{(Q_1 + Q_2)/2}}{\frac{P_2 - P_1}{(P_1 + P_2)/2}}$$

As before, when reporting a price elasticity of demand calculated by the midpoint method, we drop the minus sign and report the absolute value.

► **ECONOMICS IN ACTION**

Estimating Elasticities

You might think it's easy to estimate price elasticities of demand from real-world data: just compare percent changes in prices with percent changes in quantities demanded. Unfortunately, it's rarely that simple because changes in price aren't the only thing affecting changes in the quantity demanded: other factors—such as changes in income, changes in population, and changes in the prices of other goods—shift the demand curve, thereby changing the quantity demanded at any given price. To estimate price elasticities of demand, economists must use careful statistical analysis to separate the influence of these different factors, holding other things equal.

The most comprehensive effort to estimate price elasticities of demand was a mammoth study by the economists Hendrik S. Houthakker and Lester D. Taylor. Some of their results are summarized in Table 6-1. These estimates show a wide range of price elasticities. There are some goods, like eggs, for which demand hardly responds at all to changes in the price; there are other goods, most notably foreign travel, for which the quantity demanded is very sensitive to the price.

Notice that Table 6-1 is divided into two parts: inelastic and elastic demand. We'll explain in the next section the significance of that division. ▲

► **CHECK YOUR UNDERSTANDING** 6-1

1. The price of strawberries falls from \$1.50 to \$1.00 per carton and the quantity demanded goes from 100,000 to 200,000 cartons. Use the midpoint method to find the price elasticity of demand.
2. At the present level of consumption, 4,000 movie tickets, and at the current price, \$5 per ticket, the price elasticity of demand for movie tickets is 1. Using the midpoint method, calculate the percentage by which the owners of movie theaters must reduce price in order to sell 5,000 tickets.
3. The price elasticity of demand for ice-cream sandwiches is 1.2 at the current price of \$0.50 per sandwich and the current consumption level of 100,000 sandwiches. Calculate the change in the quantity demanded when price rises by \$0.05. Use Equations 6-1 and 6-2 to calculate percent changes and Equation 6-3 to relate price elasticity of demand to the percent changes.

Solutions appear at back of book.

TABLE 6-1

Some Estimated Price Elasticities of Demand

Good	Price elasticity of demand
Inelastic demand	
Eggs	0.1
Beef	0.4
Stationery	0.5
Gasoline	0.5
Elastic demand	
Housing	1.2
Restaurant meals	2.3
Airline travel	2.4
Foreign travel	4.1
Please find source information on the copyright page.	

►► **QUICK REVIEW**

- The **price elasticity of demand** is equal to the percent change in the quantity demanded divided by the percent change in the price as you move along the demand curve (dropping the minus sign).
- In practice, percent changes are best measured using the **midpoint method**, in which the percent change in each variable is calculated using the average of starting and final values.

Demand is **perfectly inelastic** when the quantity demanded does not respond at all to changes in the price. When demand is perfectly inelastic, the demand curve is a vertical line.

Interpreting the Price Elasticity of Demand

Med-Stat and other pharmaceutical distributors believed they could sharply drive up flu vaccine prices in the face of a shortage because the price elasticity of vaccine demand was low. But what does that mean? How low does a price elasticity have to be for us to classify it as low? How high does it have to be for us to consider it high? And what determines whether the price elasticity of demand is high or low, anyway?

To answer these questions, we need to look more deeply at the price elasticity of demand.

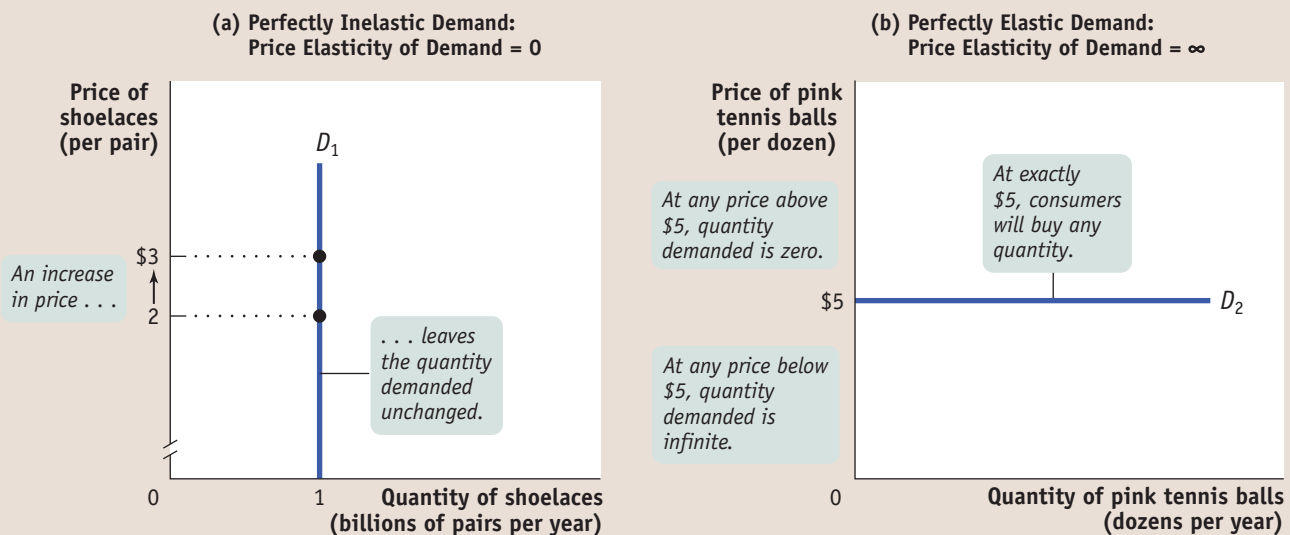
How Elastic Is Elastic?

As a first step toward classifying price elasticities of demand, let's look at the extreme cases.

First, consider the demand for a good when people pay no attention to the price—say, shoelaces. Suppose that consumers will buy 1 billion pairs of shoelaces per year regardless of the price. In this case, the demand curve for shoelaces would look like the curve shown in panel (a) of Figure 6-2: it would be a vertical line at 1 billion pairs of shoelaces. Since the percent change in the quantity demanded is zero for *any* change in the price, the price elasticity of demand in this case is zero. The case of a zero price elasticity of demand is known as **perfectly inelastic demand**.

The opposite extreme occurs when even a tiny rise in the price will cause the quantity demanded to drop to zero or even a tiny fall in the price will cause the quantity demanded to get extremely large. Panel (b) of Figure 6-2 shows the case of pink tennis balls; we suppose that tennis players really don't care what color their balls are and that other colors, such as neon green and vivid yellow, are available at \$5 per dozen balls. In this case, consumers will buy no pink balls if they cost more than \$5 per dozen but will buy only pink balls if they cost less than \$5. The demand curve will therefore be a horizontal line at a price of \$5 per dozen balls. As you move back and forth along this line, there is a change in the quantity demanded but no change in the price. Roughly

FIGURE 6-2 Two Extreme Cases of Price Elasticity of Demand



Panel (a) shows a perfectly inelastic demand curve, which is a vertical line. The quantity of shoelaces demanded is always 1 billion pairs, regardless of price. As a result, the price elasticity of demand is zero—the quantity demanded is unaffected by the price. Panel (b) shows a perfectly

elastic demand curve, which is a horizontal line. At a price of \$5, consumers will buy any quantity of pink tennis balls, but will buy none at a price above \$5. If the price falls below \$5, they will buy an extremely large number of pink tennis balls and none of any other color.

speaking, when you divide a number by zero, you get infinity, denoted by the symbol ∞ . So a horizontal demand curve implies an infinite price elasticity of demand. When the price elasticity of demand is infinite, economists say that demand is **perfectly elastic**.

The price elasticity of demand for the vast majority of goods is somewhere between these two extreme cases. Economists use one main criterion for classifying these intermediate cases: they ask whether the price elasticity of demand is greater or less than 1. When the price elasticity of demand is greater than 1, economists say that demand is **elastic**. When the price elasticity of demand is less than 1, they say that demand is **inelastic**. The borderline case is **unit-elastic demand**, where the price elasticity of demand is—surprise—exactly 1.

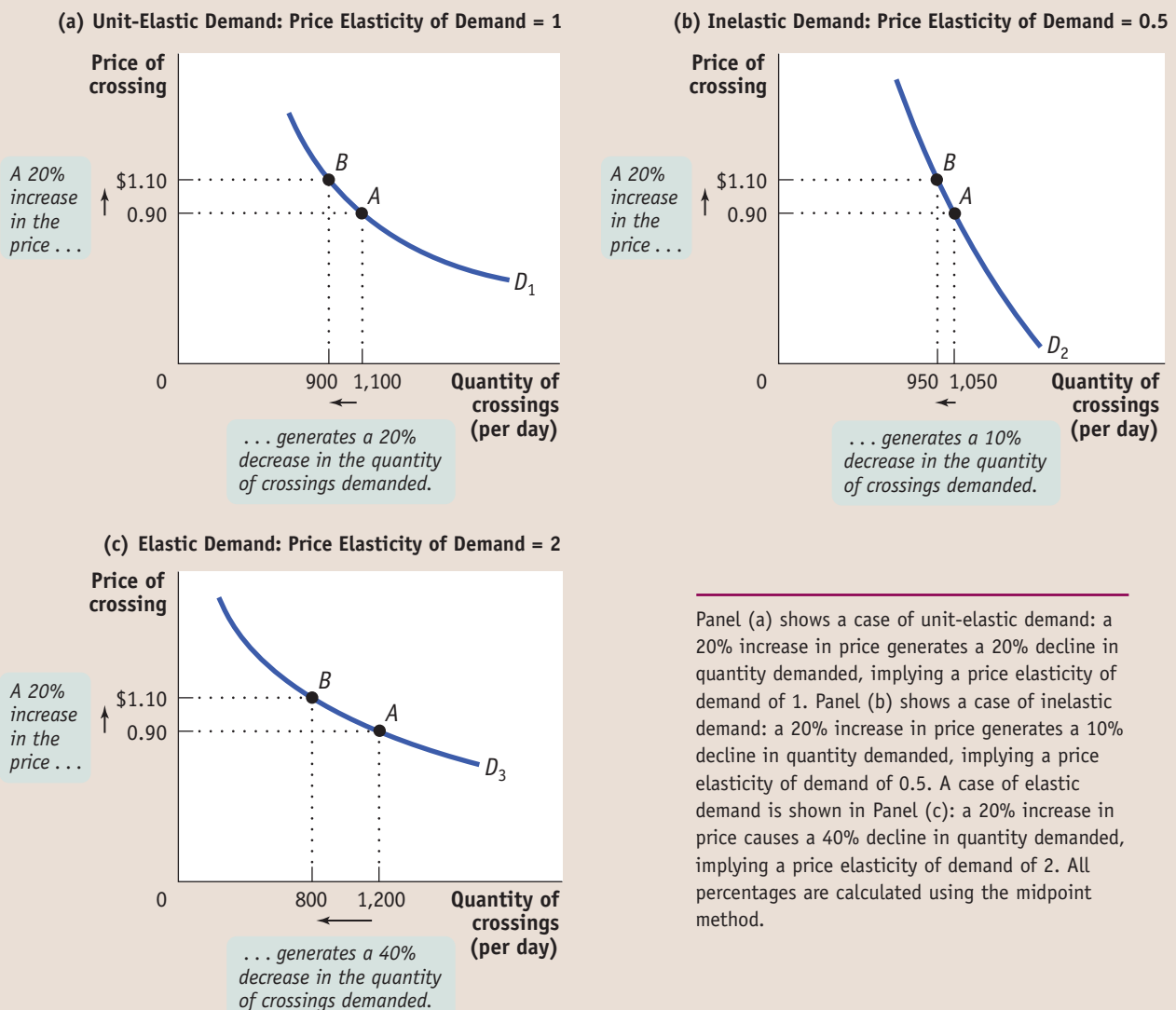
To see why a price elasticity of demand equal to 1 is a useful dividing line, let's consider a hypothetical example: a toll bridge operated by the state highway department. Other things equal, the number of drivers who use the bridge depends on the toll, the price the highway department charges for crossing the bridge: the higher the toll, the fewer the drivers who use the bridge.

Figure 6-3 shows three hypothetical demand curves—one in which demand is unit-elastic, one in which it is inelastic, and one in which it is elastic. In each case, point

Demand is **perfectly elastic** when any price increase will cause the quantity demanded to drop to zero. When demand is perfectly elastic, the demand curve is a horizontal line.

Demand is **elastic** if the price elasticity of demand is greater than 1, **inelastic** if the price elasticity of demand is less than 1, and **unit-elastic** if the price elasticity of demand is exactly 1.

FIGURE 6-3 Unit-Elastic Demand, Inelastic Demand, and Elastic Demand



The **total revenue** is the total value of sales of a good or service. It is equal to the price multiplied by the quantity sold.

A shows the quantity demanded if the toll is \$0.90 and point B shows the quantity demanded if the toll is \$1.10. An increase in the toll from \$0.90 to \$1.10 is an increase of 20% if we use the midpoint method to calculate percent changes.

Panel (a) shows what happens when the toll is raised from \$0.90 to \$1.10 and the demand curve is unit-elastic. Here the 20% price rise leads to a fall in the quantity of cars using the bridge each day from 1,100 to 900, which is a 20% decline (again using the midpoint method). So the price elasticity of demand is $20\%/20\% = 1$.

Panel (b) shows a case of inelastic demand when the toll is raised from \$0.90 to \$1.10. The same 20% price rise reduces the quantity demanded from 1,050 to 950. That's only a 10% decline, so in this case the price elasticity of demand is $10\%/20\% = 0.5$.

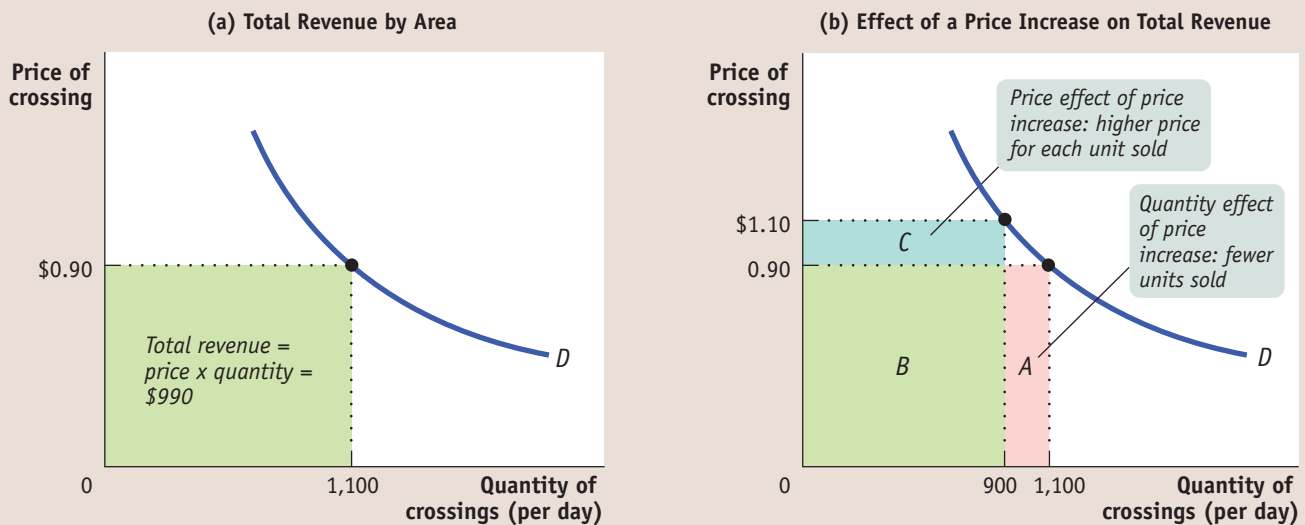
Panel (c) shows a case of elastic demand when the toll is raised from \$0.90 to \$1.10. The 20% price increase causes the quantity demanded to fall from 1,200 to 800—a 40% decline, so the price elasticity of demand is $40\%/20\% = 2$.

Why does it matter whether demand is unit-elastic, inelastic, or elastic? Because this classification predicts how changes in the price of a good will affect the *total revenue* earned by producers from the sale of that good. In many real-life situations, such as the one faced by Med-Stat, it is crucial to know how price changes affect total revenue. **Total revenue** is defined as the total value of sales of a good or service: the price multiplied by the quantity sold.

$$(6-6) \text{ Total revenue} = \text{Price} \times \text{Quantity sold}$$

Total revenue has a useful graphical representation that can help us understand why knowing the price elasticity of demand is crucial when we ask whether a price rise will increase or reduce total revenue. Panel (a) of Figure 6-4 shows the same demand curve as panel (a) of Figure 6-3. We see that 1,100 drivers will use the bridge if the toll is \$0.90. So the total revenue at a price of \$0.90 is $\$0.90 \times 1,100 = \990 . This value is equal to the area of the green rectangle, which is drawn with the bottom left corner at the point (0, 0) and the top right corner at (1,100, 0.90). In general,

FIGURE 6-4 Total Revenue



The green rectangle in panel (a) represents total revenue generated from 1,100 drivers who each pay a toll of \$0.90. Panel (b) shows how total revenue is affected when the price increases from \$0.90 to \$1.10. Due to the quantity effect,

total revenue falls by area A. Due to the price effect, total revenue increases by the area C. In general, the overall effect can go either way, depending on the price elasticity of demand.

the total revenue at any given price is equal to the area of a rectangle whose height is the price and whose width is the quantity demanded at that price.

To get an idea of why total revenue is important, consider the following scenario. Suppose that the toll on the bridge is currently \$0.90 but that the highway department must raise extra money for road repairs. One way to do this is to raise the toll on the bridge. But this plan might backfire, since a higher toll will reduce the number of drivers who use the bridge. And if traffic on the bridge dropped a lot, a higher toll would actually reduce total revenue instead of increasing it. So it's important for the highway department to know how drivers will respond to a toll increase.

We can see graphically how the toll increase affects total bridge revenue by examining panel (b) of Figure 6-4. At a toll of \$0.90, total revenue is given by the sum of the areas A and B. After the toll is raised to \$1.10, total revenue is given by the sum of areas B and C. So when the toll is raised, revenue represented by area A is lost but revenue represented by area C is gained. These two areas have important interpretations. Area C represents the revenue gain that comes from the additional \$0.20 paid by drivers who continue to use the bridge. That is, the 900 who continue to use the bridge contribute an additional $\$0.20 \times 900 = \180 per day to total revenue, represented by area C. But 200 drivers who would have used the bridge at a price of \$0.90 no longer do so, generating a loss to total revenue of $\$0.90 \times 200 = \180 per day, represented by area A. (In this particular example, because demand is unit-elastic—the same as in panel (a) of Figure 6-3—the rise in the toll has no effect on total revenue; areas A and B are the same size.)

Except in the rare case of a good with perfectly elastic or perfectly inelastic demand, when a seller raises the price of a good, two countervailing effects are present:

- *A price effect.* After a price increase, each unit sold sells at a higher price, which tends to raise revenue.
- *A quantity effect.* After a price increase, fewer units are sold, which tends to lower revenue.

But then, you may ask, what is the net ultimate effect on total revenue: does it go up or down? The answer is that, in general, the effect on total revenue can go either way—a price rise may either increase total revenue or lower it. If the price effect, which tends to raise total revenue, is the stronger of the two effects, then total revenue goes up. If the quantity effect, which tends to reduce total revenue, is the stronger, then total revenue goes down. And if the strengths of the two effects are exactly equal—as in our toll bridge example, where a \$180 gain offsets a \$180 loss—total revenue is unchanged by the price increase.

The price elasticity of demand tells us what happens to total revenue when price changes: its size determines which effect—the price effect or the quantity effect—is stronger. Specifically:

- If demand for a good is *unit-elastic* (the price elasticity of demand is 1), an increase in price does not change total revenue. In this case, the quantity effect and the price effect exactly offset each other.
- If demand for a good is *inelastic* (the price elasticity of demand is less than 1), a higher price increases total revenue. In this case, the price effect is stronger than the quantity effect.
- If demand for a good is *elastic* (the price elasticity of demand is greater than 1), an increase in price reduces total revenue. In this case, the quantity effect is stronger than the price effect.

Table 6-2 on the next page shows how the effect of a price increase on total revenue depends on the price elasticity of demand, using the same data as in Figure 6-3. An increase in the price from \$0.90 to \$1.10 leaves total revenue unchanged at \$990 when demand is unit-elastic. When demand is inelastic, the price effect dominates the quantity effect; the same price increase leads to an increase in total revenue

TABLE 6-2

Price Elasticity of Demand and Total Revenue

	Price of crossing = \$0.90	Price of crossing = \$1.10
Unit-elastic demand (price elasticity of demand = 1)		
Quantity demanded	1,100	900
Total revenue	\$990	\$990
Inelastic demand (price elasticity of demand = 0.5)		
Quantity demanded	1,050	950
Total revenue	\$945	\$1,045
Elastic demand (price elasticity of demand = 2)		
Quantity demanded	1,200	800
Total revenue	\$1,080	\$880

from \$945 to \$1,045. And when demand is elastic, the quantity effect dominates the price effect; the price increase leads to a decline in total revenue from \$1,080 to \$880.

The price elasticity of demand also predicts the effect of a *fall* in price on total revenue. When the price falls, the same two countervailing effects are present, but they work in the opposite directions as compared to the case of a price rise. There is the price effect of a lower price per unit sold, which tends to lower revenue. This is countered by the quantity effect of more units sold, which tends to raise revenue. Which effect dominates depends on the price elasticity. Here is a quick summary:

- When demand is *unit-elastic*, the two effects exactly balance; so a fall in price has no effect on total revenue.
- When demand is *inelastic*, the price effect dominates the quantity effect; so a fall in price reduces total revenue.
- When demand is *elastic*, the quantity effect dominates the price effect; so a fall in price increases total revenue.

Price Elasticity Along the Demand Curve

Suppose an economist says that “the price elasticity of demand for coffee is 0.25.” What he or she means is that *at the current price* the elasticity is 0.25. In the previous discussion of the toll bridge, what we were really describing was the elasticity *at the price* of \$0.90. Why this qualification? Because for the vast majority of demand curves, the price elasticity of demand at one point along the curve is different from the price elasticity of demand at other points along the same curve.

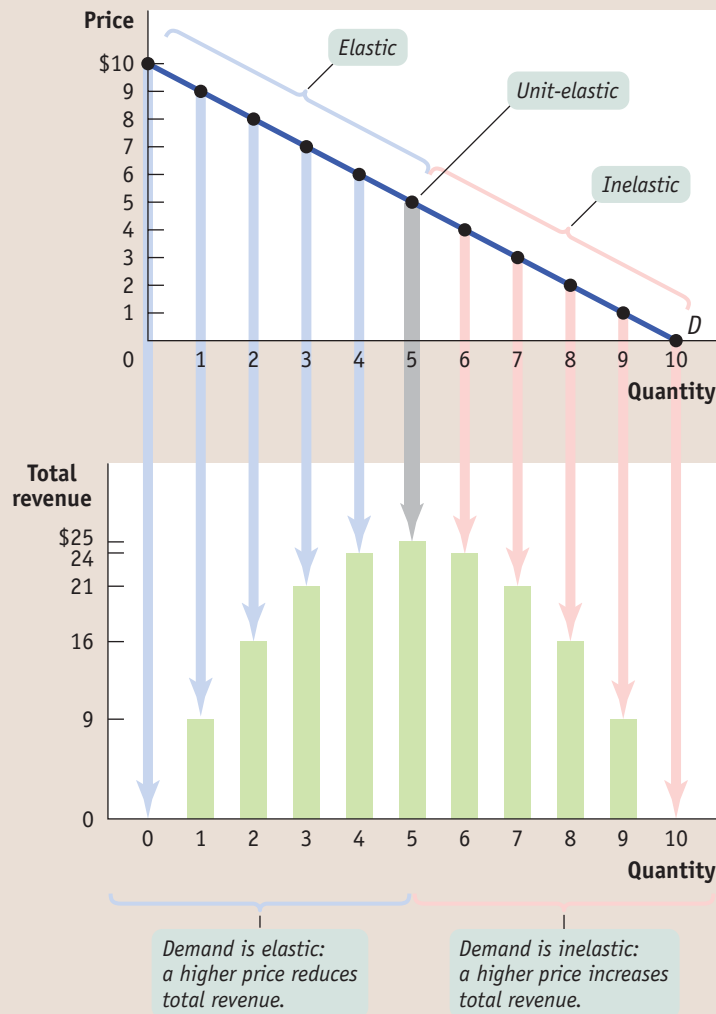
To see this, consider the table in Figure 6-5, which shows a hypothetical demand schedule. It also shows in the last column the total revenue generated at each price and quantity combination in the demand schedule. The upper panel of the graph in Figure 6-5 shows the corresponding demand curve. The lower panel illustrates the same data on total revenue: the height of a bar at each quantity demanded—which corresponds to a particular price—measures the total revenue generated at that price.

In Figure 6-5, you can see that when the price is low, raising the price increases total revenue: starting at a price of \$1, raising the price to \$2 increases total revenue from \$9 to \$16. This means that when the price is low, demand is inelastic. Moreover, you can see that demand is inelastic on the entire section of the demand curve from a price of \$0 to a price of \$5.

When the price is high, however, raising it further reduces total revenue: starting at a price of \$8, raising the price to \$9 reduces total revenue, from \$16 to \$9. This

FIGURE 6-5

The Price Elasticity of Demand Changes Along the Demand Curve



Demand Schedule and Total Revenue for a Linear Demand Curve

Price	Quantity demanded	Total revenue
\$0	10	\$0
1	9	9
2	8	16
3	7	21
4	6	24
5	5	25
6	4	24
7	3	21
8	2	16
9	1	9
10	0	0

The upper panel shows a demand curve corresponding to the demand schedule in the table. The lower panel shows how total revenue changes along that demand curve: at each price and quantity combination, the height of the bar represents the total revenue generated. You can see that at a low price, raising the price increases total revenue. So demand is inelastic at low prices. At a high price, however, a rise in price reduces total revenue. So demand is elastic at high prices.

means that when the price is high, demand is elastic. Furthermore, you can see that demand is elastic over the section of the demand curve from a price of \$5 to \$10.

For the vast majority of goods, the price elasticity of demand changes along the demand curve. So whenever you measure a good's elasticity, you are really measuring it at a particular point or section of the good's demand curve.

What Factors Determine the Price Elasticity of Demand?

The flu vaccine shortfall of 2004–2005 allowed vaccine distributors to significantly raise their prices for two important reasons: there were no substitutes, and for many people the vaccine was a medical necessity. People responded in various ways. Some paid the high prices, and some traveled to Canada and other countries to get vaccinated. Some simply did without (and over time often changed their habits to avoid catching the flu, such as eating out less often and avoiding mass transit). This experience illustrates the four main factors that determine elasticity: whether close substitutes are available, whether the good is a necessity or a luxury, the share of income a consumer spends on the good, and how much time has elapsed since the price change. We'll briefly examine each of these factors.

Whether Close Substitutes Are Available The price elasticity of demand tends to be high if there are other goods that consumers regard as similar and would be willing to consume instead. The price elasticity of demand tends to be low if there are no close substitutes.

Whether the Good Is a Necessity or a Luxury The price elasticity of demand tends to be low if a good is something you must have, like a life-saving medicine. The price elasticity of demand tends to be high if the good is a luxury—something you can easily live without.

Share of Income Spent on the Good The price elasticity of demand tends to be low when spending on a good accounts for a small share of a consumer's income. In that case, a significant change in the price of the good has little impact on how much the consumer spends. In contrast, when a good accounts for a significant share of a consumer's spending, the consumer is likely to be very responsive to a change in price. In this case, the price elasticity of demand is high.

Time In general, the price elasticity of demand tends to increase as consumers have more time to adjust to a price change. This means that the long-run price elasticity of demand is often higher than the short-run elasticity.

A good illustration of the effect of time on the elasticity of demand is drawn from the 1970s, the first time gasoline prices increased dramatically in the United States. Initially, consumption fell very little because there were no close substitutes for gasoline and because driving their cars was necessary for people to carry out the ordinary tasks of life. Over time, however, Americans changed their habits in ways that enabled them to gradually reduce their gasoline consumption. The result was a steady decline in gasoline consumption over the next decade, even though the price of gasoline did not continue to rise, confirming that the long-run price elasticity of demand for gasoline was indeed much larger than the short-run elasticity.



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►ECONOMICS IN ACTION

Responding to Your Tuition Bill

College costs more than ever—and not just because of overall inflation. Tuition has been rising faster than the overall cost of living for years. But does rising tuition keep people from going to college? Two studies found that the answer depends on the type of college. Both studies assessed how responsive the decision to go to college is to a change in tuition.

A 1988 study found that a 3% increase in tuition led to an approximately 2% fall in the number of students enrolled at four-year institutions, giving a price elasticity of demand of 0.67 ($2\%/3\%$). In the case of two-year institutions, the study found a significantly higher response: a 3% increase in tuition led to a 2.7% fall in enrollments, giving a price elasticity of demand of 0.9. In other words, the enrollment decision for students at two-year colleges was significantly more responsive to price than for students at four-year colleges. The result: students at two-year colleges are more likely to forgo getting a degree because of tuition costs than students at four-year colleges.

A 1999 study confirmed this pattern. In comparison to four-year colleges, it found that two-year college enrollment rates were significantly more responsive to changes in state financial aid (a decline in aid leading to a decline in enrollments), a predictable effect given these students' greater sensitivity to the cost of tuition. Another piece of evidence suggests that students at two-year colleges are more likely to be paying their own way and making a trade-off between attending college versus working: the study found that enrollments at two-year colleges are much more responsive to changes in the unemployment rate (an increase in the unemployment rate leading to an increase in enrollments) than enrollments at four-year colleges. So is the cost of tuition a barrier to getting a college degree in the United States? Yes, but more so at two-year colleges than at four-year colleges.

Interestingly, the 1999 study found that for both two-year and four-year colleges, price sensitivity of demand had fallen somewhat since the 1988 study. One possible explanation is that because the value of a college education has risen considerably over time, fewer people forgo college, even if tuition goes up. (See source note on copyright page.) ▲

► CHECK YOUR UNDERSTANDING 6-2

- For each case, choose the condition that characterizes demand: elastic demand, inelastic demand, or unit-elastic demand.
 - Total revenue decreases when price increases.
 - The additional revenue generated by an increase in quantity sold is exactly offset by revenue lost from the fall in price received per unit.
 - Total revenue falls when output increases.
 - Producers in an industry find they can increase their total revenues by working together to reduce industry output.
- For the following goods, what is the elasticity of demand? Explain. What is the shape of the demand curve?
 - Demand by a snake-bite victim for an antidote
 - Demand by students for green erasers

Solutions appear at back of book.

►► QUICK REVIEW

- Demand is **perfectly inelastic** if it is completely unresponsive to price. It is **perfectly elastic** if it is infinitely responsive to price.
- Demand is **elastic** if the price elasticity of demand is greater than 1; it is **inelastic** if the price elasticity of demand is less than 1; and it is **unit-elastic** if the price elasticity of demand is exactly 1.
- When demand is elastic, the quantity effect of a price increase dominates the price effect and **total revenue** falls. When demand is inelastic, the price effect of a price increase dominates the quantity effect and total revenue rises.
- Because the price elasticity of demand can change along the demand curve, economists refer to a particular point on the demand curve when speaking of “the” price elasticity of demand.
- The availability of close substitutes makes demand for a good more elastic, as does the length of time elapsed since the price change. Demand for a necessary good is less elastic, and demand for a luxury good is more elastic. Demand tends to be inelastic for goods that absorb a small share of a consumer's income and elastic for goods that absorb a large share of income.

Other Demand Elasticities

The quantity of a good demanded depends not only on the price of that good but also on other variables. In particular, demand curves shift because of changes in the prices of related goods and changes in consumers' incomes. It is often important to have a measure of these other effects, and the best measures are—you guessed it—elasticities. Specifically, we can best measure how the demand for a good is affected by prices of other goods using a measure called the *cross-price elasticity of demand*, and we can best measure how demand is affected by changes in income using the *income elasticity of demand*.

The Cross-Price Elasticity of Demand

In Chapter 3 you learned that the demand for a good is often affected by the prices of other, related goods—goods that are substitutes or complements. There you saw that a change in the price of a related good shifts the demand curve of the original good, reflecting a change in the quantity demanded at any given price. The strength of such a “cross” effect on demand can be measured by the **cross-price elasticity of demand**, defined as the ratio of the percent change in the quantity demanded of one good to the percent change in the price of the other.

The **cross-price elasticity of demand** between two goods measures the effect of the change in one good's price on the quantity demanded of the other good. It is equal to the percent change in the quantity demanded of one good divided by the percent change in the other good's price.

The **income elasticity of demand** is the percent change in the quantity of a good demanded when a consumer's income changes divided by the percent change in the consumer's income.

(6-7) Cross-price elasticity of demand between goods A and B

$$= \frac{\% \text{ change in quantity of A demanded}}{\% \text{ change in price of B}}$$

When two goods are substitutes, like hot dogs and hamburgers, the cross-price elasticity of demand is positive: a rise in the price of hot dogs increases the demand for hamburgers—that is, it causes a rightward shift of the demand curve for hamburgers. If the goods are close substitutes, the cross-price elasticity will be positive and large; if they are not close substitutes, the cross-price elasticity will be positive and small. So when the cross-price elasticity of demand is positive, its size is a measure of how closely substitutable the two goods are.

When two goods are complements, like hot dogs and hot dog buns, the cross-price elasticity is negative: a rise in the price of hot dogs decreases the demand for hot dog buns—that is, it causes a leftward shift of the demand curve for hot dog buns. As with substitutes, the size of the cross-price elasticity of demand between two complements tells us how strongly complementary they are: if the cross-price elasticity is only slightly below zero, they are weak complements; if it is very negative, they are strong complements.

Note that in the case of the cross-price elasticity of demand, the sign (plus or minus) is very important: it tells us whether the two goods are complements or substitutes. So we cannot drop the minus sign as we did for the price elasticity of demand.

Our discussion of the cross-price elasticity of demand is a useful place to return to a point we made earlier: elasticity is a *unit-free* measure—that is, it doesn't depend on the units in which goods are measured.

To see the potential problem, suppose someone told you that “if the price of hot dog buns rises by \$0.30, Americans will buy 10 million fewer hot dogs this year.” If you've ever bought hot dog buns, you'll immediately wonder: is that a \$0.30 increase in the price *per bun*, or is it a \$0.30 increase in the price *per package* (buns are usually sold by the dozen)? It makes a big difference what units we are talking about! However, if someone says that the cross-price elasticity of demand between buns and hot dogs is -0.3 , it doesn't matter whether buns are sold individually or by the package. So elasticity is defined as a ratio of percent changes, as a way of making sure that confusion over units doesn't arise.

The Income Elasticity of Demand

The **income elasticity of demand** is a measure of how much the demand for a good is affected by changes in consumers' incomes. It allows us to determine whether a good is a normal or inferior good as well as to measure how intensely the demand for the good responds to changes in income.

(6-8) Income elasticity of demand = $\frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$

Just as the cross-price elasticity of demand between two goods can be either positive or negative, depending on whether the goods are substitutes or complements, the income elasticity of demand for a good can also be either positive or negative. Recall from Chapter 3 that goods can be either *normal goods*, for which demand increases when income rises, or *inferior goods*, for which demand decreases when income rises. These definitions relate directly to the sign of the income elasticity of demand:

- When the income elasticity of demand is positive, the good is a normal good—that is, the quantity demanded at any given price increases as income increases.
- When the income elasticity of demand is negative, the good is an inferior good—that is, the quantity demanded at any given price decreases as income increases.

FOR INQUIRING MINDS

Where Have All the Farmers Gone?

What percentage of Americans live on farms? Sad to say, the U.S. government no longer publishes that number. In 1991 the official percentage was 1.9, but in that year the government decided it was no longer a meaningful indicator of the size of the agricultural sector because a large proportion of those who live on farms actually make their living doing something else. But in the days of the Founding Fathers, the great majority of Americans lived on farms. As recently as the 1940s, one American in six—or approximately 17%—still did.

Why do so few people now live and work on farms in the United States? There are two main reasons, both involving elasticities.

First, the income elasticity of demand for food is much less than 1—it is income-

inelastic. As consumers grow richer, other things equal, spending on food rises less than income. As a result, as the U.S. economy has grown, the share of income it spends on food—and therefore the share of total U.S. income earned by farmers—has fallen.

Second, agriculture has been a technologically progressive sector for approximately 150 years in the United States, with steadily increasing yields over time. You might think that technological progress would be good for farmers. But competition among farmers means that technological progress leads to lower food prices. Meanwhile, the demand for food is price-inelastic, so falling prices of agricultural goods, other things equal, reduce the total revenue of farmers. That's right:

progress in farming is good for consumers but bad for farmers.

The combination of these effects explains the relative decline of farming. Even if farming weren't such a technologically progressive sector, the low income elasticity of demand for food would ensure that the income of farmers grows more slowly than the economy as a whole. The combination of rapid technological progress in farming with price-inelastic demand for farm products reinforces this effect, further reducing the growth of farm income. In short, the U.S. farm sector has been a victim of success—the U.S. economy's success as a whole (which reduces the importance of spending on food) and its own success in increasing yields.

Economists often use estimates of the income elasticity of demand to predict which industries will grow most rapidly as the incomes of consumers grow over time. In doing this, they often find it useful to make a further distinction among normal goods, identifying which are *income-elastic* and which are *income-inelastic*.

The demand for a good is **income-elastic** if the income elasticity of demand for that good is greater than 1. When income rises, the demand for income-elastic goods rises *faster* than income. Luxury goods such as second homes and international travel tend to be income-elastic. The demand for a good is **income-inelastic** if the income elasticity of demand for that good is positive but less than 1. When income rises, the demand for income-inelastic goods rises, but more slowly than income. Necessities such as food and clothing tend to be income-inelastic.

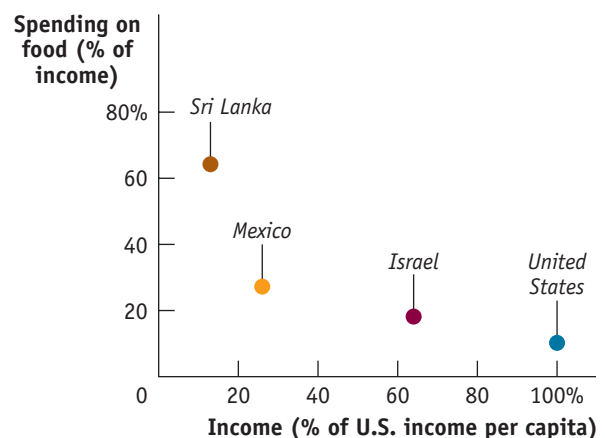
The demand for a good is **income-elastic** if the income elasticity of demand for that good is greater than 1.

The demand for a good is **income-inelastic** if the income elasticity of demand for that good is positive but less than 1.



FOOD'S BITE IN WORLD BUDGETS

If the income elasticity of demand for food is less than 1, we would expect to find that people in poor countries spend a larger share of their income on food than people in rich countries. And that's exactly what the data show. In this graph, we compare per capita income—a country's total income, divided by the population—with the share of income that is spent on food. (To make the graph a manageable size, per capita income is measured as a percentage of U.S. per capita income.) In very poor countries, like Sri Lanka, people spend most of their income on food. In middle-income countries, like Israel, the share of spending that goes to food is much lower. And it's even lower in rich countries, like the United States.



Data: Food shares from U.S. Department of Agriculture database. Income per capita from OECD, *The World Economy: Historical Statistics*.

other than Chiron. In fact, if the rise in price had precipitated a significant increase in flu vaccine production, the price would have been pushed back down. But that didn't happen because, as we mentioned earlier, it would have been far too costly and technically difficult to produce more vaccine for the 2004–2005 flu season. (In reality, the production of flu vaccine is begun a year before it is to be distributed.) This was another critical element in the ability of some flu vaccine distributors, like Med-Stat, to get significantly higher prices for their product: a low responsiveness in the quantity of output supplied to the higher price of flu vaccine by flu vaccine producers. To measure the response of producers to price changes, we need a measure parallel to the price elasticity of demand—the *price elasticity of supply*.

The **price elasticity of supply** is a measure of the responsiveness of the quantity of a good supplied to the price of that good. It is the ratio of the percent change in the quantity supplied to the percent change in the price as we move along the supply curve.

Measuring the Price Elasticity of Supply

The **price elasticity of supply** is defined the same way as the price elasticity of demand (although there is no minus sign to be eliminated here):

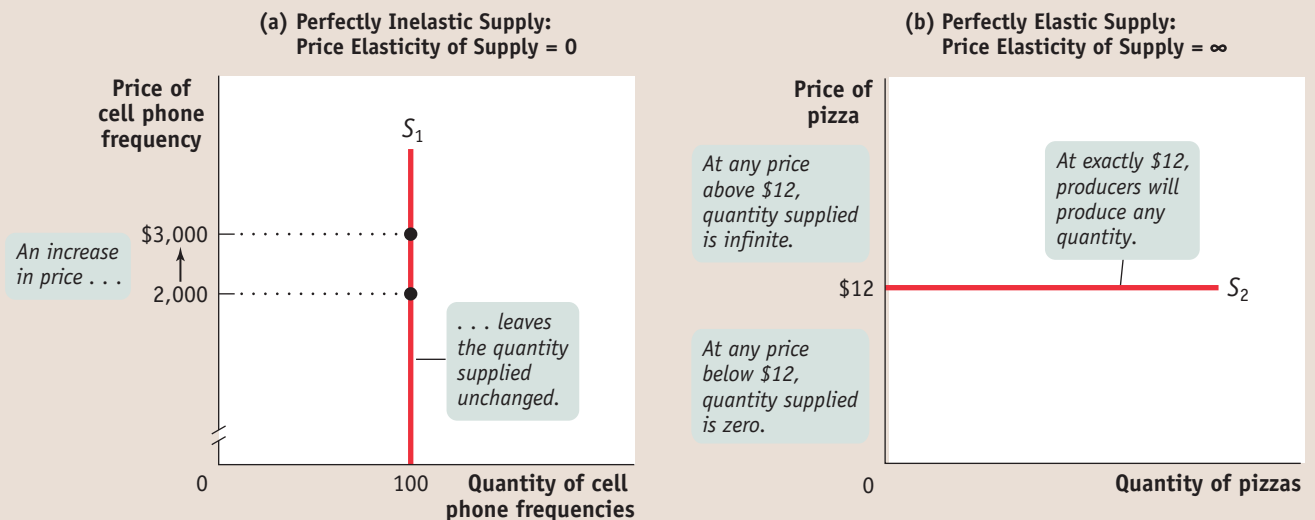
$$(6-9) \text{ Price elasticity of supply} = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

The only difference is that here we consider movements along the supply curve rather than movements along the demand curve.

Suppose that the price of tomatoes rises by 10%. If the quantity of tomatoes supplied also increases by 10% in response, the price elasticity of supply of tomatoes is 1 (10%/10%) and supply is unit-elastic. If the quantity supplied increases by 5%, the price elasticity of supply is 0.5 and supply is inelastic; if the quantity increases by 20%, the price elasticity of supply is 2 and supply is elastic.

As in the case of demand, the extreme values of the price elasticity of supply have a simple graphical representation. Panel (a) of Figure 6-6 shows the supply of cell phone frequencies, the portion of the radio spectrum that is suitable for sending and receiving cell phone signals. Governments own the right to sell the use of this part

FIGURE 6-6 Two Extreme Cases of Price Elasticity of Supply



Panel (a) shows a perfectly inelastic supply curve, which is a vertical line. The price elasticity of supply is zero: the quantity supplied is always the same, regardless of price. Panel (b) shows a perfectly elastic supply curve,

which is a horizontal line. At a price of \$12, producers will supply any quantity, but they will supply none at a price below \$12. If price rises above \$12, they will supply an extremely large quantity.

There is **perfectly inelastic supply** when the price elasticity of supply is zero, so that changes in the price of the good have no effect on the quantity supplied. A perfectly inelastic supply curve is a vertical line.

There is **perfectly elastic supply** when even a tiny increase or reduction in the price will lead to very large changes in the quantity supplied, so that the price elasticity of supply is infinite. A perfectly elastic supply curve is a horizontal line.

of the radio spectrum to cell phone operators inside their borders. But governments can't increase or decrease the number of cell phone frequencies that they have to offer—for technical reasons, the quantity of frequencies suitable for cell phone operation is a fixed quantity. So the supply curve for cell phone frequencies is a vertical line, which we have assumed is set at the quantity of 100 frequencies. As you move up and down that curve, the change in the quantity supplied by the government is zero, whatever the change in price. So panel (a) illustrates a case in which the price elasticity of supply is zero. This is a case of **perfectly inelastic supply**.

Panel (b) shows the supply curve for pizza. We suppose that it costs \$12 to produce a pizza, including all opportunity costs. At any price below \$12, it would be unprofitable to produce pizza and all the pizza parlors in America would go out of business. Alternatively, there are many producers who could operate pizza parlors if they were profitable. The ingredients—flour, tomatoes, cheese—are plentiful. And if necessary, more tomatoes could be grown, more milk could be produced to make mozzarella, and so on. So any price above \$12 would elicit an extremely large quantity of pizzas supplied. The implied supply curve is therefore a horizontal line at \$12. Since even a tiny increase in the price would lead to a huge increase in the quantity supplied, the price elasticity of supply would be more or less infinite. This is a case of **perfectly elastic supply**.

As our cell phone frequencies and pizza examples suggest, real-world instances of both perfectly inelastic and perfectly elastic supply are easy to find—much easier than their counterparts in demand.

What Factors Determine the Price Elasticity of Supply?

Our examples tell us the main determinant of the price elasticity of supply: the availability of inputs. In addition, as with the price elasticity of demand, time may also play a role in the price elasticity of supply. Here we briefly summarize the two factors.

The Availability of Inputs The price elasticity of supply tends to be large when inputs are readily available and can be shifted into and out of production at a relatively low cost. It tends to be small when inputs are difficult to obtain—and can be shifted into and out of production only at a relatively high cost.

Time The price elasticity of supply tends to grow larger as producers have more time to respond to a price change. This means that the long-run price elasticity of supply is often higher than the short-run elasticity. (In the case of the flu vaccine shortfall, time was the crucial element because flu vaccine must be grown in cultures over many months.)

The price elasticity of pizza supply is very high because the inputs needed to expand the industry are readily available. The price elasticity of cell phone frequencies is zero because an essential input—the radio spectrum—cannot be increased at all.

Many industries are like pizza and have large price elasticities of supply: they can be readily expanded because they don't require any special or unique resources. On the other hand, the price elasticity of supply is usually substantially less than perfectly elastic for goods that involve limited natural resources: minerals like gold or copper, agricultural products like coffee that flourish only on certain types of land, and renewable resources like ocean fish that can only be exploited up to a point without destroying the resource.

But given enough time, producers are often able to significantly change the amount they produce in response to a price change, even when production involves

TABLE 6-3

An Elasticity Menagerie

Name	Possible values	Significance
Price elasticity of demand = $\frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$ (dropping the minus sign)		
Perfectly inelastic demand	0	Price has no effect on quantity demanded (vertical demand curve).
Inelastic demand	Between 0 and 1	A rise in price increases total revenue.
Unit-elastic demand	Exactly 1	Changes in price have no effect on total revenue.
Elastic demand	Greater than 1, less than ∞	A rise in price reduces total revenue.
Perfectly elastic demand	∞	A rise in price causes quantity demanded to fall to 0. A fall in price leads to an infinite quantity demanded (horizontal demand curve).
Cross-price elasticity of demand = $\frac{\% \text{ change in quantity of one good demanded}}{\% \text{ change in price of another good}}$		
Complements	Negative	Quantity demanded of one good falls when the price of another rises.
Substitutes	Positive	Quantity demanded of one good rises when the price of another rises.
Income elasticity of demand = $\frac{\% \text{ change in quantity demanded}}{\% \text{ change in income}}$		
Inferior good	Negative	Quantity demanded falls when income rises.
Normal good, income-inelastic	Positive, less than 1	Quantity demanded rises when income rises, but not as rapidly as income.
Normal good, income-elastic	Greater than 1	Quantity demanded rises when income rises, and more rapidly than income.
Price elasticity of supply = $\frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$		
Perfectly inelastic supply	0	Price has no effect on quantity supplied (vertical supply curve).
	Greater than 0, less than ∞	Ordinary upward-sloping supply curve.
Perfectly elastic supply	∞	Any fall in price causes quantity supplied to fall to 0. Any rise in price elicits an infinite quantity supplied (horizontal supply curve).

>> A LOOK AHEAD...

The concept of elasticity deepens our understanding of supply and demand, helping us to predict changes in equilibrium prices and quantities in response to events. For example, we now know why vaccine distributors could significantly raise the market price of flu vaccine during the 2004–2005 flu season—because both supply and demand for flu vaccine were inelastic. Using the concept of income elasticity, we’ve also learned how changes in the incomes of consumers affect the demand for a good. With this we can explain why you’d rather be a fast-food producer than a farmer in a country where incomes are growing quickly.

But there is even more to learn with the help of elasticities. In the next chapter, we’ll see that elasticities are vitally important for tax policy: in determining how much revenue is gained by imposing a tax, in determining who actually pays the cost of the tax, and in predicting how much inefficiency is caused by a tax.]

SUMMARY

1. Many economic questions depend on the size of consumer or producer responses to changes in prices or other variables. *Elasticity* is a general measure of responsiveness that can be used to answer such questions.
2. The **price elasticity of demand**—the percent change in the quantity demanded divided by the percent change in the price (dropping the minus sign)—is a measure of the responsiveness of the quantity demanded to changes in the price. In practical calculations, it is usually best to use the **midpoint method**, which calculates percent changes in prices and quantities based on the average of starting and final values.
3. The responsiveness of the quantity demanded to price can range from **perfectly inelastic demand**, where the quantity demanded is unaffected by the price, to **perfectly elastic demand**, where there is a unique price at which consumers will buy as much or as little as they are offered. When demand is perfectly inelastic, the demand curve is a vertical line; when it is perfectly elastic, the demand curve is a horizontal line.
4. The price elasticity of demand is classified according to whether it is more or less than 1. If it is greater than 1, demand is **elastic**; if it is less than 1, demand is **inelastic**; if it is exactly 1, demand is **unit-elastic**. This classification determines how **total revenue**, the total value of sales, changes when the price changes. If demand is elastic, total revenue falls when the price increases and rises when the price decreases. If demand is inelastic, total revenue rises when the price increases and falls when the price decreases.
5. The price elasticity of demand depends on whether there are close substitutes for the good in question, whether the good is a necessity or a luxury, the share of income spent on the good, and the length of time that has elapsed since the price change.
6. The **cross-price elasticity of demand** measures the effect of a change in one good's price on the quantity of another good demanded. The cross-price elasticity of demand can be positive, in which case the goods are substitutes, or negative, in which case they are complements.
7. The **income elasticity of demand** is the percent change in the quantity of a good demanded when a consumer's income changes divided by the percent change in income. The income elasticity of demand indicates how intensely the demand for a good responds to changes in income. It can be negative; in that case the good is an inferior good. Goods with positive income elasticities of demand are normal goods. If the income elasticity is greater than 1, a good is **income-elastic**; if it is positive and less than 1, the good is **income-inelastic**.
8. The **price elasticity of supply** is the percent change in the quantity of a good supplied divided by the percent change in the price. If the quantity supplied does not change at all, we have an instance of **perfectly inelastic supply**; the supply curve is a vertical line. If the quantity supplied is zero below some price but infinite above that price, we have an instance of **perfectly elastic supply**; the supply curve is a horizontal line.
9. The price elasticity of supply depends on the availability of resources to expand production and on time. It is higher when inputs are available at relatively low cost and the longer the time elapsed since the price change.

KEY TERMS

Price elasticity of demand, p. 144
 Midpoint method, p. 146
 Perfectly inelastic demand, p. 148
 Perfectly elastic demand, p. 149
 Elastic demand, p. 149

Inelastic demand, p. 149
 Unit-elastic demand, p. 149
 Total revenue, p. 150
 Cross-price elasticity of demand, p. 155
 Income elasticity of demand, p. 156

Income-elastic demand, p. 157
 Income-inelastic demand, p. 157
 Price elasticity of supply, p. 159
 Perfectly inelastic supply, p. 160
 Perfectly elastic supply, p. 160

PROBLEMS

1. Nile.com, the online bookseller, wants to increase its total revenue. One strategy is to offer a 10% discount on every book it sells. Nile.com knows that its customers can be divided into two distinct groups according to their likely responses to the discount. The accompanying table shows how the two groups respond to the discount.

	Group A (sales per week)	Group B (sales per week)
Volume of sales before the 10% discount	1.55 million	1.50 million
Volume of sales after the 10% discount	1.65 million	1.70 million

- Using the midpoint method, calculate the price elasticities of demand for group A and group B.
 - Explain how the discount will affect total revenue from each group.
 - Suppose Nile.com knows which group each customer belongs to when he or she logs on and can choose whether or not to offer the 10% discount. If Nile.com wants to increase its total revenue, should discounts be offered to group A or to group B, to neither group, or to both groups?
2. Do you think the price elasticity of demand for Ford sport-utility vehicles (SUVs) will increase, decrease, or remain the same when each of the following events occurs? Explain your answer.
- Other car manufacturers, such as General Motors, decide to make and sell SUVs.
 - SUVs produced in foreign countries are banned from the American market.
 - Due to ad campaigns, Americans believe that SUVs are much safer than ordinary passenger cars.
 - The time period over which you measure the elasticity lengthens. During that longer time, new models such as four-wheel-drive cargo vans appear.
3. U.S. winter wheat production increased dramatically in 1999 after a bumper harvest. The supply curve shifted rightward; as a result, the price decreased and the quantity demanded increased (a movement along the demand curve). The accompanying table describes what happened to prices and the quantity of wheat demanded.

	1998	1999
Quantity demanded (bushels)	1.74 billion	1.9 billion
Average price (per bushel)	\$3.70	\$2.72

- Using the midpoint method, calculate the price elasticity of demand for winter wheat.
- What is the total revenue for U.S. wheat farmers in 1998 and 1999?
- Did the bumper harvest increase or decrease the total revenue of American wheat farmers? How could you have predicted this from your answer to part a?

4. The accompanying table gives part of the supply schedule for personal computers in the United States.

Price of computer	Quantity of computers supplied
\$1,100	12,000
900	8,000

- Calculate the price elasticity of supply when the price increases from \$900 to \$1,100 using the midpoint method.
 - Suppose firms produce 1,000 more computers at any given price due to improved technology. As price increases from \$900 to \$1,100, is the price elasticity of supply now greater than, less than, or the same as it was in part a?
 - Suppose a longer time period under consideration means that the quantity supplied at any given price is 20% higher than the figures given in the table. As price increases from \$900 to \$1,100, is the price elasticity of supply now greater than, less than, or the same as it was in part a?
5. The accompanying table lists the cross-price elasticities of demand for several goods, where the percent quantity change is measured for the first good of the pair, and the percent price change is measured for the second good.

Good	Cross-price elasticities of demand
Air-conditioning units and kilowatts of electricity	-0.34
Coke and Pepsi	+0.63
High-fuel-consuming sport-utility vehicles (SUVs) and gasoline	-0.28
McDonald's burgers and Burger King burgers	+0.82
Butter and margarine	+1.54

- Explain the sign of each of the cross-price elasticities. What does it imply about the relationship between the two goods in question?
- Compare the absolute values of the cross-price elasticities and explain their magnitudes. For example, why is the cross-price elasticity of McDonald's burgers and Burger King burgers less than the cross-price elasticity of butter and margarine?
- Use the information in the table to calculate how a 5% increase in the price of Pepsi affects the quantity of Coke demanded.

- d. Use the information in the table to calculate how a 10% decrease in the price of gasoline affects the quantity of SUVs demanded.
6. What can you conclude about the price elasticity of demand in each of the following statements?
- "The pizza delivery business in this town is very competitive. I'd lose half my customers if I raised the price by as little as 10%."
 - "I owned both of the two Jerry Garcia autographed lithographs in existence. I sold one on eBay for a high price. But when I sold the second one, the price dropped by 80%."
 - "My economics professor has chosen to use the Krugman/Wells textbook for this class. I have no choice but to buy this book."
 - "I always spend a total of exactly \$10 per week on coffee."
7. Take a linear demand curve like that shown in Figure 6-5, where the range of prices for which demand is elastic and inelastic is labeled. In each of the following scenarios, the supply curve shifts. Show along which portion of the demand curve (that is, the elastic or the inelastic portion) the supply curve must have shifted in order to generate the event described. In each case, show on the diagram the quantity effect and the price effect.
- Recent attempts by the Colombian army to stop the flow of illegal drugs into the United States have actually benefited drug dealers.
 - New construction increased the number of seats in the football stadium and resulted in greater total revenue from box-office ticket sales.
 - A fall in input prices has led to higher output of Porsches. But total revenue for the Porsche Company has declined as a result.
8. The accompanying table shows the price and yearly quantity sold of souvenir T-shirts in the town of Crystal Lake according to the average income of the tourists visiting.

Price of T-shirt	Quantity of T-shirts demanded when average tourist income is \$20,000	Quantity of T-shirts demanded when average tourist income is \$30,000
\$4	3,000	5,000
5	2,400	4,200
6	1,600	3,000
7	800	1,800

- Using the midpoint method, calculate the price elasticity of demand when the price of a T-shirt rises from \$5 to \$6 and the average tourist income is \$20,000. Also calculate it when the average tourist income is \$30,000.
- Using the midpoint method, calculate the income elasticity of demand when the price of a T-shirt is \$4 and the average tourist income increases from \$20,000 to \$30,000. Also calculate it when the price is \$7.

9. A recent study determined the following elasticities for Volkswagen Beetles:

Price elasticity of demand = 2

Income elasticity of demand = 1.5

The supply of Beetles is elastic. Based on this information, are the following statements true or false? Explain your reasoning.

- A 10% increase in the price of a Beetle will reduce the quantity demanded by 20%.
 - An increase in consumer income will increase the price and quantity of Beetles sold. Since price elasticity of demand is greater than 1, total revenue will go down.
10. In each of the following cases, do you think the price elasticity of supply is (i) perfectly elastic; (ii) perfectly inelastic; (iii) elastic, but not perfectly elastic; or (iv) inelastic, but not perfectly inelastic? Explain using a diagram.
- An increase in demand this summer for luxury cruises leads to a huge jump in the sales price of a cabin on the Queen Mary 2.
 - The price of a kilowatt of electricity is the same during periods of high electricity demand as during periods of low electricity demand.
 - Fewer people want to fly during February than during any other month. The airlines cancel about 10% of their flights as ticket prices fall about 20% during this month.
 - Owners of vacation homes in Maine rent them out during the summer. Due to the soft economy this year, a 30% decline in the price of a vacation rental leads more than half of homeowners to occupy their vacation homes themselves during the summer.
11. Use an elasticity concept to explain each of the following observations.
- During economic booms, the number of new personal care businesses, such as gyms and tanning salons, is proportionately greater than the number of other new businesses, such as grocery stores.
 - Cement is the primary building material in Mexico. After new technology makes cement cheaper to produce, the supply curve for the Mexican cement industry becomes relatively flatter.
 - Some goods that were once considered luxuries, like a telephone, are now considered virtual necessities. As a result, the demand curve for telephone services has become steeper over time.
 - Consumers in a less developed country like Guatemala spend proportionately more of their income on equipment for producing things at home, like sewing machines, than consumers in a more developed country like Canada.
12. Taiwan is a major world supplier of semiconductor chips. A recent earthquake severely damaged the production facilities of Taiwanese chip-producing companies, sharply reducing the amount of chips they could produce.
- Assume that the total revenue of a typical non-Taiwanese chip manufacturer rises due to these events. In terms of an elasticity, what must be true for this to happen?

- Illustrate the change in total revenue with a diagram, indicating the price effect and the quantity effect of the Taiwan earthquake on this company's total revenue.
- b. Now assume that the total revenue of a typical non-Taiwanese chip manufacturer falls due to these events. In terms of an elasticity, what must be true for this to happen? Illustrate the change in total revenue with a diagram, indicating the price effect and the quantity effect of the Taiwan earthquake on this company's total revenue.
13. There is a debate about whether sterile hypodermic needles should be passed out free of charge in cities with high drug use. Proponents argue that doing so will reduce the incidence of diseases, such as HIV/AIDS, that are often spread by needle sharing among drug users. Opponents believe that doing so will encourage more drug use by reducing the risks of this behavior. As an economist asked to assess the policy, you must know the following: (i) how responsive the spread of diseases like HIV/AIDS is to the price of sterile needles and (ii) how responsive drug use is to the price of sterile needles. Assuming that you know these two things, use the concepts of price elasticity of demand for sterile needles and the cross-price elasticity between drugs and sterile needles to answer the following questions.
- a. In what circumstances do you believe this is a beneficial policy?
- b. In what circumstances do you believe this is a bad policy?
14. Worldwide, the average coffee grower has increased the amount of acreage under cultivation over the past few years. The result has been that the average coffee plantation produces significantly more coffee than it did 10 to 20 years ago. Unfortunately for the growers, however, this has also been a period in which their total revenues have plunged. In terms of an elasticity, what must be true for these events to have occurred? Illustrate these events with a diagram, indicating the quantity effect and the price effect that gave rise to these events.
15. A recent report by the U.S. Centers for Disease Control and Prevention (CDC), published in the CDC's *Morbidity and Mortality Weekly Report*, studied the effect of an increase in the price of beer on the incidence of new cases of sexually transmitted disease in young adults. In particular, the researchers analyzed the responsiveness of gonorrhea cases to a tax-induced increase in the price of beer. The report concluded that "the . . . analysis suggested that a beer tax increase of \$0.20 per six-pack could reduce overall gonorrhea rates by 8.9%." Assume that a six-pack costs \$5.90 before the price increase. Use the midpoint method to determine the percent increase in the price of a six-pack, and then calculate the cross-price elasticity of demand between beer and incidence of gonorrhea. According to your estimate of this cross-price elasticity of demand, are beer and gonorrhea complements or substitutes?
16. The U.S. government is considering reducing the amount of carbon dioxide that firms are allowed to produce by issuing a limited number of tradable allowances for carbon dioxide (CO₂) emissions. In an April 25, 2007, report, the U.S. Congressional Budget Office (CBO) argues that "most of the cost of meeting a cap on CO₂ emissions would be borne by consumers, who would face persistently higher prices for products such as electricity and gasoline . . . poorer households would bear a larger burden relative to their income than wealthier households would." What assumption about one of the elasticities you learned about in this chapter has to be true for poorer households to be disproportionately affected?
17. According to a Honda press release on October 23, 2006, sales of the fuel-efficient four-cylinder Honda Civic rose by 7.1% from 2005 to 2006. Over the same period, according to data from the U.S. Energy Information Administration, the average price of regular gasoline rose from \$2.27 per gallon to \$2.57 per gallon. Using the midpoint method, calculate the cross-price elasticity of demand between Honda Civics and regular gasoline. According to your estimate of the cross-price elasticity, are the two goods complements or substitutes? Does your answer make sense?

