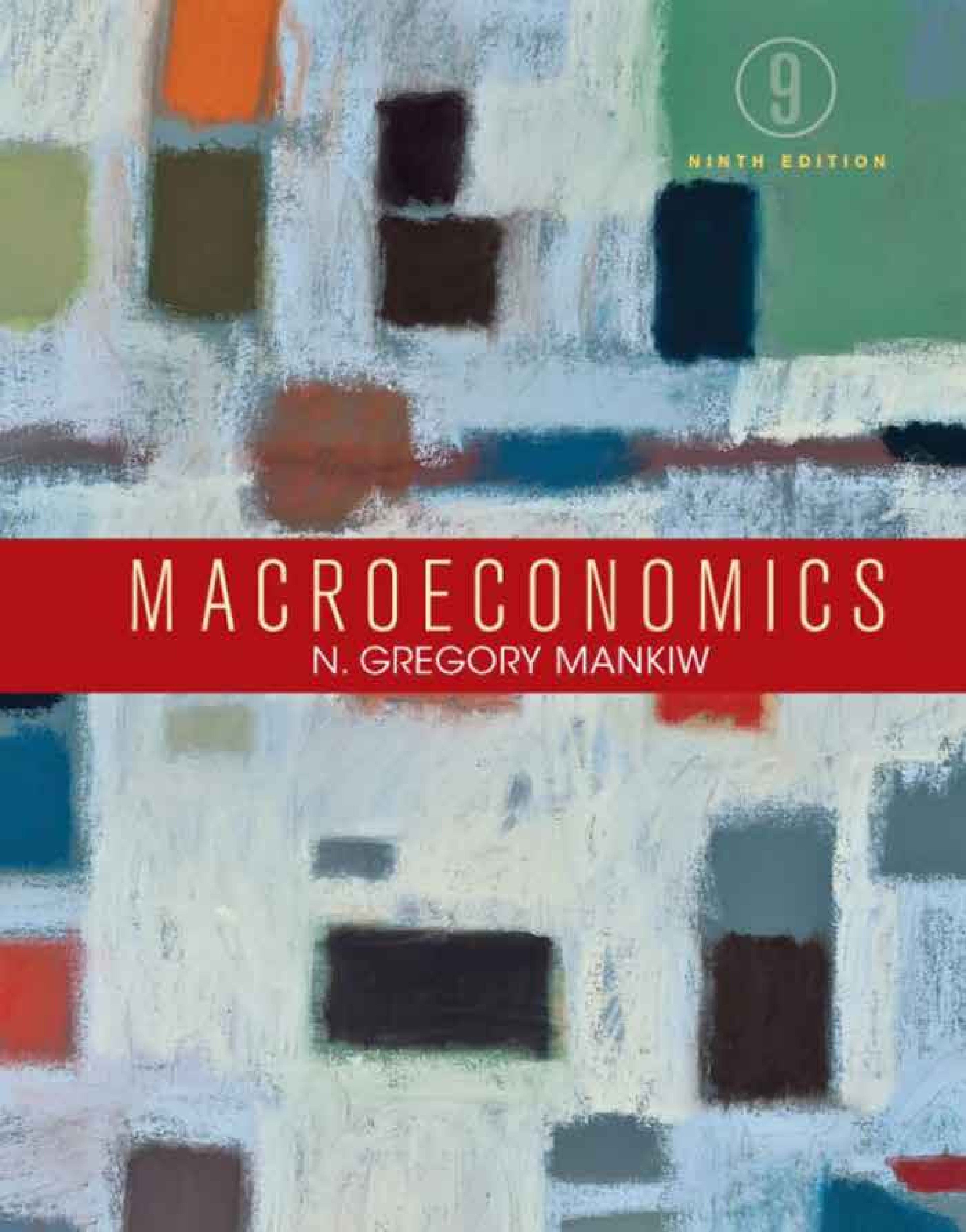

9

NINTH EDITION

MACROECONOMICS

N. GREGORY MANKIW

MACROECONOMICS

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NINTH EDITION

MACROECONOMICS

N. GREGORY MANKIW

Harvard University

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About the Author

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N. Gregory Mankiw is the Robert M. Beren Professor of Economics at Harvard University. He began his study of economics at Princeton University, where he received an A.B. in 1980. After earning a Ph.D. in economics from MIT, he began teaching at Harvard in 1985 and was promoted to full professor in 1987. At Harvard, he has taught both undergraduate and graduate courses in macroeconomics. He is also author of the best-selling introductory textbook *Principles of Economics* (Cengage Learning).

Professor Mankiw is a regular participant in academic and policy debates. His research ranges across macroeconomics and includes work on price adjustment, consumer behavior, financial markets, monetary and fiscal policy, and economic growth. In addition to his duties at Harvard, he has been a research associate of the National Bureau of Economic Research, a member of the Brookings Panel on Economic Activity, and an adviser to the Congressional Budget Office and the Federal Reserve Banks of Boston and New York. From 2003 to 2005 he was chairman of the President's Council of Economic Advisers.

Professor Mankiw lives in Wellesley, Massachusetts, with his wife, Deborah; children, Catherine, Nicholas, and Peter; and their border terrier, Tobin.

To Deborah

Those branches of politics, or of the laws of social life, on which there exists a collection of facts sufficiently sifted and methodized to form the beginning of a science should be taught ex professo. Among the chief of these is Political Economy, the sources and conditions of wealth and material prosperity for aggregate bodies of human beings. . . .

The same persons who cry down Logic will generally warn you against Political Economy. It is unfeeling, they will tell you. It recognises unpleasant facts. For my part, the most unfeeling thing I know of is the law of gravitation: it breaks the neck of the best and most amiable person without scruple, if he forgets for a single moment to give heed to it. The winds and waves too are very unfeeling. Would you advise those who go to sea to deny the winds and waves—or to make use of them, and find the means of guarding against their dangers? My advice to you is to study the great writers on Political Economy, and hold firmly by whatever in them you find true; and depend upon it that if you are not selfish or hardhearted already, Political Economy will not make you so.

John Stuart Mill, 1867

Brief Contents

Contents

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Preface

An economist must be "mathematician, historian, statesman, philosopher, in some degree . . . as aloof and incorruptible as an artist, yet sometimes as near the earth as a politician." So remarked John Maynard Keynes, the great British economist who, as much as anyone, could be called the father of macroeconomics. No single statement summarizes better what it means to be an economist.

As Keynes's assessment suggests, students who aim to learn economics need to draw on many disparate talents. The job of helping students find and develop these talents falls to instructors and textbook authors. My goal for this textbook is to make macroeconomics understandable, relevant, and (believe it or not) fun. Those of us who have chosen to be professional macroeconomists have done so because we are fascinated by the field. More important, we believe that the study of macroeconomics can illuminate much about the world and that the lessons learned, if properly applied, can make the world a better place. I hope this book conveys not only our profession's accumulated wisdom but also its enthusiasm and sense of purpose.

This Book's Approach

Macroeconomists share a common body of knowledge, but they do not all have the same perspective on how that knowledge is best taught. Let me begin this new edition by recapping my objectives, which together define this book's approach to the field.

First, I try to offer a balance between short-run and long-run issues in macroeconomics. All economists agree that public policies and other events influence the economy over different time horizons. We live in our own short run, but we also live in the long run that our parents bequeathed us. As a result, courses in macroeconomics need to cover both short-run topics, such as the business cycle and stabilization policy, and long-run topics, such as economic growth, the natural rate of unemployment, persistent inflation, and the effects of government debt. Neither time horizon trumps the other.

Second, I integrate the insights of Keynesian and classical theories. Although Keynes's *General Theory* provides the foundation for much of our current understanding of economic fluctuations, it is important to remember that classical economics provides the right answers to many fundamental questions. In this book I incorporate many of the contributions of the classical economists before Keynes and the new classical economists of the past several decades. Substantial coverage is given, for example, to the loanable-funds theory of the interest rate, the quantity theory of money, and the problem of time inconsistency. At the same time, I recognize that many of the ideas of Keynes and the new Keynesians are necessary for understanding economic fluctuations. Substantial coverage is given also to the *IS–LM* model of aggregate demand, the short-run tradeoff between inflation and unemployment, and modern models of business cycle dynamics.

Third, I present macroeconomics using a variety of simple models. Instead of pretending that there is one model that is complete enough to explain all facets of the economy, I encourage students to learn how to use and compare a set of prominent models. This approach has the pedagogical value that each model can be kept relatively simple and presented within one or two chapters. More important, this approach asks students to think like economists, who always keep various models in mind when analyzing economic events or public policies.

Fourth, I emphasize that macroeconomics is an empirical discipline, motivated and guided by a wide array of experience. This book contains numerous Case Studies that use macroeconomic theory to shed light on real-world data and events. To highlight the broad applicability of the basic theory, I have drawn the Case Studies both from current issues facing the world's economies and from dramatic historical episodes. The Case Studies analyze the policies of Alexander Hamilton, Henry Ford, George Bush (both of them!), and Barack Obama. They teach the reader how to apply economic principles to issues from fourteenth-century Europe, the island of Yap, the land of Oz, and today's newspaper.

What's New in the Ninth Edition?

Economics instructors are vigilant in keeping their lectures up to date as the economic landscape changes. Textbook authors cannot be less so. This book is therefore updated about every three years. In this ninth edition, you will find several kinds of changes.

Most obviously, tables and figures throughout the book have been revised to include the latest available data. College students take courses in economics to understand the world in which they live. It is important, therefore, that the data presented be as current as possible.

The book has also been updated to take into account recent events and economic developments. For example:

- In 2013, the Bureau of Economic Analysis revised the definition of GDP to include investment in intellectual property products; a new section in Chapter 2 discusses the change.
- Over the past few years, Bitcoin has arisen as a modern medium of exchange; a new box in Chapter 4 examines this unusual form of money.
- Between 2007 and 2014, the U.S. economy experienced a large decline in labor-force participation; a new case study in Chapter 7 examines the reasons for this development.
- In 2014, U.S. policymakers were concerned about the increasing frequency of corporate inversions; a new case study in Chapter 17 discusses the policy debate over inversions and corporate tax reform.

- In the wake of the financial crisis of 2008–2009, policymakers are increasingly taking a more macroeconomic perspective on regulating financial institutions; a new section in Chapter 20 discusses macroprudential regulation.

In addition, the book reflects the evolution of macroeconomic thought based on recent research. For example:

- A new case study in Chapter 9 discusses work by Nicholas Bloom and John Van Reenen on management practices as a source of productivity differences.
- A new case study in Chapter 11 examines research by Emi Nakamura, Jón Steinsson, and others on the size of the fiscal-policy multipliers.
- A new case study in Chapter 18 discusses work by Scott Baker, Nicholas Bloom, and Steven Davis on economic policy uncertainty.

Perhaps most important, this edition includes a significant pedagogical innovation. In most of the core chapters, some end-of-chapter problems are identified with this icon: LaunchPad. For these problems, students can go to LaunchPad to find a Work It Out tutorial for a similar problem. Because the Work It Out has a similar structure to the in-text problem, it is a resource for students to learn how to tackle the in-text problem. But because the Work It Out has different numbers and thus a different answer, the in-text problem can still be used as assigned homework. The Work It Out tutorials can be found at http://www.macmillanhighered.com/launchpad/mankiw9e.

Finally, very careful readers of this book will notice a subtle change in the use of pronouns. A nagging problem for authors is which pronoun to use for a person of unspecified gender. The traditional "he" sounds sexist to some modern readers, while "he or she" is cumbersome. So, in this edition, I use "she" in odd-numbered chapters and "he" in even-numbered chapters. That will have to do, until we all adopt some more perfect language.

As always, all the changes I made and the many others I considered were evaluated keeping in mind the benefits of brevity. From my own experience as a student, I know that long books are less likely to be read. My goal in this book is to offer the clearest, most up-to-date, most accessible course in macroeconomics in the fewest words possible.

The Arrangement of Topics

My strategy for teaching macroeconomics is first to examine the long run, when prices are flexible, and then to examine the short run, when prices are sticky. This approach has several advantages. First, because the classical dichotomy permits the separation of real and monetary issues, the long-run material is easier for students to understand. Second, when students begin studying short-run fluctuations, they understand fully the long-run equilibrium around which the economy is fluctuating. Third, beginning with market-clearing models clarifies the link between macroeconomics and microeconomics. Fourth, students learn first the material that is less controversial among macroeconomists. For all these reasons, the strategy of beginning with long-run classical models simplifies the teaching of macroeconomics.

Let's now move from strategy to tactics. What follows is a whirlwind tour of the book.

Part One, Introduction

The introductory material in Part One is brief so that students can get to the core topics quickly. Chapter 1 discusses the broad questions that macroeconomists address and the economist's approach of building models to explain the world. Chapter 2 introduces the key data of macroeconomics, emphasizing gross domestic product, the consumer price index, and the unemployment rate.

Part Two, Classical Theory: The Economy in the Long Run

Part Two examines the long run, over which prices are flexible. Chapter 3 presents the basic classical model of national income. In this model, the factors of production and the production technology determine the level of income, and the marginal products of the factors determine its distribution to households. In addition, the model shows how fiscal policy influences the allocation of the economy's resources among consumption, investment, and government purchases, and it highlights how the real interest rate equilibrates the supply and demand for goods and services.

Money and the price level are introduced next. Chapter 4 examines the monetary system and the tools of monetary policy. Chapter 5 begins the discussion of the effects of monetary policy. Because prices are assumed to be fully flexible, the chapter presents the prominent ideas of classical monetary theory: the quantity theory of money, the inflation tax, the Fisher effect, the social costs of inflation, and the causes and costs of hyperinflation.

The study of open-economy macroeconomics begins in Chapter 6. Maintaining the assumption of full employment, this chapter presents models to explain the trade balance and the exchange rate. Various policy issues are addressed: the relationship between the budget deficit and the trade deficit, the macroeconomic impact of protectionist trade policies, and the effect of monetary policy on the value of a currency in the market for foreign exchange.

Chapter 7 relaxes the assumption of full employment by discussing the dynamics of the labor market and the natural rate of unemployment. It examines various causes of unemployment, including job search, minimum-wage laws, union power, and efficiency wages. It also presents some important facts about patterns of unemployment.

Part Three, Growth Theory: The Economy in the Very Long Run

Part Three makes the classical analysis of the economy dynamic by developing the tools of modern growth theory. Chapter 8 introduces the Solow growth model as a description of how the economy evolves over time. This chapter emphasizes the roles of capital accumulation and population growth. Chapter 9 then adds technological progress to the Solow model. It uses the model to discuss growth experiences around the world as well as public policies that influence the level and growth of the standard of living. Finally, Chapter 9 introduces students to the modern theories of endogenous growth.

Part Four, Business Cycle Theory: The Economy in the Short Run

Part Four examines the short run when prices are sticky. It begins in Chapter 10 by examining some of the key facts that describe short-run fluctuations in economic activity. The chapter then introduces the model of aggregate supply and aggregate demand as well as the role of stabilization policy. Subsequent chapters refine the ideas introduced in this chapter.

Chapters 11 and 12 look more closely at aggregate demand. Chapter 11 presents the Keynesian cross and the theory of liquidity preference and uses these models as building blocks for developing the *IS–LM* model. Chapter 12 uses the *IS–LM* model to explain economic fluctuations and the aggregate demand curve. It concludes with an extended case study of the Great Depression.

The study of short-run fluctuations continues in Chapter 13, which focuses on aggregate demand in an open economy. This chapter presents the Mundell–Fleming model and shows how monetary and fiscal policies affect the economy under floating and fixed exchange-rate systems. It also discusses the debate over whether exchange rates should be floating or fixed.

Chapter 14 looks more closely at aggregate supply. It examines various approaches to explaining the short-run aggregate supply curve and discusses the short-run tradeoff between inflation and unemployment.

Part Five, Topics in Macroeconomic Theory

After developing basic theories to explain the economy in the long run and in the short run, the book turns to several topics that refine our understanding of the economy. Part Five focuses on theoretical topics, and Part Six focuses on policy topics. These chapters are written to be used flexibly, so instructors can pick and choose which topics to cover. Some of these chapters can also be covered earlier in the course, depending on the instructor's preferences.

Chapter 15 develops a dynamic model of aggregate demand and aggregate supply. It builds on ideas that students have already encountered and uses those ideas as stepping-stones to take the student close to the frontier of knowledge concerning short-run economic fluctuations. The model presented here is a simplified version of modern dynamic, stochastic, general equilibrium (DSGE) models.

The next two chapters analyze more fully some of the microeconomic decisions behind macroeconomic phenomena. Chapter 16 presents the various theories of consumer behavior, including the Keynesian consumption function, Fisher's model of intertemporal choice, Modigliani's life-cycle hypothesis, Friedman's permanent-income hypothesis, Hall's random-walk hypothesis, and Laibson's model of instant gratification. Chapter 17 examines the theory behind the investment function.

Part Six, Topics in Macroeconomic Policy

Once students have solid command of standard macroeconomic models, the book uses these models as the foundation for discussing some of the key debates over economic policy. Chapter 18 considers the debate over how policymakers should respond to short-run economic fluctuations. It emphasizes two broad questions: Should monetary and fiscal policy be active or passive? Should policy be conducted by rule or by discretion? The chapter presents arguments on both sides of these questions.

Chapter 19 focuses on the various debates over government debt and budget deficits. It gives a broad picture about the magnitude of government indebtedness, discusses why measuring budget deficits is not always straightforward, recaps the traditional view of the effects of government debt, presents Ricardian equivalence as an alternative view, and discusses various other perspectives on government debt. As in the previous chapter, students are not handed conclusions but are given the tools to evaluate the alternative viewpoints on their own.

Chapter 20 discusses the financial system and its linkages to the overall economy. It begins by examining what the financial system does: financing investment, sharing risk, dealing with asymmetric information, and fostering economic growth. It then discusses the causes of financial crises, their macroeconomic impact, and the policies that might mitigate their effects and reduce their likelihood.

Epilogue

The book ends with a brief epilogue that reviews the broad lessons about which most macroeconomists agree and discusses some of the most important open questions. Regardless of which chapters an instructor chooses to cover, this capstone chapter can be used to remind students how the many models and themes of macroeconomics relate to one another. Here and throughout the book, I emphasize that despite the disagreements among macroeconomists, there is much that we know about how the economy works.

Alternative Routes Through the Text

Although I have organized the material in the way that I prefer to teach intermediate-level macroeconomics, I understand that other instructors have different preferences. I tried to keep this in mind as I wrote the book so that it would offer a degree of flexibility. Here are a few ways that instructors might consider rearranging the material:

- Some instructors are eager to cover short-run economic fluctuations. For such a course, I recommend covering Chapters 1 through 5 so that students are grounded in the basics of classical theory and then jumping to Chapters 10, 11, 12, 14, and 15 to cover the model of aggregate demand and aggregate supply.
- Some instructors are eager to cover long-run economic growth. These instructors can cover Chapters 8 and 9 immediately after Chapter 3.

- An instructor who wants to defer (or even skip) open-economy macroeconomics can put off Chapters 6 and 13 without loss of continuity.
- An instructor who wants to emphasize economic policy can skip Chapters 8, 9, 15, 16, and 17 in order to get to Chapters 18, 19, and 20 more quickly.

The successful experiences of hundreds of instructors with previous editions suggest this text complements well a variety of approaches to the field.

Learning Tools

I am pleased that students have found the previous editions of this book user-friendly. I have tried to make this ninth edition even more so. I am most excited about the parallel problems that students can see in LaunchPad's Work It Out feature.

Case Studies

Economics comes to life when it is applied to understanding actual events. Therefore, the numerous Case Studies (many new or revised in this edition) are an important learning tool, integrated closely with the theoretical material presented in each chapter. The frequency with which these Case Studies occur ensures that a student does not have to grapple with an overdose of theory before seeing the theory applied. Students report that the Case Studies are their favorite part of the book.

FYI Boxes

These boxes present ancillary material "for your information." I use these boxes to clarify difficult concepts, to provide additional information about the tools of economics, and to show how economics relates to our daily lives. Several are new or revised in this edition.

Graphs

Understanding graphical analysis is a key part of learning macroeconomics, and I have worked hard to make the figures easy to follow. I often use comment boxes within figures to briefly describe and draw attention to the important points that the figures illustrate. The pedagogical use of color, detailed captions, and comment boxes makes it easier for students to learn and review the material.

Mathematical Notes

I use occasional mathematical footnotes to keep more difficult material out of the body of the text. These notes make an argument more rigorous or present a proof of a mathematical result. They can easily be skipped by those students who have not been introduced to the necessary mathematical tools.

Chapter Summaries

Every chapter ends with a brief, nontechnical summary of its major lessons. Students can use the summaries to place the material in perspective and to review for exams.

Key Concepts

Learning the language of a field is a major part of any course. Within the chapter, each key concept is in **boldface** when it is introduced. At the end of the chapter, the key concepts are listed for review.

Questions for Review

After studying a chapter, students can immediately test their understanding of its basic lessons by answering the Questions for Review.

Problems and Applications

Every chapter includes Problems and Applications designed for homework assignments. Some are numerical applications of the theory in the chapter. Others encourage the student to go beyond the material in the chapter by addressing new issues that are closely related to the chapter topics. In most of the core chapters, a few problems are identified with this icon: LaunchPad. For each of these problems, students can find a Work It Out tutorial on LaunchPad for *Macroeconomics,* Ninth Edition: http://www.macmillanhighered.com/launchpad/mankiw9e.

Chapter Appendices

Several chapters include appendices that offer additional material, sometimes at a higher level of mathematical sophistication. These appendices are designed so that instructors can cover certain topics in greater depth if they wish. The appendices can be skipped altogether without loss of continuity.

Glossary

To help students become familiar with the language of macroeconomics, a glossary of more than 250 terms is provided at the back of the book.

International Editions

The English-language version of this book has been used in dozens of countries. To make the book more accessible for students around the world, editions are (or will soon be) available in 15 other languages: Armenian, Chinese, French, German, Greek, Hungarian, Indonesian, Italian, Japanese, Korean, Portuguese, Romanian, Russian, Spanish, and Ukrainian. In addition, a Canadian adaptation coauthored with William Scarth (McMaster University) and a European adaptation coauthored with Mark Taylor (University of Warwick) are available. Instructors who would like information about these versions of the book should contact Worth Publishers.

Acknowledgments

Since I started writing the first edition of this book, I have benefited from the input of many reviewers and colleagues in the economics profession. Now that the book is in its ninth edition, these people are too numerous to list in their entirety. However, I continue to be grateful for their willingness to have given up their scarce time to help

me improve the economics and pedagogy of this text. Their advice has made this book a better teaching tool for hundreds of thousands of students around the world.

I would like to mention the instructors whose recent input shaped this new edition.

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A special shout-out goes to my frequent collaborator Ricardo Reis of Columbia University. Ricardo was enormously helpful in suggesting new topics and research references for this edition. In addition, I am grateful to Tina Liu, a student at Harvard, who helped me update the data, refine my prose, and proofread the entire book.

The people at Worth Publishers have continued to be congenial and dedicated. I would like to thank Catherine Woods, Vice President, Content Management, and Media Production; Charles Linsmeier, Vice President, Editorial, Sciences, and Social Sciences; Shani Fisher, Publisher; Tom Digiano, Marketing Manager; Paul Shensa, Consulting Editor; Tom Acox, Digital Solutions Manager; Lukia Kliossis, Media Editor; Lisa Kinne, Managing Editor; Tracey Kuehn, Director, Content Management Enhancement; Julio Espin, Project Editor; Paul Rohloff, Senior Production Supervisor; Barbara Seixas, Production Manager; Diana Blume, Director of Design, Content Management; Deborah Heimann, Copyeditor; Edgar Doolan, Supplements Project Editor; and Stacey Alexander, Supplements Production Manager.

Many other people made valuable contributions as well. Most important, Jane Tufts, freelance developmental editor, worked her magic on this book once again, confirming that she's the best in the business. Alexandra Nickerson did a great job preparing the index. Deborah Mankiw, my wife and in-house editor, continued to be the first reader of new material, providing the right mix of criticism and encouragement.

Finally, I would like to thank my three children, Catherine, Nicholas, and Peter. They helped immensely with this revision—both by providing a pleasant distraction and by reminding me that textbooks are written for the next generation.

N. Gregory Mankiw

March 2015

Supplements and Media

Macmillan Education LaunchPad

Resources for Students and Instructors

http://www.macmillanhighered.com/launchpad/mankiw9e

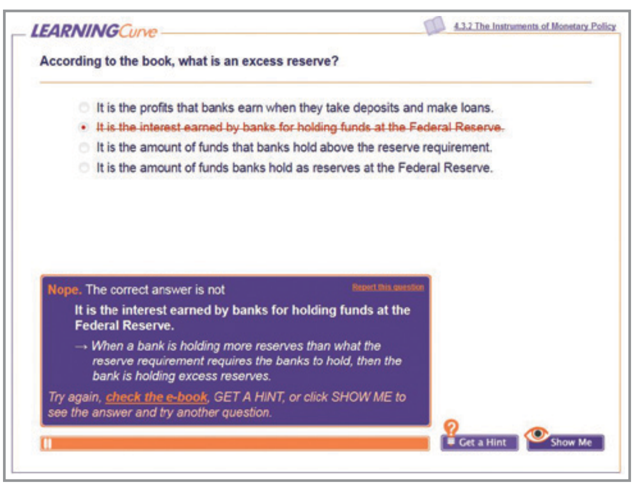
Our new coursespace, LaunchPad, combines an interactive e-Book with high-quality multimedia content and ready-made assessment options, including LearningCurve adaptive quizzing. Prebuilt curated units are easy to assign or adapt with your own material, such as readings, videos, quizzes, and discussion groups. LaunchPad also provides access to a gradebook that provides a clear window on performance for the whole class, for individual students, and for individual assignments.

Worth Publishers has worked closely with Greg Mankiw and a team of talented economics instructors to put together a variety of resources to aid instructors and students. We have been delighted at the positive feedback we have received on these supplements.

For Students

Macmillan Education LearningCurve

LearningCurve is an adaptive quizzing engine that automatically adjusts questions to a student's mastery level. With LearningCurve activities, each student follows a unique path to understanding the material. The more questions a student answers correctly, the more difficult the questions become. Each question is written specifically for the text and is linked to the relevant e-Book section. LearningCurve also provides a personal study plan for students as well as complete metrics for instructors. Proven to raise student performance, LearningCurve serves as an ideal formative assessment and learning tool. For detailed information, visit http://learningcurveworks.com.



NEW Work It Out Tutorials

New to this edition, these tutorials guide students through the process of applying economic analysis to solve a problem similar to the end-of-chapter problems found in the text. Choice-specific feedback and video explanations provide students with interactive assistance for each step of the problem.

Macro Models

These modules provide simulations of the models presented in the book. Students can change the exogenous variables and see the outcomes in terms of shifting curves and recalculated numerical values of the endogenous variables. Each module contains exercises that instructors can assign as homework.

Fed Chairman Game

Created by the Federal Reserve Bank of San Francisco, this game allows students to become Chairman of the Fed and to make macroeconomic policy decisions based on news events and economic statistics. It gives students a sense of the complex interconnections that influence the economy. It is also fun to play.

Flashcards

Students can test their knowledge of the definitions in the glossary with these virtual flashcards.

For Instructors

Instructor's Resource Manual

Robert G. Murphy (Boston College) has revised the impressive resource manual for instructors. For each chapter of this book, the manual contains notes to the instructor, a detailed lecture outline, additional case studies, and coverage of advanced topics. Instructors can use the manual to prepare their lectures, and they can reproduce whatever pages they choose as handouts for students. Each chapter also contains a Dismal Scientist Activity (www.dismalscientist.com), which challenges students to combine the chapter knowledge with a high-powered business database and analysis service that offers real-time monitoring of the global economy.

Solutions Manual

Nora Underwood (University of Central Florida) has updated the *Solutions Manual* for all the Questions for Review and Problems and Applications found in the text.

Test Bank

The *Test Bank* has been revised for the ninth edition so that it now includes over 2,500 multiple-choice questions, numerical problems, and short-answer graphical questions to accompany each chapter of the text. The *Test Bank* provides a wide range of questions appropriate for assessing students' comprehension, interpretation, analysis, and synthesis skills.

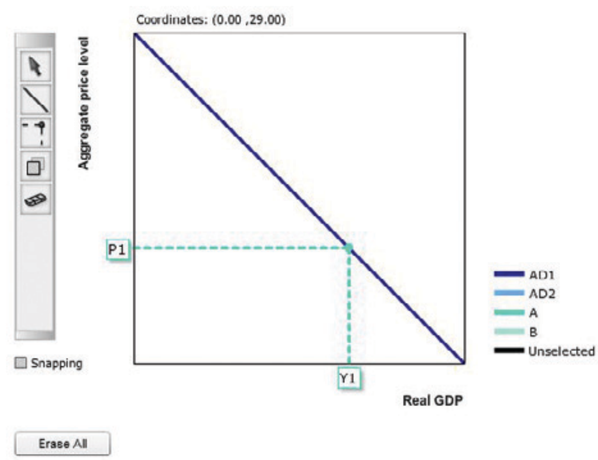
Lecture Slides

Ron Cronovich (Carthage College) has revised his lecture slides of the material in each chapter. They feature animated graphs with careful explanations and additional case studies, data, and helpful notes to the instructor. Designed to be customized or used as they are, they include easy directions for instructors who have little experience with PowerPoint.

Graphing Questions

As a further question bank for instructors building assignments and tests, the electronically gradable graphing problems utilize our own robust graphing engine. In these problems, students will be asked to draw their response to a question, and the software will automatically grade that response. Graphing questions are tagged to appropriate textbook sections and range in difficulty level and skill.

The accompanying graph shows an aggregate demand curve (AD1) with the current level aggregate price level and level of real GDP noted at point A. Suppose there is an increase in the aggregate price level. Modify the graph to reflect this change by drawing a new curve and/or plotting a new point on the aggregate demand curve. Label the new curve AD2 and/or label the new point B.



Practice and Graded Homework Assignments

Each LaunchPad unit contains prebuilt assignments, providing instructors with a curated set of multiple-choice and graphing questions that can be easily assigned for practice or graded assessment.

Additional Online Offerings

Worth/Aplia courses are all available with digital textbooks, interactive assignments, and detailed feedback. With Aplia, you retain complete control of 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/economics/

The integrated online version of the Aplia media and the Mankiw text includes the following items:

- 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 and graphing
- Instant online reports that allow instructors to target student trouble areas more efficiently

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The Science of Macroeconomics

The whole of science is nothing more than the refinement of everyday thinking.

—Albert Einstein

When Albert Einstein made the above observation about the nature of science, he was probably referring to physics, chemistry, and other natural sciences. But the statement is equally true when applied to social sciences like economics. As a participant in the economy, and as a citizen in a democracy, you cannot help but think about economic issues as you go about your life or when you enter the voting booth. But if you are like most people, your everyday thinking about economics has probably been casual rather than rigorous (or at least it was before you took your first economics course). The goal of studying economics is to refine that thinking. This book aims to help you in that endeavor, focusing on the part of the field called **macroeconomics**, which studies the forces that influence the economy as a whole.

1-1 What Macroeconomists Study

Why have some countries experienced rapid growth in incomes over the past century while others have stayed mired in poverty? Why do some countries have high rates of inflation while others maintain stable prices? Why do all countries experience recessions and depressions—recurrent periods of falling incomes and rising unemployment—and how can government policy reduce the frequency and severity of these episodes? Macroeconomics attempts to answer these and many related questions.

To appreciate the importance of macroeconomics, you need only head over to some online news Web site. Every day you can see headlines such as INCOME GROWTH REBOUNDS, FED MOVES TO COMBAT INFLATION, or STOCKS FALL AMID RECESSION FEARS. These macroeconomic events may seem abstract, but they touch all of our lives. Business executives forecasting the demand for their products must guess how fast consumers' incomes will grow. Senior citizens living on fixed incomes wonder how fast prices will rise. Recent college graduates looking for jobs hope that the economy will boom and that firms will be hiring.

Because the state of the economy affects everyone, macroeconomic issues play a central role in national political debates. Voters are aware of how the economy is doing, and they know that government policy can affect the economy in powerful ways. As a result, the popularity of an incumbent president often rises when the economy is doing well and falls when it is doing poorly.

Macroeconomic issues are also central to world politics, and the international news is filled with macroeconomic questions. Was it a good move for much of Europe to adopt a common currency? Should China maintain a fixed exchange rate against the U.S. dollar? Why is the United States running large trade deficits? How can poor nations raise their standards of living? When world leaders meet, these topics are often high on their agenda.

Although the job of making economic policy belongs to world leaders, the job of explaining the workings of the economy as a whole falls to macroeconomists. Toward this end, macroeconomists collect data on incomes, prices, unemployment, and many other variables from different time periods and different countries. They then attempt to formulate general theories to explain these data. Like astronomers studying the evolution of stars or biologists studying the evolution of species, macroeconomists cannot conduct controlled experiments in a laboratory. Instead, they must make use of the data that history gives them. Macroeconomists observe that economies differ across countries and that they change over time. These observations provide both the motivation for developing macroeconomic theories and the data for testing them.

To be sure, macroeconomics is an imperfect science. The macroeconomist's ability to predict the future course of economic events is no better than the meteorologist's ability to predict next month's weather. But, as you will see, macroeconomists know quite a lot about how economies work. This knowledge is useful both for explaining economic events and for formulating economic policy.

Every era has its own economic problems. In the 1970s, Presidents Richard Nixon, Gerald Ford, and Jimmy Carter all wrestled in vain with a rising rate of inflation. In the 1980s, inflation subsided, but Presidents Ronald Reagan and George H. W. Bush presided over large federal budget deficits. In the 1990s, with President Bill Clinton in the Oval Office, the economy and stock market enjoyed a remarkable boom, and the federal budget turned from deficit to surplus. As Clinton left office, however, the stock market was in retreat, and the economy was heading into recession. In 2001 President George W. Bush reduced taxes to help end the recession, but the tax cuts contributed to a reemergence of budget deficits.

President Barack Obama moved into the White House in 2009 during a period of heightened economic turbulence. The economy was reeling from a financial crisis, driven by a large drop in housing prices, a steep rise in mortgage defaults, and the bankruptcy or near-bankruptcy of many financial institutions. As the financial crisis spread, it raised the specter of the Great Depression of the 1930s, when in its worst year one out of four Americans who wanted to work could not find a job. In 2008 and 2009, officials in the Treasury, Federal Reserve, and other parts of government acted vigorously to prevent a recurrence of that outcome. And while they succeeded—the unemployment rate peaked at 10 percent—the downturn was nonetheless severe, the subsequent recovery was painfully slow, and the policies enacted left a legacy of greatly expanded government debt.

Macroeconomic history is not a simple story, but it provides a rich motivation for macroeconomic theory. While the basic principles of macroeconomics do not change from decade to decade, the macroeconomist must apply these principles with flexibility and creativity to meet changing circumstances.

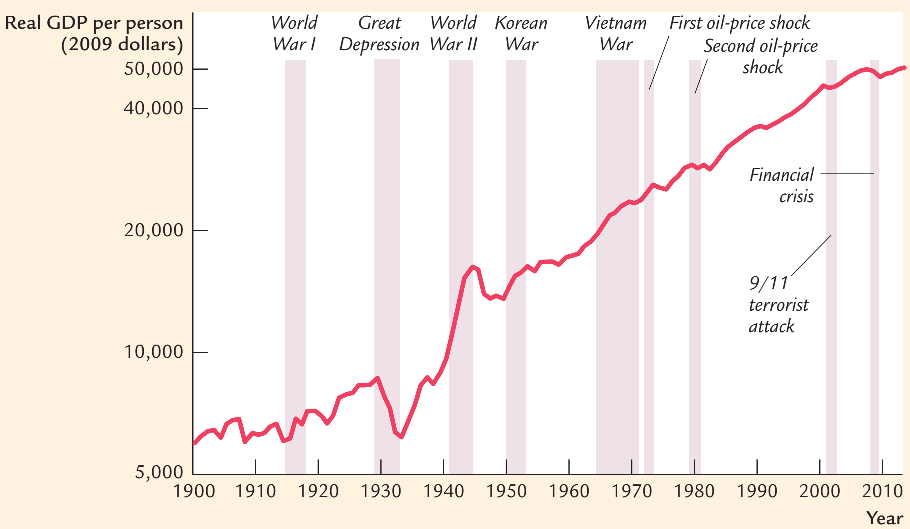
CASE STUDY

The Historical Performance of the U.S. Economy

Economists use many types of data to measure the performance of an economy. Three macroeconomic variables are especially important: real gross domestic product (GDP), the inflation rate, and the unemployment rate. **Real GDP** measures the total income of everyone in the economy (adjusted for the level of prices). The **inflation rate** measures how fast prices are rising. The **unemployment rate** measures the fraction of the labor force that is out of work. Macroeconomists study how these variables are determined, why they change over time, and how they interact with one another.

Figure 1-1 shows real GDP per person in the United States. Two aspects of this figure are noteworthy. First, real GDP grows over time. Real GDP per person

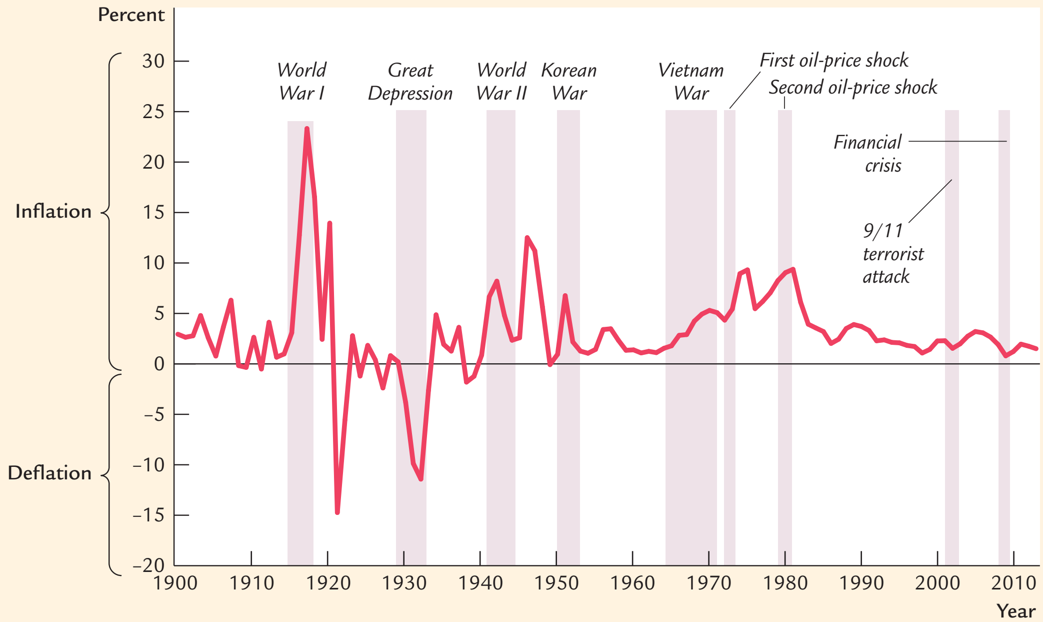
FIGURE 1-1



Real GDP per Person in the U.S. Economy Real GDP measures the total income of everyone in the economy, and real GDP per person measures the income of the average person in the economy. This figure shows that real GDP per person tends to grow over time and that this normal growth is sometimes interrupted by periods of declining income, called recessions or depressions.

Note: Real GDP is plotted here on a logarithmic scale. On such a scale, equal distances on the vertical axis represent equal percentage changes. Thus, the distance between \$5,000 and \$10,000 (a 100 percent change) is the same as the distance between \$10,000 and \$20,000 (a 100 percent change).
Data from: U.S. Department of Commerce, Economic History Association.

FIGURE 1-2



The Inflation Rate in the U.S. Economy The inflation rate measures the percentage change in the average level of prices from the year before. When the inflation rate is above zero, prices are rising. When it is below zero, prices are falling. If the inflation rate declines but remains positive, prices are rising but at a slower rate.

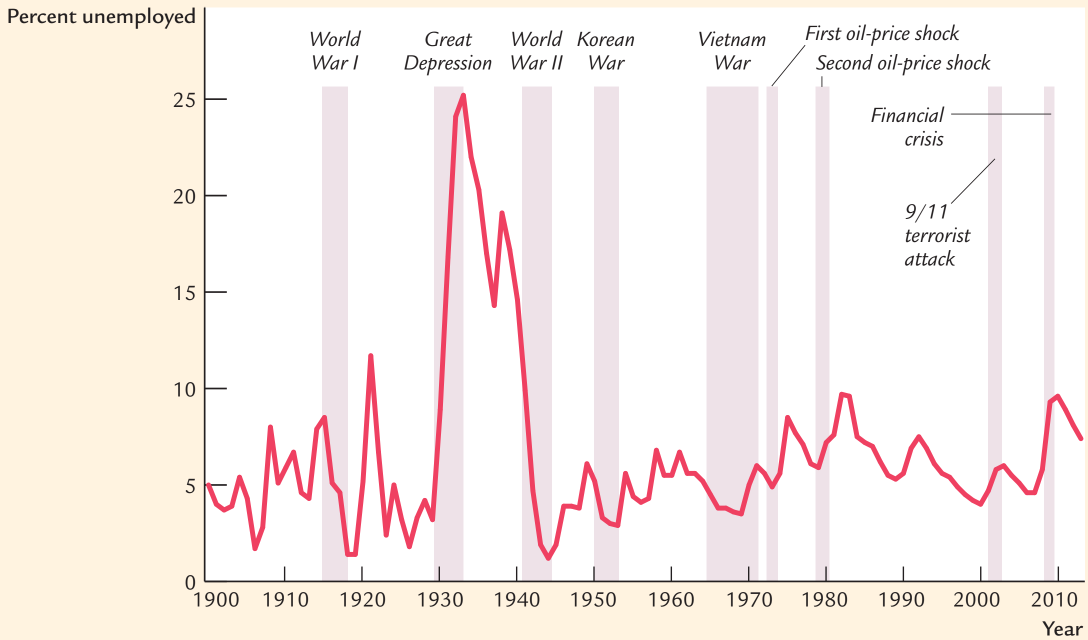
Note: The inflation rate is measured here using the GDP deflator.
Data from: U.S. Department of Commerce, Economic History Association

today is about eight times higher than it was in 1900. This growth in average income allows us to enjoy a much higher standard of living than our great-grandparents did. Second, although real GDP rises in most years, this growth is not steady. There are repeated periods during which real GDP falls, the most dramatic instance being the early 1930s. Such periods are called **recessions** if they are mild and **depressions** if they are more severe. Not surprisingly, periods of declining income are associated with substantial economic hardship.

Figure 1-2 shows the U.S. inflation rate. You can see that inflation varies substantially over time. In the first half of the twentieth century, the inflation rate averaged only slightly above zero. Periods of falling prices, called **deflation**, were almost as common as periods of rising prices. By contrast, inflation has been the norm during the past half century. Inflation became most severe during the late 1970s, when prices rose at a rate of almost 10 percent per year. In recent years, the inflation rate has been about 2 percent per year, indicating that prices have been fairly stable.

Figure 1-3 shows the U.S. unemployment rate. Notice that there is always some unemployment in the economy. In addition, although the unemployment rate has no long-term trend, it varies substantially from year to year. Recessions

FIGURE 1-3



The Unemployment Rate in the U.S. Economy The unemployment rate measures the percentage of people in the labor force who do not have jobs. This figure shows that the economy always has some unemployment and that the amount fluctuates from year to year.

Data from: U.S. Department of Labor, U.S. Census Bureau.

and depressions are associated with unusually high unemployment. The highest rates of unemployment were reached during the Great Depression of the 1930s. The worst economic downturn since the Great Depression occurred in the aftermath of the financial crisis of 2008–2009, when unemployment rose substantially. Even several years after the crisis, unemployment remained high.

These three figures offer a glimpse at the history of the U.S. economy. In the chapters that follow, we first discuss how these variables are measured and then develop theories to explain how they behave. ■

1-2 How Economists Think

Economists often study politically charged issues, but they try to address these issues with a scientist's objectivity. Like any science, economics has its own set of tools—terminology, data, and a way of thinking—that can seem foreign and arcane to the layman. The best way to become familiar with these tools is to practice using them, and this book affords you ample opportunity to do so. To make these tools less forbidding, however, let's discuss a few of them here.

Theory as Model Building

Young children learn much about the world around them by playing with toy versions of real objects. For instance, they often put together models of cars, trains, or planes. These models are far from realistic, but the model-builder learns a lot from them nonetheless. The model illustrates the essence of the real object it is designed to resemble. (In addition, for many children, building models is fun.)

Economists also use **models** to understand the world, but an economist's model is more likely to be made of symbols and equations than plastic and glue. Economists build their "toy economies" to help explain economic variables, such as GDP, inflation, and unemployment. Economic models illustrate, often in mathematical terms, the relationships among the variables. Models are useful because they help us dispense with irrelevant details and focus on underlying connections. (In addition, for many economists, building models is fun.)

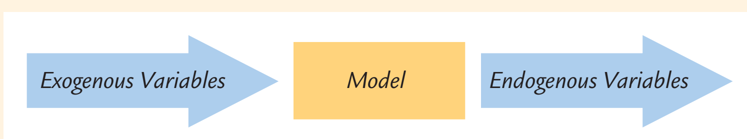
Models have two kinds of variables: endogenous variables and exogenous variables. **Endogenous variables** are those variables that a model tries to explain. **Exogenous variables** are those variables that a model takes as given. The purpose of a model is to show how the exogenous variables affect the endogenous variables. In other words, as Figure 1-4 illustrates, exogenous variables come from outside the model and serve as the model's input, whereas endogenous variables are determined within the model and are the model's output.

To make these ideas more concrete, let's review the most celebrated of all economic models—the model of supply and demand. Imagine that an economist wants to figure out what factors influence the price of pizza and the quantity of pizza sold. She would develop a model that described the behavior of pizza buyers, the behavior of pizza sellers, and their interaction in the market for pizza. For example, the economist supposes that the quantity of pizza demanded by consumers Q^d depends on the price of pizza P and on aggregate income Y. This relationship is expressed in the equation

$$Q^d = D(P, Y),$$

where $D(\ )$ represents the demand function. Similarly, the economist supposes that the quantity of pizza supplied by pizzerias Q^s depends on the price of pizza

FIGURE 1-4



How Models Work Models are simplified theories that show the key relationships among economic variables. The exogenous variables are those that come from outside the model. The endogenous variables are those that the model explains. The model shows how changes in the exogenous variables affect the endogenous variables.

P and on the price of materials P_m, such as cheese, tomatoes, flour, and anchovies. This relationship is expressed as

$$Q^s = S(P, P_m),$$

where $S(\ )$ represents the supply function. Finally, the economist assumes that the price of pizza adjusts to bring the quantity supplied and quantity demanded into balance:

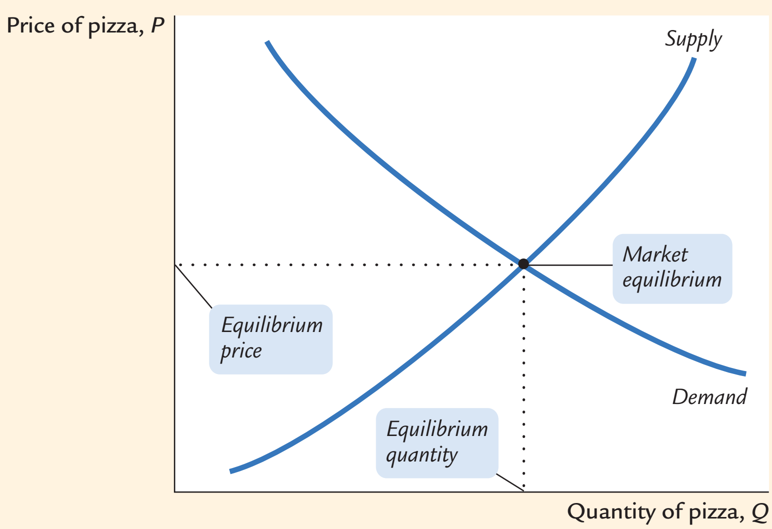
$$Q^s = Q^d.$$

These three equations compose a model of the market for pizza.

The economist illustrates the model with a supply-and-demand diagram, as in Figure 1-5. The demand curve shows the relationship between the quantity of pizza demanded and the price of pizza, holding aggregate income constant. The demand curve slopes downward because a higher price of pizza encourages consumers to buy less pizza and switch to, say, hamburgers and tacos. The supply curve shows the relationship between the quantity of pizza supplied and the price of pizza, holding the price of materials constant. The supply curve slopes upward because a higher price of pizza makes selling pizza more profitable, which encourages pizzerias to produce more of it. The equilibrium for the market is the price and quantity at which the supply and demand curves intersect. At the equilibrium price, consumers choose to buy the amount of pizza that pizzerias choose to produce.

This model of the pizza market has two exogenous variables and two endogenous variables. The exogenous variables are aggregate income and the price of

FIGURE 1-5

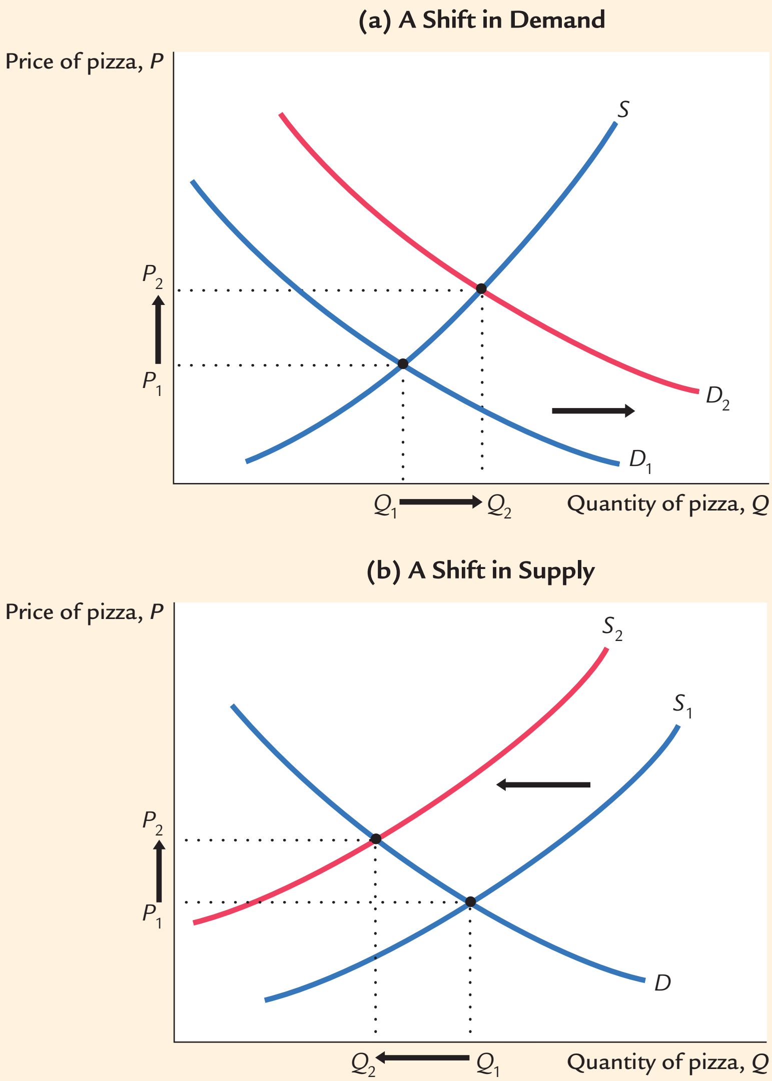


The Model of Supply and Demand The most famous economic model is that of supply and demand for a good or service—in this case, pizza. The demand curve is a downward-sloping curve relating the price of pizza to the quantity of pizza that consumers demand. The supply curve is an upward-sloping curve relating the price of pizza to the quantity of pizza that pizzerias supply. The price of pizza adjusts until the quantity supplied equals the quantity demanded. The point where the two curves cross is the market equilibrium, which shows the equilibrium price of pizza and the equilibrium quantity of pizza.

materials. The model does not attempt to explain them but instead takes them as given (perhaps to be explained by another model). The endogenous variables are the price of pizza and the quantity of pizza exchanged. These are the variables that the model attempts to explain.

The model can be used to show how a change in one of the exogenous variables affects both endogenous variables. For example, if aggregate income increases, then the demand for pizza increases, as in panel (a) of Figure 1-6. The model shows that both the equilibrium price and the equilibrium quantity of pizza rise. Similarly, if the price of materials increases, then the supply of pizza decreases, as in panel (b) of Figure 1-6. The model shows that in this case the equilibrium price of pizza rises and the equilibrium quantity of pizza falls.

FIGURE 1-6



Changes in Equilibrium In panel (a), a rise in aggregate income causes the demand for pizza to increase: at any given price, consumers now want to buy more pizza. This is represented by a rightward shift in the demand curve from D_1 to D_2. The market moves to the new intersection of supply and demand. The equilibrium price rises from P_1 to P_2, and the equilibrium quantity of pizza rises from Q_1 to Q_2. In panel (b), a rise in the price of materials decreases the supply of pizza: at any given price, pizzerias find that the sale of pizza is less profitable and therefore choose to produce less pizza. This is represented by a leftward shift in the supply curve from S_1 to S_2. The market moves to the new intersection of supply and demand. The equilibrium price rises from P_1 to P_2, and the equilibrium quantity falls from Q_1 to Q_2.

Thus, the model shows how changes either in aggregate income or in the price of materials affect price and quantity in the market for pizza.

Like all models, this model of the pizza market makes simplifying assumptions. The model does not take into account, for example, that every pizzeria is in a different location. For each customer, one pizzeria is more convenient than the others, and thus pizzerias have some ability to set their own prices. The model assumes that there is a single price for pizza, but in fact there could be a different price at every pizzeria.

How should we react to the model's lack of realism? Should we discard the simple model of pizza supply and demand? Should we attempt to build a more complex model that allows for diverse pizza prices? The answers to these questions depend on our purpose. If our goal is to explain how the price of cheese affects the average price of pizza and the amount of pizza sold, then the diversity of pizza prices is probably not important. The simple model of the pizza market does a good job of addressing that issue. Yet if our goal is to explain why towns with ten pizzerias have lower pizza prices than towns with only two, the simple model is less useful.

The art in economics lies in judging when a simplifying assumption (such as assuming a single price of pizza) clarifies our thinking and when it misleads us.

FYI

Using Functions to Express Relationships Among Variables

All economic models express relationships among economic variables. Often, these relationships are expressed as functions. A *function* is a mathematical concept that shows how one variable depends on a set of other variables. For example, in the model of the pizza market, we said that the quantity of pizza demanded depends on the price of pizza and on aggregate income. To express this, we use functional notation to write

$$Q^d = D(P, Y).$$

This equation says that the quantity of pizza demanded Q^d is a function of the price of pizza P and aggregate income Y. In functional notation, the variable preceding the parentheses denotes the function. In this case, $D(\ )$ is the function expressing how the variables in parentheses determine the quantity of pizza demanded.

If we knew more about the pizza market, we could give a numerical formula for the quantity of pizza demanded. For example, we might be able to write

$$Q^d = 60 - 10P + 2Y.$$

In this case, the demand function is

$$D(P, Y) = 60 - 10P + 2Y.$$

For any price of pizza and aggregate income, this function gives the corresponding quantity of pizza demanded. For example, if aggregate income is \$10 and the price of pizza is \$2, then the quantity of pizza demanded is 60 pies; if the price of pizza rises to \$3, the quantity of pizza demanded falls to 50 pies.

Functional notation allows us to express the general idea that variables are related, even when we do not have enough information to indicate the precise numerical relationship. For example, we might know that the quantity of pizza demanded falls when the price rises from \$2 to \$3, but we might not know by how much it falls. In this case, functional notation is useful: as long as we know that a relationship among the variables exists, we can express that relationship using functional notation.