Macroeconomics

Piet Mondrian. Composition In Red, Blue and Yellow, 1930 Oil on canvas, 18 1/8" x 18 1/8 "(46 x 46 cm)

Second Edition

J. Bradford DeLong
Martha L. Olney

TABLE 5.1
Economic Growth through Deep Time

Year	Population*	Real GDP per Capita†
5000 BC	5	$ 130
1000 BC	50	160
1 AD	170	135
1000	265	165
1500	425	175
1800	900	250
1900	1,625	850
1950	2,515	2,030
1975	4,080	4,640
2000	6,120	8,175

*World population in millions.

†Guesstimates of real GDP per capita measured in year-2000 international dollars.

Source: Joel Cohen, *How Many People Can the Earth Support?* (New York: Norton, 1995), plus authors' estimates.

TABLE 5.2
Labor-Time Costs of Commodities, 1895 and 1997

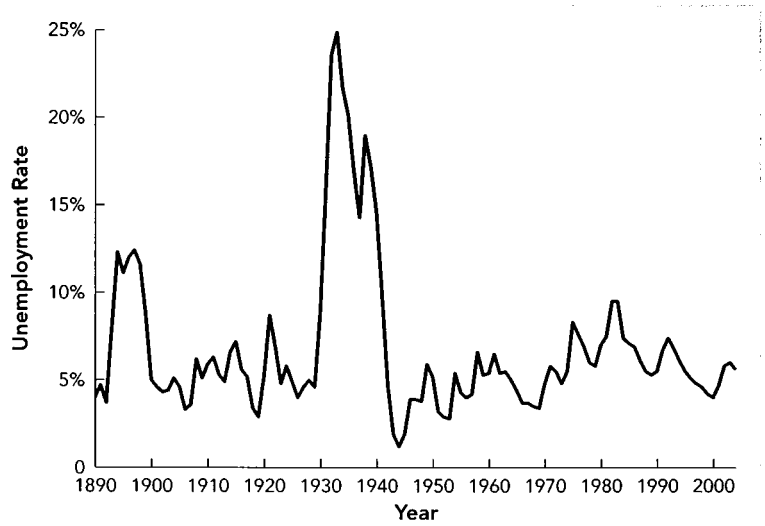
Commodity	Time to Earn (Hours)* 1895	1997	Productivity Multiple
Horatio Alger books (6 vols.)	21.0	0.6	35.0
One-speed bicycle	260.0	7.2	36.1
Cushioned office chair	24.0	2.0	12.0
100-piece dinner set	44.0	3.6	12.2
Hairbrush	16.0	2.0	8.0
Cane rocking chair	8.0	1.6	5.0
Solid gold locket	28.0	6.0	4.7
Encyclopaedia Britannica	140.0	4.0	35.0
Steinway piano	2,400.0	1,107.6	2.2
Sterling silver teaspoon	26.0	34.0	0.8
Oranges (dozen)	2.0	0.1	20.0
Ground beef (1 lb.)	0.8	0.2	4.0
Milk (1 gal.)	2.0	0.25	8.0
Television	∞	15.0	∞
Plane ticket: SFO-BOS	∞	20.0	∞
Antibiotic strep-throat cure	∞	1.0	∞
Dental X-ray	∞	2.0	∞
Laptop computer	∞	70.0	∞

*Time needed for an average worker to earn the purchase price of the commodity.

Source: 1895 Montgomery Ward catalogue and authors' calculations.

FIGURE 1.5

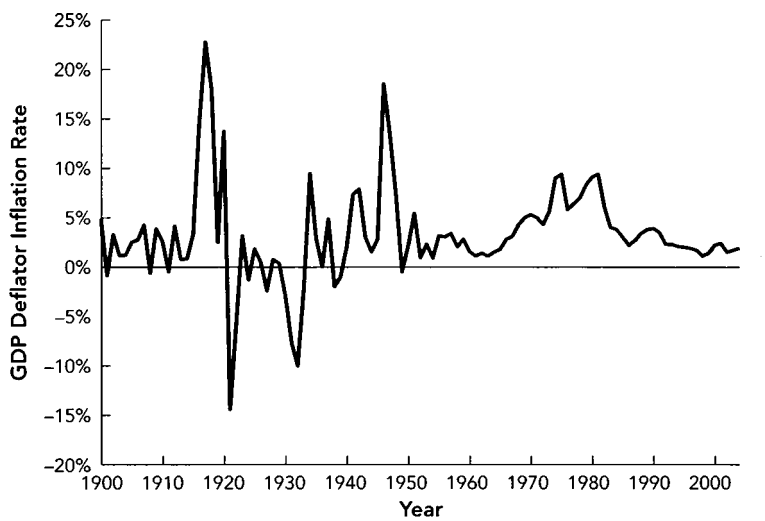
The U.S. Unemployment Rate Since World War II, the highest rate of unemployment has been the nearly 10 percent of 1982. Before World War II, peaks in unemployment were much higher, especially during the Great Depression of the 1930s.



Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office) and from Christina Romer, "Spurious Volatility in Historical Unemployment Estimates," *Journal of Political Economy*, Vol. 94 (1986), 1, pp. 1–37.

FIGURE 1.6

Inflation in the United States Before 1970, periods when inflation rose above 10 percent were confined to major wars.



Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office) and from *Historical Statistics of the United States* (Washington, DC: Government Printing Office, 1975).

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For Ann Marie Marciarille
and
For Esther Hargis

About the Authors

J. Bradford DeLong

J. Bradford DeLong is professor of economics at the University of California at Berkeley, where he has been teaching since 1995. Before starting to teach at Berkeley, he was deputy assistant secretary for economic policy in the United States Department of the Treasury (1993 to 1995), where an enormous range of issues crossed his desk — from what the Federal Reserve will do next week to whether the Uruguay Round of the GATT should be ratified to the macroeconomic implications of the (unsuccessful) health care reform. Before working at the Treasury he was an associate professor at Harvard University, where he was both an undergraduate student (B.A. 1982) and a graduate student (Ph.D. 1987). He has also taught at Boston University and MIT.

Professor DeLong is also a research associate of the National Bureau of Economic Research and a visiting scholar at the Federal Reserve Bank of San Francisco. And he is a former coeditor of the *Journal of Economic Perspectives*.

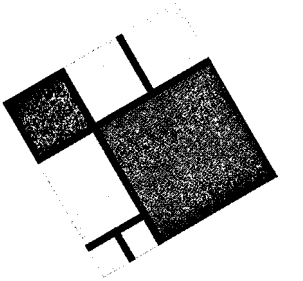
Professor DeLong's research interests range from the origins of the Great Depression to the effect of irrational speculation on stock market values; to whether there is a "new economy"; and, among other things, to the causes of long-run economic divergence across nations. He is a prolific writer and has contributed more than 100 articles to publications ranging from *The American Economic Review* to *Fortune* and *Foreign Affairs* to *The New York Times*. His own Web site contains an awesome amount of material — including reviews of books and scholarly articles and analyses of current events — and is widely considered to be one of the best academic economics Web sites available. Brad DeLong lives in Lafayette, California, with his wife and two children.

Martha L. Olney

Martha L. Olney received her B.S. in 1978 from the University of Redlands and Ph.D. in 1985 from the University of California, Berkeley. She is an adjunct professor of economics at U.C. Berkeley, where she has taught since 1992. Previously, she was a tenured member of the economics faculty at University of Massachusetts, Amherst. Professor Olney has also taught at Stanford University. Her research is in the areas of consumer spending and consumer indebtedness, focusing especially on the interwar years.

Professor Olney is the author of *Buy Now Pay Later: Advertising, Credit, and Consumer Durables* (University of North Carolina Press, 1991). Honored several times for her excellence in teaching, Professor Olney is the recipient of Distinguished Teaching Awards from the University of California, Berkeley and University of Massachusetts, Amherst. The Economic History Association awarded her the Jonathan Hughes Prize for Excellence in Teaching Economic History in 1997. Martha Olney lives in El Cerrito, California, with her partner and their son.

Brief Contents



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List of Boxes

Preface

Brad DeLong wrote the first edition of this book out of a sense that it was time for intermediate macroeconomics to spend some time in drydock and have the barnacles scraped off its hull. More than three-quarters of a century had elapsed since John Maynard Keynes wrote his *Tract on Monetary Reform,* which first linked inflation, production, employment, exchange rates, and policy together in a pattern that we today can recognize as "macroeconomics." Two-thirds of a century had elapsed since John Hicks and Alvin Hansen drew their IS and LM curves. More than one-third of a century had elapsed since Milton Friedman and Edward Phelps demolished the static Phillips curve, and since Robert Lucas, Thomas Sargent, and Robert Barro had taught us what rational expectations could mean. All this time, intermediate macroeconomics became more complicated, as new material was added while old material remained. It seemed to Brad that if he could successfully streamline the presentation of material, both traditional and modern, the result would be a more understandable and comprehensible book.

Martha Olney came on board for the second edition of this book out of a conviction that Brad had it right: The macro story of this book does move more smoothly through the water than its competitors. The focus is on what students need to know to understand our modern macroeconomy. Is a tax cut good or bad for the economy? Yes. If household saving increases, is that good or bad for the economy? Yes. By teaching both long-run growth and short-run fluctuations, and most important, in Martha's experience, by teaching the flexible-price flow of funds model, students clearly see the central dilemma policy makers face today: That what is good (or bad) for the macroeconomy in the short run may well be bad (or good) in the long run. Martha admits she was dragged into teaching long-run growth a decade or more ago when it cropped up in first one and then another textbook. She never liked the fact that the growth material seemed "crammed" into the book (and consequently into her lectures) without being part of a unifying story. But the treatment of growth in the first edition of *Macroeconomics,* and particularly the integration of Chapters 4 through 12 into one big story, have made her a full-fledged convert. Martha's best macro classes have been taught from this book.

The changes to the first edition focus almost entirely on pedagogy: What is the clearest way to teach a given concept? The second edition sticks with the five changes in the standard presentation of modern macroeconomics introduced in the first edition. Those five changes are not radical; rather they are shifts in emphasis and changes of focus. They do not require recasting of courses, but they are very

important in bringing the organization of the book into line with what students learning macroeconomics today need to know.

MAJOR INNOVATIONS OF THE FIRST EDITION

The first two changes relate to *economic growth.*

- Provide a more student-friendly way of learning *growth theory.*
- Provide sufficient coverage of *growth facts* so that students learn the how and why of both growth over time and growth across countries.

Too often undergraduates find the standard presentation of growth theory — with concepts like "output per effective worker" — to be confusing. The more understandable and robust presentation of growth theory in this book focuses on the economy's balanced-growth capital-output ratio, which is itself a very simple function of the proximate determinants of accumulation: saving rates, depreciation rates, population growth, and labor-augmenting technical change. To make the links between the fundamental determinants of growth and the workings of the economy simpler and more transparent is more than half the battle.

Economic growth is worth much more than one or even two short chapters — here the growth chapters are among the longest in this book. Students have no business leaving macroeconomics courses without understanding broad cross-country and cross-time patterns: the Industrial Revolution, the spread of industrialization, the East Asian miracle, and the American century.

The third change, long overdue, has to do with the *open economy.*

- Treat the economy as open from the beginning of the book.

It is time to simply forget about the "closed-economy case" and ask students to analyze an open economy from the very beginning of the book. Even in the United States, virtually every economic policy issue and news event has an important international dimension. Presenting the closed-economy case first gives students a lot of wrong impressions — about the size of the Keynesian multiplier, about the freedom countries have to conduct independent monetary and fiscal policies, about the relationship between saving and investment — that then have to be unlearned in the "open-economy macro" chapters. Throughout the book, save in Chapter 15, the default assumption is that the exchange rate is freely floating. This assumption was not true in the past and may not be true in the distant future, but it is true now and for the foreseeable future and is thus a reasonable working assumption.

The fourth change, also long overdue, has to do with *monetary policy.*

- Deal with interest rates, not money stocks.

In today's world, where central banks set interest rates but not money stocks, the LM curve's underlying assumption that the nominal money stock is fixed is artificial. A major reason for giving the LM curve a central place is historical; it allows one to present the Keynesian–monetarist debate of the 1970s as a debate about the relative slopes of IS and LM curves. However, this debate has been dead for a generation, and conducting much of the discussion of the determination of real GDP in a framework in which the money stock is fixed gives students the wrong intuition. The LM curve cannot be eliminated: There are monetary regimes under which the central bank does not fix the interest rate. But it can be downplayed.

In our experience in the classroom, it is much better to downplay the LM curve and focus on the key factors of the position of the IS curve and the real interest

rate that is determined by the term structure and central bank policy. This brings the presentation in the textbook much closer to what students will find when they open up *The Economist* or *The Wall Street Journal*. This makes our tasks as teachers much easier because there is no longer an artificial gap between the models taught and the actions seen in the world. And so we have made the presentation of the LM curve entirely optional by placing it in its own self-contained chapter. Instructors can easily choose to include — or exclude — coverage of the LM curve.

The fifth change has to do with the *Phillips curve* and *aggregate supply*.

- Focus on the Phillips curve and the Monetary Policy Reaction Function — not on the AS-AD diagram.

The variable on the vertical axis of the aggregate supply–aggregate demand (AS-AD) graph — the price level — is not the best price variable to use in analyzing economic policy. The best price variable is the one on the vertical axis of the Phillips curve, the inflation rate. We introduce the AS-AD graph in conjunction with IS-LM in optional Chapter 11, where the price level matters because it determines the real value of the fixed nominal money stock. But in Chapter 12 — the payoff chapter — we analyze the determination of inflation (not price level) and unemployment (not GDP). We do this by bringing together the Phillips curve on the supply side and the monetary policy reaction function (MPRF) on the demand side.

Our discussion of the expectations-augmented Phillips curve in Chapter 12 explains that rational, adaptive, and static expectations are not incompatible, but rather different strategies for dealing with the problems of inflation — each of which can be useful in the right economic environment. Students then have the full story in one comprehensive package: In the short run, with static or adaptive expectations, a tax cut can have the good effect of lowering unemployment while it alas generates inflationary pressure. Over time, our changing expectations of inflation will be met by the central bank's assault on inflation and gradually — or rapidly, depending on our expectations and the bank's hawkishness — the good effects of a tax cut will be supplanted by the bad effects of higher real interest rates and lower investment spending. It's a fireworks moment in teaching when everything from Chapter 4 through Chapter 12 comes together in one glorious finale.

PEDAGOGY

Much of the pedagogical work in this book is aimed at smoothing over what often turn out to be rough spots for the students. One important way that people learn is by watching other people solve problems, and then by repeating the process. Thus, students will note that this book contains a greater-than-usual number of worked examples. This will be especially helpful for those who hesitate before making conceptual leaps.

Boxes provided throughout the book try to reinforce the main narrative without disrupting it. They are an attempt to solve the perennial problem of how to provide additional depth and background to those who need (or want) it without boring or distracting those who wish to move on. *Macroeconomics* contains five kinds of boxes:

- *Tools* boxes remind students of some of the algebraic and conceptual tools economists use.
- *Data* boxes provide real-world information to support theoretical presentations.

- *Details* boxes provide for those who want to dig deeper into a particular subject.
- *Policy* boxes provide for those who want to know how the current thread of the book affects the making of economic policy.
- *Examples* boxes show how the concepts, ideas, and models of the current main thread of the book can be applied.

To keep students focused on the forest as well as the trees, each section ends with a Recap "box." These Recaps attempt to put the main ideas of the section into a nutshell. They are themselves recapitulated in the end-of-chapter summaries, which are also designed to review the most important concepts presented in the chapter.

The end-of-chapter exercises are divided into two sets, one that is tied to the theoretical material in the book — Analytical Exercises — and a second that is tied to recent events — Policy Exercises. And finally, an extended glossary provides fuller and deeper explanations of economics concepts than is typically found in other books. Terms in the glossary, when first encountered in the text, are italicized.

NEW TO THE SECOND EDITION

The story of the book has not changed but in several crucial points its presentation has. Chapters 4, 7, 11, and 12 were extensively revised, and the changes are noted below. Every chapter was rewritten to one degree or another, always with an eye to teachability. Definitions were inserted in the margins to aid learning. Data were updated, and a discussion of the policies of the administration of President George W. Bush (Bush 43) was incorporated.

Structure

While the treatment of many, if not all, topics is unique, the structure of the book follows a standard pattern that has served macroeconomists well. **Part 1** contains three chapters — Introduction to Macroeconomics, Measuring the Macroeconomy, and Thinking Like an Economist. **Chapter 1** begins with an overview of what macroeconomics is and then quickly focuses on six key variables that together allow one to gain a firm hold on the state of the macroeconomy. The chapter closes with a quick tour of recent macroeconomic events and policy dilemmas in the world, included both to pique students' interest and to give them a sense of the kinds of questions and issues that macroeconomics is supposed to help resolve.

Chapter 2 provides the standard review of national income accounting and other measurement issues, organized around the six key economic variables of Chapter 1.

Chapter 3, the most innovative material in this section, focuses on how economists view the world. It attempts to provide insight into the kind of "science" economics is, the dominance of the "circular flow" in how macroeconomists view the world, and how economists go about building the models they use to try to analyze the macroeconomy.

Part 2 focuses on long-run growth and contains two chapters — The Theory of Economic Growth and The Reality of Economic Growth: History and Prospect. **Chapter 4** focuses on the simple-to-understand capital-output ratio, how the economy converges to its balanced-growth equilibrium capital-output ratio, and the

effect of technological progress on productivity. In the second edition, we begin with a more graphical and less algebraic approach, starting from the no-growth equilibrium and building to the punch line: While changes in the saving rate, depreciation rate, and labor-force growth rate can change the level of the standard of living, its growth from generation to generation depends upon the growth rate of technological and organizational progress.

Chapter 5 begins with a survey of very long run economic growth before the Industrial Revolution, moves on to the Industrial Revolution itself, and then covers the astonishing economic growth in the United States over the past century and a half that has made America a remarkably rich and productive society from the standpoint of any previous century. It then shifts its focus to patterns of growth and development the world over — including the East Asian miracle, stagnation in Africa, and the convergence of the Organisation for Economic Co-operation and Development (OECD) nations to common levels of productivity and industrial structure — before concluding with a discussion of economic policies and how they affect long-run growth. In a sense, Chapter 5 should be part of *everyone's* general education. It is, in summary and compressed form, an inquiry into the nature and causes of the wealth of nations.

Part 3 presents flexible-price, business-cycle macroeconomics with two real-side chapters — Building Blocks of the Flexible-Price Model and Equilibrium in the Flexible-Price Model — and one money and inflation chapter — Money, Prices, and Inflation. Since many of the functions are the same in the flexible-price full-employment model of Part 3 and the sticky-price model of Part 4, the real-side chapters are written with an eye toward making clear what changes and what doesn't when we move from flexible- to sticky-price models. **Chapter 6** covers the determination of potential output when wages and prices are flexible; the domestic components of aggregate demand — consumption, investment spending, and government purchases — and the determinants of the final component of aggregate demand, net exports.

Chapter 7 focuses on how the demand and supply for loanable funds in the flow of funds through financial markets pushes the real interest rate to the level at which investment demand equals saving supply, the economy is at full employment, and real GDP equals potential output. In the second edition, the algebra is saved for after the intuition has been developed graphically. Instructors who wish to skip the algebra altogether can readily do so — though we wouldn't — by skipping Section 7.5.

Chapter 8 moves from the real to the monetary side in the flexible-price framework. It focuses first on the utility of money and on the simple interest-inelastic quantity theory, and then moves on to consider the determinants of the price level and inflation when money demand is sensitive to the nominal interest rate.

Part 4 presents sticky-price macroeconomics and is divided into four chapters — The Sticky-Price Income-Expenditure Framework: Consumption and the Multiplier; Investment, Net Exports, and Interest Rates: The IS Curve; The Money Market and the LM Curve; and The Phillips Curve, Expectations, and Monetary Policy. This material not only rounds out the sticky-price business-cycle framework but also reaches back to the previous section to explain under what circumstances flexible-price and under what circumstances sticky-price modeling is likely to be appropriate. **Chapter 9** provides the standard treatment of the sticky-price income-expenditure inventory-adjustment model. Its innovative feature is that the model begins and ends with the open-economy case.

Chapter 10 then builds on Chapter 9 to construct the IS curve. An immediate payoff is that the last section of Chapter 10 uses the IS curve, along with changes in the Federal Reserve's interest rate targets, to help students understand why the state of the business cycle went as it did in post–World War II America.

Chapter 11 is in the second edition a truly optional chapter that considers the case when the central bank is following a policy of money-stock targeting. It explains that the interest rate and aggregate demand are jointly determined by money demand and the money stock — together summarized in the LM curve — and by the IS curve. It concludes with the concepts of aggregate demand and aggregate supply, again in the context of a central bank that targets the money stock.

Chapter 12 puts in place the keystone for Parts 3 and 4. In the second edition, we brought together here material that in the first edition had been scattered between Chapters 11 and 12, and added worked examples to aid understanding. The chapter presents the supply side using the Phillips curve, whose key determinants are the natural rate of unemployment on the one hand and the expected rate of inflation on the other. It develops the monetary policy reaction function (MPRF) — a demand-side summary of how the unemployment and inflation rates are generated when monetary policy reacts to inflation. The MPRF is itself a nifty summary of three relationships: Okun's law (introduced in Chapter 2), the IS curve (developed in Chapter 10), and the Taylor rule. The chapter then presents the three kinds of inflation expectations we expect to see — static, adaptive, and rational expectations of inflation — and the circumstances under which we expect to see each one. The MPRF and the expectations-augmented Phillips curve are combined to produce equilibrium inflation and unemployment rates and then used to illustrate the short-run and long-run effects of changes in economic policy or environment.

Part 5 begins with economic policy in three chapters — Chapter 13, Stabilization Policy; Chapter 14, Budget Balance, National Debt, and Investment; and Chapter 15, International Economic Policy. This material allows students to think through the issues and to understand the debates about proper macroeconomic management, both for stabilization and for enhancing economic growth. These policy chapters are then followed by three more discussions that emphasize the extent to which macroeconomics is an unfinished science. Chapter 16, Changes in the Macroeconomy and Changes in Macroeconomic Policy, deals with the fact that because the macroeconomy changes over time, macroeconomists are always aiming at a moving target. Chapter 17, The Future of Macroeconomics, focuses on where macroeconomists disagree and on how the science is evolving, even in the absence of structural change in the macroeconomy. Finally, the Epilogue sums up the lessons of the book and reminds readers of what we do not know.

Flexibility

The material in the first section can be compressed to the extent that it truly is review material. However, with the exception of omitting the economic growth material — Chapters 4 and 5, which would be a shame — this book does not lend itself to reordering especially well. The introductory chapters are there for good reasons, and the chain of logic and presentation from the start of the flexible-price model in Chapter 6 through the international economic policy discussion in Chapter 15 is a cumulative one.

In his classes of 30 or so students, Brad has occasionally shortchanged the chapters after 15, but doesn't recommend it. In her classes of 400 or so students, Martha has typically made it only to Chapter 13, but regrets having to stop there. While in government Brad had many conversations with smart people who could not see why the macroeconomics they had learned 35 years ago did not immediately apply. Teaching them that the world had changed and that the way macroeconomists thought about the world had changed proved remarkably hard. The historical perspectives provided in Chapters 16 and 17 and the Epilogue are (to our way of thinking, at least) worth the effort. If you won't have time to assign them, perhaps you can weave some of the perspectives offered there into your classes as you proceed through the term.

SUPPLEMENTS

For the Instructor

Instructor's Manual Written by David DeJong at the University of Pittsburgh, this useful manual offers a number of general information elements — sample syllabi, Web resources, print resources, and some mathematical background (with some homework problems/solutions) — along with the following elements for each chapter: Overview, Annotated Outline, Mathematical Tools, Teaching Tips, Answers to Textbook Exercises, Additional Exercises (and Answers), and Additional Readings.

Test Bank Written by Edward McNertney at Texas Christian University, this manual contains almost 1,400 multiple-choice questions categorized by objective, level, type, and source. The print test bank is also available in the latest test-generating software, ensuring maximum flexibility in test preparation, including the reconfiguring of graphing exercises. This software, EZTest, is the gold standard of testing programs.

PowerPoints Prepared by Linda Ghent at Eastern Illinois University, these more than 1,000 slides contain all of the illustrations from the textbook, along with a detailed, chapter-by-chapter review of the important ideas presented in the book.

Web Site Overseen by Scott Simkins at North Carolina A&T University, this site (www.mhhe.com/economics/delong2) contains a host of offerings helpful to teachers — Better Ways to Teach Macro (suggestions for presenting a new approach), a Career Center, Economics on the Web (an annotated list of URLs useful to macroeconomists), a Graphing Library (graphs that can be used to create exercises), some Supplemental Materials (information too timely for the textbook), the entire Instructor's Manual and all the PowerPoints, and finally a link to Brad DeLong's extremely rich and diverse site. To obtain an instructor login, contact your local sales representative.

For the Student

Study Guide Prepared by co-author Martha Olney at the University of California, Berkeley, this guide takes students from development of an understanding of basic definitions through several steps to open-ended "real-world" problems. Two sets of exercises — Manipulation of Concepts and Models, and Applying the Concepts and Models — come with detailed answers. "To the

Chalkboard" boxes provide step-by-step derivations of complex graphs and all formulas plus explanations of difficult material.

Web Site The site (www.mhhe.com/economics/delong2) contains a host of offerings helpful to students — Quizzes (questions written by the test bank preparer), Graphing exercises (graphs that can be manipulated to solve exercises like those in the textbook), In the News (links to current news articles), Applying the Theory (exercises that test textbook mastery), Working with Data (exercises that help students understand how economists use data), Career Center (job opportunities in economics), Economics on the Web (an annotated list of URLs useful to macroeconomics students), and finally a link to Brad DeLong's extremely rich and diverse site.

ACKNOWLEDGMENTS

I would like to thank, first of all, my students in intermediate macroeconomics — both those who took my courses in years when they were successful and, even more, those who took my courses in years when they were not: Thinking about what went wrong and about why large groups of students did not get it has been a principal spur to this book.

I was privileged to have Martin Feldstein, Olivier Blanchard, and Thomas Sargent as my teachers in the first three macroeconomics courses that I ever took. I thought they were awesome then, and I still think so. I was also lucky enough to have Lawrence Summers as my dissertation adviser. I have surely learned more about macroeconomics from him than from any single other person. Here at Berkeley, those who have had the greatest impact on my macroeconomics teaching are Christina Romer, David Romer, and Marty Olney — especially David, whose powerful arguments about how to teach macroeconomics better I have always found convincing.

Brad DeLong

I wish to thank Brad for his good cheer and most especially for his willingness to bring me aboard. We work well together, I learn a lot, and it's fun. My students — more than 5,000 of them in this course — and teaching assistants at UMass and Cal have kept me on my toes for over two decades now. Thank you for always pushing me to be a bit clearer and for laughing with me. I learn from each of you every day.

When I entered grad school in 1978, my aim was to become a macroeconomist. But at the time, it was an almost-exclusively male club. I shied away from what I envisioned would become a lifetime of battling for acceptance, and found my way to economic history, where by focusing on the Great Depression I could ask the questions that had driven me to macro in the first place. I'm grateful to all of the forces, big and small, in the intervening 25 years that have brought me back to where I began.

My biggest thanks go to my partner Esther and our son Jimmy. For your patience with my work schedule, your love, and, Jimmy, for sharing the computer with Momma, I thank you from the bottom of my heart. I owe you a year of bedtime stories, Jimmy K.

Martha Olney

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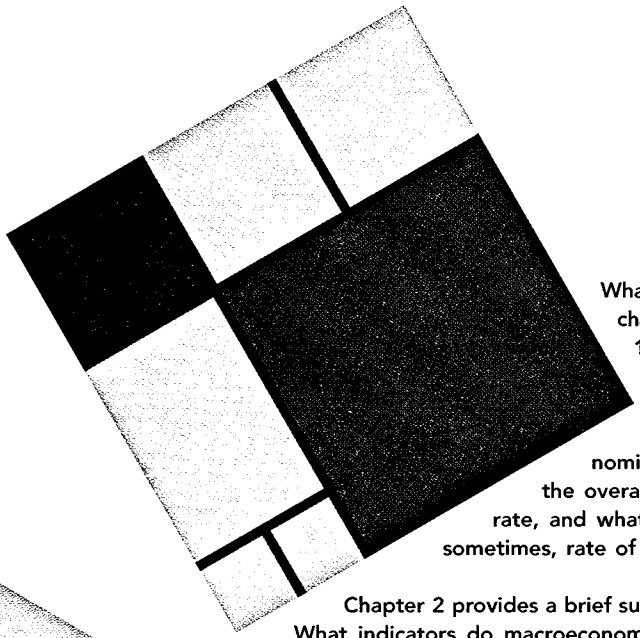
Garett Jones, *Southern Illinois University–Edwardsville*
Jinill Kim, *University of Virginia*
Ruby Kishan, *Southwest Texas State University*
Maria Kula, *Roger Williams University*
John Lapp, *North Carolina State University*
Anthony Lima, *California State University–Hayward*
Steven McCafferty, *The Ohio State University*
Roger McCain, *Drexel University*
Douglas McMillin, *Louisiana State University*
Starr McMullin, *Oregon State University*
Michael McPherson, *University of North Texas*
Chris Papageorgiou, *Louisiana State University*
Rowena Pecchenino, *Michigan State University*
Peter Pedroni, *Williams College*
Dennis Petruska, *Youngstown State University*
Uri Possen, *Cornell University*
Judy Ruha, *University of Washington*
Plutarchos Sakellaris, *University of Maryland*
Alden Shiers, *Cal Poly–San Luis Obispo*
David Spencer, *Brigham Young University*
David St. Clair, *California State University–Hayward*
Sheldon Stein, *Cleveland State University*
Philip Taylor, *Wesleyan University–Georgia*
Brian Trinque, *University of Texas–Austin*
Anne Villamil, *University of Illinois at Urbana-Champaign*
Charles Waldauer, *Widener University*
Ping Wang, *Vanderbilt University*
Charles Weise, *Gettysburg College*
Mark Wohar, *University of Nebraska–Omaha*
Robert Wright, *University of Sterling (UK)*
Jeffry Zax, *University of Colorado*

Preliminaries

PART I



What is intermediate macroeconomics? The first three chapters of this book provide an overview. Chapter 1 provides the basic guide to the major landmarks. It tells you that macroeconomics is the study not of individual markets but of the economy as a whole; that it studies total economic activity — how many people are employed, why the overall price level rises (and, rarely, falls) and at what rate, and what determines the level and rate of growth (and, sometimes, rate of decline) of total production.

Chapter 2 provides a brief survey of the major data used by macroeconomists. What indicators do macroeconomists focus on? How do they fit together? What are the national income and product accounts? These questions need to be answered before we can properly begin using macroeconomic data to understand the state of the economy.

Chapter 3 in this introductory section is "Thinking Like an Economist." Every subject has its own particular patterns of thought and fundamental assumptions that make it a separate discipline worth learning. Economists' patterns of thought, however, seem to be further from normal day-to-day experience than are those of many other disciplines. Economists have a very productive and insightful way of looking at the world, and it is different from common sense. To learn economics is to learn something genuinely new — and something instructive. Chapter 3 offers a brief introduction to the far-from-usual way that economists think: their use of graphs and equations, model building, and concepts like opportunity cost, equilibrium, and rational expectations.

CHAPTER 1

Introduction to Macroeconomics

QUESTIONS

How much richer are we than our parents were at our age?

How much richer will our children be than our grandparents were?

Will changing jobs be easy or hard in five years?

How many of us will have jobs in five years?

Will the businesses we work for vanish as demand for the products they make dries up?

Will inflation make us poor by destroying our savings or rich by eliminating our debts?

1.1 OVERVIEW

What Is Macroeconomics?

macroeconomics

The branch of economics that studies the economy as a whole: business cycles, the determinants of inflation and unemployment and long-run growth, and the effects of government fiscal and monetary policy.

What is macroeconomics? **Macroeconomics** is that subdiscipline of economics that tries to answer the six questions that begin this chapter. The answers to all these questions depend on what is happening to the economy as a whole, the economy in the large, the macroeconomy. "Macro" is, after all, nothing but a prefix meaning "large." Thus macroeconomics is the branch of economics related to the economy as a whole.

First, macroeconomists' principal task is to try to figure out why overall economic activity rises and falls. Why are measures like the total value of all production, the total income of workers and property owners, the total number of people employed, or the unemployment rate higher in some years than in others?

Second, macroeconomists also attempt to understand what determines the level and rate of change of overall prices. The proportional rate of change in the price level has a name: the inflation rate.

Third, along the way macroeconomists study other variables — such as interest rates, stock market values, and exchange rates — that play a major role in determining the overall levels of production, income, employment, and prices.

Why Macroeconomics Matters

Why does macroeconomics matter? Why should we care about the questions at the start of this chapter that are at the heart of macroeconomics? There are at least three reasons.

Cultural Literacy First, macroeconomics is a matter of cultural literacy. Much discussion in newspapers, on television, and at parties concerns the macroeconomy. This should not be surprising: The twentieth-century U.S. economy was, all in all, extraordinarily successful. Today we are on average some 50 percent richer than our parents were when they were our age. If economic growth continues at its recent pace, our children may be five or more times as rich as our grandparents were.

Our modern industrial economy has delivered increases in material prosperity and living standards that no previous generation ever saw. (We discuss this topic at greater length in Chapter 5.) This increasing material prosperity means that the economy has a cultural salience today that it did not have in previous centuries, when productivity was stagnant and material standards of living improved only as fast as a glacier moves.

Thus, if you want to follow and participate in public debates and discussions, you need to know about macroeconomics. If you don't, you won't understand news reports on changes in the economy, such as those listed in Figure 1.1.

Self-Interest A second (and more important) reason to care about macroeconomics is that the macroeconomy matters to you personally. Each of us is interested in particular issues in *micro*economics. Farmers and bakers are interested in the price of wheat; computer manufacturers and users are interested in the price of microprocessors; and economics professors are very interested in the price of economics professors. What happens in these individual markets — for wheat, for microprocessors, and for economics professors — shapes the lives of farmers, bakers, computer programmers, and economics professors.

Economics

Friday, February 18, 2005, 2:50 p.m.

Producer Prices Excluding Food, Energy Costs Climb the Most in Six Years . . .
Treasury Notes Drop as Measure of U.S. Inflation Rises More Than Forecast . . .
U.K. January Budget Surplus Widens to Three-Year High of $12.5 Billion . . .
Investors Seek Reassurance of U.K. Regulation for London Stock Exchange . . .
Shell and Exxon Tap "High Cost" Oil Sands, Gas as Other Reserves Dwindle . . .
U.K. Two-Year Gilts Decline for Fifth Straight Week Amid Signs of Growth . . .
Asian Stocks Advance as Ito-Yokado, Coles Myer Gain; Korea's Kospi Climbs . . .
Korea Electric Fourth-Quarter Net Rises Sixfold as Stronger Won Cuts Costs . . .
France Plans to Sell 50-Year Bond in 2005, First by Group of Seven Nation . . .
Ericsson, Nokia Foresee Takeovers in Saturated Market for Phone Equipment . . .
Norwegian 10-Year Notes Fall Most in World as Higher Interest Rates Loom . . .
Finland Raises $561 Million by Selling a Third of Its Stake in Sampo Bank . . .
Colombia's Peso Rises against Dollar for Fourth Week on Yield Advantage . . .
Mexican Supreme Court Orders Fox to Freeze $587 Million of Budget Spending . . .
Argentina's Merval Rises for Fourth Week, Led by Acindar; Bovespa Declines . . .
Colombia's Central Bank to Sell $1 Billion of Reserves to Help Prepay Debt . . .
Inflation Slows to Nine-Month Low in January as Cost of Vacations Declines . . .
Dollar Heads for Weekly Drop versus Euro as Greenspan Fails to Spur Buying . . .
Fuji TV May Cut Media Supply to Nippon Broadcasting if Takeover Bid Fails . . .
Japanese 10-Year Bonds Have Third Week of Declines on Stock Market Gain . . .

Source: http://www.bloomberg.com/news/index.html, February 18, 2005.

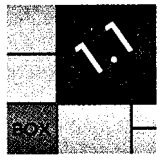
FIGURE 1.1
The Daily Flow of Economic News
Economic news flows past us constantly throughout the day. The total volume of information is overwhelming. Thus one of the major problems of macroeconomics is figuring out how to process all this information — how to make sense of it without drowning in information overload and without throwing valuable news away.

What happens in the *macro*economy shapes *everyone's* life. A rise in inflation is sure to enrich debtors (people who have borrowed) and impoverish creditors (people who have lent money to others). An expanding economy will make real incomes rise. A deep recession will increase unemployment and make those who lose their jobs have a hard time finding others. Your bargaining power vis-à-vis your employer (or, on the other side of the table, your bargaining power vis-à-vis your employees) depends on the phase of the business cycle.

Though you cannot control the macroeconomy, you can understand how it affects your opportunities. To some degree, forewarned is forearmed: Whether or not you understand your opportunities may depend on how much attention you pay in this course. The macroeconomy is not destiny: Some people do very well in their jobs and businesses in a recession, and many do badly in a boom. Nevertheless, it is a powerful influence on individual well-being. To paraphrase Russian revolutionary Leon Trotsky, you may not be interested in the macroeconomy, but the macroeconomy is interested in you.

Civic Responsibility A third important reason to care about macroeconomics is that by working together we can improve the macroeconomy. Our right to vote is one of the most precious rights human beings have ever had. In electing our government, we indirectly make macroeconomic policy. As we will see in the next section, the government's macroeconomic policy matters because it can accelerate (or decelerate) long-run economic growth and stabilize (or destabilize) the short-run business cycle. In election after election, candidates will present themselves and seek your vote. Those

who win will try to manage the macroeconomy. If you are not literate in macroeconomics, you won't be able to distinguish the candidates who might become effective macroeconomic managers from those who are clueless or cynical, promising more than they can deliver. And you need to, for many politicians cynically overpromise, and others seek to pursue economic policies that are bad for the economy in the long run but that promise to generate good short-run news — as Box 1.1 details.



ECONOMIC POLICY AND POLITICAL POPULARITY: POLICY

Politicians believe strongly that their success at the polls depends on the state of the economy. They think that fairly *and* unfairly they get the credit when the economy does well and suffer the blame when the economy does badly. One of the most outspoken political leaders on this topic was mid-twentieth-century American politician Richard M. Nixon, who publicly blamed his defeat in the 1960 presidential election on the Eisenhower administration's unwillingness to take action against an economic slump:

"The matter was thoroughly discussed by the Cabinet. . . . [S]everal of the Administration's economic experts who attended the meeting did not share [the] bearish prognosis. . . . [T]here was strong sentiment against using the spending and credit powers of the Federal Government to affect the economy, unless and until conditions clearly indicated a major recession in prospect. . . . I must admit that I was more sensitive politically than some of the others around the cabinet table. I knew from bitter experience how, in both 1954 and 1958, slumps which hit bottom early in October contributed to substantial Republican losses in the House and Senate. . . . The bottom of the 1960 dip did come in October. . . the jobless rolls increased by 452,000. All the speeches, television broadcasts, and precinct work in the world could not counteract that one hard fact."

Economic historians continue to dispute the causes of the "stagflation" — a combination of relatively high inflation and relatively high unemployment — that struck the American economy in the early 1970s, after Richard Nixon finally became president. Was it the result of his manipulation of economic policy for political goals so that during his 1972 reelection campaign the economy would look better than it had in 1960? The evidence is contradictory. But no matter how much Nixon's policy contributed to stagflation, all observers agree that his major goal was not to create a healthier economy over the long term but to make the economy look good in 1972.

Source: Richard M. Nixon, *Six Crises* (Garden City, NY: Doubleday, 1962), pp. 309–311.

Macroeconomic Policy

Growth Policy

The government's growth policy — what it does to accelerate or decelerate long-run *economic growth* — is surely the most important aspect of macroeconomic policy. Nothing matters more in the long run for the quality of life in an economy than its long-run rate of economic growth.

Consider Argentina, which was once one of the most prosperous nations in the world. In 1929, for example, it was fifth in the world in the number of automobiles per capita. Yet today Argentina is classified as a "developing" country, and as Figure 1.2 shows, it has fallen far behind rich developed industrial economies like

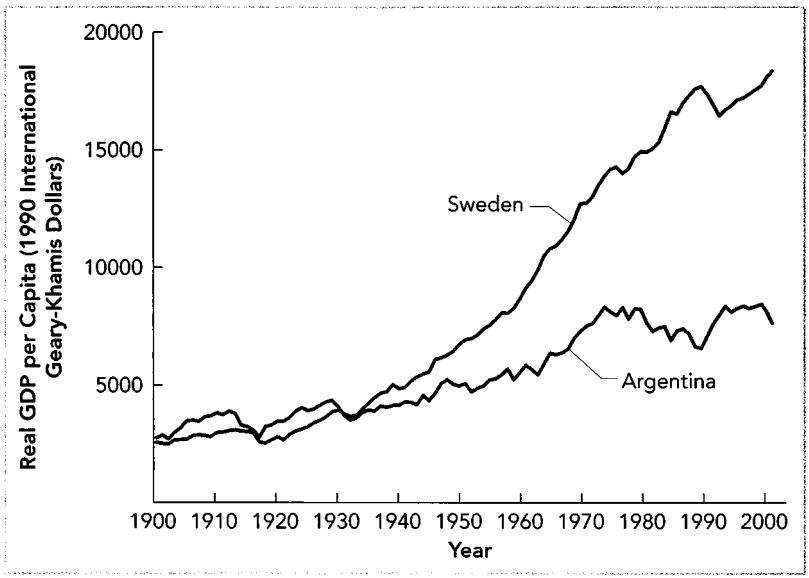


FIGURE 1.2
Long-Run Economic Growth: Sweden and Argentina, 1900–2001
At the start of the twentieth century, Argentina was richer — and seen as having a brighter future — than Sweden. But economic policies that were mostly bad for long-run growth left Argentina far behind Sweden.

Source: Angus Maddison, *The World Economy: Historical Statistics* (Paris: OECD, 2003).

Sweden. Why? Destructive economic policies have retarded Argentina's economic growth. Today Argentineans are richer than their predecessors were at the beginning of the twentieth century, but they are not nearly as well off as they might have been had Argentina's economic policies been as good and its economic growth as fast as those in Sweden.

In Scandinavian countries like Norway and Sweden, where throughout the twentieth century economic policies were supportive of growth, the past 100 years have led to extraordinary prosperity. Today economic output per person in Scandinavia is among the highest in the world. According to semiofficial estimates, Scandinavians today are more than six times as wealthy as their predecessors were at the start of the twentieth century.

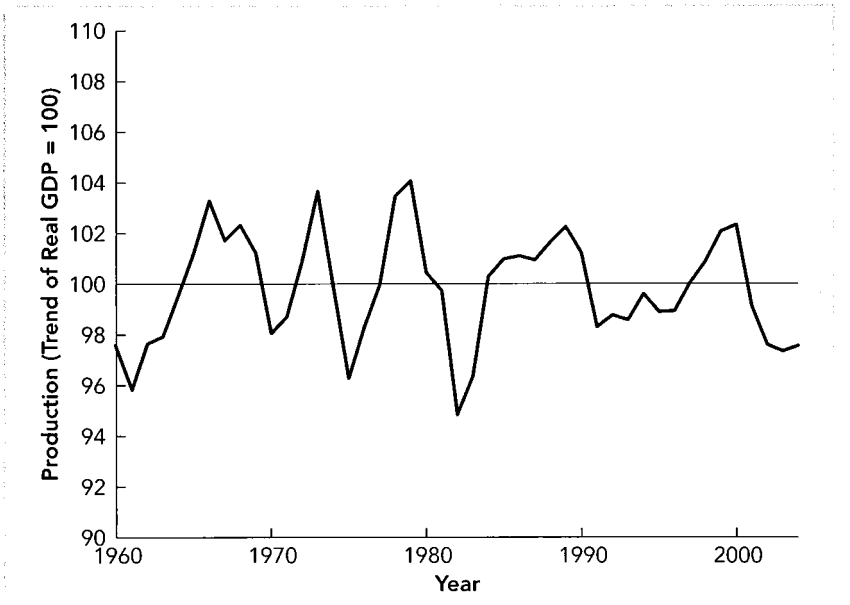
In the long run, nothing a government can do does more good for the economy than adopting good policies for economic growth.

Stabilization Policy

The second major branch of macroeconomic policy is the government's *stabilization policy*. History does not show a steady, stable, smooth upward trend toward higher production and employment. Typically, levels of production and employment fluctuate above and below long-run growth trends. Production can easily rise several percentage points above the long-run trend or fall 5 percentage points or more below the trend (see Figure 1.3). Unemployment can fall so low that businesses become desperate for workers and will spend much time and money training them. Or it can rise to 10 percent of the labor force in a deep recession, as it did in 1982.

Such fluctuations in production and employment are commonly referred to as business cycles. Periods in which production grows and unemployment falls are

FIGURE 1.3
The American Business Cycle: Fluctuations in Total Production (Real GDP) Relative to the Long-Run Growth Trend
Since 1960 business-cycle fluctuations have caused the level of production in the United States to fluctuate as much as 5 percent below or 4 percent above the trend level of real GDP.



Source: Authors' calculations based on real GDP estimates contained in the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

expansion
A period when real GDP is growing.

recession
A fall in the level of real GDP for at least six months, or two quarters of the year.

depression
A very severe recession.

deflation
The opposite of inflation: a decrease in the overall price level.

microeconomics
That field of economics that deals with the behavior of the individual elements in an economy with respect to the price of a single commodity and the behavior of individual households and businesses.

called booms, or macroeconomic **expansions.** Periods in which production falls and unemployment rises are called **recessions** or, worse, **depressions.** Booms are to be welcomed; recessions are to be feared.

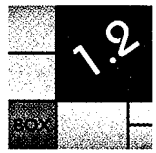
Today's governments have powerful abilities to improve economic growth and to smooth out the business cycle by diminishing the depth of recessions and depressions. Good macroeconomic policy can make almost everyone's life better; bad macroeconomic policy can make almost everyone's life much worse (see Box 1.2). For example, policy makers' reliance on the gold standard as the international monetary system during the Great Depression was the source of macroeconomic catastrophe and human misery. Thus the stakes that are at risk in the study of macroeconomics are high.

Business-cycle fluctuations are felt not only in production and employment but also in the overall level of prices. Booms usually bring inflation, or rising prices. Recessions bring either a slowdown in the rate of inflation, or *disinflation* as it is called, or an absolute decline in the price level, called **deflation.** Interest rates, the level of the stock market, and other economic variables also rise and fall with the principal fluctuations of the business cycle.

Macroeconomics versus Microeconomics

By itself macroeconomics is only half of economics. For more than half a century economics has been divided into two branches, macroeconomics and microeconomics. Macroeconomists examine the economy in the large, focusing on feedback from one component of the economy to another and studying the total level of production and employment. In contrast, **microeconomics**, which was probably the subject of your

MACROECONOMIC POLICY AND YOUR QUALITY OF LIFE: DATA



At the end of 1982 the U.S. macroeconomy was in the worst shape since the Great Depression. The unemployment rate was more than 10 percent. In an average week in 1983, some 10.7 million Americans were unemployed — actively seeking work but unable to find a job that seemed worth taking. That year the average unemployed American had already been unemployed for more than 20 weeks. The average household income in the United States was 8 percent below its long-run trend.

By contrast, at the end of 2000 U.S. unemployment was just 4 percent, and average household income was 4 percent above trend. In which year would you rather have been trying to find a job?

Bad macroeconomic policy makes years like 1982 and 1983 much more common than years like 1999 and 2000. Although good macroeconomic policy cannot maintain the degree of relative prosperity seen in 2000 indefinitely, it can all but eliminate the prospect of years like 1982 and 1983.

last economics course, deals with the economy in the small. Microeconomists study the markets for single commodities, examining the behavior of individual households and businesses. They focus on how competitive markets allocate resources to create producer and consumer surplus, as well as on how markets can go wrong.

The two groups of economists also differ in their views of how markets work. Microeconomists assume that imbalances between demand and supply are resolved by changes in prices. Rises in prices bring forth additional supply, and falls in prices bring forth additional demand, until supply and demand are once again in balance. Macroeconomists consider the possibility that imbalances between supply and demand are resolved by changes in quantities rather than in prices. That is, businesses may be slow to change the prices they charge, preferring instead to expand or contract production until supply balances demand. Table 1.1 summarizes these differences in approach.

TABLE 1.1
The Two Branches of Economics

Macroeconomists	Microeconomists
Focus on the economy as a whole.	Focus on the markets for individual commodities and on the decisions of single economic agents.
Spend much time analyzing how total income changes and how changes in income cause changes in other modes of economic behavior.	Hold total income constant.
Spend a great deal of time and energy investigating how people form their expectations and change them over time.	Don't worry much about how decision makers form their expectations.
Consider the possibility that decision makers might change the quantities they produce before they change the prices they charge.	Assume that economic adjustment occurs first through prices that change to balance supply and demand and that only afterward do producers and consumers react to the changed prices by changing the quantities they make, buy, or sell.

In every generation, economists attempt to integrate microeconomics and macroeconomics by providing "microfoundations" for the macroeconomic topics of inflation, the business cycle, and *long-run growth*. But no one believes that the bridge between microeconomics and macroeconomics has yet been soundly built. Economists are divided roughly evenly between those who think that the failure to successfully integrate microeconomics and macroeconomics is a flaw that urgently needs to be corrected and those who think it is a regrettable but minor annoyance. Thus less knowledge may carry over from microeconomics to macroeconomics than one might expect or hope. Be careful in trying to apply the principles and conclusions of microeconomics to macroeconomic questions — and vice versa.

RECAP OVERVIEW

Macroeconomics is that branch of economics related to not individual markets but the economy as a whole. The government's *growth policy* — what it does to accelerate or decelerate long-run economic growth — is surely the most important aspect of macroeconomic policy. Nothing matters more in the long run for the quality of life in an economy than its long-run rate of economic growth. The second major branch of macroeconomic policy is the government's *stabilization* policy. Typically, levels of production and employment fluctuate above and below long-run growth trends. Periods in which production grows and unemployment falls are called *booms*, or *macroeconomic expansions*. Periods in which production falls and unemployment rises are called *recessions*, or, worse, *depressions*.

1.2 TRACKING THE MACROECONOMY

Economic Statistics and Economic Activity

Macroeconomics could not exist without the economic statistics that are systematically collected and disseminated by governments. Estimates of the value and composition of economic activity, principally those contained in the *national income and product accounts* (*NIPA*) reported by the U.S. Commerce Department's *Bureau of Economic Analysis*, are the fundamental data of macroeconomics. We cannot try to explain fluctuations in economic activity unless we know what those fluctuations are. But what is economic activity?

Whenever you work for someone and get paid, that is economic activity. Whenever you buy something at a store, that is economic activity. Whenever the government taxes you and spends its money to build a bridge, that is economic activity. In general, if a flow of money is involved in a transaction, economists will count that transaction as economic activity. Overall, economic activity is the pattern of transactions in which things of real, useful value — resources, labor, goods, and services — are created, transformed, and exchanged. If a transaction does not involve something of useful value being exchanged for money, odds are that NIPA will not count it as part of economic activity.

In the United States, individual economic statistics are released month by month and quarter by quarter, a quarter being a three-month period: a quarter of a year. Thus you will often hear economists and other analysts talk about the "change in inventories in the second quarter." Table 1.2 shows a sample of the kinds of

TABLE 1.2

The Flow of Economic Data, 2003–2004

The items below are a representative selection of recent economic data, reported quarterly — that is, calculated four times a year, once for January through March, once for April through June, once for July through September, and once for October to December.

The Glossary will tell you much more about what these numbers mean.

	2003				2004		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Percent changes at annual rates							
Production and Demand							
Gross domestic product	1.9	4.1	7.4	4.2	4.5	3.3	4.0
Personal consumption expenditures	2.7	3.9	5.0	3.6	4.1	1.6	5.1
Nonresidential fixed investment	−0.1	11.8	15.7	11.0	4.2	12.5	13.0
Residential investment	7.5	9.1	22.4	9.6	5.0	16.5	1.6
Exports of goods and services	−1.5	−1.6	11.3	17.5	7.3	7.3	6.0
Imports of goods and services	−2.0	2.5	2.8	17.1	10.6	12.6	4.6
Government purchases	0.2	7.2	0.1	1.6	2.5	2.2	0.7
Inflation							
Gross domestic purchases	3.9	0.4	1.6	1.2	3.4	3.5	2.0
Personal consumption expenditures	3.2	0.7	1.6	1.2	3.3	3.1	1.3
Gross domestic product	2.9	1.1	1.3	1.4	2.7	3.2	1.4
Billions of dollars, seasonally adjusted annual rates							
Federal Government Finances:							
Receipts	1,888.6	1,902.5	1,816.4	1,900.6	1,915.3	1,949.1	1,956.7
Current expenditures	2,170.2	2,266.9	2,249.4	2,279.8	2,306.3	2,329.1	2,340.8
Surplus or Deficit (−)	−281.6	−364.4	−433.0	−379.2	−391.0	−380.0	−384.1
Inventories:							
Change in private inventories	10.6	−15.3	−3.7	3.5	36.2	59.0	31.6
Ratio, Inventories to final sales	2.55	2.51	2.45	2.42	2.42	2.43	2.40
Balance of payments:							
Current account	−553	−536	−527	−508	−589	−658	−659
Various							
Labor Market							
Unemployment rate (percent)	5.8	6.1	6.1	5.9	5.7	5.6	5.4
Payroll growth (thousands)	−254	−53	99	302	531	693	401
Stock Market							
S&P 500 (index)	847	988	1,019	1,081	1,124	1,133	1,118
NASDAQ (index)	1,349	1,632	1,856	1,957	1,979	2,001	1,885
Nominal Interest Rates							
3-month (percent per year)	1.13	0.92	0.94	0.90	0.94	1.27	1.65
10-year (percent per year)	3.81	3.33	4.27	4.27	3.83	4.73	4.13
BAA (percent per year)	6.95	6.19	6.79	6.60	6.11	6.78	6.27
Exchange Rate							
Value of 100 yen ($)	0.84	0.84	0.85	0.92	0.93	0.91	0.91
Value of 1 euro ($)	1.07	1.14	1.13	1.19	1.25	1.20	1.22

Source: 2005 *Economic Report of the President.*

economic data that economists, politicians, and others, including investors in the stock and bond markets, use to assess the course of the economy. The sheer number of statistics is confusing at first glance, but all the statistics either (1) are direct measures of six key economic indicators that together tell most of the story or (2) are primarily useful as partial forecasts of or as factors that help determine the six key indicators of economic activity.

Six Key Variables

You can get a good idea of the pulse of recent economic activity by simply looking at the six key economic variables. Together they summarize the state of the macroeconomy. If you want to be able to say more than "the economy is good" or "the economy is not so good," you need to understand and be able to analyze these six variables:

- Real gross domestic product.
- The unemployment rate.
- The inflation rate.
- The interest rate.
- The level of the stock market.
- The exchange rate.

The first two are the most important: They are directly and immediately connected to people's material well-being. The other four are indicators and controls that are not directly and immediately connected to people's current material well-being, but they profoundly influence the economy's direction. Let's look at each of these indicators more closely.

Real GDP

real GDP

Inflation-adjusted gross domestic product; the most commonly used measure of national product, output, and income earned through domestically produced goods and services.

The first key variable is the level of real gross domestic product, called **real GDP** or often just GDP for short. "Real" means that this measure corrects for changes in the overall level of prices. If total spending doubles because the average level of prices doubles but the total flow of commodities does not change, then real GDP does not change. Economic variables are either *real* — that is, they have been adjusted for changes in the price level and inflation — or *nominal* — that is, they have not been adjusted for changes in the price level and inflation. "Gross" means that this measure includes the replacement of worn-out and obsolete equipment and structures as well as completely new investment. (Gross measures contrast with net measures, which include only investment that adds to the capital stock — not investment that merely replaces worn-out and obsolete capital stock. Net measures are better than gross measures, but the information needed to construct them is not as reliable.)

"Domestic" means that this measure counts economic activity that happens in the United States, whether or not the workers are legal residents and whether or not the factories are owned by American companies. (Domestic measures contrast with national measures, which count all the economic activity conducted by U.S. citizens and other permanent residents and by the companies they own.) Finally, "product" means that real GDP represents the production of *final goods and services*. It includes both consumption goods (things that consumers buy, take home or take out, and consume) and investment goods (things like machine tools, office equipment, and newly constructed houses and office buildings, which boost the

country's capital stock and productive capacity). It also includes government purchases, things that the government (acting as our collective agent) buys and uses.

Real GDP divided by the number of workers in the economy is the most frequently used summary index of the economy (see Box 1.3). It is a measure of how well the economy produces goods and services that people find useful — the necessities, conveniences, and luxuries of life. It is, however, a flawed and imperfect index. It says nothing, for instance, about the relative distribution of the nation's economic product. And because it measures market prices, not user satisfaction, it is an imperfect measure of material well-being. Nevertheless, **real GDP per worker** remains the best readily available economic index.

real GDP per worker

One of the best available measures of long-term economic growth: real GDP divided by the number of workers (or, alternatively, by the total number of hours worked).

The Unemployment Rate

The second key variable is the **unemployment rate.** The unemployed are people who want to work and are actively looking for jobs but have not yet found one (or have not yet found one that they consider attractive enough to take rather than continue to look for a still better job). The unemployment rate is equal to the number of unemployed people divided by the total labor force, which is the sum of the number of unemployed people and the number of people who have jobs. The U.S. Labor Department's *Bureau of Labor Statistics* conducts the *Current Population Survey,* a random survey of 60,000 of America's households, every month. The estimated number of unemployed workers obtained from the survey is then divided by the estimated total labor force, also obtained from the survey. The result is that month's unemployment rate. It is released to the public on the first Friday of the next month.

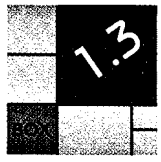
unemployment rate

The share of the labor force who are looking for but have not found an acceptable job.

Most people consider unemployment to be a bad thing, and it usually is. Yet it is important to notice that an economy with no unemployment at all would probably be a badly working economy. Just as an economy needs inventories of goods — goods in transit, goods in process, goods in warehouses and sitting on store shelves — in order to function smoothly, it needs "inventories" of jobs looking for workers (vacancies) and workers looking for jobs (the unemployed). An economy in which each business grabbed the first person who walked through the door to fill a newly open job and in which each worker took the first job offered would be a less productive economy. Workers should be somewhat choosy about what jobs they take. They should decline jobs when they think that "this job pays too little" or "this job would be too unpleasant." Likewise, employers should be choosy about which workers they hire. Such *frictional unemployment* is an inevitable part of the process that makes good matches between workers and firms — matches that pair qualified workers with jobs that use their qualifications.

During recessions and depressions, however, unemployment is definitely not frictional. In these downturns in the business cycle the unemployment rate can rise far above the level resulting from a normal and healthy process of job search. The market economy breaks down, failing to match workers willing and able to work with businesses that could put their skills and labor power to making useful goods and services. Economists call this type of unemployment *cyclical unemployment.* In the United States during the Great Depression the unemployment rate rose to 25 percent (see Box 1.4). In Germany during the same period, the rate rose to 33 percent.

When the unemployment rate is high, the market economy is not functioning well. The unemployment rate is the best indicator of how well the economy is doing relative to its productive potential. In recent years, however, some economists have worried that the unemployment rate is becoming less useful as an indicator of the amount of "slack" in the economy — the gap between production and



U.S. REAL GDP PER WORKER: DATA

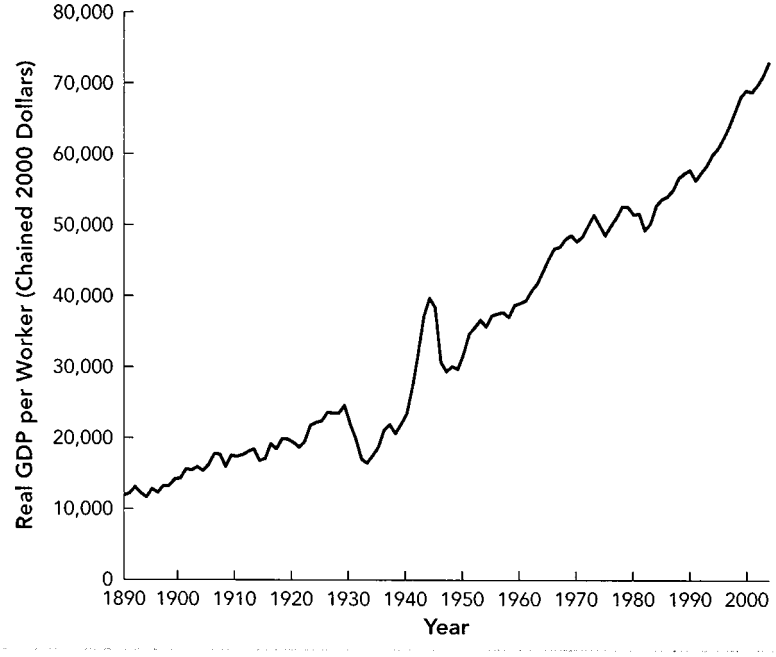
In the year 2000, calculated using 2000 prices, officially measured U.S. real GDP per worker — the total value of all final goods and services produced in the United States divided by the number of workers in the labor force — reached $73,000. The measured productivity of the average American worker had more than sextupled since 1890, when the standard estimate of 2000-price real GDP per worker was some $12,000. Amazingly, this upward leap in economic well-being was accomplished in a little over four generations.

Figure 1.4 shows this upward trend in real GDP per worker. Despite temporary setbacks in recessions and depressions — of which the Great Depression of the 1930s was by far the largest — the principal event of the twentieth century was this sextupling of measured real GDP per worker. Other macroeconomic events visible in the figure include the World War II boom, the 1974–1975 and the 1980–1983 major recessions, the 1990–1991 minor recession, the two-decade-long period of stagnation from the early 1970s to the early 1990s — a period that saw the 1973 and 1979 sharp oil price increases by OPEC and the large investment-reducing government budget deficits of the 1980s — and the pre-1973 and post-1995 decade-long booms.

Note that this figure says nothing at all about how economic growth was distributed. In fact, the years between 1930 and 1970 saw the middle and working classes diminish the relative income gap between themselves and the rich. The years between 1970 and the present have seen this gap open wider once again.

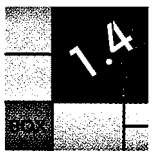
FIGURE 1.4

Officially Measured Real GDP per Worker (Chained 2000 Dollars) in the United States Measured U.S. real GDP per worker has multiplied sixfold since 1890.



Source: Angus Maddison, *Monitoring the World Economy* (Paris: OECD, 1995), as updated by the authors.

THE U.S. UNEMPLOYMENT RATE IN THE TWENTIETH CENTURY: DATA

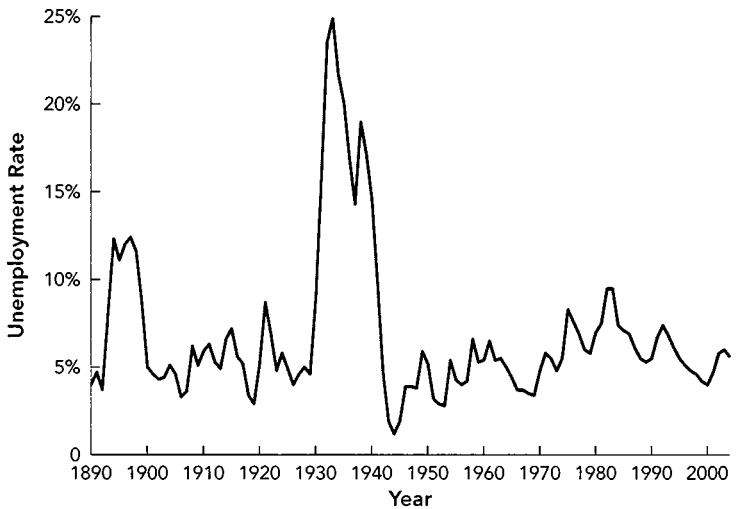


In the twentieth century the U.S. unemployment rate dipped as low as 1.5 percent during World War II and reached as high as 25 percent during the Great Depression, the principal macroeconomic catastrophe of the past century. No other recession or depression in the nation's history, not even the depression of the early 1890s, came close to having the Great Depression's devastating impact (see Figure 1.5).

Since World War II, the U.S. unemployment rate has fluctuated between 3 and 10 percent, with the highest rates occurring in the decades of the 1970s and 1980s.

FIGURE 1.5

The U.S. Unemployment Rate Since World War II, the highest rate of unemployment has been the nearly 10 percent of 1982. Before World War II, peaks in unemployment were much higher, especially during the Great Depression of the 1930s.



Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office) and from Christina Romer, "Spurious Volatility in Historical Unemployment Estimates," *Journal of Political Economy*, Vol. 94 (1986), 1, pp. 1–37.

the economy's potential. Employment fell sharply in the early 2000s, but the unemployment rate did not rise by much. This raised the possibility that many adults who were calling themselves "out of the labor force" were in fact discouraged workers — people who would be looking for (and finding) jobs if the macroeconomic news were better — and thus should be taken into account in calculating the economy's productive potential.

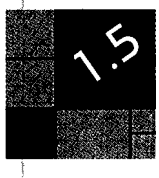
The Inflation Rate

A third key economic indicator is the inflation rate, a measure of how fast the overall price level is rising. If the inflation rate this year is 5 percent, that means that in general things cost 5 percent more this year than they cost last year in money

inflation rate

The annual rate of change of the overall level of prices in the economy.

terms, in terms of the symbols printed on dollar bills. A very high inflation rate — more than 20 percent a month, say — can cause massive economic destruction, as the price system breaks down and the possibility of using profit-and-loss calculations to make rational business decisions vanishes. Such episodes of *hyperinflation* are among the worst economic disasters that can befall an economy. But not since the Revolutionary War has the United States experienced hyperinflation. Box 1.5 tracks the inflation rate in the United States over the past century.

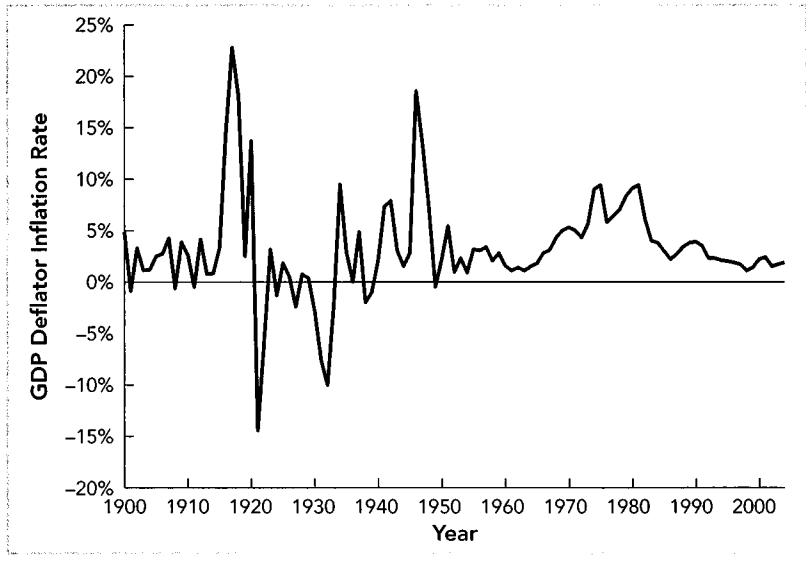


U.S. INFLATION RATES IN THE TWENTIETH CENTURY: DATA

In the United States in the twentieth century significant peaks of inflation occurred during World Wars I and II, when overall rates of price increase peaked at more than 20 percent per year (see Figure 1.6). Before World War II, deep recessions like the Great Depression of the 1930s were accompanied by *deflation:* a decline in the level of overall prices that bankrupted businesses and banks, exacerbating the fall in output and employment.

FIGURE 1.6

Inflation in the United States Before 1970, periods when inflation rose above 10 percent were confined to major wars.



Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office) and from *Historical Statistics of the United States* (Washington, DC: Government Printing Office, 1975).

Strangely, moderate inflation rates — a little more than 10 percent a year, say — are highly unsettling to consumers and business managers. Moderate inflation should not seriously compromise consumers', investors', and managers' ability to determine the best use of their financial resources or to calculate profitability. Yet all these groups are strongly averse to it. Politicians in the industrialized economies have discovered that if they fail to preside over low and stable inflation rates then they are likely to lose the next election.

Since World War II there has been only one single year — in the late 1940s — during which the price level declined. Otherwise, there has been inflation. Post–World War II inflation has come in two varieties: the "creeping" inflation of the 1950s, early and mid-1960s, and 1990s, too small and slow for anyone to pay much attention to it; and the "trotting" inflation of the late 1960s, 1970s, and 1980s — too high to ignore and too tempting a political football for politicians to resist blaming the current government.

The steep decline in inflation that occurred in the early 1980s is called the "Volcker disinflation," after then–Federal Reserve Chair Paul Volcker. Alarmed by the accelerating inflation of the late 1970s and early 1980s, Volcker decided to raise interest rates in order to decrease *aggregate demand*. In doing so, he risked a deep recession, which came in 1982–1983. But his action did stop the rise in inflation and reduce it back to the "creeping" range.

The Interest Rate

interest rate

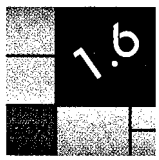
The price, measured in percent per year, paid for borrowing money. Conversely, the return earned by saving.

The fourth key economic indicator is the **interest rate**. Though economists speak of "the" interest rate, there are actually many different interest rates applying to loans of different durations and different degrees of risk. (After all, the person or business entity to whom you lend your money may be unable to pay it back; that is a risk you accept when you make a loan.) The different interest rates often move up or down together, so economists speak of "the" interest rate, referring to the entire complex of different rates. But interest rates do not move in concert all the time. The causes of variations in the *yield curve*, which describes the pattern of interest rates, are an important part of macroeconomics.

The interest rate is important because it governs the redistribution of purchasing power across time. Those people or business enterprises who think they can make good use of additional financial resources borrow, promising to return the purchasing power they use today with *interest* in the future. Those business enterprises or people who have no immediate use for their financial resources lend, hoping to profit when the borrower returns the borrowed sum — what financiers call the principal — with interest.

When economists think about interest rates, they almost always prefer to focus on the real interest rate rather than the nominal interest rate. The *nominal interest rate* is the interest rate in terms of money — for example, how many dollars' worth of interest a borrower must pay to borrow a given sum of money for one year. The *real interest rate* is the interest rate in terms of goods and services — for example, how much purchasing power over goods and services a borrower must pay in order to borrow a given amount of purchasing power for one year. The difference between the two is that nominal interest rates do not take proper account of the effect of inflation; real interest rates do.

Whenever interest rates are low — that is, when money is "cheap" — investment tends to be high, because businesses find that a wide range of possible investment projects will generate enough cash to pay the interest on borrowed money, repay the principal of the loan, and still produce a profit. Whenever interest rates are high — that is, when money is "dear" — investment tends to be low, because businesses find that most possible investment projects will not generate enough cash flow to repay the principal and the high interest. Box 1.6 shows changes in real interest rates in the United States since 1960.



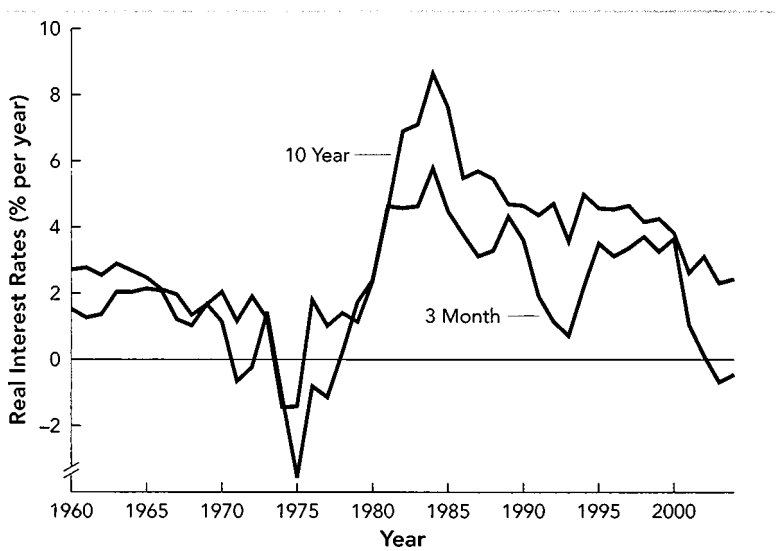
REAL INTEREST RATES: DATA

Interest rates on long-term debt, like the 10-year notes issued by the U.S. Treasury, are usually higher than interest rates on short-term debt, like the 3-month Treasury bills. Whenever long-term interest rates are lower than short-term interest rates, the yield curve is said to be "inverted." An inverted yield curve is one of the signals of a possible coming recession.

Interest rates have fluctuated widely in the United States since 1960 (see Figure 1.7). Real interest rates — that is, interest rates adjusted for inflation — have even been negative at times. During the 1970s nominal — money — interest rates were so low and inflation was so high that the interest and principal on a short-term loan bought fewer commodities when the loan was repaid than the original principal could have purchased when the loan was made. In the early 1980s — the Volcker years — interest rates increased radically. They remained higher than their levels in the 1950s and 1960s until 2001 when the Federal Reserve, led by Alan Greenspan, lowered nominal rates eleven times to stimulate the macroeconomy.

FIGURE 1.7

U.S. Real Interest Rates, 1960–2004 Between the Volcker disinflation of the early 1980s and the Greenspan rapid-fire cuts of nominal interest rates in 2001, real interest rates in the United States were markedly higher than they had been during the 1970s and even the 1960s. Since the early 1980s the yield curve has also been relatively steeply sloped; that is, the gap between long-term interest rates (like the interest rate on the 10-year U.S. Treasury note) and short-term interest rates (like the interest rate on the three-month U.S. Treasury bill) has been relatively large.



Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office) and from *Historical Statistics of the United States* (Washington, DC: Government Printing Office, 1975).

The Stock Market

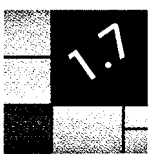
stock market

The market in which the shares of common stock that carry ownership of companies are bought and sold.

The level of the **stock market** is the key economic indicator you hear about most often — you hear about it every single day unless you try hard to avoid the news. The level of the stock market is an index of expectations for the future. When the stock market is high, investors expect economic growth to be rapid, profits to be high, and unemployment to be relatively low. (Note, however, that there is an element of tail chasing in the stock market. Perhaps it would be more accurate to say that the stock market is high when average opinion expects that average opinion will expect that future economic growth will be rapid.) Conversely, when the stock market is low, investors expect the economic future to be relatively gloomy.

At times, such as the end of the 1960s or the end of the 1990s, the stock market appears significantly overvalued compared to its standard historical patterns. During such episodes investors are implicitly forecasting a major boom and continued rapid productivity growth. When their forecasts turn out to be wrong, these investors are severely disappointed with their stock market investments. Box 1.7 shows the course of the U.S. stock market over the past century.

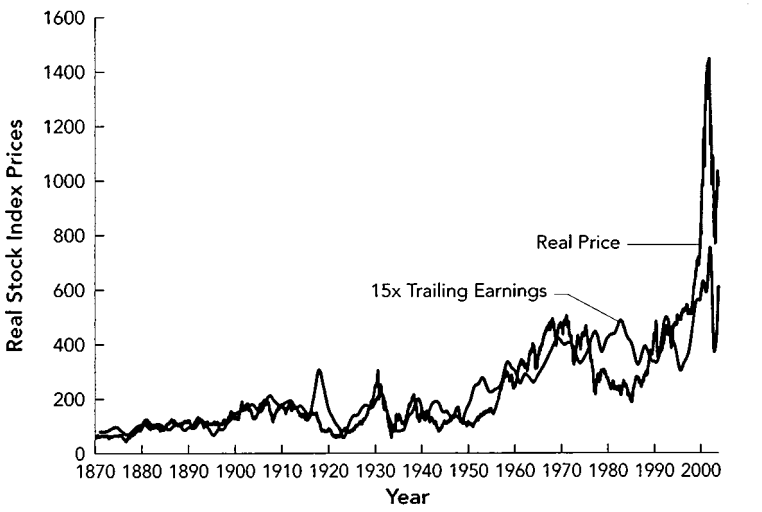
THE STOCK MARKET: DATA



For more than a century and a quarter, the United States has had a thick market in equities — the "stocks" of a corporation, pieces of paper that indicate ownership of its shares. One of the major indexes that track the performance of the stock market as a whole is Standard and Poor's composite index, the S&P 500. Figure 1.8

FIGURE 1.8

Real Stock Index Prices Since 1997 real stock index prices have far exceeded their standard, conventional valuation of 15 times earnings.



Source: Authors' calculations from data in Robert Shiller, *Market Volatility* (Cambridge, MA: MIT Press, 1987), as subsequently extended by Shiller, www.yale.edu/~rshiller/.

plots the real value — that is, the value adjusted for inflation — of this stock market index over time.

Over the past century, on average, a share of stock has traded for about 15 times its past year's, or "trailing," earnings per share. Earnings per share are calculated by dividing a corporation's annual profits by the number of shares of stock the corporation has outstanding. The 15-times-earnings figure is only an average: Companies with good prospects for growth sell for more than 15 times their earnings, and corporations seen as being in decline sell for less.

In some years expectations of the future of the economy are relatively depressed, and stock indexes like the S&P 500 sell for much less than the 15 times earnings rule of thumb. Consider 1982, when the stock market as a whole was worth 40 percent less than 15 times earnings.

Since 1997 real stock index prices have far exceeded their standard, conventional valuation of 15 times earnings. A large part of this was the result of the speculative mania — the "irrational exuberance" — of the dot-com bubble of the late 1990s. But a large gap between the stock market and conventional valuations remains even after the collapse of the dot-com bubble. Economists differ over how much of this phenomenon is due to (1) a continued irrational speculative mania that has outlasted even the stock market crash of 2000–2001, (2) an increased tolerance for risk, (3) a reflection of low interest rates, or (4) expectations of more rapid future economic growth.

The Exchange Rate

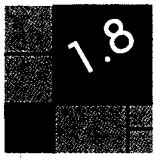
nominal exchange rate

The rate at which one country's money can be turned into another's; the price of one unit of foreign currency in terms of the home currency.

real exchange rate

The rate at which goods produced in a foreign country can be bought or sold for goods produced in the home country; the price of foreign-produced goods relative to domestic-produced goods.

The sixth and last key economic quantity is the *exchange rate.* The **nominal exchange rate** is the rate at which the moneys of different countries can be exchanged for one another. The **real exchange rate** is the rate at which the goods and services produced in different countries can be exchanged for one another. The exchange rate governs the terms on which international trade and investment take place. When the domestic currency is appreciated, its value in terms of other currencies is high. Foreign-produced goods are relatively cheap for domestic buyers, but domestic-made goods are relatively expensive for foreigners. In these circumstances imports are likely to be high; exports are likely to be low. When the domestic currency is depreciated, the opposite is the case. Domestically made goods are cheap for foreign buyers. Thus exports are likely to be high. But domestic consumers' and investors' power to purchase foreign-made goods is limited. Thus imports are likely to be low. Box 1.8 details the effects of changes in the U.S. exchange rate since 1977.

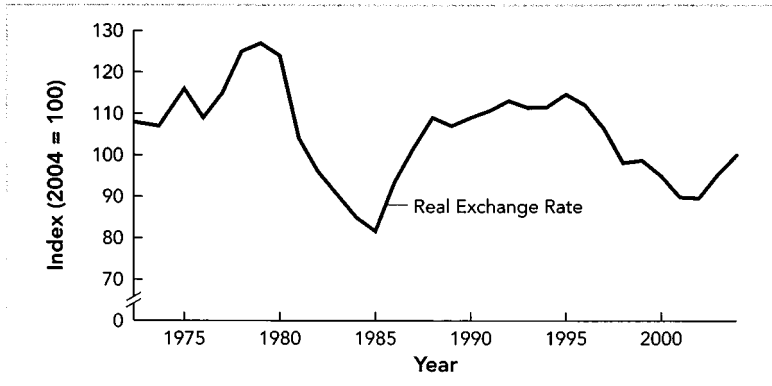


THE EXCHANGE RATE: DETAILS

The terms on which people in one country can buy goods and services made in other countries and sell the goods and services they make themselves are summarized in the exchange rate. The nominal exchange rate tells how many units of domestic currency it takes to buy 1 unit of foreign currency; it is the value of a foreign currency. The real exchange rate adjusts for differences in the rate of inflation between countries. Thus it measures the relative price of tradeable goods: how much in the way of foreign-produced goods can be bought with 1 unit of domestically produced goods.

FIGURE 1.9

The U.S. Real Exchange Rate: The Dollar against a Composite Index of Foreign Currencies The most significant fluctuation in the U.S. exchange rate came during the large depreciation of foreign currencies in the early and mid-1980s. By 1985 foreign-made goods were less than two-thirds as expensive relative to U.S.-made goods as they had been at the start of the decade.



Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

Before the early 1970s, the U.S. exchange rate was *fixed* vis-à-vis other major currencies in the Bretton Woods system. The U.S. Treasury stood ready to buy or sell dollars in exchange for other currencies at fixed parities determined by each country's posted valuation of its currency in terms of gold.

Since the early 1970s the U.S. exchange rate has been *floating* — free to move up or down in response to the market forces of supply and demand (see Figure 1.9). When U.S. interest rates are relatively high compared to those of other countries — as in the early 1980s — the dollar *appreciates*. In such a case the dollar becomes much more valuable, as many people try to invest in America to capture the high interest rates. We then say that the value of the exchange rate is relatively low. The exchange rate is defined as the value (in terms of dollars) of foreign currency: When the relative value of the dollar rises, the value in dollars of foreign currency falls.

When U.S. interest rates fall relative to those in other countries, the dollar tends to *depreciate,* to fall in value, so U.S. goods are cheap to buy and easy to sell. When the dollar's value is low and the dollar has depreciated, the exchange rate — the value in dollars of foreign currency — is relatively high.

Real GDP, the unemployment rate, the inflation rate, the interest rate, the stock market, and the exchange rate — these are the six key economic indicators. Know the values of these key variables in context — both their relative levels today and their recent trends — and you have a remarkably complete picture of the current state of the macroeconomy.

RECAP TRACKING THE MACROECONOMY

Know and understand six key variables, and you understand most of what there is to know about the state of the macroeconomy. The first key variable is the level of real GDP — the real inflation-adjusted value of goods and services. The second key variable is the unemployment rate — the fraction of the labor force that is out of work. The third key variable is the inflation rate — a measure of how rapidly the overall price level is changing. The fourth key variable is the interest rate. When economists think about interest rates, they almost always prefer to focus on the real interest rate rather than the nominal interest rate. The fifth key variable is the level of the stock market. The level of the stock market is a good indicator of investor confidence and of the likely future pace of investment spending. The sixth and last key variable is the exchange rate — the price at which goods made here at home are exchanged for goods made abroad.

1.3 THE CURRENT MACROECONOMIC SITUATION

The United States

As of the end of 2004, the U.S. macroeconomy was enjoying a moderately strong but uneven recovery. The collapse of the dot-com stock market bubble in 2000 and the September 11, 2001, terrorist destruction of the World Trade Center and attack on the Pentagon triggered a decline in economic activity — a recession — as businesses that were more pessimistic about the prospect of future profits and scared of the uncertainty produced by terrorism cut back their investment spending, and production and employment fell. Between the beginning of the recession and the end of 2001, the U.S. economy lost 0.9 million jobs. In response to these adverse shocks, the *Federal Reserve* reduced interest rates far and fast to try to encourage businesses to invest more: The three-month money-market nominal interest rate that had been 6.74 percent per year in the summer of 2000 had been cut to 1.75 percent per year by the late fall of 2001 and to 1 percent by the middle of 2003. And the Bush tax cuts directed more money into the hands of consumers, who increased their spending, which reduced the magnitude of the recession's spending shortfall.

Thus slowly in 2002 and more rapidly in 2003, the economy began to recover. Demand and production began to grow again. However, demand and production growth in 2003 and 2004 was, in everyone's estimation, insufficient. Because of rapid underlying productivity growth in the American economy, the renewed economic expansion did little to expand employment. With a relatively disappointing job market, wages did not rise by much. The recovery of 2003 and 2004 did enormous amounts to boost productivity and profits, substantial amounts to boost production, but little to boost employment or wages.

By the end of 2004 there were renewed worries among economists. One set of worries was that the United States could not afford the large tax cuts of the Bush administration — that they would produce very large budget deficits that would retard economic growth in the future. The Bush tax cuts, in combination with the extra defense spending authorized after September 11, eliminated the government budget surplus that had been painfully created during the 1990s. Given our low

private saving rate, the elimination of public saving was likely in the medium run to reduce investment, and thus to slow growth. And the tax cuts were not designed in a way that would produce many significant supply-side production benefits. The principal long-run impact of the tax cuts would be a further reduction in America's already low national saving rate and a slowing of economic growth.

Moreover, by the end of 2004 there were worries that a forthcoming sharp decline in the value of the dollar would provide a further adverse and contractionary shock to the United States and to the world economy. Should foreign exchange speculators lose confidence in the dollar, the value of foreign currency could rise far and fast, possibly causing macroeconomic problems. Economists are very good at pointing out economic situations that are inconsistent with fundamental values — policies, imbalances, or balance sheet problems that cannot possibly last and are bound to end, perhaps in a crisis. But they are bad at forecasting when and how such imbalances will end.

The recession of 2001 had been preceded by a remarkable decade-long economic boom. Policy makers and economists advocating the Clinton administration's economic programs — deficit reduction and the lowering of trade barriers — had done so in the interest of accelerating long-run growth. Reduced trade barriers would allow for closer international integration, a finer international division of labor, and increased productivity. Deficit reduction would make possible high-investment economic expansion, which would then become high-productivity growth expansion.

Until 1996 there were few signs that high investment was leading to high productivity growth, but then the pace of economic growth exploded. Perhaps the political claims in the early 1990s that deficit reduction would ignite a high-investment and high-productivity growth recovery were coming true. Perhaps the U.S. economy was simply benefiting from the sudden wave of rapid productivity growth driven by the technological revolutions in data processing and data communications. The most likely possibility was and is that both were true. This was confirmed by the continuation of rapid growth in American labor productivity through the recession of 2001 and into the recovery that followed. The "new economy" of the 1990s that optimists had seen as the result of technological revolutions in information technology was indeed a reality, and the principal beneficiaries were consumers who found themselves able to buy at low prices and businesses that found that computerization greatly increased productivity.

Europe

In the early 2000s 11 western European countries adopted the euro as their common currency. The adoption of the euro was followed not by strong growth, but by stagnation and recession. European unemployment rates mounted toward 10 percent between 2000 and 2004, and real GDP growth for the euro zone was rarely above 2 percent per year. There was certainly room for economic expansion in Europe: Consumer prices were rising at less than 2 percent per year. The challenge for European economic policy remains one of avoiding rises in inflation while attempting to reduce western Europe's distressingly high and stubborn rate of unemployment, yet interpreting the European Central Bank's actions as part of any policy intended to try to meet that challenge remains difficult.

However, for the first time in decades Europeans were hopeful that the next decade would bring a reduction, not an increase, in unemployment. Changes in policy are making the European labor market more flexible and in the long run

should make it easier for firms to change the number of workers they employ, which should make it easier for workers to find jobs and thus lower unemployment. Most of western Europe is perhaps half a decade behind the United States in its adoption of data processing and data communications technology. Thus there is good reason to hope that the information-technology-driven productivity growth acceleration experienced by the United States in the late 1990s should be visible in western Europe in the late 2000s.

And in eastern Europe, economies continue to grow, as the long and slow process of "transition" away from communism has continued.

Japan

As of the end of 2004, Japanese interest rates remained astonishingly low — 0.03 percent per year in the three-month money market — and were expected to remain low for the foreseeable future. Japan was still undergoing deflation, with consumer prices expected to fall by 1.0 percent in the next year.

Fortunately, Japan was no longer in recession: The country had experienced six straight quarters of positive growth in real GDP. Although unemployment in Japan remained above 5 percent — an astonishingly high level for Japan — it was no longer increasing. There was good reason to believe that Japan's decade-long experience with stagnation and recession was over, and that Japanese economic growth had resumed.

The start of the 1990s saw the collapse of the Japanese stock and real estate markets, the end of the so-called *bubble economy.* The 1990s as a whole saw the breakdown of the Japanese model of economic growth, as the economy stagnated for much of the decade. Now there is a general recognition that Japan faces a structural economic crisis. But there is no political consensus as to what is to be done, and the major political steps that need to be taken to restore growth — restructuring the Japanese financial system and deregulating transportation and distribution — have been long delayed.

The Bank of Japan is now pursuing a policy of making *short-term safe nominal interest rates* as close to zero as it can. But what matters for investment spending is not a low short-term safe nominal interest rate but a low long-term risky real interest rate, and that will remain high as long as bond traders fear that (1) the low-interest rate policy may be temporary, (2) many companies may go bankrupt and never repay the money they borrow, and (3) prices may decline more rapidly, turning low nominal interest rates into high inflation-adjusted real interest rates. For most of the 1990s and into the early 2000s, even interest rates near zero proved insufficient to boost investment.

Emerging Markets

Elsewhere in the world, the big economic news is the enormous growth booms in China and in India. Together their populations make up 40 percent of the human race, and their economies were expected to grow at 8 percent and 6 percent in 2005, respectively. The pace of investment in China is blistering as its exports continue to expand: China consumes more than a quarter of the world's steel and cement. China's boom is driven by its manufacturing exports. India's boom is driven by investment for the internal market and by growing exports of business and other services to the world's industrial core.

In the case of China, the boom is further driven by an undervalued exchange rate. The Chinese government would rather sell its workers' products cheaply than watch the value of its currency rise and risk high unemployment in its major cities. The Bank of China (along with other Asian central banks) buys up huge amounts of dollar-denominated assets every month in order to keep the value of the U.S. dollar from falling and the value of the Chinese yuan from rising. The U.S. government does not strongly object: Purchases by the Bank of China keep U.S. interest rates from rising and allow the funding of the U.S. government budget deficit and of much U.S. private investment that could not be covered by America's own small national saving.

As of the end of 2004, the financial crisis in East Asia of the past decade was only a distant memory. The panic that started in 1997 on the part of investors in New York, Frankfurt, London, and Tokyo, and the consequent withdrawal of their money from emerging market economies, imposed very high costs: massive bankruptcies, high interest rates, increases in unemployment, falls in production. But foreign investors appear to have regained confidence in East Asian economies.

However, the destabilizing factors in the world economy that made for the East Asian crisis of 1997–1998 are still present, as can be seen by the crash of the Argentinean economy at the end of 2001. Many argued that a critical cause of the East Asian crisis and, before it, the Mexican financial crisis was that the governments retained the ability to devalue and depreciate the currency and that that was a key source of the capital flight that rippled through their economies and set off the crises. Argentina, however, handed authority over its exchange rate to an independent organization — a "currency board." Yet that did not help. When in 2001 investors in New York, Frankfurt, London, Tokyo, and elsewhere became worried that the Argentine government's failure to balance its budget heralded a future of more rapid money printing and inflation, the same factors came into play. And the fact of Argentina's currency board only meant that the crisis became more convoluted and difficult to resolve — it was still not resolved three years after its beginning.

Elsewhere in Latin America as of 2005 growth continued to be positive, but disappointing. The Mexican government continued to wrestle with the problem of fixing its still-insolvent banking system. Brazil struggled under the burden of its large national debt and attempted to fulfill the hopes of growth with equity raised by the election of left-of-center president Luis Ignacio da Silva.

The most disappointing areas of the world as far as economic growth was concerned continued to be the Middle East and Africa.

Chapter Summary

1. Macroeconomics is the study of the economy in the large — the determination of the economywide levels of production, employment and unemployment, and inflation or deflation.
2. There are three key reasons to study macroeconomics: to gain cultural literacy, to understand how economic trends affect you personally, and to exercise your responsibility as a voter and citizen.
3. The six key variables in macroeconomics are real GDP, the unemployment rate, the inflation rate, the interest rate, the level of the stock market, and the exchange rate.

Key Terms

macroeconomics (p. 4)
expansion (p. 8)
recession (p. 8)
depression (p. 8)
deflation (p. 8)
microeconomics (p. 8)
real GDP (p. 12)
real GDP per worker (p. 13)
unemployment rate (p. 13)
inflation rate (p. 15)
interest rate (p. 17)
stock market (p. 19)
nominal exchange rate (p. 20)
real exchange rate (p. 20)

Analytical Exercises

1. What are the key differences between microeconomics and macroeconomics?
2. Why are real GDP and the unemployment rate important macroeconomic variables?
3. Why are the interest rate and the level of the stock market important economic variables?
4. Roughly, what was the highest level that the U.S. inflation rate reached in the twentieth century? What was the highest peacetime unemployment rate?
5. Roughly, how much higher is measured real GDP per worker today than it was in 1973?

Policy Exercises

1. What was the rate of real GDP growth in the United States in 2004?
2. What is the current unemployment rate?
3. What is the current inflation rate? If you find more than one inflation rate listed, are the rates consistent with each other?
4. What is the current level of the stock market? How does it compare to the level of the stock market at the beginning of 2000?
5. How does the current level of the stock market compare with the historical average, roughly 15 times a stock market index's trailing earnings?

CHAPTER 2

Measuring the Macroeconomy

QUESTIONS

What key data do macroeconomists look at?

How are key macroeconomic data estimated and calculated?

What is the difference between nominal and real values?

How are stock market values related to interest rates?

How are interest rates related to the price level and the inflation rate?

How is unemployment related to total production?

What is right — and what is wrong — with the key measure of economic activity, real GDP?

2.1 MACROECONOMIC DATA

Economics is a social science: It is about us, about what we do. Thus it shares with other social sciences one important source of information: introspection. We can ask ourselves "Why did I do that?" or "If I had done that, what would I have been thinking?" We can ask other people, and listen to their answers ("I did that because . . ."). In most of the other social sciences, however, the overwhelming source of information is introspection, either our own or other people's.

Economists are in a better position than most other social scientists as far as their sources of information are concerned. Everything that passes through the economy is priced and sold. Thus economists have quantitative data to work with: prices, quantities, and values. Having quantitative data allows economists to do more than many other social scientists. They can use theories to make not just qualitative but quantitative forecasts ("The change from Carter- to Reagan-era fiscal policy reduced the growth rate of the U.S. economy by 0.3 percent per year"). With data they can test theories, comparing what was actually the case to what various theories would have predicted.

The most important macroeconomic data are, of course, the six key variables introduced in Chapter 1:

- Real GDP (gross domestic product).
- The unemployment rate.
- The inflation rate.
- The interest rate.
- The level of the stock market.
- The exchange rate.

Learn about these six measurements of the economy — what their current values are, what their trends have been over time, what their future values are projected to be, how they are calculated, and what they mean — and you will have an excellent knowledge of the state of the economy. Table 2.1 summarizes the major features of these key economic variables. Let's see in more detail what they are and how they are calculated, but in reverse order — starting with the exchange rate and ending with real GDP.

RECAP THE IMPORTANCE OF DATA

In most of the other social sciences, the overwhelming source of information is introspection — either our own or other people's. Economists share this source, but they have the advantage that everything that passes through the economy is priced and sold. Thus economists have quantitative data to work with: prices, quantities, and values. Having quantitative data allows economists to do more than many other social scientists. Especially important is the ability to measure the six key variables — real GDP, the unemployment rate, the inflation rate, the interest rate, the stock market, and the exchange rate.

TABLE 2.1
The Six Key Economic Variables

Variable	Details	Importance
Real GDP	Rough synonyms include GNP, NNP, NDP, national income, aggregate demand, and total production.	The principal measure of material well-being and economic productivity.
Unemployment rate	As reported, omits "discouraged workers" who would like to work but have stopped looking for jobs.	The principal measure of how far production is falling short of potential output; a measure of the relative distribution of economic well-being.
Inflation rate	Most economists think officially reported statistics overstate the true increase in the nominal cost of living by 0.5 to 1 percent per year.	The proportional rate of change of the price level. Central banks today view their principal mission as ensuring price stability — keeping the rate of inflation low enough that nobody worries about it much.
Interest rate	The most important interest rates are "real" — those that control for the effects of inflation — and long-term.	The real long-term interest rate is the principal determinant of the level of investment and a principal determinant of future production growth.
Stock market	A broad index like the S&P is better than a narrow index like the Dow-Jones.	The stock market summarizes into one single index a large number of influences on investment, including investors' optimism, expected future profits, and the real interest rate.
Exchange rate	Once again, the most important rate is the real rate.	The exchange rate determines the relative price of foreign-made goods in terms of home-produced goods. Economists usually work with an index of the value of the dollar against an average of all other currencies and call it the exchange rate.

2.2 THE EXCHANGE RATE

Nominal versus Real Exchange Rates

We define the **nominal exchange rate**, which we will call e for "exchange," to be the value of *foreign currency* in terms of the home currency — in the case of the United States, the dollar. The nominal exchange rate is thus the relative price of two different kinds of money. It is set in the *foreign exchange market.*

nominal exchange rate

The rate at which one country's money can be turned into another's; the price of one unit of foreign currency in terms of the home currency.

What is the foreign exchange market, and how does it work? Domestic exporters earn foreign currency when they export. They sell their goods to people abroad, who have foreign currency — yen or yuan or euros or pounds or pesos — to pay them. Foreign producers earn domestic currency when they sell us imports. They sell their goods to people here, who have home currency — in the case of the United States, dollars — to pay them.

Both domestic exporters and foreign producers have a problem. Domestic exporters can't pay their own domestic workers with foreign currency — their workers expect to be paid in the home currency, dollars. Foreign producers can't pay their own workers with domestic currency — their workers expect to be paid in the foreign currency, yen or yuan or euros or pounds or pesos. Foreign producers need to trade the dollars they have earned from selling us imports for money that is useful to them; domestic exporters need to trade the foreign currency they have earned by selling exports for dollars that they can use.

How do foreign producers and domestic exporters solve this problem? They turn to the foreign exchange market, where those who have foreign currency — say, euros € — but want dollars exchange it for dollars, and those who have dollars but want foreign currency exchange dollars for other currencies. Those with foreign currency who want dollars include not only domestic exporters but also foreigners wishing to invest in the United States. Those with dollars who want foreign currency include not only foreigners who have sold Americans imports but also American residents who wish to invest abroad. (See Figure 2.1.)

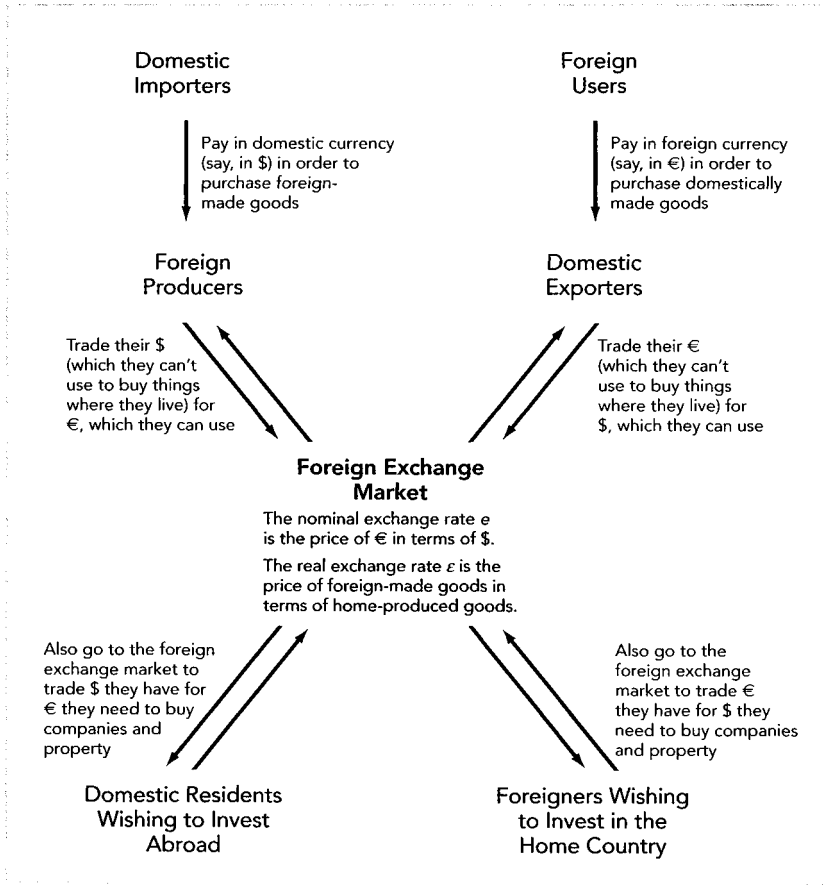


FIGURE 2.1
The Market for Foreign Exchange
In the foreign exchange market, domestic exporters and foreigners wishing to travel or to invest trade their foreign currency for domestic currency. Conversely, those who want foreign currency trade domestic currency for it.

If the dollar (the currency of the United States) and the euro (€, the currency of the European Union) trade on the foreign exchange market for \$1.20 = €1.00, then a single euro costs \$1.20 in U.S. currency. It takes less than one euro — €0.83 and change — to buy a single dollar. And 1.20 is the value of the dollar–euro exchange rate: It is the value of the euro in terms of the dollar.

Economists are less interested in the nominal exchange rate than in what we will call ε, the **real exchange rate**: the nominal rate adjusted for changes in the value of the currency. The nominal — the money — exchange rate can change without affecting the pattern of cross-national trade. When the real exchange rate — the rate in terms of goods and services — changes, the pattern of cross-national trade will change as well. The nominal exchange rate tells us the value of foreign currencies in terms of the home currency. The real exchange rate tells us the value of foreign-produced goods in terms of home-produced goods.

real exchange rate

The real exchange rate is the rate at which goods produced in a foreign country can be bought or sold for goods produced in the home country; the price of foreign-produced goods relative to domestic-produced goods.

Suppose a burst of inflation doubled the price level in the United States, so everything that once cost \$1 in the United States now costs \$2, everything that used to cost \$2 now costs \$4, and so on. Suppose also that the nominal exchange rate changed from \$1.20 = €1.00 to \$2.40 = €1.00. Before the burst of inflation you could sell goods in Europe for €0.83, turn the euros into \$1.00, and buy American goods. After the burst of inflation you could sell goods in Europe for €0.83, turn the euros into \$2.00, and buy exactly the same American goods as before. The change in the nominal exchange rate has offset the change in the U.S. price level. In this case the real exchange rate — the rate at which goods trade for goods — has not changed. The terms at which the goods of one country are traded for the goods of another are the same.

Now suppose that a burst of inflation doubled the price level in the United States but that \$1.20 still exchanges for €1.00 on the foreign exchange market. Has the exchange rate changed? The nominal exchange rate has not changed: €0.83 will still get you a paper dollar; \$1.20 will still get you a euro. However, that paper dollar will buy only as many goods in the United States as 50 cents would have bought before. The doubling of the U.S. price level, coupled with the unchanged nominal exchange rate, means that the same quantity of U.S.-made goods will buy twice as many European-made goods. Flip it over: From the U.S. perspective, the cost of internationally produced goods has halved: The real exchange rate has halved.

Of course, if the price levels in different countries do not change, then there is no distinction between a change in the nominal exchange rate and a change in the real exchange rate. If the nominal exchange rate doubled — changed from \$1.20 = €1.00 to \$2.40 = €1.00 — but the price levels in the United States and Europe remained the same, then investors would need twice as many dollars to buy the same amount of foreign currency. Thus it would cost twice as many U.S.-made goods to buy the same amount of foreign-made goods. From the U.S. perspective, the real exchange rate would have doubled.

The Real Exchange Rate

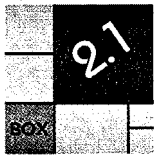
Calculating the Real Exchange Rate

Thus to calculate the real exchange rate ε, you need to know three pieces of information. First, you need to know the price level in the home country — call it P, for price. Second, you need to know the price level abroad — call it P^f: P for price, f for foreign. Third, you need to know the nominal exchange rate, e.

You can then calculate the value of the real exchange rate by multiplying the nominal exchange rate by the ratio of the foreign price level to the home price level:

$$\varepsilon = \frac{e \cdot P^f}{P}$$

Box 2.1 illustrates how the process works.



CALCULATING THE REAL EXCHANGE RATE: AN EXAMPLE

Suppose that the index of the U.S. price level is 120, the index of the euro-zone price level is 83.33, and the nominal exchange rate — the value of a euro in dollars — is 1.20: \$1.20 = €1.00. Then the real exchange rate would be

$$\varepsilon = \frac{e \cdot P^f}{P} = \frac{1.20 \cdot 83.33}{120} = 0.83$$

Now suppose that the U.S. price level were to rise to 150, the foreign price level were to rise to 120, and the nominal value of the euro were to fall to parity: \$1.00 = €1.00. Then the real exchange rate would become

$$\varepsilon = \frac{e \cdot P^f}{P} = \frac{1.00 \cdot 120}{150} = 0.80$$

The price of foreign goods in terms of domestic goods — the real exchange rate — has fallen. That is all there is to calculating real exchange rates.

- Holding the nominal exchange rate — the dollar cost of foreign currency — fixed, increases in the domestic price level lower the real exchange rate, which is the real value of foreign-produced goods in terms of home-produced goods.
- Holding the nominal exchange rate — the dollar cost of foreign currency — fixed, increases in the foreign price level raise the real exchange rate, which is the real value of foreign-produced goods in terms of home-produced goods.
- Holding the domestic and foreign price levels fixed, increases in the nominal exchange rate — in the dollar cost of foreign currency — raise the real exchange rate, which is the real value of foreign-produced goods in terms of home-produced goods.

Calculating the Overall Exchange Rate: Index Numbers

If you open up a newspaper in search of the exchange rate for the dollar, you will not find it. Instead, you will find a list of rates similar to the one in Table 2.2 but with many more entries — one line for almost every country.

An exchange rate for the dollar is listed against each and every other currency — a dollar–Swiss franc exchange rate, a dollar–yen exchange rate, a dollar–euro exchange rate, a dollar–pound exchange rate, a dollar–Canadian dollar exchange rate, a dollar–Mexican peso exchange rate, and more than 100 more for all the other currencies. Which of these is *the* exchange rate?

TABLE 2.2
Sample Exchange Rates

Currency	Value
Australian dollar*	0.7582
British pound*	1.8768
Canadian dollar	1.2219
Chinese yuan	8.2765
The euro*	1.3084
Japanese yen	104.17
New Zealand dr*	0.6945
Swiss franc	1.1815

*U.S. dollars per currency unit; otherwise, currency units per U.S. dollar.

In this situation economists do what they usually do when they are confronted with too much variety. They take an average and hope that deviations from the average will cancel each other out. In other words, they construct an **index number** to stand in place of the more than 100 exchange rates of the U.S. dollar against other currencies. The usual approach is to take a trade-weighted average, in which each currency receives a weight equal to its share of total U.S. trade: multiply the change in the real exchange rate vis-à-vis each other country by that country's share of U.S. trade, and add up all the results. Figure 2.2 presents the exchange rate index from 1983 to 2004.

index number

A number that isn't a set sum, value, or quantity in well-defined units (like dollars, people, or percent) but that is a quantity relative to a base year given an arbitrary index value of 100.

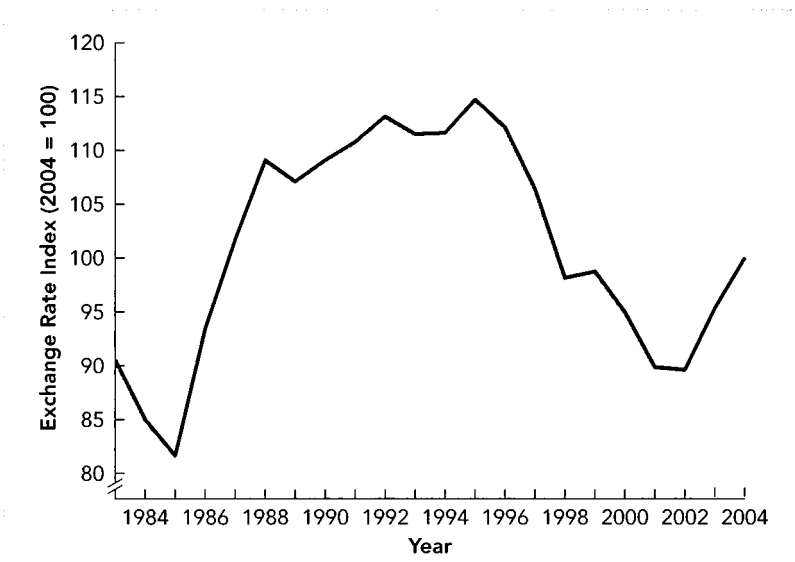


FIGURE 2.2
The Exchange Rate Index, 1983–2004

In 2002 — a year when the dollar was strong — the real exchange rate for the U.S. dollar was some 20 percent below its level in 1992 — a year when the dollar was weak. In 2002 a given amount of foreign-made goods could be used to purchase only 80 percent as many U.S.-made goods as it could have purchased in 1992. Since 2002, the dollar has weakened.

Source: Authors' calculations from the 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

RECAP THE EXCHANGE RATE

Domestic exporters earn foreign currency when they export — sell goods to people abroad. Foreign producers earn domestic currency when they sell us imports — sell their goods to people here. Both then have a problem. Domestic exporters can't pay domestic workers with foreign currency. Foreign producers can't pay foreign workers with domestic currency. Domestic producers need to trade the foreign currency they have earned for dollars they can use. They turn to the foreign exchange market, where those who have foreign currency but want dollars exchange it for dollars, and those who have dollars but want foreign currency exchange dollars for other currencies.

2.3 THE STOCK MARKET AND INTEREST RATES

The Stock Market

stock market

The market on which the shares of common stock that carry ownership of companies are bought and sold.

We don't have to calculate the value of an index for the **stock market** because news agencies perform that task for the public. The best — the most representative — index of the U.S. stock market is probably Standard and Poor's composite index, usually called the S&P 500. The index you will hear about most, however, is the Dow-Jones Industrial Average (DJIA). But if the DJIA tells a different story from the S&P, ignore it; it is less representative of the market than is the S&P 500.

Although we don't have to assemble and calculate a stock market index, we do have to divide the numbers reported in the news by some measure of the price level — usually either the GDP deflator or the consumer price index (CPI). If both the price level and the (nominal) value of the stock market double, a representative share of stock is worth no more in real terms. To arrive at real magnitudes, economists deflate nominal magnitudes like a stock index by some measure of the price level. In this case we are most interested in the real value of the stock market.

The Utility of Knowledge about the Stock Market

Current stock market indexes are the easiest economic statistics to get. But what good is knowing the real value of the stock market to a macroeconomist? The stock market is a sensitive indicator of the relative optimism or pessimism of investors, and therefore it is a good forecaster of future investment spending.

To see why, we need to think about the mechanisms underlying the stock market. Most investors in the stock market face a choice between holding stocks and holding bonds. **Stocks** are shares of ownership of a corporation, and they give you ownership of that corporation's profits or earnings. **Bonds** are debts that the corporation owes you. A bond is a piece of paper that gives you periodic interest payments and, at the bond's *maturity*, returns to you the principal amount of the bond.

stock

A tradable financial instrument that is a share of ownership of a corporation.

bond

A tradable financial instrument that is a promise by a business or a government to repay money that it has borrowed.

The rate of return on money invested in bonds is simply the interest payment the bond issuer makes divided by the price of the bond. Call this real rate of interest in the economy r. If you invest in shares of stock, what is your rate of return? You paid a price P^S (P for price, s for stock) for each share. The corporation reports earnings E^S per share. Some of those earnings will be paid out directly to *shareholders* in the form of *dividends*. Others will be retained and reinvested, boosting

the corporation's fundamental value. Both components increase shareholder wealth, and together they are the return on the investment in stocks. Thus an investor in stocks gets a return on each dollar invested of

$$\frac{E^s}{P^s}$$

Which will the investor prefer to hold, stocks or bonds? Saying that investors will prefer stocks if E^s/P^s is greater than r is not quite right. Investments in stocks are widely perceived to be risky. The company might go bankrupt, its reported earnings might be rigged, or the market might go down. As compensation for this risk, investors in stocks demand an extra return called the *risk premium,* or σ^s (the Greek lowercase letter sigma, with s for stocks as a superscript). So investors will want to hold only stocks if

$$\frac{E^s}{P^s} > r + \sigma^s$$

Investors will want to hold safer bonds if

$$\frac{E^s}{P^s} < r + \sigma^s$$

And investors will be willing to hold either stocks or bonds if

$$\frac{E^s}{P^s} = r + \sigma^s$$

Since in the world outside the classroom we see investors holding both stocks and bonds — some holding one, some holding the other, and some holding both — it is this last equation that must be true: This is our *equilibrium condition.* If it does not hold, investors as a group will be either frantically selling stocks (and so pushing the prices of stocks down) or frantically buying stocks (and so pushing the prices of stocks up).

If we turn this equation around, the value of stocks is equal to corporate earnings divided by the sum of the real interest rate on bonds and the risk premium:

$$P^s = \frac{E^s}{r + \sigma^s}$$

However, there is one more complication. The accounting earnings reported in the financial press — call them E^a — are not the earnings E^s that belong in the numerator of the stock valuation equation. The financial press reports what the firm's accountants have calculated, but investors are interested in some long-run average of expected future earnings. To apply the stock-price valuation formula, you also need an estimate of the relationship between the current earnings E^a that you see in the newspaper and "permanent" earnings E^s. (See Figure 2.3.)

The Stock Market Summarizes a Lot of Information

The real value of the stock market sums up, in one number that is reported every day,

- The current level of accounting earnings: reported corporate profits.
- Whether investors are optimistic (expecting long-run earnings to be above today's level) or pessimistic (expecting long-run earnings to be below today's level), and how optimistic or pessimistic they are.

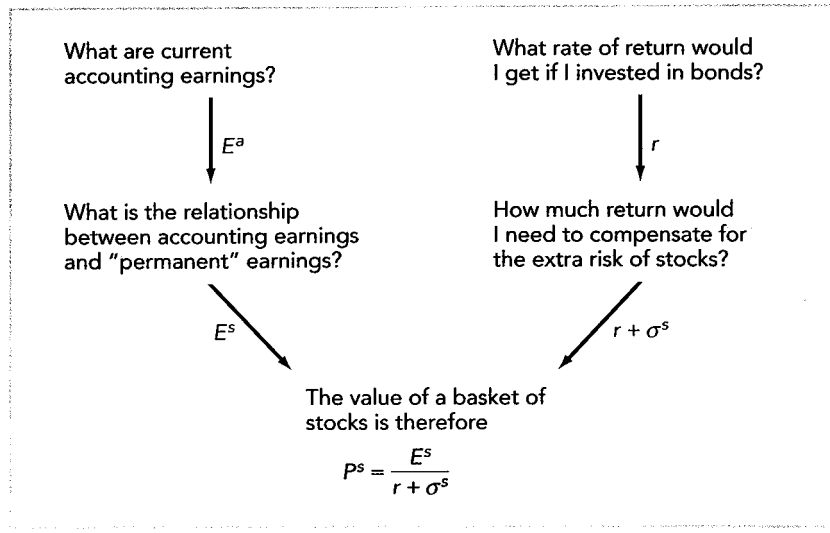


FIGURE 2.3
Calculating the Value of a Basket of Stocks

- The current cost of capital — whether money is cheap and easy to borrow (in which case r is low) or expensive (in which case r is high).
- Attitudes toward risk — whether people are strongly averse to the risks involved in entrepreneurship (in which case σ^s is high) or willing to gamble on new industries and new businesses (in which case σ^s is low).

These are the factors that determine whether corporate managers are willing to undertake investments to boost their companies' capital stocks. Thus the stock market summarizes all the information relevant to the economywide level of investment spending. Its usefulness as a summary of all the information relevant to determining investment spending is the reason it is one of the six key variables of macroeconomics.

Interest Rates

The interest rate is the price at which purchasing power can be shifted from the future into the present — borrowed today with a promise to pay it back with interest in the future. Interest is not a single lump sum but an ongoing stream of payments made over time. Thus it is what economists call a *flow variable*. A flow variable cannot be measured simply as a quantity; it must be measured as a quantity per unit of time. In the case of the interest rate, it is measured not just as a percentage of the amount borrowed, the principal, but as a percentage *per year*.

Economists like to talk about "the" interest rate in the same way that they like to talk about "the" exchange rate. But just as there are a large number of different exchange rates, there are a large number of interest rates. Loans of higher risk carry higher interest rates: Whomever you lent your money to might not pay it back — that is a risk you accepted when you lent in the first place. Loans of

TABLE 2.3
U.S. Treasury Bond Market

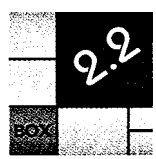
Term	Coupon	Maturity	Price	Yield	Change
3-month	—	5/26/2005	2.66%	2.71%	+0.030
6-month	—	8/25/2005	2.86%	2.95%	+0.015
2-year	3.375	2/28/2007	99 22/32	3.53%	+0.000
5-year	3.500	2/15/2010	98 5/32	3.91%	+0.006
10-year	4.000	2/15/2015	97 27/32	4.27%	−0.020
30-year	5.375	2/15/2031	111 1/32	4.64%	−0.030

Source: *Bloomberg Business News*, February 25, 2005.

different duration carry different interest rates as well. Moreover, differences in tax treatment — whether and when you have to pay taxes on interest earned from bonds — also lead to differences in interest rates. Thus even U.S. government bonds — the ultimate in safe investments — have no single interest rate. Table 2.3 shows a small sample of the interest rates — the column labeled "yield" — quoted on U.S. Treasury securities with maturities between a few months and 30 years.

Moreover, the interest rates published in the newspaper are nominal rates: They tell how much money you earn in interest per year if you lend out a sum of dollars now and collect the principal at the loan's maturity. You will not be surprised to learn that economists are interested instead in the real interest rate: how much purchasing power over goods and services you get in the future in return for trading away your purchasing power over goods and services today.

When we calculate real exchange rates, or real stock values, or real GDP, we divide the nominal exchange rate or stock index value or nominal GDP level by the price level, but that is not what we do to calculate real interest rates. Instead of *dividing* the nominal interest rate by the price level, we *subtract* the inflation rate — the percentage rate of change in the price level — from the nominal interest rate to get the real interest rate. Box 2.2 explains how.

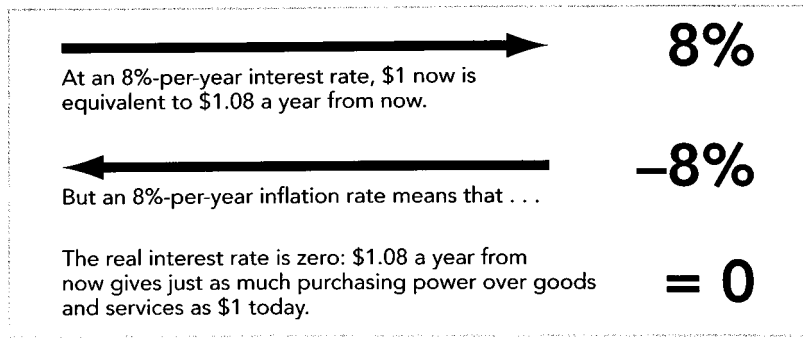


CALCULATING REAL INTEREST RATES: AN EXAMPLE

Why subtract the inflation rate from the nominal interest rate? Suppose you borrow $10 million for one year at a nominal interest rate of 8 percent per year. Suppose further that the annual inflation rate is also 8 percent, so the price level will rise by 8 percent between now and next year. Thus whatever goods you want to buy will be more expensive. Let's say you want to buy television sets priced at $200 a set this year; they will cost $216 a set by next year.

Right now when you borrow, you get $10 million. Next year you will have to pay back $10.8 million — $10 million principal and $800,000 interest. You borrow enough now to buy 50,000 TV sets. Next year, when you pay back your loan with interest, you will pay the lender $10.8 million, just enough money to buy 50,000 TV sets. Thus you will return the same purchasing power over

FIGURE 2.4
The Real versus the Nominal Interest Rate



goods and services as what you borrowed, making a real interest rate of zero (see Figure 2.4).

Suppose the inflation rate had been 4 percent, so the price of a standard basket of goods and services, and of the TV sets you are buying, will rise from $200 to $208 next year. You borrow $10 million, enough to buy 50,000 TV sets. Next year, when you pay back your loan with its 8 percent annual interest, you will pay the lender $10.8 million, enough money to buy 51,923 TV sets. The extra 1,923 TV sets are a 3.846 percent increase in purchasing power over goods and services. Thus you will return 3.846 percent more purchasing power than you borrowed. However, to keep things simple, economists round the percentage off and call it a 4 percent real interest rate. (You will find that economists often round off numbers, drop small terms from equations, and generally do whatever they can to make things simpler.)

Thus the rule: To calculate a *real* interest rate, subtract the inflation rate from the *nominal* interest rate.

RECAP THE STOCK MARKET AND INTEREST RATES

We don't have to calculate an index for the stock market because news agencies perform that task for the public already. We do, however, have to divide the numbers reported in the news by some measure of the price level in order to adjust for inflation and determine the real value of the stock market. To arrive at real magnitudes, economists *divide* nominal magnitudes like a stock index by some measure of the price level in order to arrive at *real* magnitudes. In this case we are most interested in the real value of the stock market. Note that when we calculate real interest rates, we do not divide the nominal interest rate by the price level. Instead we *subtract* the inflation rate — the percentage rate of change in the price level — from the nominal interest rate to get the real interest rate.

2.4 THE PRICE LEVEL AND INFLATION

The Consumer Price Index

price level

The average level of nominal prices in the economy.

consumer price index (CPI)

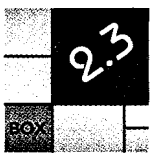
The most frequently used measure of the cost of living; it measures the cost of a basket of consumer goods.

GDP deflator

The ratio of nominal GDP to real GDP.

The idea that economists need to measure the price level and to use it to calculate real quantities has come up several times already. Estimating the **price level** and its proportional rate of change — the inflation rate — is at the heart of macroeconomics.

The most frequently seen measure of the overall price level is the **consumer price index**, or **CPI**. (Other measures of prices include the producer price index of prices paid not by consumers but by companies, the economywide **GDP deflator**, and the domestic purchases deflator.) The CPI is calculated and reported once a month by the Bureau of Labor Statistics. It is an expenditure-weighted index, in which each good or service receives a weight equal to its share in total expenditure in the *base year*. (See Box 2.3 for a sample calculation.)



CALCULATING PRICE INDEXES: AN EXAMPLE

One standard example economists use to illustrate how a price index is calculated is an index for consumers of fruit (perhaps because calculating indexes allows economists to really add apples and oranges). Suppose that in the base year a consumer buys \$4.50 worth of oranges at a price of \$0.75 a pound, \$4.20 worth of apples at \$1.20 a pound, \$0.90 worth of pears at \$0.90 a pound, and \$0.40 worth of bananas at \$0.40 a pound. Then, with a total of \$10 spent on fruit in the base year, the price index for fruit will be given by

$$\begin{aligned}\text{Price index for fruit} = &\left(\frac{\text{price of oranges today}}{\text{price of oranges in base year}} \times \text{orange index weight}\right) \\ &+ \left(\frac{\text{price of apples today}}{\text{price of apples in base year}} \times \text{apple index weight}\right) \\ &+ \left(\frac{\text{price of pears today}}{\text{price of pears in base year}} \times \text{pear index weight}\right) \\ &+ \left(\frac{\text{price of bananas today}}{\text{price of bananas in base year}} \times \text{banana index weight}\right) \\ = &\left(\frac{\text{price of oranges today}}{\$0.75} \times 45\right) + \left(\frac{\text{price of apples today}}{\$1.20} \times 42\right) \\ &+ \left(\frac{\text{price of pears today}}{\$0.90} \times 9\right) + \left(\frac{\text{price of bananas today}}{\$0.40} \times 4\right)\end{aligned}$$

We multiply the shares of total annual expenditure on each fruit by 100 so that in the base year the price index will be equal to 100, as is customary for economists to do.

Now consider a year in which, as shown in Table 2.4 on page 40, the price of oranges has risen to \$1.50, the price of apples has fallen to \$1.00, and the prices of pears and bananas have not changed. The overall fruit price index will be

$$\text{Price index for fruit} = \left(\frac{\$1.50}{\$0.75} \times 45\right) + \left(\frac{\$1.00}{\$1.20} \times 42\right) + \left(\frac{\$0.90}{\$0.90} \times 9\right) + \left(\frac{\$0.40}{\$0.40} \times 4\right) = 138$$

TABLE 2.4
Calculating a Price Index for Fruit: An Example

Fruit	Base-Year Expenditure	Base-Year Price (per Pound)	Subsequent-Year Price (per Pound)
Oranges	$4.50	$0.75	$1.50
Apples	4.20	1.20	1.00
Pears	0.90	0.90	0.90
Bananas	0.40	0.40	0.40

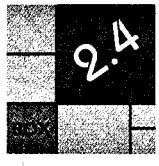
Bureau of Labor Statistics
A bureau of the U.S. Department of Labor that calculates the unemployment rate and the consumer price index (CPI).

The **Bureau of Labor Statistics** changes the basket of goods and services used in constructing the CPI on a somewhat irregular basis. It updates the basket every five years if it has the money in its budget to do so; if not, it updates the basket every 10 years. Statisticians try to keep the weighted "market basket" of goods and services used in calculating the index reasonably close to the goods and services consumers are currently buying. If it were not, the CPI would be of doubtful relevance. Who would care about the rate of change in the price of a statistical market basket that didn't represent what consumers were really buying?

Kinds of Index Numbers

Using relative expenditure levels in a fixed base year as the weights in a price index produces a kind of index that economists call a Laspeyres index. The CPI is a Laspeyres price index. Another type of index, a Paasche index, is in a sense the opposite of a Laspeyres index. The expenditure weights in a Laspeyres index are fixed: A Laspeyres index of production or consumption counts up the current dollar value of what is produced or consumed and divides by what the value of what is produced or consumed would have been if all commodities had sold for their prices in the base year. The expenditure weights in a Paasche index are variable: If expenditures on a particular good rise this year and make it a large part of the current dollar value, then that good's weight in the price index will rise too. The second most-often-seen indicator of the price level, the GDP deflator, is a Paasche index. Box 2.4 compares the pluses and minuses of these two kinds of price indexes.

In general, a Laspeyres index overstates price increases. In the real world, when some items become expensive, consumers substitute and buy other items that remain



LASPEYRES AND PAASCHE INDEX NUMBERS: DETAILS

To see the difference between a Laspeyres and a Paasche index, return to our fruit example in Box 2.3. Suppose the prices of apples, pears, and bananas remain at their base-year levels, but surprise frosts destroy the orange crops in both Florida and California. The price of oranges skyrockets to $8.25 a pound (see Table 2.5), so no one buys any oranges — instead, consumers double their purchases of apples, pears, and bananas to 7 pounds of apples, 2 pounds of pears, and 2 pounds of bananas.

The CPI for fruit, a Laspeyres index, would then be

$$\text{Price index for fruit} = \left(\frac{\$8.25}{\$0.75} \times 45\right) + \left(\frac{\$1.20}{\$1.20} \times 42\right) + \left(\frac{\$0.90}{\$0.90} \times 9\right) + \left(\frac{\$0.40}{\$0.40} \times 4\right) = 550$$

According to this index, the price of fruit is five and a half times as high as that in the base year.

The deflator for fruit, a Paasche index, will be

- Total nominal expenditure on fruit in the frost year: $11
- Cost of buying those pieces of fruit in the base year: $11
- Dividing the first number by the second and following the standard practice of multiplying by 100, we discover that the price of fruit has not changed from its base-year value, 100.

TABLE 2.5
Two Different Kinds of Indexes: An Index Number Example

Fruit	Base-Year Expenditure	Base-Year Price (per Pound)	Subsequent-Year Price (per Pound)	Subsequent-Year Expenditure
Oranges	$4.50	$0.75	$8.25	$0.00
Apples	4.20	1.20	1.00	8.40
Pears	0.90	0.90	0.90	1.80
Bananas	0.40	0.40	0.40	0.80

cheap. But a Laspeyres index, because it is based on a fixed market basket of goods and services, does not take account of this substitution. Thus it suffers from what economists call substitution bias, and it tends to overstate changes. A Paasche index, on the other hand, understates the increase in fruit prices. It calculates the difference between the price today of the fruit you bought and the price back in the base year. The Paasche index takes account of substitution. But it doesn't take account of the fact that the substituted items are less valued than the items they replace. The Paasche index reports, in the example of Box 2.4, that the skyrocketing price of oranges has no effect on fruit prices. Yet it makes no sense to say that a frost that makes oranges completely unaffordable has no effect on the price of fruit.

So which is the "correct" price index? Neither: There is no final and definitive resolution to this "index number problem." All price indexes are imperfect. All try to summarize in a single number what is inherently a multidimensional reality of many prices changing in different directions and different proportions.

To strike a balance between the two types of indexes and their two types of biases, the Commerce Department's Bureau of Economic Analysis and the Labor Department's Bureau of Labor Statistics have begun to move toward hybrid indexes. To reduce substitution bias, the Bureau of Labor Statistics has begun using geometric averages — multiply two numbers together and take the square root — instead of

Bureau of Economic Analysis

A bureau in the U.S. Department of Commerce that maintains the national income and product accounts, the NIPA.

arithmetic averages. And the Bureau of Economic Analysis has begun using a procedure called *chain weighting* to construct its indexes.

With chain weighting, each year's proportional change in the index is calculated using a different base year. For instance, the percentage change in the index from 1999 to 2000 is calculated using the average of 1999 and 2000 as the base; the change from 2000 to 2001 is calculated using the average of 2000 and 2001 as the base; and the change from 2001 to 2002 is calculated using the average of 2001 and 2002 as the base. The results of these calculations are then "chained" together to make up the index.

The Inflation Rate

The CPI is reported once a month in the form of the percentage change in consumer prices over the preceding month. "Consumer prices in November rose 0.3 percent above their level in October," a newscaster will say. Eventually, 12 monthly changes in consumer prices over the course of the year are added up and become that year's inflation rate. "The consumer price inflation rate in 2004 was 2.3 percent," the newscaster will say.

inflation rate

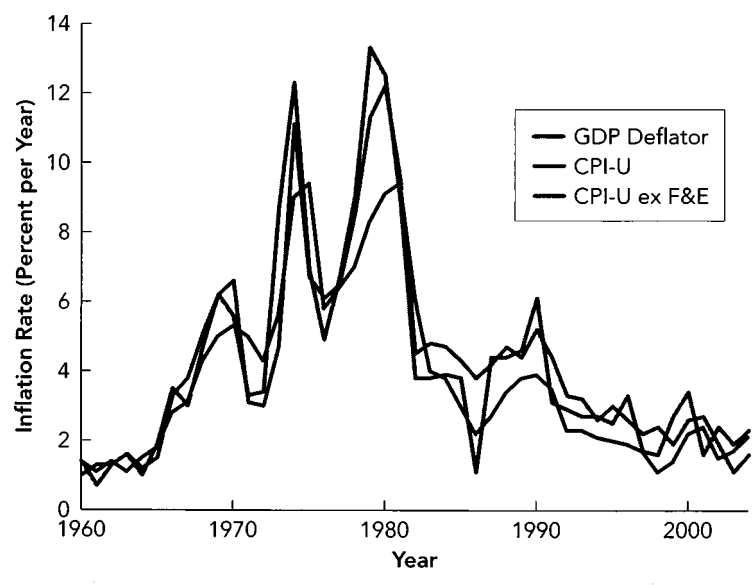
The annual rate of change of the overall level of prices in the economy.

Because the inflation rate is a measure of the rate of change in prices over time, it is a flow variable. When we speak of the inflation rate, we speak of it as such-and-such percent *per year.* Speaking of the inflation rate without reference to a measure of time is incomplete. But people do, and we always assume that when the time measure is omitted, the inflation percentage is an annual rate.

What the inflation rate is at any moment depends on which price level it is based on. The CPI-based inflation rate will not be exactly the same as the GDP-deflator-based inflation rate. Figure 2.5 plots three different measures of inflation in the

FIGURE 2.5
Different Measurements of U.S. Inflation, 1960–2004

Different measures of inflation tell slightly different stories about inflation. But all tell the same broad story: Differences are small relative to the large swings in the inflation rate from one decade to another.



Source: 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

United States: the GDP deflator, a CPI for all urban consumers (the CPI-U), and a CPI that omits the volatile prices of food and energy, which can cause severe transitory fluctuations in the overall index (the CPI-U ex F&E).

RECAP THE PRICE LEVEL AND INFLATION

Already the idea that economists need to measure the price level and to use it to calculate real quantities has come up several times. Estimating the price level and its proportional rate of change — the inflation rate — is at the heart of macroeconomics. The most frequently seen measure of the overall price level is the consumer price index, or CPI. It is a fixed weight — a Laspeyres — index of prices. Each good or service receives a weight equal to its share in total expenditure in the base year. And periodically the base year is moved forward in time.

2.5 UNEMPLOYMENT

Calculating the Unemployment Rate

unemployment rate
The share of the labor force who are looking for but have not found an acceptable job.

The **unemployment rate** is a key indicator of economic performance. An economy with persistent high unemployment is wasting its productive resources: Its level of output is below its productive potential. Such an economy surely has a lower level of social welfare than otherwise might easily be attained. Being unemployed is not pleasant, and neither is fearing unemployment for no other reason than the turning of the wheel of the business cycle.

Keeping unemployment low is one of the chief goals of macroeconomic policy. Yet in the course of the business cycle unemployment rises and falls. Figure 2.6 shows the annual unemployment rate in the United States since 1950. It shows the large variation in unemployment. Even though the second half of the twentieth century saw nothing like the extraordinary peaks of unemployment in the *Great Depression*, the unemployment rate still varied from a low of less than 4 percent of the labor force to a high of almost 10 percent of the labor force.

Every month the Labor Department's Bureau of Labor Statistics (BLS) sends interviewers to talk to 60,000 households in a nationwide survey called the Current Population Survey (CPS). The BLS uses the CPS data to estimate the unemployment rate — the fraction of people who (1) wanted a job, (2) looked for a job, but (3) could not find an acceptable job. Statisticians classify the people who are interviewed into four categories:

1. Those who were employed in some sort of job when interviewed.
2. Those who were out of the labor force and did not want a job immediately.
3. Those who did want a job immediately but had not been looking for one because they did not think they could find one.
4. Those who did want a job immediately, had been looking, but had not found a job they would take.

According to the BLS definition of the unemployment rate, the *labor force* is group 1 plus group 4 — those who had jobs plus those who were looking for jobs:

$$\text{Labor force} = \text{employed} + \text{looking for work}$$

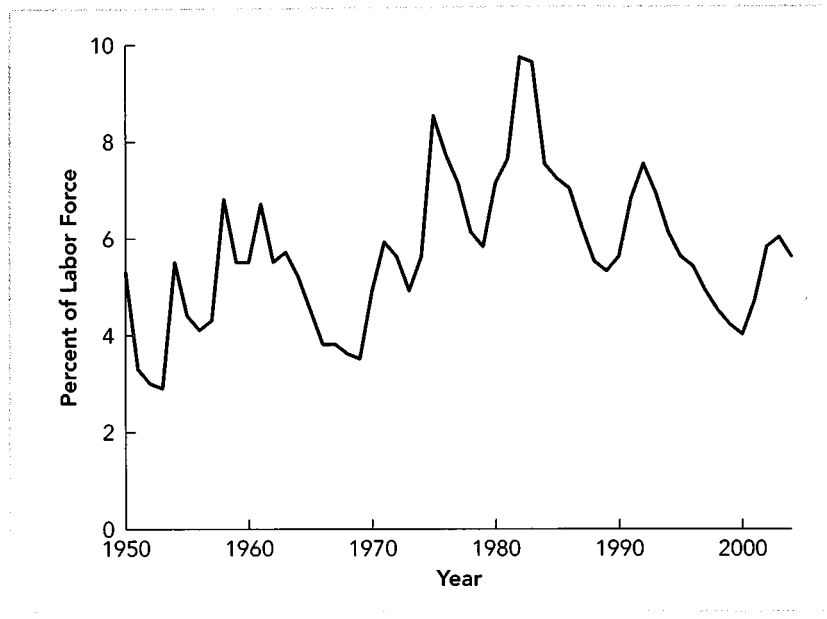


FIGURE 2.6
The U.S. Unemployment Rate since 1950
On average, the unemployment rate was relatively low in the 1950s — about 4.5 percent. It then rose to an average of nearly 6 percent in the 1970s and 7 percent in the 1980s before falling back to near 4 percent in the second half of the 1990s. In addition to these slow decade-to-decade swings, we also see the ups and downs of the business cycle — the boom of the late 1960s, the deep recession of 1982–1983, the smaller recession of 1990–1992, and the recession that began in 2001, among others.

Source: 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

The unemployment rate is the number of unemployed — those in group 4 — divided by the total labor force:

$$\text{Unemployment rate} = \frac{\text{looking for work}}{\text{employed} + \text{looking for work}}$$

In contrast to the inflation rate, which is a flow variable, the unemployment rate is a *stock variable*. Saying that the current unemployment rate is 5 percent, with no reference to a measure of time, makes perfect sense.

The official unemployment rate may well underestimate the real experience of unemployment. Someone in group 3, who wants a job but has given up looking, certainly feels unemployed and may well feel as unemployed as someone in group 4. Perhaps these *discouraged workers* should be included in the unemployment rate. Furthermore, some people in group 1 have part-time jobs but want full-time jobs. Perhaps these part-timers for economic reasons should be counted as unemployed, or as half-unemployed.

Economists have noted striking and persistent variations in unemployment by demographic group and class. Teenagers age 16 to 19 have higher unemployment rates than adults, African-Americans have higher unemployment rates than whites, and high school dropouts have higher unemployment rates than those who have postgraduate degrees. For most of the post–World War II period (but not recently) women have had higher unemployment rates than men. Significantly, recessions don't just raise the unemployment rate; they disproportionately raise the unemployment rate among these high-unemployment groups. Figure 2.7 contrasts the unemployment rates of various groups of workers.

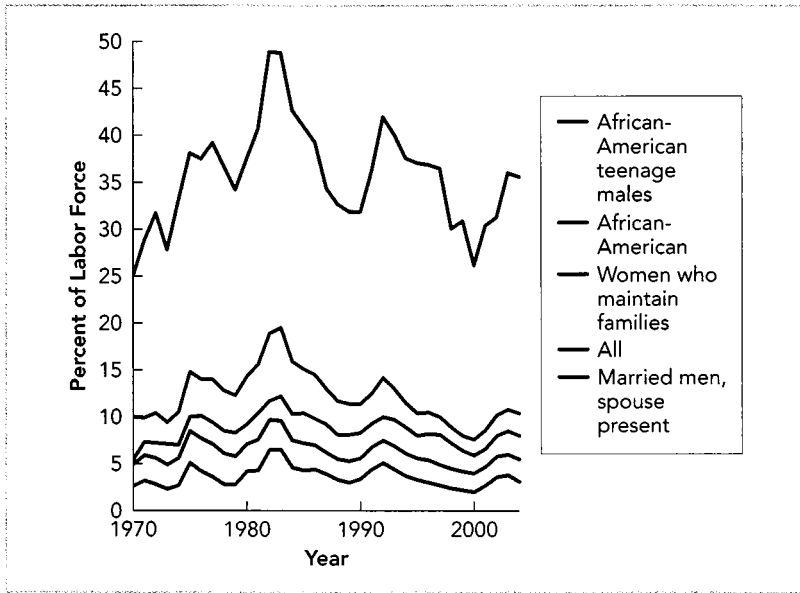


FIGURE 2.7
U.S. Unemployment Rates by Demographic Group, 1970–2004
The higher a group's average unemployment rate, the more the group's unemployment rate rises in recessions (and falls in booms). Recessions — times of high and rising unemployment — are unusually difficult for teenage and adult African-American workers.

Source: 2005 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

The question "How long is the typical person who loses his or her job unemployed?" is hard to answer because it is ambiguous. Most people who become unemployed on any one day — say, July 16, 2005 — remain unemployed for only a short time; more than half find a job within a month. Yet of all the people who are unemployed on July 16, 2005, some three-quarters will be unemployed for more than two months before they find another job.

Okun's Law

For most of the time in the United States since World War II, the unemployment rate has been tightly coupled with the rate of growth of real GDP in a relationship called **Okun's law** (see Figure 2.8). From any one year to the next, the very simple equation

$$\begin{array}{l}\text{Percentage change}\\ \text{in real GDP}\end{array} = \begin{array}{l}\text{percentage growth in potential output} -\\ (2.5)(\text{percentage-point change in unemployment rate})\end{array}$$

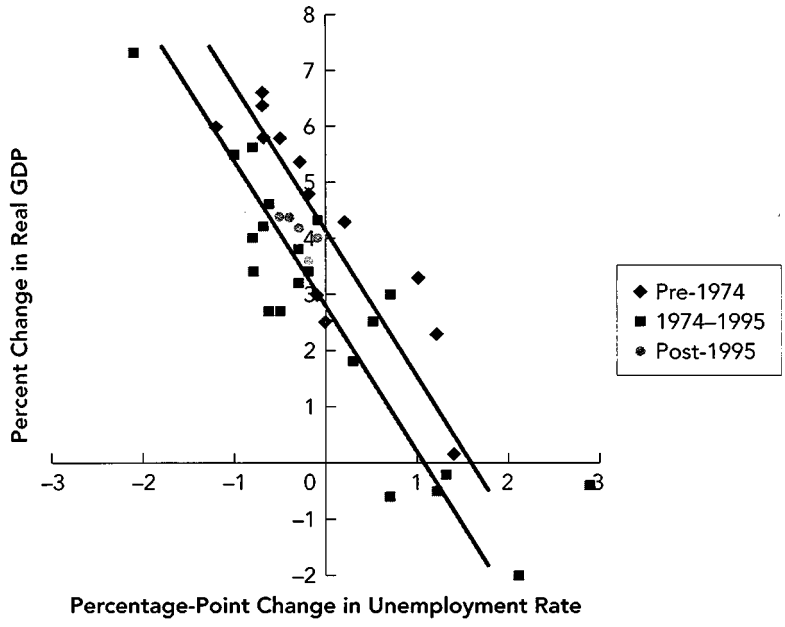
fits the data well. According to Okun's law, unemployment falls (rises) when real GDP grows faster (slower) than *potential output*. Specifically, in the United States a 1-percentage-point fall in the unemployment rate is associated with an extra 2.5 percentage points of growth in real GDP relative to potential output. For example, in a year in which potential output grew 2 percent and the unemployment rate fell by 1 percentage point, real GDP would grow by fully 4.5 percent.

Because of Okun's law, if you know what is happening to real GDP relative to potential output, you have a good idea of what is happening to the unemployment rate, and vice versa. Box 2.5 explains the details of Okun's law.

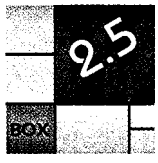
Okun's law
The association between unemployment and real GDP: Periods of high (or low) unemployment are the same as periods of low (or high) growth of real GDP relative to potential output.

FIGURE 2.8
Okun's Law

An extra 2.5 percent of growth in a year's real GDP is associated with a 1-percentage-point decline in the unemployment rate. Note that before 1974 the real GDP growth rate that kept unemployment constant was about 4 percent per year. Between 1974 and 1995, the unemployment rate was constant when real GDP growth was about 2.8 percent per year. Since 1995 there have been signs that the old pre-1974 relationship is reemerging. We call the rate of growth at which the unemployment rate is constant the rate of growth of potential output. The fall in the rate of growth of potential output after 1973 — the so-called productivity growth slowdown — is one of the most important features of recent American economic history.



Source: Authors' calculations from the 2001 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).



FORMS OF OKUN'S LAW: DETAILS

Okun's law sees not a 1-to-1 relation but a 2.5-to-1 relationship between real GDP growth and the unemployment rate. That is, a 1-percentage-point fall in the unemployment rate is associated not with a 1 but a 2.5 percent boost in the level of production.

Why is the Okun's law coefficient so large? Why isn't it the case that a 1-percentage-point fall in unemployment produces a 1 percent rise in output, or even less? Part of the answer is that the unemployment rate, as officially measured, does not count discouraged workers. In a recession, the number of people at work falls, the number of people looking for work rises, and the number of people who are not looking for work because they doubt they could find jobs — but who would be working if business conditions were better — rises. When conditions improve, many of these discouraged workers return to the labor force. Because the conventionally measured unemployment rate does not include these discouraged workers, more than a 1 percent rise in real GDP is needed to reduce the unemployment rate by 1 percentage point.

In addition, when business returns to normal, firms' initial response is not to hire more employees but to ask existing employees to work longer hours. So average

hours of work per week go up, and the unemployment rate falls by less than one would otherwise expect.

Finally, in some industries, employing more workers increases production by more than a proportional amount: Product design and setup need to be done only once, no matter how much is produced. Thus businesses that have economies of scale do not need twice as many workers to produce twice as much output.

Since 2000 the quantitative form of Okun's law has shifted: The Okun's law coefficient appears to have grown even larger than 2.5. More than 2.5 percent growth of real GDP relative to potential output is now needed to lower the unemployment rate by 1 percentage point. We are not yet sure whether Okun's law will return to its old pattern or, if it does not, what the new quantitative relationship between unemployment and the output gap is. Many economists think that the relatively stagnant employment levels seen between 2000 and 2005 led a great many people who would seek jobs in normal times to temporarily drop out of the labor force, and so artificially lowered the unemployment rate. We must wait a few years to learn whether the change in the Okun's law coefficient is permanent, temporary, or — allowing for measurement error — even nonexistent!

RECAP THE UNEMPLOYMENT RATE

The unemployment rate is a key indicator of economic performance. An economy with persistent high unemployment is wasting its productive resources: its level of output is below its productive potential. Moreover, the official unemployment rate may well underestimate the real experience of unemployment in the American economy.

2.6 REAL GDP

Sixth and last of the key economic variables is real GDP, the most frequently used measure of economic performance. You will see other measures of total production and total income as well. All of them are close cousins of real GDP: GNP (*gross national product*), NNP (*net national product*), NDP (*net domestic product*), and NI (*national income*). And you will hear commentators refer to "total output," "total production," "*national product*," "total income," and "national income." Except when you are focusing explicitly on the details of the national income and product accounts (NIPA), treat all these terms as synonyms for real GDP.

real GDP

Inflation-adjusted gross domestic product; the most commonly used measure of national product, output, and income. Equal as well to total expenditure on domestically produced goods and services.

Calculating Real GDP

Real GDP is calculated by adding up the value of all final goods and services produced in the economy. Because it measures the rate at which goods and services are produced, real GDP is a flow variable; it is usually expressed as an annual amount. Often, however, you will not hear the phrase "per year." But when you hear that real GDP in the fourth quarter of 2002 was such and such, remember that such a statement means that the flow of production in the fourth quarter was such and such *per year*. And when you hear that real GDP in the fourth quarter of 2002 grew at so-and-so percent, remember that such a statement means that real GDP in the fourth quarter grew at so-and-so percent *per year* — the difference

NIPA

National income and product accounts; the system that government statisticians use to measure, estimate, and check data on the flow of economic activity.

between real GDP in the third quarter and real GDP in the fourth quarter is only one-quarter of the reported annual growth rate.

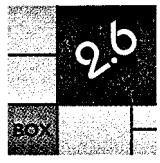
What are the final goods and services that make up GDP? A final good or service is something that is not used further in production during the course of the year. Thus final goods and services include

- Everything bought by consumers.
- Everything bought by businesses not as an input for further production but as an investment to increase the business's capital stock and expand its future production capacity.
- Everything bought by the government.

Because GDP measures *product* and not *spending,* it includes a balancing item, *exports* minus *imports.* Because exported goods bought by foreigners were made in the United States, they are part of GDP and need to be added to the total. Because imported goods bought by consumers, installed as pieces of investment, or bought by the government were not made in the United States, they are not part of gross domestic product, so imports need to be subtracted from GDP.

Real and Nominal GDP

When economists add up final goods and services produced in the year to calculate GDP, how do they weight each good or service? The answer is that they use market value — what people paid for a good or service — in the calculation of *nominal GDP.* Box 2.6 presents a stylized, hypothetical example of how this is done.



WEIGHTING GOODS AND SERVICES BY THEIR MARKET VALUES: AN EXAMPLE

How do economists weight goods and services by their market values? Recall the discussion of the CPI in Box 2.3 in which the representative consumer bought 11.5 pounds of fruit:

Fruit	Quantity (Pounds)	Price (per Pound)
Oranges	6	$0.75
Apples	3.5	1.20
Pears	1	0.90
Bananas	1	0.40

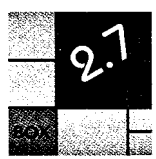
If these quantities were the final goods and services produced in a particular year — let's call it year 1 — and we then wanted to measure the GDP of fruit, we simply multiply the quantities produced by their market prices:

$$\begin{aligned} \text{GDP} &= (6 \text{ lbs. oranges} \times \$0.75/\text{lb.}) + (3.5 \text{ lbs. apples} \times \$1.20/\text{lb.}) \\ &\quad + (1 \text{ lb. pears} \times \$0.90/\text{lb.}) + (1 \text{ lb. bananas} \times \$0.40/\text{lb.}) \\ &= \$10.00 \end{aligned}$$

The nominal GDP of fruit in year 1 is $10.

In 2003 nominal GDP (that is, GDP measured at 2003 prices) was $11.00 trillion; in 2002 nominal GDP (that is, measured at 2002 prices) was $10.49 trillion. Thus the growth rate of nominal GDP between 2002 and 2003 was 4.9 percent. But this nominal measure of GDP, in which current-year prices are used to weight the final goods and services produced and to calculate growth rates, is clearly not a good measure of *productivity* or material output. It confuses changes in the overall price level — inflation or deflation — with changes in total production. Suppose production in the next year stayed unchanged but prices doubled; nominal GDP would double. Suppose production doubled but prices stayed the same; nominal GDP would also double. Although nominal GDP does not distinguish between these two sources of increase in total expenditure, we need to distinguish between them. Hence economists favor real GDP — the value of final goods and services weighted by the prices of some particular base year. Box 2.7 illustrates the weighting of goods and services in terms of base-year prices.

WEIGHTING GOODS AND SERVICES BY THEIR BASE-YEAR VALUES: AN EXAMPLE



Recall the hypothetical example in Box 2.6. Assume that in the year following year 1 — year 2 — the prices and quantities of fruit produced are as follows:

Fruit	Quantity (Pounds)	Price (per Pound)
Oranges	8	$1.00
Apples	3.5	1.20
Pears	1	0.50
Bananas	1	0.40

Now we can calculate nominal GDP of fruit in both year 1 and year 2 and real GDP of fruit (at year 1 prices) in both year 1 and year 2:

- Nominal GDP of fruit in year 1: $10.00
- Real GDP of fruit in year 1 (at year 1 prices): $10.00
- Nominal GDP of fruit in year 2: $13.10
- Real GDP of fruit in year 2 (at year 1 prices): $11.50

The nominal quantity grows by 31 percent between year 1 and year 2. The real quantity grows by only 15 percent between year 1 and year 2. The difference is inflation, the change in the price level.

Whenever you hear a statement such as "Real GDP in 2002 was 10.07 trillion 2000 dollars," remember that "2000 dollars" means that 2000 is the base year of the calculation. When measured using 2000 prices, GDP in 2002 — real GDP — was not $10.49 trillion but only $10.07 trillion. The difference, the gap between $10.49 trillion and $10.07 trillion, was due to price inflation between 2000 and 2002. Real GDP between 2002 and 2003 rose by only 3.0 percent, not 4.9 percent.

As has been noted, economists construct an alternative index number for the rate of inflation, the GDP deflator, from nominal GDP and real GDP. The procedure is

1. Calculate nominal GDP.
2. Calculate real GDP.
3. Divide the first number by the second; the quotient is the GDP deflator.

The GDP deflator is a Paasche index — the kind of index that tends to understate the effect on the price level of a rise in the price of a particular good. While the GDP deflator takes account of purchasers' ability to substitute away from items that have increased prices, it does not take account of the reduction in utility — the implicit cost to consumers — of settling for second best.

Intermediate Goods, Inventories, and Imputations

Intermediate Goods

GDP is defined as the market value of final goods and services produced. Thus so-called *intermediate goods* — goods sold to another business for use in further production — are excluded from GDP. A product made by one business and sold to another will eventually show up in the national income and product accounts and be counted as part of GDP. It will show up when the second business sells its product (which will by then embody the value added by the first producer) to a consumer, an investor, a foreign purchaser, or the government. Meanwhile, because the value of an intermediate good is included in the price of the final good that the intermediate good is used to make, its value must be excluded from GDP.

For example, if a builder buys wood from a lumber mill to build a house, the value of the wood becomes part of the value of the house. To count the sale of the wood to the home builder as well as the sale of the newly built house to its purchaser would be to count the wood twice. And what would happen if the builder bought the lumber mill and thus no longer had to buy finished wood? GDP should not go down just because two businesses have merged.

One way to think about intermediate goods is that GDP represents the economic value added at every stage of production. The *value added* by any one business is equal to the total value of the firm's products minus the value of the materials and intermediate goods the firm purchases. In computing value added from start to finish, each intermediate good and service enters the calculation twice: once with a plus sign, when the value added of the business that made the good is calculated, and once with a minus sign, when the value added of the business that uses the good is calculated. Using this value-added approach, every good and service in the economy cancels out except those that are not sold to other businesses for use in the production process. The goods whose values do not cancel out are the final goods and services — consumption goods, goods purchased by the government, goods purchased as part of investment, and net exports.

Inventories

What happens if the production process is not finished when the end of the year rolls around and the Commerce Department's Bureau of Economic Analysis (BEA) closes the books on that year's GDP calculation? Some intermediate goods will not have been used to produce goods for final sale. The value has already been added in making the intermediate good, but no final good that embodies that value has yet been sold. The NIPA finesses this problem by treating inventories at the end of a period as a special kind of final good, a form of investment. A business that

produces intermediate goods or final goods and doesn't sell them by the end of the year is treated as having "purchased" those goods for itself as part of its capital stock. The general rule is that whenever a business increases its end-of-period inventory, that increase is counted as a component of investment and of final demand.

What happens the next year when the final goods are finished and sold? The value of those final goods sold becomes part of the next period's GDP. But the intermediate goods that went into them are counted as a negative investment, a disinvestment, in inventory. Thus the intermediate goods left over from this year and used next year are subtracted from next year's GDP.

Imputations

What about goods and services that are produced and consumed but not sold in the marketplace? Such goods and services lack prices and market values; how are they counted in GDP? In some cases national income accounts estimate — they guess, really — what goods or services would have sold for on the market if there had been a market.

The largest such "imputation" in the NIPA is found in housing. When somebody rents an apartment or a house, the rent he or she pays to the landlord becomes part of GDP as the purchase of "housing services" by the renter. When a landlord rents a house to a tenant, the landlord is selling a service — the usefulness of having a roof over the renter's head — just as a barber is selling a service when a customer gets a haircut. Thus rent is one item in consumer spending on services.

However, about 60 percent of all Americans own their own houses and are their own landlords. These homeowners do not write a monthly rent check to themselves. Counting renter-occupied housing as part of GDP but ignoring owner-occupied housing would not be consistent. Therefore GDP includes the *imputed rent* on owner-occupied dwellings — the amount the BEA thinks that owner-occupied apartments and houses would rent for if they were rented out.

The inclusion of the cost of goods and services bought by the government may also be understood as an imputation. Since citizens do not directly pay firefighters, police officers, judges, and other government employees, the value of what the government spends on firefighting — in wages, insurance, materials, and so forth — is counted in GDP.

Components of Real GDP

How does the Bureau of Economic Analysis construct its measure of real GDP? The BEA includes in its measure of real GDP, which we will always denote by Y in equations and diagrams, the values of the following:

- Goods and services that are ultimately bought and used by households (except for newly constructed buildings); these goods and services are termed **consumption spending** (denoted C).
- Goods and services (including newly constructed buildings) that become part of society's business or residential *capital stock;* these goods and services are termed **investment spending** (denoted I). *Gross investment* spending is divided into two parts: the capital consumption allowance, or the *depreciation* of worn-out or obsolete capital; and *net investment,* which increases the total capital stock. Investment can be divided into four components: houses and apartments (residential *structures*), other buildings and infrastructure (nonresidential structures), machines (*producers' durable equipment*), and, as noted above, the change in business inventories (see Table 2.6).

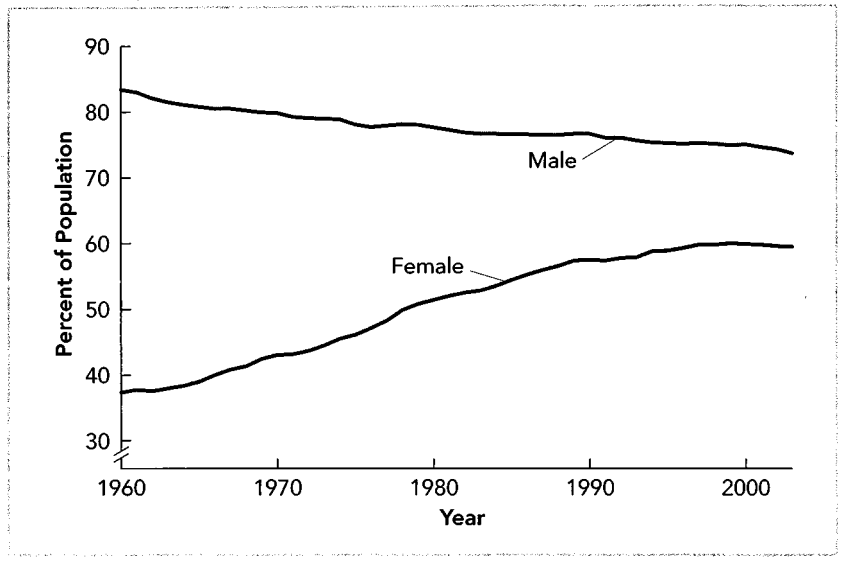
consumption spending

Spending on goods and services purchased and used by consumers.

investment spending

That portion of total spending devoted to increasing business capacity and the economy's capital stock.

FIGURE 2.9
Labor-Force Participation Rates by Gender, 1960–2003
The paid-labor-force *participation rates* of men and women have been converging for a generation, as male labor-force participation has fallen slightly and female participation has grown rapidly. What were the counterparts of the women who worked for wages in 2003 doing back in 1960? They were working, but not for wages. And their work then wasn't counted as part of GDP.



Source: 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

What Isn't in GDP but Should Be

Moreover, many expenditures excluded from the NIPA, and thus from GDP, probably should not be. Production that takes place within the household is excluded from GDP. That is, the work family members do to keep their own households going, for which they are not paid, is excluded from GDP. This exclusion warps our picture of the U.S. economy. In 2000 some 129 million Americans, male and female, worked a total of about 206 billion paid hours (and some 7 million Americans spent a total of 5 billion hours looking for jobs). But many Americans — most of them adult women — also spent at least 100 billion hours performing services such as cooking, cleaning, shopping, and chauffeuring that would count as employment and would count in GDP if they were receiving pay for them rather than doing them for their own families. As Figure 2.9 shows, less than 40 percent of American women were counted in the labor force in 1960, even though most of them would have said that they worked full days. Within-the-household production has never been counted as part of GDP. When the NIPA system was set up, economists believed that obtaining reasonable, credible, defensible estimates of the economic value of within-the-household production would be difficult or impossible.

Yet the exclusion of within-the-household production makes a difference not just for the level of national product but for its rate of growth. Over time the border between paid market and unpaid nonmarket, within-the-household work has shifted. Be suspicious of economic growth rates based on total GDP, GDP per capita, or GDP per adult, because they are distorted by the shifting dividing line between what people do and how they arrange their work. A meal cooked is a meal cooked whether it is part of the market-paid work of a restaurant chef or part of the unpaid work of a homemaker. Over time the share of meals prepared in the first way has grown, while the share of meals prepared in the second way has shrunk.

This shift in the dividing line between home cooking and dining out has raised measured GDP, but the shift by itself is not an increase in society's wealth.

Depletion, Pollution, and "Bads"

The NIPA system makes no allowance for the depletion of scarce natural resources. To the extent that an economy produces a high income in the act of using up valuable natural resources, that income is not true GDP at all but the depletion of natural resources. Kuwait, Qatar, and Saudi Arabia have high levels of measured real GDP per worker, but much of their income arises not out of sustainable production but out of the sale of limited and depletable natural resources. A better system would have a category for the depletion of natural resources.

Moreover, the NIPA contains no category for the production of "bads" — things that you would rather not have. Producing more smog does not diminish GDP. The extra cases of lung cancer produced by cigarette smoking do not diminish GDP (indeed, they raise the medical care sector's contribution to GDP). If the demand for locks and alarm systems rises because crime increases, GDP increases. As noted before, GDP is a measure only of the economy's level of productive effort, not of well-being.

"bads"

Elements produced by an economy that diminish consumers' welfare and that would constitute a subtraction from GDP in some better, future system of social accounts to measure economic welfare.

RECAP REAL GDP

Real GDP is calculated by adding up the value of all final goods and services produced in the economy. Because it measures the rate at which goods and services are produced, real GDP is a flow variable: Remember that real GDP is measured as the value of goods and services produced *per year*. Real GDP has four components: (1) consumer spending for final goods and services, (2) investment spending by firms to increase their capital stock, (3) purchases of goods and services by the government (including the time of bureaucrats), and (4) net exports.

Chapter Summary

1. Because economics studies goods and services that flow through the market and are bought and sold with prices attached, economists have a lot of quantitative data to work with.
2. The real exchange rate is the relative price at which two countries' goods exchange for each other. You calculate it by adjusting the nominal exchange rate for changes in the price levels in the two countries.
3. The level of the stock market is a valuable summary index of a range of factors that affect investment: the current level of profits, investors' optimism or pessimism, the real rate of interest, and attitudes toward risk.
4. Real interest rates are much more important variables to keep track of than are nominal interest rates. Calculate the real interest rate by subtracting the rate of inflation from nominal interest rates.
5. The most commonly seen measure of the price level is the consumer price index (CPI). The proportional rate of change of the price level is called the inflation rate.
6. Unemployment and total output are linked through Okun's law: A 1-percentage-point change in the unemployment rate comes with a 2.5 percent change in the opposite direction in the level of output relative to potential output.
7. Real GDP is the most frequently seen measure of the overall level of economic activity. It is the value — calculated using market prices in some chosen base year — of all final goods and services produced in a year.
8. The line between what's in GDP and what's not in GDP is principally the result of economists' beliefs in the 1940s and 1950s about what could be readily measured. It is not the result of a set of principled decisions about what kinds of activities should and should not be included in a measure of material welfare.

Key Terms

nominal exchange rate (p. 29)
real exchange rate (p. 31)
index number (p. 33)
stock market (p. 34)
stock (p. 34)
bond (p. 34)
price level (p. 39)
consumer price index (CPI) (p. 39)
GDP deflator (p. 39)
Bureau of Labor Statistics (p. 40)
Bureau of Economic Analysis (p. 41)
inflation rate (p. 42)
unemployment rate (p. 43)
Okun's law (p. 45)
real GDP (p. 47)
NIPA (p. 47)
consumption spending (p. 51)
investment spending (p. 51)
government purchases (p. 52)
net exports (p. 52)
"bads" (p. 55)

Analytical Exercises

1. Are capital goods — large turbine generators, jet airliners, bay-spanning bridges — intermediate goods or final goods? How are they included in GDP?
2. How do the labor and other factors of production that go into producing intermediate goods ultimately get counted in GDP?
3. Explain whether or not and why the following items are included in the calculation of GDP:
   a. Increases in business inventories.
   b. Sales of existing homes.
   c. Fees earned by real estate agents on selling existing homes.
   d. Income earned by Americans living and working abroad.
   e. Purchases of IBM stock by your brother.
   f. Purchase of a new tank by the Department of Defense.
   g. Rent that you pay to your landlord.
4. Which interest rate concept — the nominal interest rate or the real interest rate — do lenders and borrowers care more about? Why?
5. Which is the more important measure for assessing an economy's performance, real GDP or nominal GDP?

Policy Exercises

1. In 1979 the (short-term) nominal interest rate on three-month Treasury bills averaged 10 percent, and the GDP deflator rose from 50.88 to 55.22.
   a. What was the annual rate of inflation in 1979? What was the real interest rate in 1979?
   b. Were real interest rates higher in 1979 or in 2003, when the (short-term) nominal interest rate on three-month Treasury bills was 1.0 percent and the inflation rate was 1.7 percent?
2. In 1992 the implicit GDP deflator (in 1992 dollars) was equal to 100; in 1993 it was equal to 102.64. What was the annual rate of inflation between 1992 and 1993? In 1993 the implicit GDP deflator (in 1992 dollars) was equal to 102.64; in 1994 it was 105.09. What was the annual rate of inflation between 1993 and 1994?
3. In 1992 both nominal GDP and real GDP (measured in 1992 dollars) were equal to $6.244 trillion. By 1997 nominal GDP had risen to $8.111 trillion, and the implicit GDP deflator had risen to 111.57. What was real GDP in 1997? What was the average rate of real GDP growth between 1992 and 1997?
4. In 1997 nominal GDP was $8.111 trillion, and the implicit GDP deflator (measured in 2000 dollars) was 93.85. By 2003 nominal GDP had risen to $10.977 trillion, and the implicit GDP deflator had risen to 105.64. What was real GDP in 2003? What was the average rate of real GDP growth between 1997 and 2003?

CHAPTER 3

Thinking Like an Economist

QUESTIONS

In what way and to what degree can we say that economics is a science?

What do economists mean by a "model"?

Why are economists so attracted to formal, mathematical models?

What patterns and habits of thought do you need to learn in order to be able to think like an economist?

3.1 UNDERSTANDING MACROECONOMICS

Every new subject that you learn requires that you learn not just new facts but also new patterns of thought. Every intellectual discipline has its own way of thinking about the world, which you need to learn. That is, after all, what makes a subject a discipline: A discipline allows (and forces) people to think about a slice of the world in some new way.

Economics is no exception. Think of it this way: There is a sense in which learning a new intellectual discipline like macroeconomics is similar to learning a new language. Economists' way of thinking allows us to see the economy more sharply and clearly than if we were limited to thinking like a sociologist, or a political scientist, or a business reporter. (Of course, restricting yourself to one mode of thought can also have costs. Thinking only like an economist can also cause us to miss certain relationships that are hard to quantify or hard to think of as purchases and sales. That is why economics is not the only social science, and we need sociologists, political scientists, historians, psychologists, and anthropologists as well.)

In this chapter we will survey the intellectual landmarks of economists' system of thought. The idea is to help you orient yourself in the mental landscape of macroeconomics. For some of you this chapter will seem pointless and obvious. But for some of you it will be like a lightbulb being turned on: "So that's what's going on!" you will think.

Economics: How Is It Like a Science?

If you are coming to economics from a background in the natural sciences, you probably expect economics to be something like a natural science, only less so: To the extent that it works, it works more or less like chemistry, though it does not work as well. Economic theories are unsettled and poorly described. Economists' predictions are often wrong.

If you hold these opinions, you are half-right. While economics is like a science in many respects, it is not and cannot be identical to a natural science. It is a *social* science. Its subject is not electrons or elements but human beings: people and how they behave. This subject matter has several important consequences. Some of them make economics easier than a natural science, some of them make economics harder than a natural science, and some of them just make it different.

First, because economics is a social science, debates within economics last a lot longer and are much less likely to end in a clear consensus than are debates in the natural sciences. The major reason is that different people have different views of what makes a free, a good, a just, or a well-ordered society. They look for an economy that harmonizes with their vision of what a society should be. They ignore or explain away facts that turn out to be inconvenient for their particular political views. People are, after all, only human.

Economists try to approach the objectivity that characterizes most work in the natural sciences. After all, what is is, and what is not is not. Even if wishful thinking or predispositions contaminate the results of a single study, later studies can correct the error. But economists never approach the unanimity with which physicists embraced the theory of relativity, chemists embraced the oxygen theory of combustion, and biologists rejected the Lamarckian inheritance of acquired characteristics. Biology departments do not have Lamarckians. Chemistry departments do not have phlogistonists. But economics departments do have a wide variety of

points of view and schools of thought. Because economists never approach unanimity, maintaining a diversified intellectual portfolio is important in economics.

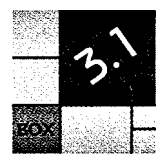
Second, the fact that economics is about people means that economists cannot ethically undertake large-scale experiments. Economists cannot set up special situations in which potential sources of disturbance are reduced to a minimum, then observe what happens, and generalize from the results of the experiment (where sources of disturbance are absent) to what happens in the world (where sources of disturbance are common). Thus the experimental method, the driver of rapid progress in many of the natural sciences, is largely lacking in economics. This flaw makes economics harder to analyze, and it makes economists' conclusions much more tentative and subject to dispute than is the case with natural sciences.

Third, the subjects economists study — people — have minds of their own. They observe what is going on around them, plan for the future, and take steps to avoid future consequences that they foresee and fear will be unpleasant. At times they simply do what they want, just because they feel like doing it. Thus in economists' analyses the present often depends not just on the past but on the future as well — or on what people expect the future to be. Box 3.1 presents one example of this: how people's expectations of the future and particularly their fear that there might be a depression contributed to the coming of the Great Depression of the 1930s.

expectations

What investors, consumers, employers, and workers think the future will be like.

EXPECTATIONS AND THE COMING OF THE GREAT DEPRESSION: AN EXAMPLE



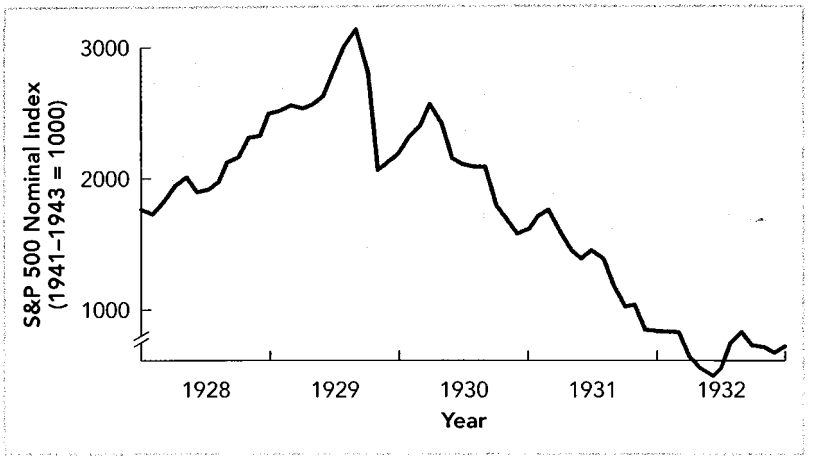
An important example of how people's expectations can change the course of economic events comes from the stock market crash of 1929. The crash changed what Americans expected about the future of the economy, and the shifts in spending caused by their changed expectations played a key role in causing the greatest economic depression in American history, the Great Depression.

On October 29, 1929, the price of shares traded on the New York Stock Exchange suffered their largest one-day percentage drop in history. Stock values bounced back a bit initially, but by the end of the week they were down by more than a quarter (see Figure 3.1 on page 60). Gloom fell over Wall Street. Many people had lost a lot of money.

At that time stock ownership was confined to the rich. Middle-class Americans owned little stock. Nonetheless, the crash affected their perceptions of the economy: Bad times were coming. Because people expected the economic future to be dimmer, many cut back on spending, especially on big-ticket consumer durables. The 1920s had been the first decade in which consumer credit was widely available to finance purchases of cars, refrigerators, stoves, and washing machines. With the economic future uncertain, spending on consumer durables collapsed. It made sense to borrow to buy a consumer durable only if you were confident that you could make the payments and pay off the loan. If you thought the economic future might be bad, you had a powerful incentive to avoid debt. And in the short run the easiest way to avoid debt is to refrain from purchasing large consumer durables on credit.

You can probably guess what happened in the months after the crash. Most people simply stopped buying big-ticket items like cars and furniture. This massive drop in demand reduced new orders for goods. The drop in output generated layoffs

FIGURE 3.1
The Stock Market, 1928–1932



Source: J. Bradford DeLong and Andrei Shleifer, "Closed End Fund Discounts: A Yardstick of Small-Investor Sentiment," *Journal of Portfolio Management* 18:2 (Winter 1992), pp. 46–53.

in many industries. Even though most people's incomes had not yet changed, their expectations of their future income had.

The drop in demand produced by this shift in expectations helped bring on what people feared; it put America on the path to the Great Depression. The Great Depression happened in large part because people expected something bad to happen. Without that pessimistic shift in expectations triggered by the crash of 1929, there would have been no Great Depression. ■

This third wrinkle is the thing that does the most to make economics very hard. Natural scientists can always assume the arrow of causality points from the past to the future. In economics people's expectations of the future mean that the arrow of causality often points the other way, from the (anticipated) future back to the present. This means that sometimes in economics things will happen just because they are expected to happen — and that if they weren't expected to happen, they would not.

Reliance on Quantitative Models

In spite of the political complications, the nonexperimental nature, and the peculiar problems of cause and effect in economics, the discipline of economics remains very quantitative. Economists are lucky in that almost everything that they study comes to us already labeled, measured, and quantified: prices, values, transactions all come with numbers attached or are numbers. Thus economics makes heavy use of arithmetic and algebra, whereas most of political science, sociology, and history do not. Economics makes heavy use of arithmetic to measure economic variables of interest. Economics makes heavy use of algebra in building the simplified,

stripped-down mathematical models that economists use to try to understand the relationships between these economic variables.

The American economy is complex: 140 million workers, 10 million firms, and 100 million households buying and selling some $30 trillion worth of final and intermediate goods and services per year. Economists must simplify it. You can't talk about 140 million individuals and expect to understand everything. So you simplify. You restrict your attention to a very few simple **behavioral relationships** — cause-and-effect links between economic quantities — and a handful of **equilibrium conditions** — conditions that must be satisfied for economic activity to be stable and for supply and demand to be in balance.

behavioral relationship

A connection between economic variables that is the result of people's actions.

equilibrium condition

A relationship between two economic quantities that holds because the operation of the system as a whole pushes the economy to a state in which the relationship holds.

What is a behavioral relationship? It's something like a rule that relates the number of workers and the value of the capital stock to the total amount of goods and services produced in the economy. It's something like a rule that tells us how consumer spending changes when household income changes. What's an equlibrium condition? It's something like supply equals demand. Economists attempt to capture these behavioral relationships and equilibrium conditions in simple algebraic equations and geometric diagrams. Then they try to apply their equations and graphs to the real world, while hoping that their simplifications have not made the model a distorted and faulty guide to how the real-world economy works.

Among economists, the process of reducing the complexity and variation of the real-world economy to a handful of equations is known as "building a model." Using models to understand what is going on in the complex real-world economy has been a fruitful intellectual strategy. But model building tends to focus on the variables and relationships that fit easily into the algebraic model. It overlooks other factors.

model

A construct that aims to establish relationships — usually quantitative — between and among economic variables.

An Emphasis on the Abstract

Economics might have developed as a descriptive science, like sociology or political science. If it had, courses in economics would concentrate on economic institutions and practices and the institutional structure of the economy as a whole. But economics has instead become a more abstract science that emphasizes general principles applicable to a variety of situations. Thus a large part of economics involves a particular set of tools. Economics is a unique way of thinking about the world that is closely linked with these analytical tools and is couched in a particular technical language and relies on a particular set of data. While you can get a lot out of sociology and political science courses without learning to think like a sociologist or a political scientist (because of their focus on institutional description), you cannot get much out of an economics course without learning to think like an economist.

Introducing the Rhetoric of Economics

Surrounding the models, economists build a special rhetoric: a set of analogies and metaphors that economists use to help laypeople grasp the functioning of the macroeconomy. Metaphors and analogies are the basic stuff of human thought. To understand something we do not know, we will often compare it to something we do know.

Economics is no exception. In economics, curves "shift" and money has a "velocity." When the *central bank* raises interest rates and throws people out of work, economists say that this "pushes the economy down the Phillips curve." Conversely, when the central bank lowers interest rates and the economy booms, economists say that this "pushes the economy up the Phillips curve" — as if the

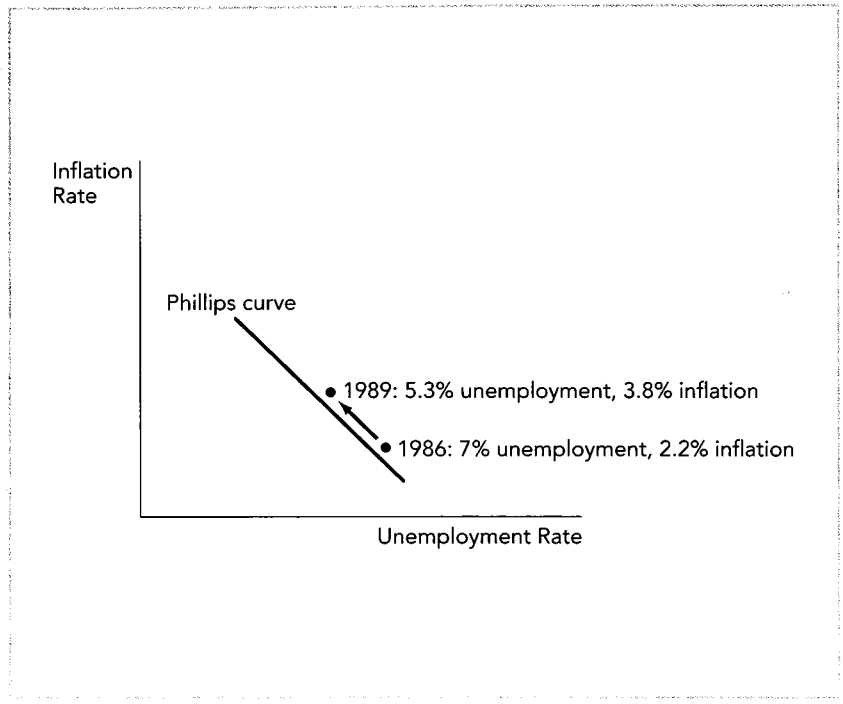


FIGURE 3.2
Pushing the Economy Up the Phillips Curve
Between 1986 and 1989 the Federal Reserve's expansionary monetary policy reduced interest rates and increased total spending. Increased total spending meant that unemployment fell from 7 percent in 1986 to 5.3 percent in 1989. As unemployment fell, inflation rose from 2.2 percent in 1986 to 3.8 percent in 1989. Economists talk about this change by saying, "Between 1986 and 1989 the Federal Reserve's expansionary monetary policy pushed the economy up and to the left along the Phillips curve" (which depicts the short-run relationship between unemployment and inflation).

Source: 2004 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

economy were a dot on a diagram drawn on a piece of paper, constrained to move along a particular curve called the *Phillips curve*, and monetary policy really did push the dot up and to the left (see Figure 3.2).

As a student you should be conscious of (and a little critical of) the rhetoric of economics. If you don't understand the metaphors, much of economics may simply be incomprehensible. All will become clear, or at least clearer, if you are conscious of the metaphors. For example, there is a central dominant metaphor in macroeconomics, the circular flow metaphor, without which discussions of the "velocity" of money are simply incomprehensible. The circular flow metaphor compares the process of spending throughout the economy to the flow of a liquid. Thus if the total amount of spending increases but the quantity of money does not, the money must be "flowing" faster than it did in the past, since a fixed quantity of pieces of money are changing hands more often. Hence money must have a higher speed or velocity. Without the concept of spending as a circular flow of purchasing power, references to the velocity of money will make no sense.

circular flow

The central, dominant metaphor in macroeconomics which states that purchasing power flows from businesses to households and back in a circular fashion.

Much of the rhetoric of economics can be reduced to four dominant concepts:

- The image of the **circular flow** of purchasing power through the economy — the circular flow of economic activity.
- The use of the word "market" to describe intricate and decentralized processes of exchange, as if all the workers and all the jobs in the economy really were being matched in a single open-air market.

- The idea of **equilibrium**: that economic processes tend to move the economy into some sort of balance and to keep the economy at this point of balance.
- The use of graphs and diagrams as an alternative to arithmetic and equations as tools to express economic relationships. Economists identify equations with geometric curves; situations of equilibrium with points where curves cross; and changes in the economic environment or in economic policy with shifts in the positions of particular curves.

equilibrium
A state of balance in a particular market or in the economy as a whole.

We will look next at the circular flow of economic activity. The market, equilibrium, and the relationship between graphs and equations will be covered in later sections.

RECAP UNDERSTANDING MACROECONOMICS

While economics is a science, it is not a *natural* science. It is a *social* science. The subjects economists study — people — have minds of their own, and think ahead. Thus in economics it is common for the (expected) future to influence the past, and chains of causation can get very tangled. Economics might have developed as a descriptive science, like sociology or political science. It didn't. Economics, instead, developed as an abstract, simplifying, model-oriented discipline.

3.2 THE CIRCULAR FLOW OF ECONOMIC ACTIVITY

When economists speak of the "circular flow" of economic activity, they have a definite picture in mind. They see patterns of spending, income, and production as liquid flowing through various sets of pipes. In this extended metaphor, categories of agents in the economy — all businesses, the government, all households — are the pools into and out of which the fluid of purchasing power (i.e., money) flows. Thus economists think of economic activity — the pattern of production and spending in the economy — as a circular flow of purchasing power through the economy.

The circular flow metaphor allows them confidently to predict that changes in one part of the economy will affect the whole and to explain what the likely effects will be. It allows them to simplify economic behavior, to understand a great deal about the entire set of decisions made by all different agents in different parts of the economy by thinking of just a few typical decisions made by just a few abstract agents whose decisions nevertheless represent the decisions made by all the households, businesses, investors, consumers, and workers in the economy.

The Circular Flow Diagram

Figure 3.3 shows a simplified diagram of the circular flow. It omits the government and international trade. Nevertheless, it is a good starting point for our discussion. In this figure, money payments flow from firms to households as businesses pay their workers and their owners for their labor and capital. This is the *income side* of the circular flow: Firms buy the factors of production, capital and labor, from the households that own them. Money payments then flow from households to firms as households buy goods. This is the *expenditure side* of the circular flow: Households buy final goods and services from businesses. Note that these flows

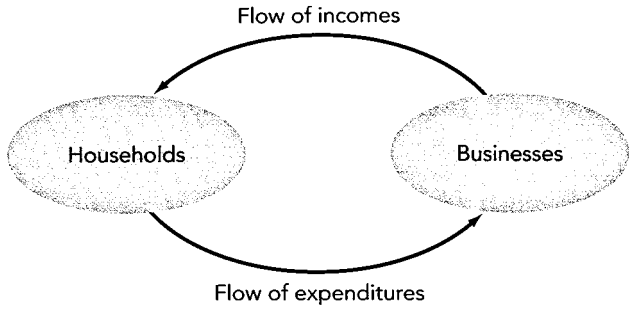


FIGURE 3.3
The Circular Flow Diagram
Households spend money buying the products made by businesses, and businesses turn around and spend the same money buying factors of production — workers' time and attention, finance, the use of land and other property — from households.

balance: The purchasing power that firms earn by selling their goods is the same as the purchasing power that firms spend by buying factors of production, and the incomes of households are equal to their total expenditures.

This simplified diagram is expanded in Figure 3.4 to take account of the roles of the government, *financial markets,* and international trade and investment. But the core idea of a balanced circular flow of purchasing power is still present. Along the top of the diagram there is still the flow of incomes to households from businesses as businesses purchase labor and other factors of production from the households that own them. All these components of business expenditure — rent, wages, salaries, benefits, interest, and profits — become the components of household income.

At the bottom of the diagram are the uses of household incomes — consumption spending, *taxes,* and *household saving.* Consumption spending flows directly to businesses as households purchase consumption goods. Total taxes flow to the government, which uses some of this revenue to make *transfer payments* — classified here as negative taxes — back to households, uses most of it for government purchases, and borrows the resulting *government budget deficit* from financial markets as the government funds its budget deficit by issuing bonds.

Households save the portion of their incomes that is left over after taxes and consumption spending. This saving flows into financial markets as it is put into banks and mutual funds. Businesses seeking to invest draw on the pool of saving to gain financing for purchasing capital goods to expand their productive capacity. Exports serve as an addition to (and imports a subtraction from) total demand for domestically made products.

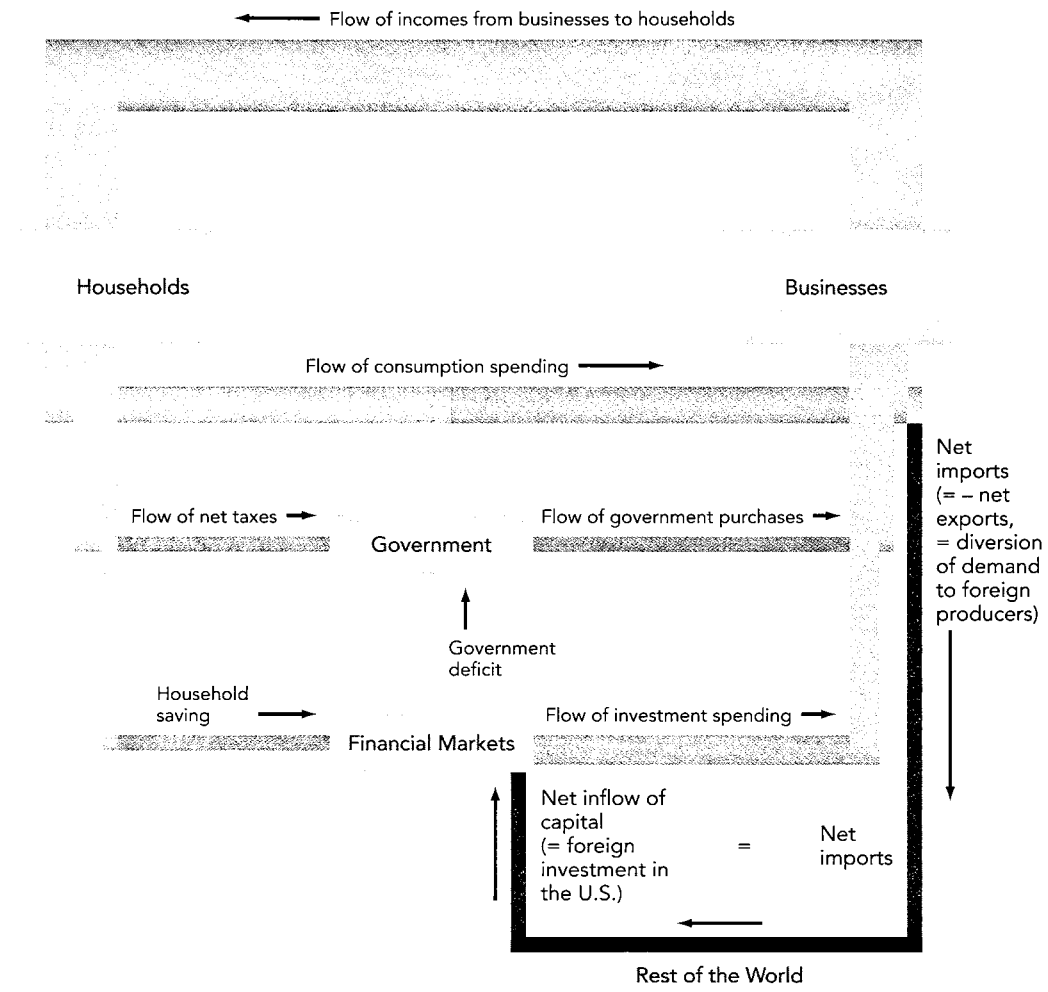
At the right of Figure 3.4 we have the components of planned expenditure or *aggregate demand:* consumption spending, government purchases, investment spending, and net exports (which are, in the United States today, net imports, a subtraction from GDP, because imports are greater than gross exports).

Within the business sector, businesses buy and sell intermediate goods from each other as they strive to produce goods and services and make profits. Within the household sector, households buy and sell assets from and to one another. These within-the-business-sector and within-the-household-sector transactions are important components of the economy. But because they net out to zero within the business sector or within the household sector, they are not counted as part of the circular flow of economic activity. And so the circular flow diagram pays little attention to them, and

FIGURE 3.4

The Circular Flow of Economic Activity

This version of the circular flow is complicated by the addition of the government and financial markets to the diagram. Not all final goods and services are bought by households. Some are bought by the government, which taxes to raise resources to finance itself. Some are bought by businesses seeking to invest, which raise the needed resources by issuing stock, issuing bonds, and borrowing — all of which take place in *financial markets*. This version is also complicated by its recognizing that there is a world outside, a world that buys the products of domestic businesses and that invests through domestic financial markets.



macroeconomics as a discipline does not focus on the exchange of intermediate goods between businesses or on the exchange of used goods between households.

Is the circular flow still a little unclear? Let's try to get a better grasp of it. Let's take a closer look at one particular part of the circular flow: a dollar paid out by a business as a dividend to a shareholder who is a member of a household. The dollar is partial payment for a factor of production owned by the household — the capital that has been invested in the business by the shareholder. When the dividend check is deposited, it becomes part of the shareholder's household income. Three things happen to household income: Some of it is spent on consumption goods and services, some of it is paid to the government in taxes, and some of it is not spent but saved.

Suppose the household doesn't spend this particular dollar but simply keeps the money in the bank, thus saving it for future use. The bank will notice that it has an extra dollar on deposit and will loan that dollar out to a business in need of cash to build up its inventory. That business will then spend the dollar buying goods and services as it builds up its inventory. As soon as the dollar shows up as a component of business investment spending, the circular flow is complete. The dollar's worth of purchasing power has flowed from the business sector to the household sector, then flowed as part of the flow of savings into the financial markets, and finally flowed out of the financial markets and back to the business sector as part of business investment spending.

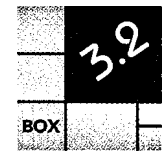
Different Measures of the Circular Flow

Income, production, and expenditure can be measured at three different points in the circular flow:

1. At the point where consumers, exporters, the government, and firms that are making investments purchase goods and services from businesses. This measurement is *real GDP*, or total output. It is the total economywide production of final goods and services. It is the expenditure-side measure of the circular flow.
2. At the point in the circular flow where businesses pay households for the factors of production. Businesses need labor, capital, and natural resources, all factors of production owned directly or indirectly by households. When businesses buy factors of production, they provide households with incomes. This measurement is called total income, or *national income*. It is the income-side measure of the circular flow.
3. At the point where households decide how to use their income. How much do they save? How much do they pay in taxes? How much do they spend on consumption goods? This measure of the circular flow of economic activity is the *uses-of-income* measure.

The measure used most frequently is the expenditure-side measure: the gross domestic product produced by firms and demanded by purchasers. It is estimated by summing the four components of spending (and sales) — consumption, government purchases, investment, and net exports. If we compare the expenditure-side measure of GDP with the income-side or uses-of-income measure, we will find that, aside from differences created by different accounting conventions, they are equal (see Box 3.2). They are equal because the circular flow principle is designed into the national income and product accounts (NIPA). Every expenditure on a final good or service is accounted for as a payment to a business. Every dollar payment that flows into a business is then accounted for as paid out

ACCOUNTING DEFINITIONS AND STATISTICAL DISCREPANCIES: TOOLS



Because of the technical details of national income accounting, the different measures of the circular flow do not exactly balance. The gap is the *statistical discrepancy*. All pieces of GDP reported by the Commerce Department are estimates. All estimates are imperfect. It is not unusual for $90 billion a year to go "missing" in the circular flow; as Table 3.1 shows, this happened in the third quarter of 2004.

TABLE 3.1
Measures of the U.S. Circular Flow (in Billions of Dollars per Year), Third Quarter of 2004

Gross domestic product	$11,815
Minus: Depreciation	−1,498
Equals: Net domestic product	$10,317
Plus: Net factor incomes from abroad	+38
Equals: Net national product	$10,355
Minus: Statistical discrepancy	−90
Equals: National income	$10,265

Source: Authors' calculations from the 2005 edition of *The Economic Report of the President* (Washington, DC: Government Printing Office).

to somebody. It can be paid out as income — wages, fringe benefits, profits, interest, or rent — or as an expenditure on goods or services of another business that then, in turn, purchases factors of production.

What if you want to withdraw your income from the circular flow? Suppose, for instance, that you simply take the dollar bills you receive and use them to buy something old and precious from another household — a bar of gold, say. And suppose you keep the bar of gold in your basement. Doesn't that break the circular flow? The answer is that it does not. You no longer have your income, but the household that you bought the gold bar from does. That household will then spend it on consumption goods, save it, or have it taxed away.

What if you decided not to spend your dollar bills, not to pay them in taxes, and not to save them in the bank? Suppose you decided to hide the dollar bills in your basement? Doesn't that break the circular flow? The answer, again, is that it does not. When you hide the dollar bills in the basement, the Bureau of Engraving and Printing will notice that the total number of dollar bills circulating in the economy has dropped. It will print up more dollar bills and hand them to the Treasury. The government will spend these extra dollar bills, and thus replace the ones you hid. The net effect is the same as it would be if you had saved the dollar bills by lending them out to the government through the purchase of a Treasury bond. There are only two differences between buying a Treasury bond and your basement storage scheme:

1. You have a stack of dollar bills in your basement rather than a piece of paper with the words "Treasury bond" written on it.
2. The government does not pay interest on the dollar bills stacked in your basement, but it does pay interest on its bonds. In the circular flow diagram, you saved your income, but you saved it in a relatively pointless way by making the government an interest-free loan.

RECAP THE CIRCULAR FLOW OF ECONOMIC ACTIVITY

Money flows from households to firms as households buy goods. This is the "expenditure side" of the circular flow: Households buy *final goods and services* from businesses. Businesses then turn around and buy factors of production from households. These payments make up household income. This is the "income side" of the circular flow. The circular flow principle is that the two flows must match: In the economy as a whole, expenditure must equal income.

3.3 PATTERNS OF ECONOMISTS' THOUGHT

Besides the circular flow of economic activity, three other sets of concepts, not obvious to outsiders, dominate the patterns of economists' thought: the idea of markets, the idea of equilibrium, and the use of math in the form of graphs and equations. Let's look at each of these in turn — the first two briefly, and the last at much greater length.

Markets

Economists often speak as if all economic activity took place in great open-air marketplaces like those of medieval merchant cities. Contracts between workers and bosses are made in the "labor market." All the borrowing of money from and the depositing of money into banks take place in the "money market." Supply and demand balance in the "*goods market.*" Indeed, in the market squares of preindustrial trading cities you could survey the buyers and sellers and form a good idea of what was being sold and for how much.

In using the open-air markets of centuries past as a metaphor for the complex processes of matching and exchange that take place in today's modern industrial economy, economists are assuming that information travels fast enough and buyers and sellers are well enough informed for prevailing prices and quantities to be as they would be if we actually could walk around the perimeter of a marketplace and examine all buyers and sellers in an hour. In most cases this bet that a decentralized matching process is like an open-air market will be a good intellectual bet to make. But sometimes (for example, in situations of so-called *structural unemployment*, where people who could work effectively at some of the jobs in the economy find that those jobs are not open) it may not be.

Equilibrium

Economists spend most of their time searching for the state of equilibrium — a point or points of balance at which some economic quantity is neither rising nor falling because the different economic forces pushing or pulling it up or down exactly counteract each other. The dominant metaphor is that of an old-fashioned scale whose two pans are in balance.

The search for equilibrium is an attempt to simplify the problem of understanding how the economy will behave. Economists' questions are much easier to analyze if we can identify "points of rest" where the pressures for economic quantities to rise and fall are evenly balanced. Once the potential points of rest have been identified, economists can figure out how fast economic forces will push the

economy to those points of equilibrium. The search for points of equilibrium, followed by an analysis of the speed of adjustment to equilibrium, is the most common way of proceeding in any economic analysis.

Do not forget, however, that this pattern of thought is merely an aid to understanding economic theories and principles. It is not the theories and principles themselves. The theories and principles, in turn, are just aids to understanding the reality; they are not themselves the reality.

Graphs and Equations

In the seventeenth century, the French philosopher and mathematician René Descartes spent much of his life demonstrating that graphs and equations can be thought of as two different ways of representing the same underlying concepts. An algebraic equation relating two variables x and y can also be seen as a curve drawn on a graph where the value of x is marked on the horizontal axis and the value of y is marked on the vertical axis. Thus each of the variables in the equation can be thought of as one of the axes of the graph. The set of points whose x-axis value is the first variable and whose y-axis value is the second — that is, the set of points for which the equation holds — makes up a line or curve on the graph. That line or curve is the equation (see Figure 3.5). Thus the solution to a set of two equations is the point on the graph where the two curves that represent the equations intersect. Moreover, you can just as easily move back in the other direction, by thinking of a curve in terms of the equation that generates it. Today economists make very extensive use of these ideas from Descartes's analytic geometry.

analytic geometry
The idea that graphs and equations are two different ways of expressing the same concepts.

Just after the end of World War II Professor *Paul Samuelson* of MIT discovered that many of his students were much more comfortable manipulating diagrams than solving algebraic equations. With diagrams, they could see what was going on in a hypothetical economy. Thinking of how a particular curve would shift was often easier than thinking of the consequences of changing the value of the constant term in an equation.

When economists translate their algebraic equations into analytical geometric diagrams, they do things that may annoy you. Economists (like mathematicians) think

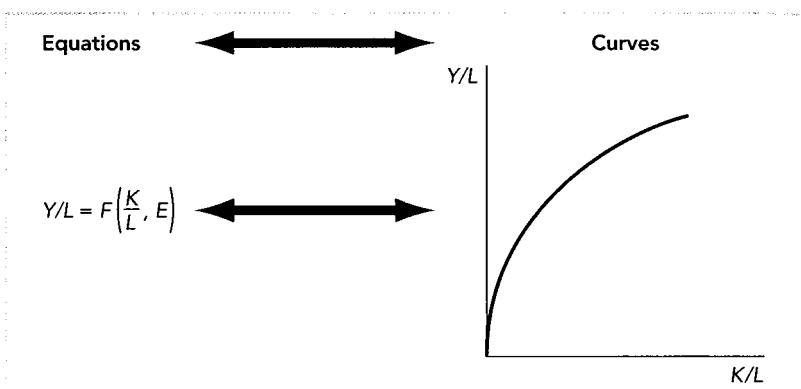


FIGURE 3.5
Two Forms of the Production Function
Economists build their arguments by moving back and forth between equations and diagrams representing the same relationship. The graph on the right is the geometric representation of the algebraic equation on the left.

of a "line" as a special kind of "curve" (and it is: It is a curve with zero curvature). So you may find words — in this book, in your lecture, or in your section — referring to a "Phillips curve," but when you look at the accompanying diagram, you see that it is a straight line. Do not let this bother you. Economists use the word "curve" to preserve a little generality.

If you find analytic geometry easy and intuitive, then Samuelson's intellectual innovation will make macroeconomics more accessible to you. Behavioral relationships become curves that shift about on a graph. Conditions of economic equilibrium become dots where curves describing two behavioral relationships cross (and thus both behavioral relationships are satisfied). Changes in the state of the economy become movements of a dot. Understanding economic theories and arguments becomes as simple as moving lines and curves around on a graph and looking for the place where the correct two curves intersect. And solving systems of equations becomes easy, as does changing the presuppositions of the problem and noting the results.

If you are not comfortable with analytic geometry, then you need to find other tools to help you think like an economist. Remember that the graphs are merely tools to aid your understanding. If they don't, then you need to concentrate on understanding and manipulating the algebra, or understanding and using the verbal descriptions of a problem. Use whatever method feels most comfortable. Grab hold of what makes most sense to you, and recognize that all of these approaches are ways of reaching the same conclusions.

RECAP PATTERNS OF ECONOMISTS' THOUGHT

Three concepts in addition to the circular flow dominate the patterns of economists' thoughts. Understand these three concepts and their role in economic analysis and you will be well on your way to being an economist. The three concepts are *markets* — where trades take place; *equilibrium* — points where economic forces are in balance; and *mathematical expression* through graphs and equations.

3.4 MODEL BUILDING

Economists use their graphs and equations to build their mathematical models. The first thing to remember about their models is that they are simple: Simplification is at the core of economists' model building. Economists build simple models for two reasons. First, no one really understands excessively complicated models. A model is of little use if economists cannot understand the logic behind its prediction. Second, the predictions generated by simple models are nearly as good as the ones generated by more complex models. While the economic models used by the Federal Reserve or the *Congressional Budget Office* are more complicated than the models presented in this textbook, in essence they are cousins of the models used here.

You may have heard that economics is more of an art than a science. This means that the rules for effective and useful model building — for omitting unnecessary detail and complexity while retaining the necessary and important relationships — are nowhere written down. In this important respect, economists tend to learn by

doing or by example. But almost every successful construction of a macroeconomic model follows certain fundamental steps. These include the use of representative agents, a focus on opportunity costs in understanding agents' decisions, and careful attention to the effect of people's expectations on events.

Representative Agents

One simplification that macroeconomists, but not microeconomists, invoke constantly is that all participants in the economy are the same or, rather, that the differences between businesses and workers do not matter much for the issues macroeconomists study. Thus macroeconomists analyze a situation by examining the decision making of a single **representative agent** — be it a business, a worker, or a saver. They then generalize to the economy as a whole from what would be the rational decisions of that single representative agent.

representative agents
A simplification often made in macroeconomics that assumes all participants in the economy are the same.

The use of representative agents makes macroeconomics simpler, yet it also makes some questions very hard to analyze. Consider unemployment: The key concept is that some workers have jobs but others do not. If one has adopted the simplifying assumption of a single representative worker, how can one worker represent both those who are employed and those who are not?

The assumption of a representative agent is also useless when the relative distribution of income and wealth among people in the economy is the important question. Consider an economy in which everyone works equally hard, but 1 million lucky people receive $10,000,000 a year in income and 99 million receive $10,000 a year in income. Now consider an economy in which all 100 million people work equally hard and each receives $80,000 a year in income. Almost all of us would think that the second was a happier and fairer economy, even though total income in the first economy amounts to $10.99 trillion and total income in the second economy amounts to only $8 trillion. As noted earlier, every discipline sees some things clearly and some things fuzzily. Distribution and its impact on social welfare are an area that macroeconomics has trouble bringing into focus.

Opportunity Cost

Perhaps the most fundamental principle that economists use in modeling the decisions individuals make is the principle that there is always a choice. You could always have chosen to do something else. And the very act of making a choice excludes your ability to have done its alternatives instead: It forecloses your opportunities.

If you keep your wealth in the form of easily spendable cash, you pass up the chance to keep it earning interest in the form of bonds. If you keep your wealth in the form of interest-earning bonds, you pass up the capability of immediately spending it on something that suddenly strikes your fancy. If you spend it on consumption goods, you pass up the opportunity to save. Economists use the term **opportunity cost** to refer to the value of the best alternative that you forgo in making any particular choice.

opportunity cost
The next best opportunity forgone in order to do something else.

At the root of every behavioral relationship is somebody's decision. In analyzing such decisions, economists always think about the decision maker's opportunity costs. What else could the decision maker do? What opportunities and choices does the decision maker foreclose by taking one particular course of action? Many

students make economics a lot harder than it has to be by not remembering that this opportunity-cost way of thinking is at the heart of every behavioral relationship in an economic model.

The Focus on Expectations

Many times the opportunity cost of taking some action today is not an alternative use of the same resources today but a forgone opportunity to save one's resources for the future. A worker trying to decide whether to quit a job and search for another will be thinking about future wages after a successful search. A consumer trying to decide whether to spend or save will be thinking about what interest rate savings will earn in the future.

No one, however, knows the future. At best people can form rational and reasonable expectations of what the future might be. Hence nearly every behavioral relationship in macroeconomic models depends on expectations of the future. Expectations formation is a central, perhaps *the* central, piece of macroeconomics. Every macroeconomic model must explain the amount of time people can spend thinking about the future, the information they have available, and the rules of thumb they use to turn information into expectations.

As we will see in Chapter 12, economists tend to consider three types of expectations:

- *Static expectations,* in which decision makers simply don't think about the future.
- *Adaptive expectations,* in which decision makers assume that the future is going to be like the recent past.
- *Rational expectations,* in which decision makers spend as much time as they can thinking about the future and know as much (or more) about the structure and behavior of the economy as the model builder does.

The behavior of an economic model will differ profoundly depending on what kind of expectations economists build into the model.

Solving Economic Models: Behavioral Relationships and Equilibrium Conditions

When economists are trying to analyze the implications of how people act — say, how the overall level of production would change with a larger capital stock — they almost always write an equation that represents a behavioral relationship. This behavioral relationship states how the effect (the total level of production) is related to the cause (the available capital stock). The economist usually draws a diagram to help visualize the relationship and writes it down verbally. For example, an economist trying to relate an economy's productive resources to the level of economic output would reason: "A larger capital stock means that the average employee will have more machines and equipment to work with, and this will increase total production per worker. But increases in capital will probably be subject to *diminishing returns,* so the gain in production from increasing the capital stock per worker from $40,000 to $80,000 will be less than the gain in production from increasing the capital stock per worker from $0 to $40,000." Box 3.3 fleshes out this example of a behavioral relationship — in this case, the *production function.* This particular behavioral relationship, the production function, is a very important part of the next chapter.

THE PRODUCTION FUNCTION: AN EXAMPLE OF A BEHAVIORAL RELATIONSHIP

One of the key behavioral relationships in macroeconomics is the *production function,* which specifies the relationship between the economy's productive resources. The production function relates:

- The economy's capital-labor ratio (how many machines, tools, and structures are available to the average worker), written K/L (K for *capital* and L for labor, the number of workers in the economy).
- The level of technology or efficiency of the labor force, written E.
- The level of real GDP per worker, written Y/L (Y for real GDP or total output and L for the number of workers in the economy).

An economist could write the production function in this general, abstract form:

$$\frac{Y}{L} = F\left(\frac{K}{L}, E\right)$$

This formula states that the level of output per worker is some *function,* F, of K/L and E; that is, the level of output per worker depends in a systematic and predictable way on the capital-labor ratio and the *efficiency of labor* in the current year. But this abstract form does not specify the particular form of this systematic and predictable relationship.

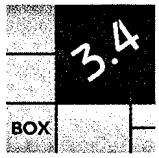
Alternatively, an economist could write the production function in a particular algebraic form, for example, the Cobb-Douglas form, which is convenient to use (Box 3.4 explains why):

$$\frac{Y}{L} = \left(\frac{K}{L}\right)^{\alpha} \times E^{1-\alpha}$$

This equation states: "Take the capital-labor ratio, raise it to the exponential power α, and multiply the result by the efficiency of labor E raised to the exponential power $(1 - \alpha)$. The result is the level of output per worker that the economy can produce." While this equation is more particular than the abstract form $Y/L = F(K/L, E)$, it remains flexible: The parameter α could have any of a wide range of different values, and the efficiency of labor E could have any value. This Cobb-Douglas algebraic form still stands for a whole family of possible production functions. The values chosen for E and α will tell us exactly which production function is the real one and thus what the behavioral relationship is between the economy's resources and its output. Once we know the values of E and α, we can calculate what the output per worker will be for every possible value of capital per worker.

Why do economists choose to write the production function in this particular algebraic form? Ease of use is the key reason. This form of the production function makes a lot of calculations *much* simpler and more straightforward than other forms.

In addition to analyzing behavioral relationships, economists consider equilibrium conditions — conditions that must be true if the economy is to be in balance. If an equilibrium condition does not hold, then the state of the economy must be changing rapidly, moving toward a state of affairs in which the equilibrium condition does hold. In microeconomics the principal equilibrium condition



WORKING WITH EXPONENTS: SOME TOOLS

What is the point behind the use of the Cobb-Douglas production function, with all its exponents?

$$\frac{Y}{L} = \left(\frac{K}{L}\right)^{\alpha} \times E^{1-\alpha}$$

Recall that exponents greater than 1 are a means of repeated multiplication. Thus 2^1 is 2 multiplied by itself once, that is, 2; 2^2 is 2 times itself twice, that is, $2 \times 2 = 4$; 2^3 is 2 times itself three times, that is, $2 \times 2 \times 2 = 8$. Recall that exponents between 1 and zero are a way of taking roots. Thus $2^{0.5}$ is the square root of 2, and $2^{1/3}$ is the cube root of 2.

Whenever the Cobb-Douglas production function is used, the *parameters* that are the exponents will be between zero and 1. In fact, in most applications of this production function the parameter α will be something like ½. Raising the capital-labor ratio to the α power is something like taking the square root of the capital-labor ratio. So the production function will state that output per worker is proportional to the square root of the capital-labor ratio. This function (a) is easy to calculate or look up for particular cases, (b) is one with which we have a lot of experience, (c) is an increasing function (so it fits the intuitive requirement that more capital is useful), and (d) is a function with diminishing returns — the higher the capital stock, the less valuable is the next investment in expanding the capital stock still further. Thus a lot of features that economists would like a sensible behavioral relationship between the capital-labor ratio and output per worker to have are already built into the Cobb-Douglas production function.

Moreover, using the Cobb-Douglas production function offers an additional advantage. It makes calculating *growth rates* easy. Output per worker is proportional to the capital-labor ratio raised to the power α. Thus if nothing else is changing, the growth rate of output per worker equals α times the growth rate of the capital-labor ratio. If α is ½ and if the capital-labor ratio is growing at 4 percent per year and if efficiency of labor is not changing, then output per worker is growing at

$$\frac{1}{2} \times 4\% = 2\% \text{ per year.}$$

is that supply must equal demand. If it does not, then buyers who find themselves short are frantically raising their bids (and prices are rising) or sellers who find themselves with excess inventory are frantically trying to shed it (and prices are falling). Only if supply equals demand can the price in a market be stable. In macroeconomics, the supply-must-equal-demand equilibrium condition is the most important, but there are other important equilibrium conditions too. Box 3.5 provides an example of one that will be very important in Chapter 4: the equilibrium condition required for balanced economic growth.

If the equilibrium conditions are not satisfied, then the economy cannot be stable. Someone's expectations must turn out to be false, or someone's plans for what to buy and sell must be unsatisfied. If the behavioral relationships are not satisfied, the relationships are not adequately describing our behavior. So the behavioral

A SAMPLE EQUILIBRIUM CONDITION — THE CAPITAL-OUTPUT RATIO: AN EXAMPLE

An important equilibrium condition that is not of the supply-must-equal-demand form is the equilibrium condition for *balanced growth,* which plays a big part in Chapter 4. This equilibrium condition relates the following economic variables:

- The share of total income in the economy that is saved and invested, written s.
- The proportional rate of growth of the labor force, written n.
- The proportional rate of growth of the efficiency of the labor force, written g.
- The *depreciation rate* — the rate at which capital wears out — written δ (Greek lowercase letter delta).

Growth will be *balanced* if, and only if, the ratio of the economy's stock of capital K to its level of output Y is constant. This equilibrium condition holds if, and only if, the capital-to-output ratio K/Y is equal to

$$\frac{K}{Y} = \frac{s}{n + g + \delta}$$

The capital-output ratio must be equal to the economy's saving rate s divided by the sum of the population growth rate n, the labor efficiency growth rate g, and the depreciation rate δ.

If the capital-output ratio is lower than this value, it will grow because net investment will be high relative to the capital stock. If the capital-output ratio is higher than this value, it will shrink because net investment will be low relative to the capital stock. In either case, the capital-output ratio will converge to its *balanced-growth equilibrium* level over time.

Thus this balanced-growth capital-output-ratio equation satisfies the two requirements for being an equilibrium condition. If the economy does not satisfy the equilibrium condition, it will be heading toward it. If the economy satisfies the equilibrium condition, it will remain in the same place.

relationships must be satisfied as well; they tell us what choices people make given the situations in which they find themselves.

Economists hope that the simplified behavioral relationships of models are a good enough match to actual behavior. And they hope that the actual economy moves to equilibrium rapidly enough that the only situations they need to consider are those in which the equilibrium conditions hold. If both of these hopes are fulfilled, then economists' models are powerful ways of analyzing what's going on in the real economy out there in the world.

Why Do Economists Use So Much Algebra?

Algebraic equations turn out to be a remarkably good way to summarize cause-and-effect behavioral relationships in economics, so economists use a lot of them.

You can understand why economists might use a lot of arithmetic. After all, so many economic concepts are already or can be easily quantified. But arithmetic has its limits. It restricts you to one case, and one case only. Algebra — because it has variables that can take on any of an uncountable number of values — allows you to think, at least implicitly, about many different cases at once.

You may be able to pass — even do well in — a macroeconomics course without feeling comfortable with all the algebra. In this book we generally go through each topic three times: once in words, stating the logic of the argument and telling which quantities influence which others; once in algebra; and once in diagrams that represent the algebraic and verbal relationships. If you don't understand a concept the first time it is presented, you have two more chances. Recognize, however, that words, equations, and diagrams are simply three ways of presenting the same material. They should agree. So a discrepancy between your understanding of the algebra, the diagrams, and the words is a sign that something has gone wrong.

For many students, economists' heavy use of algebra is a very useful tool that helps them understand. For others, it is a stumbling block. If algebra does not sing to you, there are ways to compensate: focus on the words and the diagrams, and realize that the algebra is just another way of saying the same things that the verbal descriptions say and to show the same things that the diagrams show. Or work through the equations for sample values of variables — assume that real GDP is $10 trillion, for example, and solve the abstract equations with specific numerical values. That algebra is one of the primary languages that economists use for their models does not mean that it is ever the only way to think about the economy.

RECAP MODEL BUILDING

Economists use models, and stress simple models, for no one really understands excessively complicated models and a model is of little use if you cannot understand the logic behind it. Economists consider two types of relationships between variables in building their models, *behavioral relationships* and *equilibrium conditions* — conditions that must be true if the economy is to be in balance. They base their behavioral relationships on an analysis of representative agents' *opportunity costs*. And they use algebraic equations to describe both kinds of relationships between variables.

Chapter Summary

1. Economists' ways of thinking are strange — peculiar to their intellectual discipline.
2. Economics is abstract. Today's economics courses focus more on analytic tools and chains of reasoning and less on institutional descriptions.
3. Economics is a relatively mathematical subject because so much of what it analyzes can be measured. Thus economists use arithmetic to count things and use algebra because it is the best way to analyze and understand arithmetic.
4. When macroeconomists build models, they usually follow four key strategies:
   - Strip down a complicated process to a few economy-wide behavioral relationships and equilibrium conditions.
   - Simplify — ignore differences between people in the economy.
   - Look at opportunity costs as ways to understand behavioral relationships.
   - Focus on expectations of the future, and how such expectations affect the present.

Key Terms

expectations (p. 59)
behavioral relationship (p. 61)
equilibrium condition (p. 61)
model (p. 61)
circular flow (p. 62)
equilibrium (p. 63)
analytic geometry (p. 69)
representative agents (p. 71)
opportunity cost (p. 71)

Analytical Exercises

1. What do you think a science is? List five characteristics that you think a science must have. Which of these does economics satisfy?
2. List five characteristics that you think a science must not have. Which of these does economics satisfy?
3. Why does the fact that economic agents take actions today that depend on their expectations of the future make economics an extra-hard subject?
4. What do economists mean when they say that it is time to "build a model" of a situation or a problem?
5. List four metaphors that you have heard people use in talking about the economy that are now, or were at the time, obscure to you.
6. In what sense can a line on a graph be an equation?
7. What advantage do models with symbolic parameters (which can later be varied or specified) have over models in which the parameters are specific numbers hard-wired into the equations of the model?
8. What are behavioral relationships? List five behavioral relationships that you have encountered in previous economics courses.
9. What are equilibrium conditions? List some equilibrium conditions that you have encountered in previous economics courses.
10. Which do you think is the best measure of the circular flow of economic activity: GDP, NDP, NNP, or national income? Why?