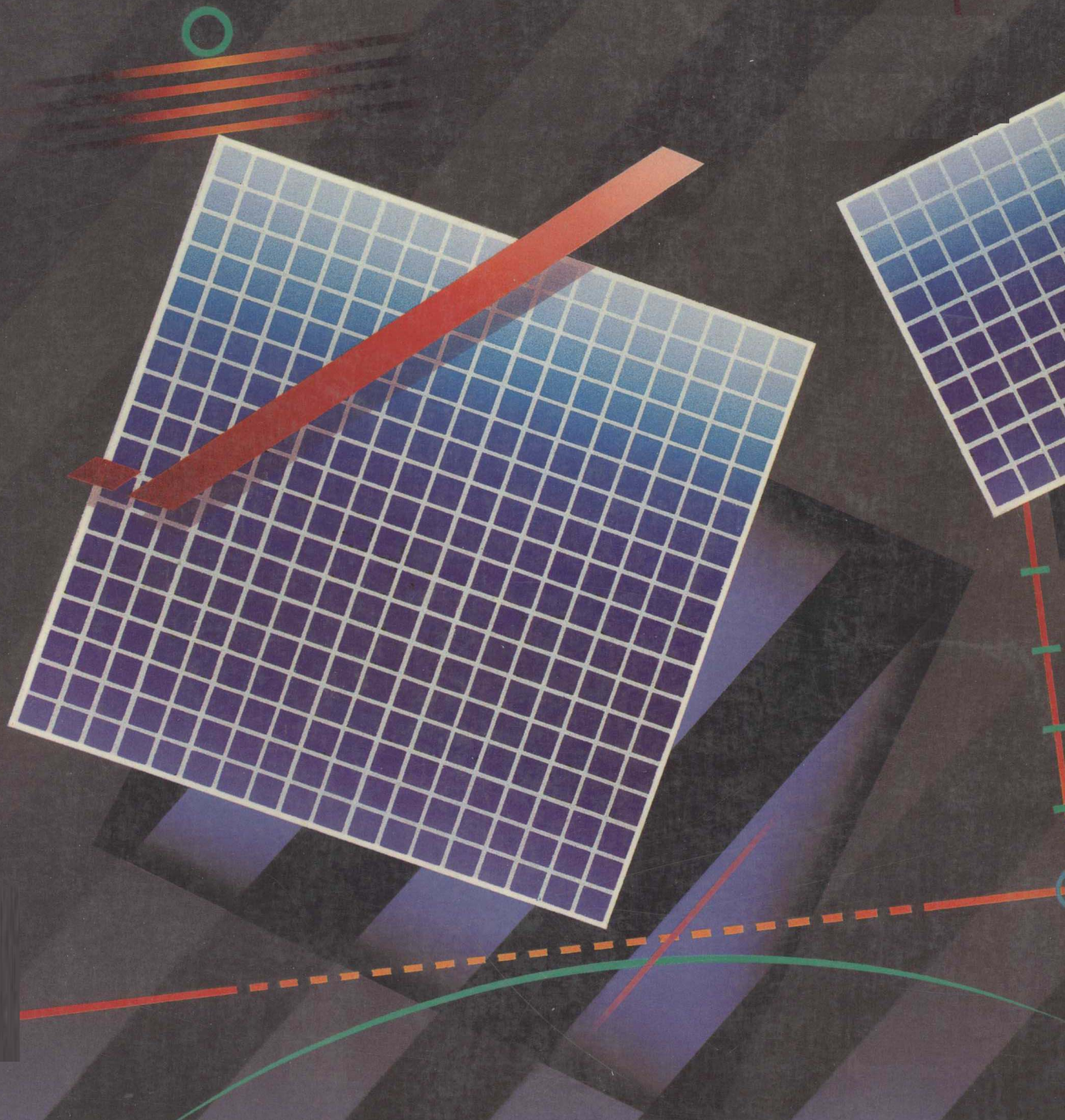


MICROECONOMICS

PAUL A. SAMUELSON AND WILLIAM D. NORDHAUS



MICROECONOMICS

A VERSION OF ECONOMICS

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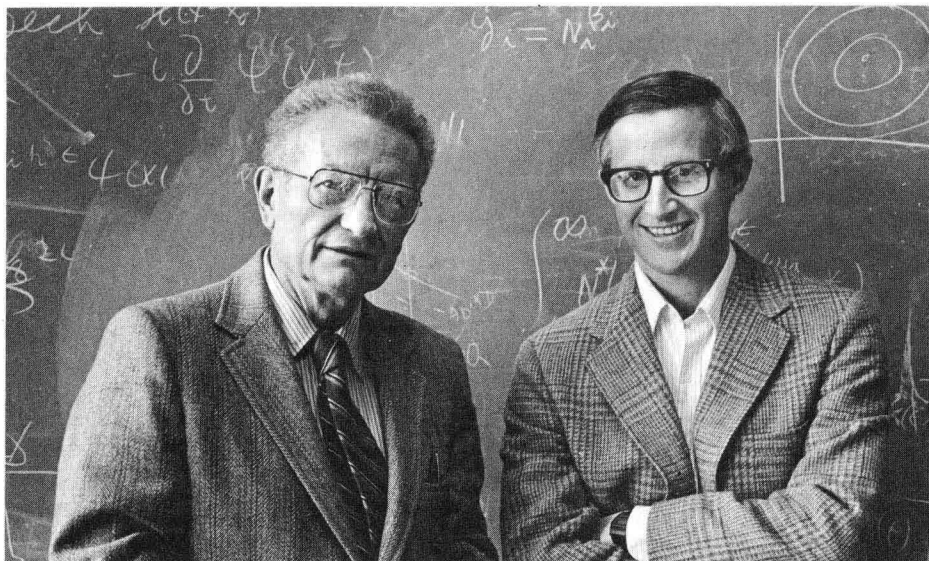
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ABOUT THE AUTHORS



Thomas Moon

Paul A. Samuelson (*left*) founder of the renowned MIT graduate department of economics, was trained at the University of Chicago and Harvard. His many scientific writings brought him world fame at a young age, and he was the first American to receive a Nobel Prize in economics (1970). One of those rare scientists who can communicate with the lay public, Professor Samuelson long wrote an economics column for *Newsweek*. He testifies often before Congress and serves as academic consultant to the Federal Reserve, the U.S. Treasury, and various private, nonprofit organizations. He was economic adviser to President John F. Kennedy. Professor Samuelson plays tennis daily, and his family's size doubled when triplets arrived.

William D. Nordhaus (*right*) is one of America's eminent economists. Born in New Mexico, he was an undergraduate at Yale, received his Ph.D. in economics at MIT, and is now the John Musser Professor of Economics at Yale University and a member of the Cowles Foundation for Research in Economics. His economic research has spanned a wide variety of topics—including inflation, energy, technological change, regulation, resource and environmental economics, and trends in profits and productivity. In addition, Professor Nordhaus takes a keen interest in economic policy. He served as a Member of President Carter's council of Economic Advisors from 1977 to 1979 and writes occasionally for *The New York Times* and other periodicals. From 1986 to 1988, he served as Provost of Yale University; in this capacity he negotiated a labor contract, helped invest a large endowment, oversaw a major investment program, and managed a large organization. He regularly teaches the Principles of Economics course at Yale. Professor Nordhaus and his family live in New Haven, Connecticut and share an enthusiasm for music, hiking, and skiing.

PREFACE TO MICROECONOMICS

Books are the carriers of civilization. Without books, history is silent, literature dumb, science crippled, thought and speculation at a standstill. They are engines of change, windows on the world, lighthouses erected in a sea of time.

Barbara Tuchman

THIS book has served as the standard bearer for the teaching of elementary economics since the landmark 1948 edition. Each new edition has distilled the deepest thinking of economists about how the economy works and about what society can do to improve people's living standards.

But economics is an evolving science; it must solve emerging puzzles and grapple with current dilemmas of public policy. The 1980s saw the emergence around the world of a new emphasis on the use of markets to allocate resources. This rediscovery of the market occurred not only in capitalist countries like the United States but also in socialist countries like China and the Soviet Union. As countries turned increasingly to the market to answer the age-old questions of political economy, the need to understand the strengths and weaknesses of the price mechanism—which is the study of microeconomics—takes on a renewed vitality.

The other major development of the 1980s was the discovery by Americans that they were part of a complex global trading system. Over the course of the last decade, many American industries lost their preeminence to competitors from East Asia. As a result, the United States began to incur huge trade deficits so

that, by decade's end, the United States was the world's largest debtor. International economics came again to the fore.

All these and a host of other issues test the ingenuity of modern economics. The need to keep *Economics* at the forefront of modern economic analysis in the rapidly evolving world economy motivated the fruitful collaboration of the twelfth edition—a collaboration between two scholarly generations. This thirteenth edition continues that new tradition, affording the authors an exciting opportunity to forge a synthesis of modern mainstream economics and to present not only the enduring truths of microeconomic analysis but also the new approaches to microeconomics that are being applied to so many areas of social and political activity. New approaches featured here include the rise of the Chicago school and the impact of that school on regulation and antitrust policy, the neo-conservative doctrines about poverty and social programs, and the new-wave theories of economic protection.

Our task in these pages is straightforward: to present a clear, accurate, and interesting introduction to the principles of modern microeconomics and to the institutions of the American and world economy. Our primary goal is to survey microeconomics. But in doing this we would rather be right than exciting; our experience shows that economics no longer deserves its old title as “the dismal science,” and besides it is anything but dull.

THE THIRTEENTH EDITION

The thirteenth edition continues the last edition's sweeping reorganization and rewriting. The book has been through a searching review for superfluous elements: every paragraph, every figure, and every table has been scrutinized to ensure that it is both necessary and clearly expressed. Many a sentence and appendix has fallen before the merciless scissors. While we have ruthlessly trimmed unnecessary details or outmoded theories, nothing essential has been sacrificed.

We are sometimes asked our philosophy in writing an introductory textbook. Above all, we want this book to be authoritative, comprehensive, and clear:

- The thirteenth edition contains an *authoritative* statement of modern economic science. The road to economic knowledge has been an arduous one traveled by many generations of economists. The outcome of this journey, surveyed in these pages, is an improved understanding of comparative advantage and international trade, the pricing of products and inputs, the determinants of poverty along with the structure of antipov-erty programs, and the forces that lead to economic discrimination. This text will explain how modern microeconomics views each of these pivotal topics.

- A *comprehensive* survey of modern microeconomics needs 650 pages. Reports of teachers advised us that no major topic has been omitted. Between these covers you will find all the major themes and topics of our subject, from absolute advantage to zero-pollution emissions, from mercantilism to libertarian economics. There is freedom to choose.

- Most of all, we try to be *clear*. What good are deep theorems that no student can understand? Every page has been studied by reviewers and students to weed out inessential digressions or inapt phrasing. Nietzsche once complained about “the offensive simplicity of the style” of the nineteenth century economist John Stuart Mill. We would love to be indicted for that offense.

Revisions in this Edition

Economics is a dynamic science—changing to reflect the shifting trends in economic affairs, in finance, in the world economy, and in society at large. This book evolves along with the science it surveys. Every chapter has moved forward in time to keep pace with economic analysis and policy. What are the major changes?

1. Increased Emphasis on International Economics

Americans are learning that no nation is an island. Our living standards are affected by technological developments in Japan and Germany; our companies must contend with competitors from Korea and Brazil. Similarly, no complete understanding of modern economics is possible without a thorough grounding in the world economy. The thirteenth edition therefore contains a new emphasis on the essential elements of international economics.

The major new themes in this edition include: analysis of the relation of protectionism to game theory in Chapters 12 and 26; an up-to-date analysis of the debt crisis in Chapter 24; a new presentation of the theory of comparative advantage in Chapter 25; an analysis of the reasons behind economists' realistic disillusionment with floating exchange rates in Chapter 27; and a survey of the problem of the stubborn U.S. trade deficit and growing foreign indebtedness in Chapter 27.

2. Comprehensive Modern Treatment of Factor Markets

In a modern economy, factor markets are just as important as product markets. Our approach is to present a thorough analysis of the general principles of price and output determination in factor markets, a lucid treatment of marginal productivity theories, and thoughtful studies of labor, resource, and capital markets.

This analysis of factor markets contains a number of special topics that are indispensable for understanding today's complex world: the theory of rent and unique factors of production; the tragedy of the commons related to global environmental problems; the theory of capital and interest along with an application to the determination of business profits; two chapters on labor markets, including the modern theory of discrimination and the doctrine of comparable worth; and a discussion of the economic roots of poverty, including an audit of neoconservative fears that the mixed economy is losing ground on economic betterment of poorer groups.

3. Unified Treatment of Production and Cost

Earlier editions treated production and cost theory separately. The thirteenth edition has unified these two topics into a pair of chapters, Chapters 8 and 9, so that the essential duality of these two topics can be exploited. The exposition is buttressed by a real-world example of oil pipelines, based on engineering data, that allows students to appreciate how cost and production data are grounded in technological data and shows diminishing returns at work.

4. Clear Exposition of Major Ideas

We have pored over every chapter to improve the clarity of the exposition. The comments of over 1000 students as well as suggestions of teachers, practitioners, and experts have been incorporated in the thirteenth edition.

The introductory chapter now spells out the essence of economics with intriguing and important illustrations; more than 100 new end-of-chapter examples have been added to focus student attention on key concepts or policy issues; Chapter 5's elementary analysis of supply and demand now includes additional examples and has been redrafted for ease of comprehension; the treatment of comparative advantage in Chapter 25 has been revised for greater coherence; new tables help summarize essential points of analysis, and new sections on economic growth, price and income elasticities, and comparative advantage help deepen students' understanding.

The glossary, which was first introduced in the twelfth edition, has been carefully tuned to meet the needs of this edition; all major terms now have a capsule definition that students can easily turn to. As a new study aid, the most important terms are printed in boldface when first defined in the text; they all then appear again in the glossary to reinforce the indispensable vocabulary of economics in the student's mind.

One of the distinguishing features of *Economics* has been the presentation of central but sometimes advanced theories in understandable ways. For the thirteenth edition we have redrafted the chapters on general equilibrium, public choice, and decisions of the firm to make these topics understandable to beginning students.

5. Increased Emphasis on History and Policy

Economics is at its core an empirical science. It first aims to explain the world around us and then helps us craft economic policies, based on sound economic principles, that can improve society's real-world functioning.

Drawing upon history, economic chronicles, and the authors' experience, the thirteenth edition places a renewed emphasis on empirical evidence to illustrate economic theories. The chapters on microeconomics draw upon case studies, economic history, business decisions, and real-world experience to illustrate the fundamental principles. Examples such as OPEC pricing, airline deregulation, the comparable worth controversy, antitrust policy and practice, collective bargaining by labor unions, production theory, and an analysis of tax reform help bring the theorems of microeconomics to life.

This "hands-on" approach to economics allows students to understand better the relevance of economic analysis to real-world problems.

Optional Matter

Economics courses range from one-quarter surveys to year-long intensive honors courses. This textbook has been carefully designed to meet all situations. The more advanced materials have been placed in appendixes or specially designated sections. These will appeal to curious students and to demanding courses that want to survey the entire discipline thoroughly. As is traditional with this book, we have included advanced problems to test the mettle of the most dedicated student.

If yours is a fast-paced course, you will appreciate the careful layering of the more advanced material. Hard-pressed students can skip the advanced sections, encountering the core of microeconomic analysis without losing the thread of economic reasoning. And for those who teach the bright honors students, this book will challenge the most advanced young scholar. Indeed, many of today's leading economists have written to say they have used parts of *Economics* all along their pilgrimage to the Ph.D.

Format

The thirteenth edition has adapted the successful new format introduced in the last edition. There are more headings to remind the student of the thrust of the argument. Special footnotes (in gray boxes) are reserved for important and useful illustrations of the core material in the chapter.

New features in this edition include scores of fresh end-of-chapter questions, with a special emphasis upon short problems that reinforce the major concepts surveyed in the chapter. Terms printed in bold type mark the first occurrence and definition of the most important words that constitute the language of economics. And many tables and figures have been added or redrawn to crystallize essential parts of the analysis.

But these many changes have not altered one bit the central stylistic beacon that has guided *Economics* since its first days: to use simple sentences, clear explanations, and concise tables and graphs.

The Microeconomics Split Edition

An important innovation in the thirteenth edition is the decision to provide two paperback volumes, *Microeconomics* (Chapters 1–4 and 18–40 of the full text) and *Macroeconomics* (Chapters 1–17 and 36–40 of the full text). This new format will allow greater economy and flexibility to the one-semester or one-quarter course.

In designing the paperback split editions, we have made each split completely self-contained. You can move straight through the chapters in *Microeconomics* knowing that the exposition, cross-references, and examples have been tailored with your needs in mind. At the same time, no material has been cut from this split edition, so you can be confident that a careful study of *Microeconomics* will provide the full range of analysis, policy discussion, and history that is given in the full text. Whether your special interest is comparable worth, the tragedy of the commons, or oligopoly theory, you can find in these pages the entire discussion of microeconomics contained in the thirteenth edition of *Economics*.

Auxiliary Teaching and Study Aids

Students of this edition will benefit greatly from the *Study Guide*. This carefully designed aid has been prepared by Professor Gary Yohe of Wesleyan University, who worked in close collaboration with us in our revision. Both when used alongside classroom discussions and when employed independently for self-study, the *Study Guide* has proved to be an impressive success.

In addition, instructors will find the *Instructor's Manual and Test Bank* useful for planning their courses and preparing multiple sets of test questions in both print and computerized format. Moreover, McGraw-Hill has designed a beautiful set of two-color overhead transparencies for presenting the tabular and graphical material in the classroom. Additional figures from the text are available on transparency masters. These items can all be obtained by contacting your local McGraw-Hill sales representative.

Economics in the Computer Age

This edition is accompanied by the *Interactive Economic Graphic Tutorial* to accompany Samuelson/Nordhaus, which combines text, graphics, page references to the book, and key concepts on the same screen. Shifts in curves are shown by arrows that guide the student through economic processes step by step. The program is available for the IBM PC and compatibles; it will reinforce the text and provide personal instruction for the central concepts of *Economics*.

Acknowledgments

This book has two authors but a multitude of collaborators. We are profoundly grateful to colleagues, reviewers, students, and McGraw-Hill's staff for contributing to the timely completion of the thirteenth edition of *Economics*.

Colleagues at MIT, Yale, and elsewhere who graciously contributed their comments and suggestions include E. Cary Brown, Robert J. Gordon, Lyle Gramley, Paul Joskow, Alfred Kahn, Richard Levin, Robert Litan, Joseph Pechman, Merton J. Peck, Gustav Ranis, Paul Craig Roberts, Herbert Scarf, Robert M. Solow, James Tobin, Janet Yellen, and Gary Yohe.

In addition, we have benefited from the tireless devotion of those whose experience in teaching elementary economics is embodied in this edition. We are particularly grateful to John E. Anderson, Eastern Michigan University; Jeff A. Ankrom, Wittenberg University; Mark Bagnoli, University of Michigan; James H. Barrow, Wilkes Community College; Gerald E. Breger, University of South Carolina; Thomas P. Breslin, Trenton State College; Kristyn C. Brown, Baylor University; Dennis M. Byrne, University of Akron; Sue Cain, Pittsburgh State University; K. Laurence Chang, Case Western Reserve University; Charles R. Chittle, Bowling Green State University; Raymond L. Cohn, Illinois State University; Christopher M. Cornwell, West Virginia University; Michael J. Cravatta, Richland Community College; Ross P. Daniel, Louisiana State University; William Dawes, SUNY at Stony Brook; Loraine Donaldson, Georgia State University; Joseph Earley, Loyola Marymount University; Paul G. Farnham, Georgia State University; Raymond P. H. Fishe, University of Miami; Eric Fisher, Cornell University; Kevin F. Forbes, Catholic University; Ralph G. Fowler, Diablo Valley College; George C. Georgiou, Towson State University; Frank W. Gery, St. Olaf College; Ron D. Gilbert, Texas Tech University; Amihai Glazer, University of California—Irvine; Michael J. Gootzeit, Memphis State University; Mitchell Harwitz, SUNY—University at Buffalo; Roger S. Hewett, Drake University; Ann Helwege, Tufts University; John Hillard, University of Leeds, England; Harold Hotelling, Oakland University; John Huttman, San Francisco State University; Eric Jensen, College of William and Mary; Nasrin Jewell, College of St. Catherine; Warren L. Jones, Western Illinois University; M. Barbara Killen, University of Minnesota; Philip A. Klein, Pennsylvania State University; Soyon Lee, Illinois Benedictine College; Dennis Patrick Leyden, University of North Carolina at Greensboro; David Loschky, University of Missouri—Columbia; Steven J. Matusz, Michigan State University; Richard A.

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Students at MIT, Yale, and other colleges and universities have served as an “invisible college.” They constantly challenge and test us, helping to make this edition less imperfect than its predecessor. Although they are too numerous to enumerate, their influence is woven through every chapter.

A small group of student coworkers devoted their time and energy to this edition, especially Larry Burtshy, Howard Chang, Akiva Dickstein, Elizabeth Gregory, Keith Hwang, Martin Lariviere, John Garen, and Don Smythe. The statistical and historical material was prepared and double-checked by Tan Yong Hui. Clerical assistance was provided by Glenna Ames. Judith Hickey provided invaluable editorial, logistical, and stylistic assistance.

McGraw-Hill’s New York team included Designer Joan O’Connor, Senior Editing Supervisor Peggy Rehberger, Assistant Production Manager Diane Renda, and Economics Editor Scott Stratford, along with Senior Editor Elisa Adams who provided unerring advice from the inception of this edition to its completion. This group of skilled professionals turned a mountain of paper into a finely polished work of art.

TO THE SOVEREIGN READER

The thirteenth edition marks the fortieth birthday of *Economics*. The first twelve editions of this book have opened the world of economics to millions of students around the world, and this edition can also serve you well.

One book studied in a single course cannot make you an expert in the subject. But then, most students are not pursuing careers in economics. Rather, you are likely to be concerned with gaining a basic understanding of how our complex economy works. We have therefore laid out a survey of the essential concepts and policy problems of modern microeconomics as simply as we can, omitting no important topics, using no misleading oversimplifications, but burdening you with no unnecessary complications.

Who has been uppermost in our minds as we wrote this thirteenth edition? You, the beginning student. On every page we have asked: What are the crucial forces that will influence our economy in the 1990s and the early twenty-first century? What tools will be most helpful for men and women entering careers in business, law, government, and the 1001 other paths that young people follow?

At every point in the writing of this edition we have worked to clarify and sharpen the analysis, to make sure the tables and charts are well labeled, and to check for the relevance of each historical illustration.

The Intellectual Marketplace

Markets will hold center stage in the pages that follow: markets for corn and wheat, stocks and bonds, French francs and Japanese yen, unskilled labor and highly trained neurosurgeons. There is also a marketplace of ideas, where contending schools of economists develop their theories and attempt to persuade their colleagues. You will find a fair and impartial review of the thinking of the intellectual giants of our profession in the chapters that follow—from the early economists like Adam Smith, David Ricardo, and Karl Marx to modern-day titans like Milton Friedman and Robert Solow.

You have probably read in the newspaper about supply and demand, antitrust policy, the trade deficit, and the government debt. After you have completed a thorough study of microeconomics in this textbook, you will not only know precisely what these words mean; you will also understand the economic forces that influence and determine them.

How to Study Economics

We have designed this book so that it can be fruitfully used by the beginning freshman as well as by advanced students in the severest honors course. It is carefully layered so that each reader can pursue topics quickly or in depth.

Divide and Conquer

No one can tell you the best way to read a textbook, for individual styles differ greatly among students. But educators and psychologists offer counsel about certain tried-and-true methods that will help you learn the subject more quickly and retain the material longer.

To begin with, this is obviously not a novel or a detective story. Economics is best learned by daily study in small chunks. Don't wait until 2 or 3 days before a test to begin your studies; make steady progress through the material by keeping up with the assigned reading.

For each chapter, begin by searching for the basic ideas for perspective. You may first want to skim through the material, look at the summary, and study the major concepts and definitions. Next, read the material carefully, underlining the important sentences and taking notes on focal ideas. Then refresh your memory by reading the final summary, reviewing the major concepts, and going back through the chapter to doublecheck the highlights.

Read Actively

Above all, be an active participant in your study. Always ask yourself, "Why is this important?" or "What is a current example of this theory?" Think of new examples as you study the text. Read the newspaper to witness economic history unfolding daily. Argue about the analysis or examples with your teachers and classmates. Do the end-

of-chapter questions and work through Professor Gary Yohe's *Study Guide* to help cement the important concepts in your mind and test the limits of your understanding.

Skoal!

Our envy goes with you, the beginning student, as you set out to explore the exciting world of economics for the first time. This is a thrill that, alas, you can experience only once in a lifetime. So, as you begin, we wish you bon voyage!

Paul A. Samuelson
William D. Nordhaus

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