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MACROECONOMICS

Daron Acemoglu
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Dedication

*With love for Annika, Aras, Arda, Eli,
Greta, Mason, Max, and Noah,
who inspire us every day.*

About the Authors



Daron Acemoglu is an Institute Professor in the Department of Economics at the Massachusetts Institute of Technology. He has received a B.A. in economics from the University of York, 1989; an M.Sc. in mathematical economics and econometrics from the London School of Economics, 1990; and a Ph.D. in economics from the London School of Economics in 1992.

He is an elected fellow of the National Academy of Sciences, the American Academy of Arts and Sciences, the Econometric Society, the European Economic Association, and the Society of Labor Economists. He has received numerous awards and fellowships, including the inaugural T. W. Schultz Prize from the University of Chicago in 2004, the inaugural Sherwin Rosen Award for outstanding contribution to labor economics in 2004, the Distinguished Science Award from the Turkish Sciences Association in 2006, the John von Neumann Award, Rajk College, Budapest, in 2007, the Carnegie Fellowship in 2017, the Jean-Jacques Laffont Prize in 2018, and the Global Economy Prize in 2019.

He was also the recipient of the John Bates Clark Medal in 2005, awarded every two years to the best economist in the United States under the age of 40 by the American Economic Association, the Erwin Plein Nemmers Prize, awarded every two years for work of lasting significance in economics, and the BBVA Frontiers of Knowledge Award in Economics, Finance and Management. He holds honorary doctorates from the University of Utrecht, Bosphorus University, University of Athens, Bilkent University, University of Bath, Ecole Normale Supérieure, Saclay Paris, and the London Business School.

His research interests include political economy, economic development and growth, human capital theory, growth theory, innovation, inequality, search theory, network economics, and learning.

His books include *Economic Origins of Dictatorship and Democracy* (jointly with James A. Robinson), which was awarded the Woodrow Wilson and the William Riker prizes, *Introduction to Modern Economic Growth*, and *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (jointly with James A. Robinson), which has become a *New York Times* bestseller, and *The Narrow Corridor: States, Societies, and the Fate of Liberty* (jointly written with James A. Robinson).



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List was elected a Member of the American Academy of Arts and Sciences in 2011, and a Fellow of the Econometric Society in 2015. He also received the Arrow Prize for Senior Economists in 2008, the Kenneth Galbraith Award in 2010, the Yrjo Jahnsson Lecture Prize in 2012, and the Klein Lecture Prize in 2016. He received an honorary doctorate from Tilburg University in 2014, and from the University of Ottawa in 2017. John was also named a Top 50 Innovator in the Non-Profit Times for 2015 and 2016 for his work on charitable giving. He also served in the White House on the Council of Economic Advisers from 2002–2003, and is a Research Associate at the NBER.

His research focuses on questions in microeconomics, with a particular emphasis on using field experiments to address both positive and normative issues. For decades his field experimental research has focused on issues related to the inner-workings of markets, the effects of various incentives schemes on market equilibria and allocations, how behavioral economics can augment the standard economic model, on early childhood education and interventions, and most recently on the gender earnings gap in the gig economy (using evidence from rideshare drivers).

His research includes over 200 peer-reviewed journal articles and several published books, including the 2013 international best-seller, *The Why Axis: Hidden Motives and the Undiscovered Economics of Everyday Life* (with Uri Gneezy).

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CHAPTERS ON THE WEB

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- WEB Chapter 1** Financial Decision Making
- WEB Chapter 2** Economics of Life, Health and the Environment
- WEB Chapter 3** Political Economy

What's New in the Third Edition?

In our new edition of *Macroeconomics*, in addition to updating the existing data and empirical features, we have added Evidence-Based Economics Problems at the end of each chapter. These exercises provide students meaningful practice in analyzing and interpreting real-world economic questions. Here are some examples of other changes in the edition. Throughout this revision, we updated the data and charts to the most recent releases and made the text current for the recent global recession, the COVID-19 pandemic, and the 2020 election. We also undertook a number of more specific changes and added various new materials as we detail next.

- In Chapter 1, we've added new coverage on how to examine the economic impacts of COVID-19 through positive and normative lenses. We also discuss the trade-offs between health and economic output during the COVID-19 crisis. New Evidence-Based Economics Problems focus on the opportunity cost of social media, higher education, and going to a movie.
- In Chapter 4, we tell the story of how stay-at-home orders in 2020 impacted the demand for gasoline. A new Letting the Data Speak section profiles how the price of crude oil temporarily fell below \$0 per barrel.
- In Chapter 5, we explore the macroeconomic indicators related to the COVID-19 recession. A new Evidence-Based Economics Problem highlights the national income accounting identity.
- Chapter 6 includes new Evidence-Based Economics Problems on efficiency and determinants of cross-country differences in GDP per capita.
- Chapter 7 features new Evidence-Based Economics Problems on GDP growth and investment into human capital, physical capital, and technology.
- In Chapter 8, a new Evidence-Based Economics Problem examines whether economic development is tied to climate.
- In Chapter 9, we added a new Evidence-Based Economics section about wages and employment during the COVID-19 pandemic. A new Letting the Data Speak feature profiles racial discrimination in the labor market. An updated "Luddites and Robots" Choice and Consequence feature explores future implications of AI on employment. New Evidence-Based Economics Problems assess downward wage rigidity and labor market contractions.
- In Chapter 10, we examine savings rate and bank failures during the COVID-19 recession and include a new Evidence-Based Economics Problem on bank failures.
- In Chapter 11, we explore the Fed's reaction to the COVID-19 recession. Our new treatment of monetary policy emphasizes interest on reserves (IOR), which is now the key mechanism that the Fed uses to pin down the federal funds rate. A new Letting the Data Speak section includes research on inflation expectations. The Evidence-Based Economics Problem examines the quantity theory of money.
- In Chapter 12, we offer an updated and expanded discussion on the causes of recessions and a new Evidence-Based Economics section tracking the recession of 2020 and the global economic impact of the COVID-19 pandemic. New Evidence-Based-Economic Problems cover the 2007–2009 and 2020 recessions, as well as an application of Okun's Law.
- In Chapter 13, we've added a new discussion of the government expenditure multiplier during the 2007–2009 and 2020 recessions. We examine shifting the federal funds rate by shifting the demand for reserves and analyze recent changes in the

Fed's balance sheet and the federal funds rate. Chapter 13 also includes this new material:

- We discuss quantitative easing, the Fed's role as lender of last resort, and monetary policy at the zero lower bound.
- A new Evidence-Based Economic Problem examines the spending multipliers of the CARES act, which builds from in-chapter explorations of the CARES act and the impact of fiscal policy on government deficits.
- Chapter 14 contains an updated Choice and Consequence feature on trade policy and politics, including recent changes in U.S. trade policy and Brexit. New Evidence-Based Economics Problems examine economic growth, different sectors of the economy, and child labor.
- Using updated data from 2020, Chapter 15 investigates the foreign exchange market and how it relates to the real economy. Updated Evidence-Based Economics Problems on managed exchange rates explore how George Soros's hedge funds made considerable profits by betting on the devaluation of the British pound, Thai baht, and U.S. dollar.

Solving Learning and Teaching Challenges

Many students who take introductory economics courses have difficulty seeing the relevance of the key concepts of opportunity cost, trade-offs, scarcity, and demand and supply to their lives and their careers. This reduces the willingness of many students to prepare for class and to be engaged during class. With this textbook, we show them how to apply economic thinking creatively to improve their work, their choices, and their daily lives. One of our main objectives in writing this textbook was to show that the fundamentals of economics are not just exciting but also alive with myriad personal applications.

We love economics. We marvel at the way economic systems work. When we buy a smartphone, we think about the complex supply chain and the hundreds of thousands of people who played a role in producing an awe-inspiring piece of technology that was assembled from components manufactured across the globe.

The market's ability to do the world's work without anyone being in charge strikes us as a phenomenon no less profound than the existence of consciousness or life itself. We believe that the creation of the market system (and the regulations that keep it well-functioning, for example, by addressing externalities) is one of the greatest achievements of humankind.

We wrote this book to highlight the simplicity of economic ideas and their extraordinary power to explain, predict, and improve what happens in the world. We want students to master the *essential* principles of economic analysis. With that goal in mind, we identify the three key ideas that lie at the heart of the economic approach to understanding human behavior: optimization, equilibrium, and empiricism.

The breakneck speed of modern technological change has, more than ever, injected economics into the lives—and hands—of our students. The technologies that they use daily illustrate powerful economic forces in action: Uber users observe real-time congestion in the transportation market when they confront surge pricing, and Airbnb travelers explore the relationships among location, convenience, and price by comparing listings near different subway stops in the same city.

As educators, it's our job to transform economic concepts into language, visual representations, and empirical examples that our students understand. Today, markets are much more interactive than they were only a decade ago, and they exemplify that it is not just competitive markets with perfect information that are relevant to our economic lives. Our students routinely take part in auctions, purchase goods and services via organized platforms such as Uber, have to struggle with pervasive informational asymmetries as they participate in online exchanges, and have to guard themselves against a bewildering array of mistakes and traps that are inherent to these new transactions.

In this ever-changing world, students must understand not just well-known economic concepts such as opportunity cost, supply, and demand but also modern ones such as game theory, auctions, socio-economic inequality, and behavioral mistakes. It is these modern

concepts, which are bit parts in most Principles textbooks, that occupy center stage in ours. Today economic analysis has expanded its conceptual and empirical boundaries and, in doing so, has become even more relevant and useful.

This new world provides opportunities for the teaching of economics as well, provided that we adjust our Principles canon to include modern and empirically based notions of economics. This has been our aim from day one and continues to be our aim in this third edition.

At a time when competing empirical claims abound and news sources across the political spectrum are denounced as “fake,” our students need the skills to systematically question and evaluate what they read. That is why, in our Evidence-Based Economics segments and end-of-chapter assignments, we examine both the implications and the limitations of academic studies. We hope that our textbook will help form a new generation of careful thinkers, smart decision makers, engaged citizens, and even a few future economists!

Our Vision: Three Unifying Themes

Optimization

The first key principle is that people try to choose the best available option: *optimization*. We don't assume that people always successfully optimize, but we do believe that people try to optimize and often do a relatively good job of it. Because most decision makers try to choose the alternative that offers the greatest net benefit, optimization is a useful tool for predicting human behavior. Optimization is also a useful prescriptive tool. By teaching people how to optimize, we improve their decisions and the quality of their lives. By the end of this course, every student should be a skilled optimizer—without using complicated mathematics, simply by using economic intuition.

Equilibrium

The second key principle extends the first: economic systems operate in *equilibrium*, a state in which everybody is simultaneously trying to optimize. We want students to see that they're not the only ones maximizing their well-being. An economic system is in equilibrium when each person feels that he or she cannot do any better by picking another course of action. The principle of equilibrium highlights the connections among economic actors. For example, Apple stores stock millions of iPhones because millions of consumers are going to turn up to buy them. In turn, millions of consumers go to Apple stores because those stores are ready to sell those iPhones. In equilibrium, consumers and producers are simultaneously optimizing, and their behaviors are intertwined.

Empiricism

Our first two principles—optimization and equilibrium—are conceptual. The third is methodological: *empiricism*. Economists use *data* to test economic theories, learn about the world, and speak to policymakers. Accordingly, data play a starring role in our book, though we keep the empirical analysis extremely simple. It is this emphasis on matching theories with real data that we think most distinguishes our book from others. We show students how economists use data to answer specific questions, which makes our chapters concrete, interesting, and fun. Modern students demand the evidence behind the theory, and our book supplies it.

For example, we begin every chapter with an empirical question and then answer that question using data. One chapter begins by asking:

Why are you so much more prosperous than your great-great-grandparents were? Later in that chapter, we demonstrate the central role played by technology in explaining U.S. economic growth and why we are much better off than our relatives a few generations ago.

In our experience, students taking their first economics class often have the impression that economics is a series of theoretical assertions with little empirical basis. By using data, we explain how economists evaluate and improve our scientific insights. Data also make concepts more memorable. Using evidence helps students build intuition because data move the conversation from abstract principles to concrete facts. Every chapter

sheds light on how economists use data to answer questions that directly interest students. Every chapter demonstrates the key role that evidence plays in advancing the science of economics.

Features

All of our features showcase intuitive empirical questions.

- In **Evidence-Based Economics (EBE)**, we show how economists use data to answer the question we pose in the opening paragraph of the chapter. The EBE uses actual data from field experiments, lab experiments, or naturally occurring data, while highlighting some of the major concepts discussed within the chapter. This tie-in with the data gives students a substantive look at economics as it plays out in the world around them.

The questions explored aren't just dry intellectual ideas; they spring to life the minute the student sets foot outside the classroom—*Is Facebook free? Is college worth it? Are tropical and semitropical areas condemned to poverty by their geographies? What caused the recession of 2007–2009? Are companies like Nike harming workers in Vietnam?*

EVIDENCE-BASED

ECONOMICS

Q: What caused the recession of 2020?

The recession of 2020 was caused by the COVID-19 pandemic, which reduced the productivity of economic exchange. Because of the risk of infection, households became less willing to demand goods and services that involved in-person contact, and many industries could not profitably *and* safely supply goods and services.

The first documented U.S. infection occurred on January 15, 2020. The severity of the public health threat was not widely recognized at this time, although the COVID-19 virus was already rapidly spreading in Wuhan, China. For example, on February 24, President Donald Trump tweeted, “The Coronavirus is very much under control in the USA. We are in contact with everyone and all relevant countries. CDC & World Health have been working hard and very smart. Stock Market starting to look very good to me!” The first deaths in the United States occurred two days later—February 26—and by late April over 2,000 people were dying each day from COVID-19 infections.

- **Letting the Data Speak** is another feature that analyzes an economic question by using real data as the foundation of the discussion. Among the many issues we explore are such topics as life expectancy and innovation, living in an interconnected world, and why Chinese authorities historically kept the yuan undervalued (but no longer do so).

LETTING THE

DATA SPEAK

The Day Oil Became Garbage

Something extraordinary happened in the oil market on April 20, 2020. On this day, the demand curve for oil shifted sharply to the left because of the global COVID-19 pandemic.⁵ The market price of crude oil deliverable in Cushing, Oklahoma, (a huge pipeline crossroads in the United States where oil deliveries are made) temporarily fell below \$0 per barrel. At the end of the trading day, the price closed at $-\$37.63/\text{barrel}$ (yes, that is a minus sign). In a nutshell, the storage facilities in this major oil hub were so full that traders were worried about where they were going to stick all of the oil that was coming through the pipelines (and not getting used to make jet

fuel and gasoline, products with drastically reduced demand because of lockdowns and stay-at-home orders).

Crude oil in Cushing, Oklahoma, temporarily became like garbage: something you have to pay people to take away. The negative price for oil only lasted for one day, but it was a sign of how deep the 2020 economic crisis had become. It's also a lesson in how a market works when the quantity demanded is less than the quantity supplied at a zero price. It's possible for a market price to be negative—like the price of garbage—if you have to pay someone to remove something that you can't freely store.

- In keeping with the optimization theme, in a feature titled **Choice & Consequence** we ask students to make a real economic decision or evaluate the consequences of past real decisions. We then explain how an economist might analyze the same decision. Among the choices investigated are such questions and concepts as the power of exponential growth, foreign aid and corruption, and policies that address the problem of banks that are “too big to fail.”

CHOICE & CONSEQUENCE

The Power of Exponential Growth

You have two choices. You can either start a job with a salary of \$1,000 per month and a 6 percent increase in your salary every month, or you can start with a salary of \$2,000 but never get a raise. Which one of these two options do you prefer?

The answer might naturally vary from person to person. If you have an immediate need for money, you may be attracted by the prospect of a \$2,000 paycheck. But before you rush to sign on the dotted line for the \$2,000-per-month job, think of the implications of the 6 percent monthly increase. With a 6-percent-per-month increase, your monthly salary will already exceed \$2,000 after only a year. After 4 years, it will be approximately \$16,400 a month. So if you were thinking of staying in this job for more than a year, starting with a lower salary might be a much better idea.

The first option is attractive, at least for those of you intending to stay with it for a while, precisely because of exponential growth. The 6-percent-per-month increases in salary do not apply to the base salary (if they did, this would have increased your salary by \$60 every month). Rather, they compound, meaning that each 6 percent applies to the amount that has accumulated up to that point. Thus after 1 month, your salary will be \$1,060. After 2 months, it is $\$1,060 \times 1.06 = \$1,123.60$. After 3 months, it is $\$1,123.60 \times 1.06 = \$1,191.02$, and so on. We will next see that exponential growth plays the same role in countries' growth trajectories as in your potential income from these two hypothetical jobs.

An even more dramatic illustration of the power of exponential growth comes from the story of the invention of

the game of chess in ancient India. According to legend, the inventor of the game exploited the power of exponential growth when asked for a reward for his invention by the king.¹ He proposed that the king place a single grain of wheat on the first square of the chessboard, two on the second, four on the third, and eight on the fourth. Then continue doubling the number of grains for all sixty-four squares on the board, and he would receive the total amount of wheat on the board. The king, hearing the request, thought it trivial—but when his treasurers calculated the final tally, they returned to him in shock. The total amount, they found, was more than 18,000,000,000,000,000,000,000 grains of wheat—far more than they could ever produce in their entire kingdom. Indeed, today, this amount of wheat would allow you to distribute a ton of wheat to every person in the world every day for 6 months. A good story to remember both as a reminder of the power of exponential growth and as a pointer for you if you have to make choices between different options with varying growth prospects.



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Macroeconomics: Flexibility Chart

Core Approach	Emphasis on Long-Run Growth	Emphasis on International
Chapter 1: The Principles and Practice of Economics	Chapter 1: The Principles and Practice of Economics	Chapter 1: The Principles and Practice of Economics
Chapter 2: Economic Science: Using Data and Models to Understand the World (optional)	Chapter 2: Economic Science: Using Data and Models to Understand the World (optional)	Chapter 2: Economic Science: Using Data and Models to Understand the World (optional)
Chapter 2 Appendix: Constructing and Interpreting Charts and Graphs	Chapter 2 Appendix: Constructing and Interpreting Charts and Graphs	Chapter 2 Appendix: Constructing and Interpreting Charts and Graphs
Chapter 3: Optimization: Trying to Do the Best You Can (optional)	Chapter 3: Optimization: Trying to Do the Best You Can (optional)	Chapter 3: Optimization: Trying to Do the Best You Can (optional)
Chapter 4: Demand, Supply, and Equilibrium	Chapter 4: Demand, Supply, and Equilibrium	Chapter 4: Demand, Supply, and Equilibrium
Chapter 5: The Wealth of Nations: Defining and Measuring Macroeconomic Aggregates	Chapter 5: The Wealth of Nations: Defining and Measuring Macroeconomic Aggregates	Chapter 5: The Wealth of Nations: Defining and Measuring Macroeconomic Aggregates
Chapter 6: Aggregate Incomes	Chapter 6: Aggregate Incomes	Section 6: Aggregate Incomes
Chapter 7: Economic Growth	Chapter 7: Economic Growth	Chapter 7: Economic Growth
Chapter 8: Why Isn't the Whole World Developed? (optional)	Chapter 8: Why Isn't the Whole World Developed?	Chapter 8: Why Isn't the Whole World Developed? (optional)
Chapter 9: Employment and Unemployment	Chapter 9: Employment and Unemployment	Chapter 9: Employment and Unemployment
Chapter 10: Credit Markets	Chapter 10: Credit Markets	Chapter 10: Credit Markets
Chapter 11: The Monetary System	Chapter 11: The Monetary System	Chapter 11: The Monetary System
Chapter 12: Short-Run Fluctuations	Chapter 12: Short-Run Fluctuations	Chapter 12: Short-Run Fluctuations
Chapter 13: Countercyclical Macroeconomic Policy	Chapter 13: Countercyclical Macroeconomic Policy	Chapter 13: Countercyclical Macroeconomic Policy
Chapter 14: Macroeconomics and International Trade (optional)	Chapter 14: Macroeconomics and International Trade (optional)	Chapter 14: Macroeconomics and International Trade
Chapter 15: Open Economy Macroeconomics (optional)	Chapter 15: Open Economy Macroeconomics (optional)	Chapter 15: Open Economy Macroeconomics

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The Principles and Practice of Economics



Is Facebook free?

Facebook doesn't charge you a monthly fee, so it's tempting to say "it's free."

Here's another way to think about it: what do you give up when you use Facebook? Stop reading for a moment and answer that question:

What do you give up when you use Facebook?

Facebook may not take your money, but it does take your data and your time. For the moment, let's focus on your time (although your data are very valuable too!). When you spend time on Facebook, you are giving up an alternative use of your time. You could spend that time playing soccer, watching YouTube, napping, studying, listening to Spotify, or pursuing any other activity that generates something that you value. For example, you could spend the time earning money. If a typical college student went cold turkey on social media and reallocated just that time to paid work, they would earn enough money to pay the annual lease on a sports car.

A part-time job is just *one* alternative way to use the time you spend on Facebook, Instagram, TikTok, and hundreds of other social media apps. In *your* view, what is the best alternative use of your social media time? That's the economic way of thinking about the time *cost* of Facebook, which we'll explore further in the Evidence-Based Economics feature in this chapter.

In this chapter, we introduce you to the economic way of thinking about the world. Economists study all of the choices that people make, from the big decisions like choosing a job to the small decisions like logging onto Facebook or any other social media platform. To understand those choices, economists focus on the costs and benefits involved, including subtle costs like the activities that get *crowded out*.

How do people make all of these choices? How should people make these choices? Economists have answers that will occasionally surprise you and, most importantly, help you make choices that improve your well-being.

CHAPTER OUTLINE

1.1	1.2	1.3	EBE	1.4	1.5	1.6
The Scope of Economics	Three Principles of Economics	The First Principle of Economics: Optimization	Is Facebook free?	The Second Principle of Economics: Equilibrium	The Third Principle of Economics: Empiricism	Is Economics Good for You?