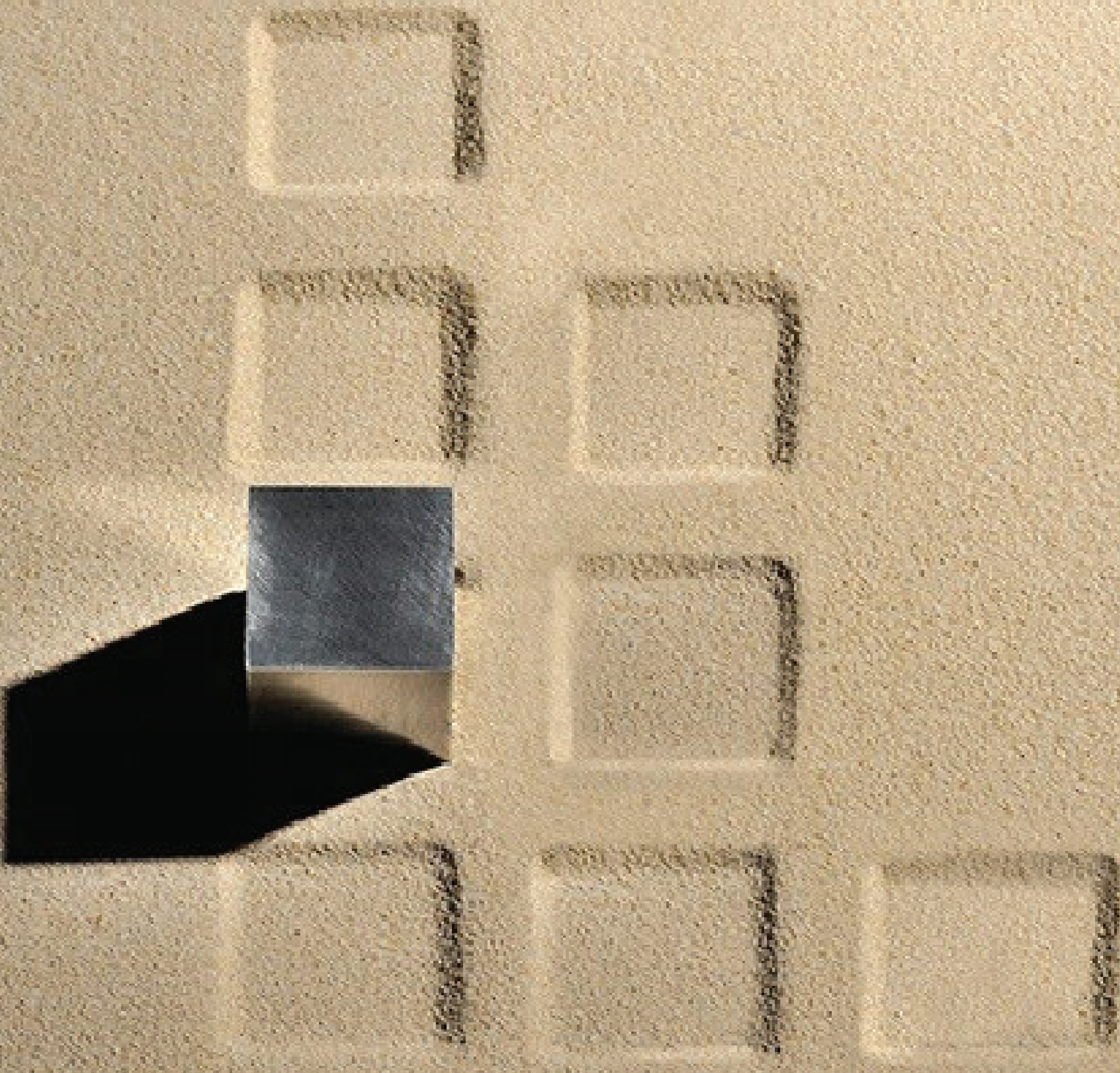
Microeconomics

Jeffrey M. Perloff

8th edition



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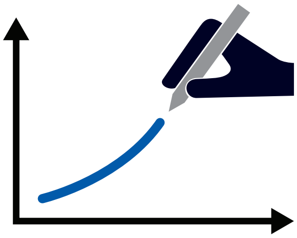

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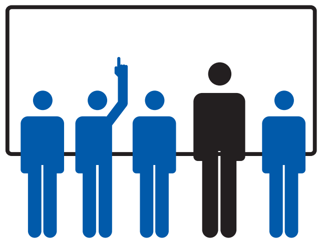

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$$P = c + dQ_s$$

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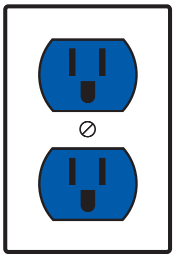

- **Mobile Ready**—Students and instructors can access multimedia resources and complete assessments right at their fingertips, on any mobile device.

Symbols Used in This Book

v = *ad valorem* tax (or tariff) rate, or an exponent in a Cobb-Douglass production function

Δ [capital delta] = change in the following variable (for example, the change in p between Periods 1 and 2 is $\Delta p = p_2 - p_1$, where p_2 is the value of p in Period 2 and p_1 is the value in Period 1)

ε [epsilon] = the price elasticity of demand

η [eta] = the price elasticity of supply

$\mathscr{L}$ = lump-sum tax

π [pi] = profit = revenue − total cost = $R - C$

σ [sigma] = standard deviation

θ [theta] = probability or share

ξ [xi] = the income elasticity of demand

Abbreviations, Variables, and Function Names

AFC = average fixed cost = fixed cost divided by output = F/q

AVC = average variable cost = variable cost divided by output = VC/q

AC = average cost = total cost divided by output = C/q

AP_Z = average product of input Z (for example, AP_L is the average product of labor)

C = total cost = variable cost + fixed cost = $VC + F$

CRS = constant returns to scale

CS = consumer surplus

CV = compensating variation

D = market demand curve

D_r = *residual* demand curve

DRS = decreasing returns to scale

DWL = deadweight loss

F = fixed cost

i = interest rate

I = indifference curve

IRS = increasing returns to scale

K = capital

L = labor

LR = long run

m = constant marginal cost

M = materials

MC = marginal cost = $\Delta C/\Delta q$

MP_Z = marginal (physical) product of input Z (for example, MP_L is the marginal product of labor)

MR = marginal revenue = $\Delta R/\Delta q$

MRS = marginal rate of substitution

$MRTS$ = marginal rate of technical substitution

MU_Z = marginal utility of good Z

n = number of firms in an industry

p = price

PPF = production possibility frontier

PS = producer surplus = revenues − variable costs = $R - VC$

Q = market (or monopoly) output

$\overline{Q}$ = output quota

q = firm output

R = revenue = pq

r = price of capital services

s = per-unit subsidy

S = market supply curve

S_o = supply curve of all the other firms in the market

SC = a market of economies of scope

SR = short run

t = specific or unit tax (or tariff)

T = tax revenue ($\alpha\, pQ$, τQ, $\rho\pi$)

U = utility

VC = variable cost

w = wage

W = welfare

Y = income or budget

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New York, NY

For Alexx, Gregg, Laura, and Spenser

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Preface

When I was a student, I fell in love with microeconomics because it cleared up many mysteries about the world and provided the means to answer new questions. I wrote this book to illustrate that economic theory has practical, problem-solving uses and is not an empty academic exercise.

This book shows how individuals, policy makers, lawyers and judges, and firms can use microeconomic tools to analyze and resolve problems. For example, students learn that

- individuals can draw on microeconomic theories when deciding about issues such as whether to invest and whether to sign a contract that pegs prices to the government's measure of inflation;
- policy makers (and voters) can employ microeconomics to predict the impact of taxes, regulations, and other measures before they are enacted;
- lawyers and judges can use microeconomics in antitrust, discrimination, and contract cases; and
- firms can apply microeconomic principles to produce at minimum cost and maximize profit, select strategies, decide whether to buy from a market or to produce internally, and write contracts to provide optimal incentives for employees.

My experience in teaching microeconomics for the departments of economics at MIT; the University of Pennsylvania; and the University of California, Berkeley; the Department of Agricultural and Resource Economics at Berkeley; and the Wharton Business School has convinced me that students prefer this emphasis on real-world issues.

How This Book Differs from Others

This book differs from other microeconomics texts in three main ways:

- It places greater emphasis than other texts on *modern theories*—such as industrial organization theories, game theory, transaction cost theory, information theory, contract theory, and behavioral economics—that are useful in analyzing actual markets.
- It uses *real-world economic examples* to present the basic theory and offers many more Applications to a variety of real-world situations.
- It employs step-by-step *problem-based learning* to demonstrate how to use microeconomic theory to solve business problems and analyze policy issues.

Modern Theories

This book has all of the standard economic theory, of course. However, what sets it apart is its emphasis on modern theories that are particularly useful for understanding how firms behave and the effects of public policy.

Industrial Organization How do firms differentiate their products to increase their profits? When does market outcome depend on whether firms set prices or quantities? What effects do government price regulations have on firms' behavior? Industrial organization theories address these and many other questions.

Game Theory What's the optimal way to bid in an auction? How do firms set prices to prevent entry of rival firms? What strategy should parents use when their college-graduate child moves back in with them? Game theory provides a way of thinking about strategies and it provides methods to choose optimal strategies.

Contract Theory What kind of a contract should a firm offer a worker to induce the employee to work hard? How do people avoid being exploited by other people who have superior information? Modern contract theory shows how to write contracts to avoid or minimize such problems.

Behavioral Economics Should a firm allow workers to opt in or opt out of a retirement system? How should people respond to ultimatums? We address questions such as these using behavioral economics—one of the hottest new areas of economic theory—which uses psychological research and theory to explain why people deviate from rational behavior.

Real-World Economics

This book demonstrates that economics is practical and provides a useful way to understand actual markets and firms' and consumers' decisions in two ways. First, it presents the basic theory using models estimated with real-world data. Second, it uses the theory to analyze hundreds of real-world applications.

Using Estimated Models to Illustrate Theory The text presents the basic theory using estimated demand curves, supply curves, production functions, and cost functions in most chapters. For example, students learn how imported oil limits the price that U.S. oil producers can charge based on estimated supply and demand curves, derive a Japanese beer manufacturer's cost curve using an estimated production function, examine the regulation of natural gas monopolies employing estimated demand and cost curves, and analyze oligopoly firms' strategies using estimated demand curves and cost and profit data from the real-world rivalries between United Airlines and American Airlines and between Coke and Pepsi.

Applications Applications use economic theory to predict the price effect of allowing drilling in the Arctic National Wildlife Refuge based on estimated demand and supply curves, demonstrate how iTunes price increases affect music downloads using survey data, explain why some top-end designers limit the number of designer bags customers can buy, analyze why Amazon raised the price for its Prime service, and measure the value of using the Internet.

Problem-Based Learning

People, firms, and policy makers have to solve economic problems daily. This book uses a problem-solving approach to demonstrate how economic theory can help them make good decisions.

Solved Problems After the introductory chapter, each chapter provides an average of over five Solved Problems. Each Solved Problem poses a qualitative or quantitative question and then uses a step-by-step approach to model good problem-solving techniques. These issues include whether Peter Guber and Joe Lacob should have bought the Golden State Warriors, how to determine Intel's and AMD's profit-maximizing quantities and prices using their estimated demand curves and marginal costs, and how regulating a monopoly's price affects consumers and firms.

Challenges Starting with Chapter 2, each chapter begins with a Challenge that presents information about an important, current real-world issue and concludes with a series of questions about that material. At the end of the chapter, a Challenge Solution answers these questions using methods presented in that chapter. That is, a Challenge combines an Application and a Solved Problem to motivate the material in the chapter. The issues covered include the price and quantity effects from introducing genetically modified foods, why Americans buy more ebooks than do Germans, whether higher salaries for star athletes raise ticket prices, whether it pays to go to college, and how Heinz can use sales to increase its profit on ketchup.

End-of-Chapter Questions Starting with Chapter 2, each chapter ends with an extensive set of Questions, many of which draw on topical, real-world issues. Each Solved Problem and Challenge has at least one associated end-of-chapter question that references them and asks students to extend or reapply their analyses. Many of the Questions relate to the Applications. Answers to selected end-of-chapter Questions appear at the end of the book, and all of the end-of-chapter Questions are available in MyEconLab for self-assessment, homework, or testing.

What's New in the Eighth Edition

The Eighth Edition of *Microeconomics* is substantially updated and modified based on the extremely helpful suggestions of faculty and students who used the first seven editions. The major changes in this edition are:

- All the Challenges and almost all the examples and Applications throughout the book are updated or new.
- The book has several new and many revised Solved Problems.
- Many of the end-of-chapter Questions are new, updated, or revised.
- All chapters are revised.
- Each substantive chapter has a new feature, in which we analyze a *Common Confusion*.

(And, possibly most importantly, the book has two new cartoons.)

Challenges, Solved Problems, and Questions

All of the Challenges are new or updated. Because users requested more Solved Problems, I increased the number of Challenges and Solved Problems in this edition to 111, many of which are new or substantially revised. Every Solved Problem has at least one associated Question at the end of the chapter.

About 40% of these Solved Problems refer to real-world events. Many of these are associated with an adjacent Application or example in the text. In addition to the Challenges, examples of a paired Application and Solved Problem include the effect of oil drilling in the Arctic National Wildlife Refuge on prices, the opportunity cost of getting an MBA, the social cost of a natural gas price ceiling, Apple's iPad pricing, and the price effects of reselling textbooks bought abroad in the United States.

Starting with Chapter 2, the end of each chapter has an average of over 42 verbal, graphical, and mathematical Questions. This edition has 810 Questions, 47 more than in the previous edition. Over 12% of the Questions are new or updated. Many of these Questions refer to recent real-life events and issues drawn from newspapers, journal articles, and other sources.

Applications

The Eighth Edition has 133 Challenges and Applications, 4 more than in the previous edition. Of these, 35% are new and 53% are updated, so that 87% are new or updated. The vast majority of the Applications cover events in 2015 and 2016, a few deal with historical events, and the remaining ones examine timeless material.

To make room for the new Applications, older Applications from the Seventh Edition were moved to MyEconLab. Also, several new ones have been added to the hundreds of Applications and other materials in MyEconLab.

New and Revised Material in Chapters

I have revised every chapter—including most sections. Every chapter has new and updated Applications and Challenges. Virtually every chapter has updated examples and statistics. Some of the larger changes include:

- Chapters 2 and 3 are substantially rewritten. They illustrate the basic supply-and-demand theory using empirical estimates from the avocados, coffee, corn, ethanol, and oil markets. The major coffee example is new to this edition. Three Solved Problems are significantly revised.
- Chapters 4 and 5 are reorganized and significantly revised, particularly the section *Cost-of-Living-Adjustments* in Chapter 5.
- Chapter 6 has a substantially modified section, *Production*, and light revisions elsewhere.
- Chapter 7 is moderately revised, particularly the material associated with Figure 7.2.
- Chapter 8 is substantially revised, particularly the beginning of the *Two Steps to Maximizing Profit* section, the discussion of the shutdown decision, the *Competition in the Short Run* section, the section on *Entry and Exit*, and the section *Long-Run Market Supply When Input Prices Vary with Output*, as well as several figures.
- Chapter 9 is substantially rewritten, particularly the introduction, the section on *Policies That Shift Supply and Demand Curves*, the discussion of trading oil, which uses a new estimated model. In this chapter and following chapters, deadweight loss is expressed as a negative number consistently.
- Chapter 10 a Solved Problem, the comparison of Pareto superiority, and the material of *Efficiency and Equity* are rewritten.
- Chapter 11 has two new Solved Problems and all the material on Apple is revised.
- Chapter 12 is moderately revised throughout, the group discrimination material is reorganized and significantly revised, and the two-part pricing material is lightly revised. It contains a new Solved Problem.
- Chapter 13 is significantly revised. The section *Cartels* is reorganized and rewritten. The sections *Cournot Oligopoly* and *Comparison of Competitive, Stackelberg, Cournot, and Collusive Equilibria* are rewritten.
- Chapter 14 has two new Solved Problems. The static game section is completely reorganized and rewritten. The dynamic game section is significantly revised. The chapter has a new discussion of double auctions.

- Chapter 15 has a modified Table 15.1, Figures 15.9 and 15.10, and a discussion of monopsony.
- Chapter 16 has two rewritten Solved Problems and many facts are updated.
- Chapter 17 has a rewritten discussion of framing, a significantly modified Solved Problem, a new introduction to the section on *Reducing Risk*, and a new subsection *Just Say No*.
- Chapter 18 has substantially revised sections on the Coase Theorem, club goods, and public goods.
- Chapter 19 is moderately rewritten and has a substantially revised Solved Problem.
- Chapter 20 has a new Challenge Solution.

A New Feature: Common Confusions

A new feature in this edition are discussions of *Common Confusions*—widely held but false beliefs. After Chapter 1, every chapter has at least one Common Confusion. We use economic theory to explain why these beliefs are incorrect.

Alternative Organizations

Because instructors cover material in different orders, I designed this textbook for maximum flexibility. The most common approach to teaching microeconomics is to follow the sequence of the chapters in the first half of this book: supply and demand (Chapters 2 and 3), consumer theory (Chapters 4 and 5), the theory of the firm (Chapters 6 and 7), and the competitive model (Chapters 8 and 9). Many instructors then cover monopoly (Chapter 11), price discrimination (Chapter 12), oligopoly (Chapters 13 and 14), input markets (Chapter 15), uncertainty (Chapter 17), and externalities (Chapter 18).

A common variant is to present uncertainty (Sections 17.1 through 17.3) immediately after consumer theory. Many instructors like to take up welfare issues between discussions of the competitive model and noncompetitive models, as Chapter 10, on general equilibrium and economic welfare, does. Alternatively, some instructors cover this chapter at the end of the course. Faculty can assign material on factor markets earlier: Section 15.1 could follow the chapters on competition, and the remaining sections could follow Chapter 11. The material in Chapters 14–20 can be presented in a variety of orders, though Chapter 20 should follow Chapter 19 if both are covered, and Section 17.4 should follow Chapter 16.

Many business school courses skip consumer theory (and possibly some aspects of supply and demand, such as Chapter 3) to allow more time for consideration of the topics covered in the second half of this book. Business school faculty may want to place particular emphasis on game and theory strategies (Chapter 14), capital markets (Chapter 16), and modern contract theory (Chapters 19 and 20).

Optional, technically demanding sections are marked with a star (★). Subsequent sections and chapters can be understood even if these sections are skipped.

MyEconLab

MyEconLab's powerful assessment and tutorial system works hand-in-hand with the Eighth Edition of *Microeconomics*. It includes comprehensive homework, quiz, test, and tutorial options, allowing students to test their knowledge and instructors to manage all assessment needs in one program. Students and instructors can register, create, and access all of their MyLab courses, regardless of discipline, from one convenient online location: **http://www.pearsonmylab.com**.

Key features in the MyEconLab course for *Microeconomics* Eighth Edition include the following resources for students and instructors:

- **Enhanced Pearson eText.** The Enhanced eText helps students to learn on their own by helping them better understand course material. The worked examples, animations, and interactive tutorials bring learning to life. Students can apply these concepts using self-assessment, algorithmic exercises in MyLab, providing students with a complete digital learning experience.
- **MyEconLab Videos.** Key figures and concepts from the textbook are presented in step-by-step animations with audio explanations of the action. These new videos are embedded in the eText and accessible through MyEconLab.
- **MyEconLab Solved Problems.** Many students have difficulty applying economics concepts to solving problems. The goal of this digital resource is to help students overcome this hurdle by learning how to solve an economic problem by breaking it down into steps. Each Solved Problem in MyEconLab and the eText also includes at least one additional graded practice exercise for students. These interactive tutorials help students apply basic problem-solving skills to homework, quizzes, and exams. The goal is for students to build skills they can use to analyze real-world economic issues they hear and read about in the news.
- **Additional Readings (Applications, Supplemental Material, and Solved Problems).** Additional Applications, Supplemental Material, and Solved Problems are available in MyEconLab.
- **NEW: Math Review Exercises in MyEconLab.** MyEconLab now offers a rich array of assignable and auto-graded exercises covering fundamental math concepts geared specifically to principles and intermediate economics students.
- **Practice.** Algorithmically generated homework and study plan exercises with instant feedback ensure varied and productive practice that help students improve their understanding and prepare for quizzes and tests. Many exercises require the student to draw figures or solve mathematic problems.
- **Learning Resources.** Personalized learning aids such as Help Me Solve This problem walkthroughs, Teach Me explanations of the underlying concept, and figure Animations provide on-demand help when students need it most.
- **Personalized Study Plan.** The Study Plan acts as a tutor, providing personalized recommendations for each student based on his or her demonstrated ability to master the learning objectives in your course. Consequently, students focus on precisely the areas they need to review using customized practice and learning aids—such as videos and eText, tutorials. You can use the report available in the Gradebook to lecture on the material for which students need the most support.
- **Learning Catalytics.** Learning Catalytics™ helps you generate class discussion, customize your lecture, and promote peer-to-peer learning with real-time analytics. Learning Catalytics allows students to use their smart phones, tablets, or laptops to respond to your questions or to engage in interactive tasks during class. You can use this information to adjust your teaching strategy in real time.
- **Current News Exercises.** Every week, Pearson scours the news, finds a current article appropriate for a microeconomics course and adds a gradable exercise based on it to MyEconLab.
- **Reporting Dashboard.** Faculty can view, analyze, and report learning outcomes clearly and easily using the Reporting Dashboard. It is available via the Gradebook and fully mobile-ready. The Reporting Dashboard presents student performance data at the class, section, and program levels in an accessible, visual manner.

- **LMS Integration.** You can now link to MyEconLab from Blackboard Learn, Brightspace by D2L, Canvas, or Moodle. Thus, you can directly access MyEconLab assignments, rosters, and resources. You can also synchronize grades with your LMS gradebook. Students need sign-on only once to obtain access to all their personalized learning resources.
- **Mobile Ready.** Students and instructors can access multimedia resources and complete assessments from any mobile device.
- **Experiments in MyEconLab.** Flexible, easy to assign, auto-graded, and available in Single and Multiplayer versions, the Experiments in MyEconLab make learning fun and engaging.

For more information, visit **http://www.myeconlab.com**.

Supplements

A full range of supplementary materials to support teaching and learning accompanies this book.

- The *Online Instructor's Manual* revised by Leonie Stone has many useful and creative teaching ideas. It also offers a chapter outline, additional discussion questions, additional questions and problems, and solutions for all additional questions and problems.
- The *Online Solutions Manual* provides solutions for all the end-of-chapter questions in the text.
- The *Online Test Bank* by Lourenço Paz of Syracuse University features problems of varying levels of complexity, suitable for homework assignments and exams. Many of these multiple-choice questions draw on current events.
- The *Computerized Test Bank* reproduces the Test Bank material in the TestGen software, which is available for Windows and Macintosh. With TestGen, instructors can easily edit existing questions, add questions, generate tests, and print the tests in a variety of formats.
- The *Online PowerPoint Presentation* by Ting Levy of Florida Atlantic University contains text figures and tables, as well as lecture notes. These slides allow instructors to walk through examples from the text during in-class presentations.

These teaching resources are available online for download at the Instructor Resource Center, **http://www.pearsonhighered.com**, and on the catalog page for *Microeconomics*. **This title is available as an eBook and can be purchased at most eBook retailers.**

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My greatest debt is to my students. My students at MIT; the University of Pennsylvania; and the University of California, Berkeley, patiently dealt with my various approaches to teaching them microeconomics and made useful (and generally polite) suggestions.

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J. M. P.

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Introduction

1

An Economist's Theory of Reincarnation: If you're good, you come back on a higher level. Cats come back as dogs, dogs come back as horses, and people—if they've been really good like George Washington—come back as money.

microeconomics
the study of how individuals and firms make themselves as well off as possible in a world of scarcity and the effects of their actions on markets and the entire economy

If each of us could get all the food, clothing, and toys we wanted without working, no one would study economics. Unfortunately, most of the good things in life are scarce—we can't all have as much as we want. Thus, scarcity is the mother of economics. **Microeconomics** is the study of how individuals and firms make themselves as well off as possible in a world of scarcity and the effects of their actions on markets and the entire economy. Microeconomics is often called *price theory* to emphasize the important role that prices play. Microeconomics explains how the actions of all buyers and sellers determine prices and how prices influence the decisions and actions of individual buyers and sellers.

In this chapter, we examine three main topics

1. **Microeconomics: The Allocation of Scarce Resources.** Microeconomics is the study of the allocation of scarce resources.
2. **Models.** Economists use models to make testable predictions.
3. **Uses of Microeconomic Models.** Individuals, governments, and firms use microeconomic models and predictions in decision making.

1.1 Microeconomics: The Allocation of Scarce Resources

Individuals and firms allocate their limited resources to make themselves as well off as possible. Consumers pick the mix of goods and services that makes them as happy as possible given their limited wealth. Firms decide which goods and services to produce, where to produce them, how much to produce to maximize their profits, and how to produce those a given level of output at the lowest cost by using more or less of various inputs such as labor, capital, materials, and energy. The owners of a depletable natural resource such as oil decide when to use it. Government decision makers—to benefit consumers, firms, or government bureaucrats—decide which goods and services the government produces and whether to subsidize, tax, or regulate industries and consumers.

Trade-Offs

People make trade-offs because they can't have everything. A society faces three key trade-offs:

- **Which goods and services to produce:** If a society produces more cars, it must produce fewer of other goods and services, because society has a limited amount of *resources*—workers, raw materials, capital, and energy—available to produce goods.
- **How to produce:** To produce a given level of output, a firm must use more of one input if it uses less of another input. For example, cracker and cookie manufacturers switch between palm oil and coconut oil, depending on which is less expensive.
- **Who gets the goods and services:** The more of society's goods and services you get, the less someone else gets.

Who Makes the Decisions

The government may explicitly make these three allocation decisions for society. Alternatively, the interaction of independent choices by many individual consumers and firms may determine society's allocation decisions.

In the former Soviet Union, the government told manufacturers how many cars of each type to make and which inputs to use to make them. The government also decided which consumers would get a car.

In most other countries, how many cars of each type are produced and who gets them are determined by how much it costs to make cars of a particular quality in the least expensive way and how much consumers are willing to pay for them. More consumers would own a handmade Rolls-Royce Phantom and fewer would buy a mass-produced Toyota Camry if a Rolls-Royce was not 18 times more expensive than a Camry.

Prices Determine Allocations

Prices link the decisions about *which goods and services to produce*, *how to produce them*, and *who gets them*. Prices influence the decisions of individual consumers and firms, and the interactions of those decisions by consumers, firms, and the government determine price.

market
an exchange mechanism that allows buyers to trade with sellers

Interactions between consumers and firms take place in a **market**, which is an exchange mechanism that allows buyers to trade with sellers. A market may be a town square where people go to trade food and clothing, or it may be an international telecommunications network over which people buy and sell financial securities. Typically, when we talk about a single market, we refer to trade in a single good or group of goods that consumers view as very similar, such as Fuji apples, soft drinks, movies, novels, or automobiles.

Most of this book concerns how prices are determined within a market. We show that the number of buyers and sellers in a market and the amount of information they have help determine whether the price equals the cost of production. We also show that if no market is available—and hence no market price—serious problems, such as high levels of pollution, result.

Application

Twinkie Tax

Many American, Australian, British, Canadian, New Zealand, and Taiwanese jurisdictions are proposing a *Twinkie tax* on unhealthful fatty and sweet foods or a tax on sugary soft drinks to reduce obesity and cholesterol problems, particularly among children. One survey found that 45% of adults would support a 1¢ tax per pound on soft drinks, chips, and butter, with the revenues used to fund health education programs.

In recent years, many communities around the world debated (and some passed) new taxes on sugar-sweetened soft drinks. In 2014, Rosa DeLauro, a Connecticut Congressional representative, proposed a national soda tax. New beverage taxes went into effect in Mexico in 2014 and in Berkeley, California, in 2015. In 2016, the United Kingdom announced it would impose a soft drink tax in 2018. At least 23 states differentially tax soft drinks, candy, chewing gum, and snack foods such as potato chips. Today, many school districts throughout the United States ban soft drink vending machines. This ban discourages consumption, as would an extremely high tax. Britain's largest life insurance firm charges obese people higher premiums for life insurance policies.

New taxes will affect *which foods are produced*, as firms offer new low-fat and low-sugar products, and *how fast foods are produced*, as manufacturers reformulate their products to lower their tax burden. These taxes will also influence *who gets these goods* as consumers, especially children, replace them with less expensive, untaxed products.[1]

1.2 Models

Everything should be made as simple as possible, but not simpler. —Albert Einstein

model
a description of the relationship between two or more economic variables

To *explain* how individuals and firms allocate resources and how market prices are determined, economists use a **model**: a description of the relationship between two or more economic variables. Economists also use models to *predict* how a change in one variable will affect another.

Application

Income Threshold Model and China

According to an *income threshold model*, no one who has an income level below a particular threshold buys a particular consumer durable, such as a refrigerator or car. The theory also holds that almost everyone whose income is above that threshold buys the product.

If this theory is correct, we predict that, as most people's incomes rise above the threshold in emergent economies, consumer durable purchases will increase from near zero to large numbers virtually overnight. This prediction is consistent with evidence from Malaysia, where the income threshold for buying a car is about $4,000.

In China, incomes have risen rapidly and now exceed the threshold levels for many durable goods. As a result, experts correctly predicted that the greatest consumer durable goods sales boom in history would take place there. Anticipating this boom, companies from around the globe greatly increased their investments in durable goods manufacturing plants in China. Annual foreign direct investments went from $916 million a year in 1983 to $127 billion in 2015. In anticipation of this growth potential, even traditional political opponents of the People's Republic—Taiwan, South Korea, and Russia—are investing in China.

One of the most desirable durable goods is a car. Li Rifu, a 46-year-old Chinese farmer and watch repairman, thought that buying a car would improve the odds that his 22- and 24-year-old sons would find girlfriends, marry, and produce

[1] The sources for Applications are available at the back of this book.

grandchildren. Soon after Mr. Li purchased his Geely King Kong car for the equivalent of $9,000, both sons met girlfriends, and his older son got married.

First-time customers buy four-fifths of all new cars sold in China. An influx of first-time buyers was responsible for Chinese car sales increasing by a factor of 15 between 2000 and 2015. By 2010, China became the second largest manufacturer of motor vehicles. By 2014, China was producing more cars than the United States and Japan combined, as well as more than the entire European Union.

Simplifications by Assumption

We stated the income threshold model in words, but we could have presented it using graphs or mathematics. Regardless of how we describe the model, an economic model is a simplification of reality that contains only its most important features. Without simplifications, it is difficult to make predictions, because the real world is too complex to analyze fully.

By analogy, if the manual accompanying your new smart TV has a diagram showing the relationships between all the parts in the TV, the diagram will be overwhelming and useless. In contrast, if it shows a photo of the lights on the front of the machine with labels describing the significance of each light, the manual is useful and informative.

Economists make many *assumptions* to simplify their models.[2] When using the income threshold model to explain car buying in China, we *assume* that factors other than income, such as the color of cars, are irrelevant to the decision to buy cars. Therefore, we ignore the color of Chinese cars in describing the relationship between average income and the number of cars consumers want. If this assumption is correct, by ignoring color, we make our analysis of the auto market simpler without losing important details. If we're wrong and these ignored issues are important, our predictions may be inaccurate.

Throughout this book, we start with strong assumptions to simplify our models. Later, we add complexities. For example, in most of the book, we assume that consumers know the price each firm charges. In many markets, such as the New York Stock Exchange, this assumption is realistic. It is not realistic in other markets, such as the market for used automobiles, in which consumers do not know the prices each firm charges. To devise an accurate model for markets in which consumers have limited information, we add consumer uncertainty about price into the model in Chapter 19.

Testing Theories

Blore's Razor: *When given a choice between two theories, take the one that is funnier*.

Economic *theory* is the development and use of a model to test *hypotheses*, which are predictions about cause and effect. We are interested in models that make clear, testable predictions, such as "If the price rises, the quantity demanded falls." A theory that says "People's behavior depends on their tastes, and their tastes change randomly at random intervals," is not very useful because it does not lead to testable predictions.

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[2]An economist, an engineer, and a physicist are stranded on a desert island with a can of beans but no can opener. How should they open the can? The engineer proposes hitting the can with a rock. The physicist suggests building a fire under it to build up pressure and burst the can open. The economist thinks for a while and then says, "*Assume* that we have a can opener . . . ."

An alternative theory.

Economists test theories by checking whether predictions are correct. If a prediction does not come true, they may reject the theory.[3] Economists use a model until evidence refutes it or someone creates a better model.

A good model makes sharp, clear predictions that are consistent with reality. Some very simple models make sharp predictions that are incorrect, and other more complex models make ambiguous predictions—any outcome is possible—which are untestable. The skill in model building is to chart a middle ground.

The purpose of this book is to teach you how to think like an economist in the sense that you can build testable theories using economic models or apply existing models to new situations. Although economists think alike in that they develop and use testable models, they often disagree. One may present a logically consistent argument that prices will go up next quarter. Another, using a different but equally logical theory, may contend that prices will fall. If the economists are reasonable, they agree that pure logic alone cannot resolve their dispute. Indeed, they agree that they'll have to use empirical evidence—facts about the real world—to find out which prediction is correct.

Maximizing Subject to Constraints

In most economic models, a decision maker maximizes an objective subject to a constraint. Consumers maximize their well-being subject to a budget constraint, which says that their resources limit how many goods they can buy. Firms maximize profits subject to technological and other constraints. Governments may try to maximize the welfare of consumers or firms subject to constraints imposed by limited resources and the behavior of consumers and firms. The limit on resources plays a crucial role in these models. Were it not for scarcity, people could consume unlimited amounts of goods and services, and sellers could become rich beyond limit.

The maximizing behavior of individuals and firms determines society's three main allocation decisions: which goods are produced, how they are produced, and who gets them. For example, firms sell diamond-studded pocket combs only if it is profitable to sell them. The firms make and sell these combs only if consumers value the combs at least as much as it costs the firm to produce them. Consumers buy the combs only if they get more pleasure from the combs than they would from other goods they could buy with the same resources.

Positive Versus Normative

Using models of this maximizing behavior sometimes leads to predictions that seem harsh or heartless. For instance, a World Bank economist predicted that if an African

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[3] We can use evidence on whether a theory's predictions are correct to *refute* the theory but not to *prove* it. If a model's prediction is inconsistent with what actually happened, the model must be wrong, so we reject it. However, even if the model's prediction is consistent with reality, the model's prediction may be correct for the wrong reason. Hence, we cannot prove that a model is correct—we can only *fail to reject it*.

government used price controls to keep the price of food low during a drought, food shortages would occur and people would starve. The predicted outcome is awful, but the economist was not heartless. The economist was only making a scientific prediction about the relationship between cause and effect: Price controls (cause) lead to food shortages and starvation (effect).

positive statement
a testable hypothesis about cause and effect

Such a scientific prediction is a **positive statement**: a testable hypothesis about cause and effect. "Positive" does not mean that we are *certain* about the truth of our statement—it only indicates that we can *test* the truth of the statement.

If the World Bank economist is correct, should the government control prices? If the government believes the economist's predictions, it knows that the low prices help those consumers who are lucky enough to be able to buy as much food as they want while hurting both the firms that sell food and the people who are unable to buy as much food as they want, some of whom may die. As a result, the government's decision to use price controls or not depends on whether the government cares more about the winners or the losers. In other words, to decide on its policy, the government makes a value judgment.

Instead of making a prediction and then testing it before making a value judgment of whether to use price controls, the government could make a value judgment directly. The value judgment could be based on the belief that "because people *should* have prepared for the drought, the government *should not* try to help them by keeping food prices low." Alternatively, the judgment could be based on the view that "people *should* be protected against price gouging during a drought, so the government *should* use price controls."

normative statement
a conclusion as to whether something is good or bad

These two statements are *not* scientific predictions. Each is a value judgment or **normative statement**: a conclusion as to whether something is good or bad. A normative statement is untestable because a value judgment cannot be refuted by evidence. It is a prescription rather than a prediction. A normative statement concerns what somebody believes *should* happen; a positive statement concerns what *will* happen.

Although people may draw a normative conclusion without first conducting a positive analysis, a policy debate is better informed if positive analyses are conducted first.[4] For instance, if your normative belief is that the government should help the poor, should you vote for a candidate who advocates a higher minimum wage (a law that requires that firms pay wages at or above a specified level)? One who believes in a European-style welfare system (guaranteeing health care, housing, and other basic goods and services)? A politician who wants an end to our current welfare system? Someone who wants to implement a negative income tax (in which the less income a person has, the more the government gives that person)? Or a candidate who favors job training programs? Positive economic analysis can be used to predict whether these programs will benefit poor people but not whether they are good or bad. Using these predictions and your value judgment, you can decide for whom to vote.

Economists' emphasis on positive analysis has implications for what we study and even our use of language. For example, many economists stress that they study people's *wants* rather than their *needs*. Although people need certain minimum levels of food, shelter, and clothing to survive, most people in developed economies have enough money to buy goods well in excess of the minimum levels necessary to maintain life. Consequently, in wealthy countries, calling something a "need" is often a value judgment. You almost certainly have been told by some elder that "you *need*

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[4] Some economists draw the normative conclusion that, as social scientists, economists *should* restrict ourselves to positive analyses. Others argue that we shouldn't give up our right to make value judgments just like the next person (who happens to be biased, prejudiced, and pigheaded, unlike us).

a college education." That person was probably making a value judgment—"you *should* go to college"—rather than a scientific prediction that you will suffer terrible economic deprivation if you do not go to college. We can't test such value judgments, but we can test a hypothesis such as "One-third of the college-age population *wants* to go to college at current prices."

1.3 Uses of Microeconomic Models

Because microeconomic models *explain* why economic decisions are made and allow us to make *predictions*, they can be very useful for individuals, governments, and firms in making decisions. Throughout this book, we consider examples of how microeconomics aids in actual decision making.

Individuals can use microeconomics to make purchasing and other decisions (Chapters 4 and 5). Consumers' purchasing and investing decisions are affected by inflation and cost of living adjustments (Chapter 5). Whether it pays financially to go to college depends, in part, on interest rates (Chapter 16). Consumers decide for whom to vote based in part on candidates' views on economic issues.

Firms must decide which production methods to use to minimize cost (Chapter 7) and maximize profit (starting with Chapter 8). They may choose a complex pricing scheme or advertise to raise profits (Chapter 12). They select strategies to maximize profit when competing with a small number of other firms (Chapters 13 and 14). Some firms reduce consumer information to raise profits (Chapter 19). Firms use economic principles to structure contracts with other firms (Chapter 20).

Your government's elected and appointed officials use (or could use) economic models in many ways. Recent administrations have placed increased emphasis on economic analysis. Today, economic and environmental impact studies are required before many projects can commence. The President's Council of Economic Advisers and other federal economists analyze and advise national government agencies on the likely economic effects of all major policies.

One major use of microeconomic models by governments is to predict the probable impact of a policy before it is adopted. For example, economists predict the likely impact of a tax on the prices consumers pay and on the tax revenues raised (Chapter 3), whether a price control will create a shortage (Chapter 2), the differential effects of tariffs and quotas on trade (Chapter 9), and the effects of regulation on monopoly price and the quantity sold (Chapter 11).

Summary

1. **Microeconomics: The Allocation of Scarce Resources.** Microeconomics is the study of the allocation of scarce resources. Consumers, firms, and governments must make allocation decisions. The three key trade-offs a society faces are which goods and services to produce, how to produce them, and who gets them. These decisions are interrelated and depend on the prices that consumers and firms face and on government actions. Market prices affect the decisions of individual consumers and firms, and the interaction of the decisions of individual consumers and firms determines market prices. The organization of the market, especially the number of firms in the market and the information consumers and firms have, plays an important role in determining whether the market price is equal to or higher than marginal cost.
2. **Models.** Models based on economic theories are used to predict the future or to answer questions about how some change, such as a tax increase, will affect various sectors of the economy. A good theory is simple to use and makes clear, testable predictions that are not

refuted by evidence. Most microeconomic models are based on maximizing behavior. Economists use models to construct *positive* hypotheses concerning how a cause leads to an effect. These positive questions can be tested. In contrast, *normative* statements, which are value judgments, cannot be tested.

3. **Uses of Microeconomic Models.** Individuals, governments, and firms use microeconomic models and predictions to make decisions. For example, to maximize its profits, a firm needs to know consumers' decision-making criteria, the trade-offs between various ways of producing and marketing its product, government regulations, and other factors. For large companies, beliefs about how a firm's rivals will react to its actions play a critical role in how it forms its business strategies.

Supply and Demand

2

Talk is cheap because supply exceeds demand.

Challenge

Quantities and Prices of Genetically Modified Foods

Countries around the globe are debating whether to permit firms to grow or sell genetically modified (GM) foods, which have their DNA altered through genetic engineering rather than through conventional breeding.[1] The introduction of GM techniques can affect both the quantity of a crop that farmers supply and whether consumers want to buy that crop.

At least 29 countries grow GM food crops, which are mostly herbicide-resistant varieties of corn (maize), soybean, and canola (oilseed rape). Developing countries grow more GM crops than developed countries, though the United States plants 40% of worldwide GM acreage. As of 2015, the largest GM-producing countries are (in order) the United States, Brazil, Argentina, India, Canada, and China. European farmers produce virtually none of the world's GM crops, growing them on only 0.1% of their cultivatable land.

According to some polls, 70% of consumers in Europe object to GM foods. Fears cause some consumers to refuse to buy a GM crop (or the entire crop if consumers cannot distinguish non-GM from GM products). Consumers in other countries, such as the United States, are less concerned about GM foods. However, even in the United States, a 2015 poll found that 57% of U.S. consumers believe that GM foods are generally unsafe to eat, whereas 88% of scientists believe they are generally safe. The U.S. National Academy of Science reported in 2016 that they could find no evidence to support claims that genetically modified organisms are dangerous for either the environment or human health.

As of 2016, 65 nations require labeling of GM foods, including European Union countries, Japan, Australia, Brazil, Russia, China, and the United States. Consumers are unlikely to avoid GM crops if products are unlabeled.

Will the use of GM seeds lead to lower prices and more food sold? What happens to prices and quantities sold if many consumers refuse to buy GM crops? We will use the models in this chapter to answer these questions at the end of the chapter.

To analyze questions concerning the price and quantity responses to the introduction of new products or technologies, new government regulations or taxes, or other events, economists may use the *supply-and-demand model*. When asked, "What is the most important thing you know about economics?" a common reply is, "Supply equals demand." This statement is a shorthand description of one of the simplest yet most powerful models of economics. The supply-and-demand model describes how consumers and suppliers interact to determine the quantity and price of a good or

[1]Sources for Challenges, which appear at the beginning of chapters, and Applications, which appear throughout the chapters, are listed at the end of the book.