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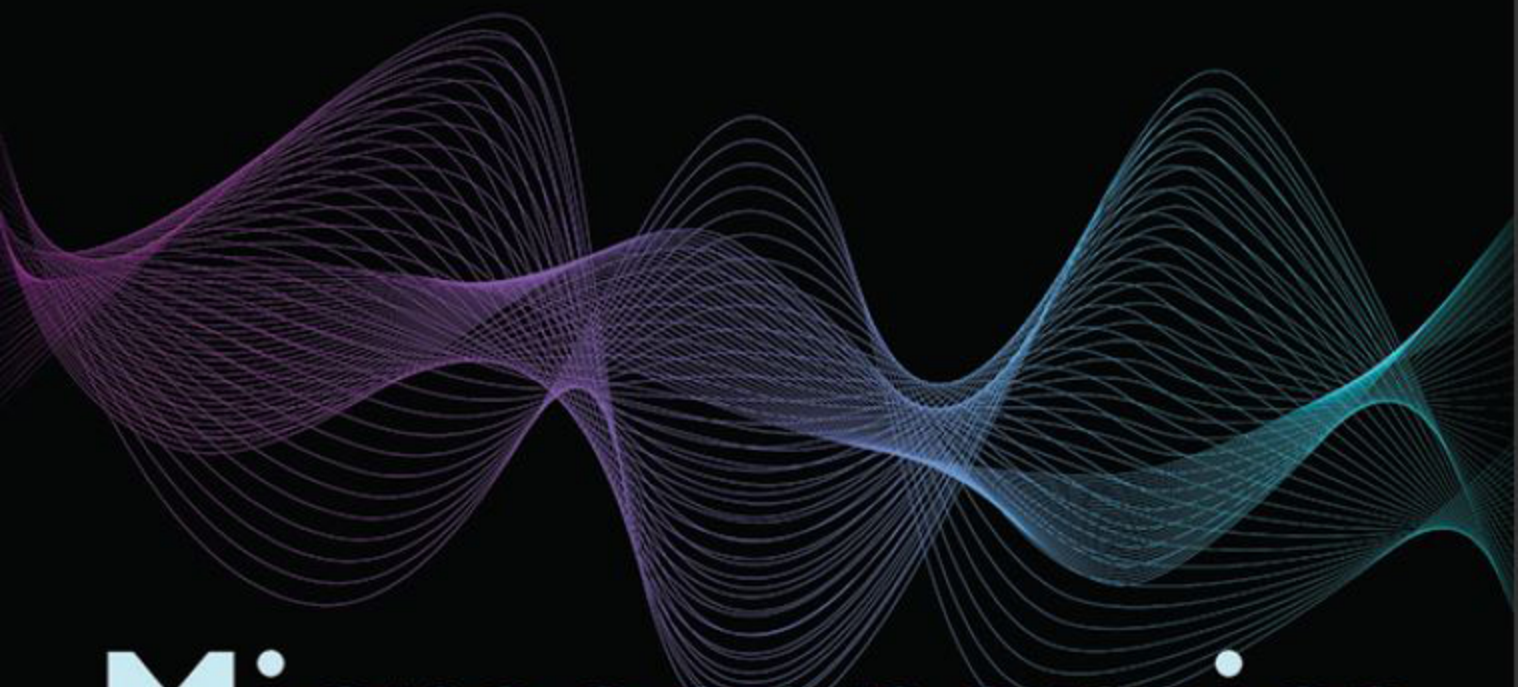

Microeconomics

Theory and Applications with Calculus

FIFTH EDITION

Jeffrey M. Perloff

MICROECONOMICS

THEORY AND APPLICATIONS WITH CALCULUS

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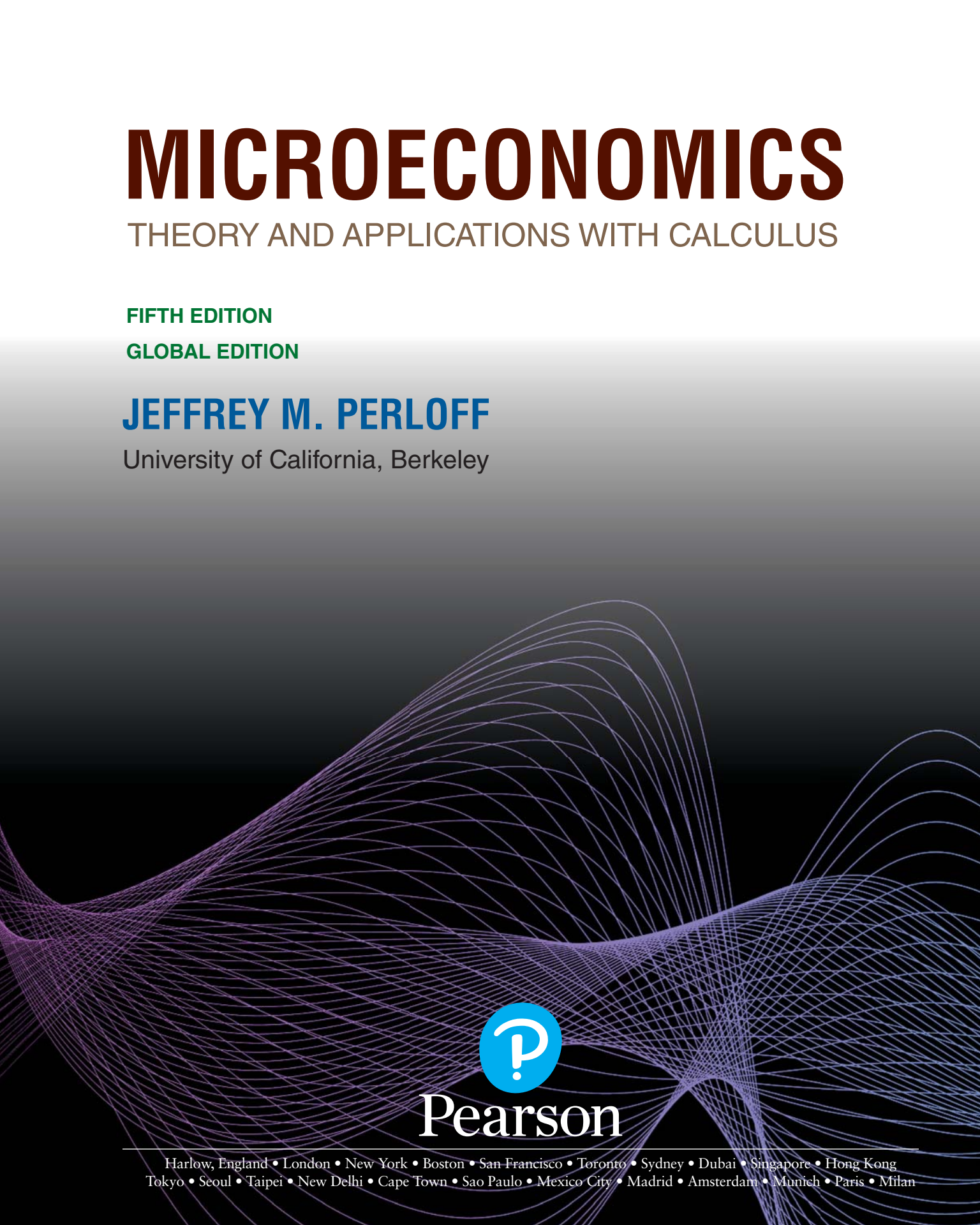

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Brief Contents

Contents

Preface

This book is a new type of intermediate microeconomics textbook. Previously, the choice was between books that use calculus to present formal theory dryly and with few, if any, applications to the real world and books that include applications but present theory using algebra and graphs only. This book uses calculus, algebra, and graphs to present microeconomic theory based on actual examples and then uses the theory to analyze real-world problems. My purpose is to show that economic theory has practical, problem-solving uses and is not an empty academic exercise.

This book shows how individuals, policymakers, and firms use microeconomic tools to analyze and resolve problems. For example, students learn that:

- individuals can draw on microeconomic theories when deciding whether to invest and whether to sign a contract that pegs prices to the government's measure of inflation;
- policymakers (and voters) can employ microeconomics to predict the impact of taxes, regulations, and other measures before they are enacted;
- lawyers and judges use microeconomics in antitrust, discrimination, and contract cases; and
- firms apply microeconomic principles to produce at least 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 the Massachusetts Institute of Technology; the University of Pennsylvania; 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.

Changes in the Fifth Edition

This edition is substantially revised:

- It added an extensive Appendix on basic calculus (which was available only online in the previous edition).
- It includes two new features: Common Confusions and Unintended Consequences. Common Confusions describe a widely held belief that economic theory or evidence rejects. Unintended Consequences describe how some policies and other actions have potent side-effects beyond the intended ones.
- All the chapters are moderately to substantially revised and updated, including the many examples embedded in the chapters, Solved Problems, end-of-chapter problems, and other features.

- Of this edition's 128 Applications, 81% are new (26%) or revised (55%). Sixty percent of the Applications are international. In addition, we've added 23 Applications to MyLab Economics, bringing the total number of additional Applications online to 238.
- Compared to the previous edition, this edition has 7 additional figures (215 total), 2 more photos (52), and 4 new cartoons (22), which I claim illustrate important economic concepts.

Revised Chapters

Some of the major changes in the presentation of theories in the chapters include:

Supply and Demand. Chapter 2 was generally rewritten and has a revised section on taxes.

Consumer Theory. The most important changes to Chapters 3–5 include a major revision to the consumer surplus section, an embedded example based on UberX, more details about federal marginal tax rates, and a new Solved Problem.

Production and Costs. Chapter 6 has a new discussion of kinked isoquants based on self-driving trucks and a revised discussion of efficiency and a revised Challenge Solution. Chapter 7 also has a revised discussion of efficiency and a revised Challenge Solution.

Competition. Chapters 8 and 9 have revised Challenge Solutions and a Solved Problem, a new Solved Problem, a revised section comparing tariffs to quotas, a revised discussion of efficiency and market failures including adding a discussion of allocative inefficiency. This edition now systematically defines deadweight loss as a positive number in this chapter and in subsequent chapters.

General Equilibrium and Economic Welfare. Chapter 10 has a revised Solved Problem.

Monopoly. Chapter 11 has many changes. The previous section on Network Externalities was replaced with a new section, Internet Monopolies: Network Externalities, Behavioral Economics, and Natural Monopoly, which emphasizes new economic challenges in internet industries. Subsections include new discussions of two-sided markets and disruptive technologies. It includes a revised and a new Solved Problem.

Pricing and Advertising. Chapter 12 has many new examples. The key price discrimination analysis now uses Tesla car sales in the United States and in Europe (based on actual data, as always). Its discussions on identifying groups, two-part pricing, the mathematical parts of the Challenge Solution, and several figures are revised. One of the Solved Problems is new.

Game Theory and Oligopoly. Chapter 13 on game theory has two new Solved Problems. It uses new examples to illustrate the theory. It has a new two-sided market section. Its section on Dynamic Games is revised. It has new material on limit pricing and double auctions. Chapter 14 has revised discussions of strategic trade and differentiated products and new figures and a table.

Factor Markets. Chapter 15 includes a new discussion on the frequency of compounding. The Challenge Solution is revised.

Uncertainty. Chapter 16 has a revised section on the risk premium and now formally defines certainty equivalence.

Externalities and Public Goods. Chapter 17 has a new Solved Problem. The section on public goods is completely revised including the figure.

Asymmetric Information. Chapter 18 has revisions to the sections on Products of Unknown Quality and Universal Coverage. It includes a new section on noisy monopoly.

Challenges, Solved Problems, and End-of-Chapter Exercises

The Solved Problems (which show students how to answer problems using a step-by-step approach) and Challenges (which combine an Application with a Solved Problem) are very popular with students, so this edition increases the number by 6 to 116. After Chapter 1, each chapter starts with a Challenge (a problem based on an Application) and ends with its solution. In addition, many of the Solved Problems are linked to Applications. Each Solved Problem has at least one similar end-of-chapter exercise, which allows students to demonstrate that they've mastered the concept in the Solved Problem.

This edition has 809 end-of-chapter exercises, which is over 8% more than in the last edition. Of the total, 12% are new or revised and updated. Every end-of-chapter exercise is available in MyLab Economics. Students can go to MyLab Economics to complete the exercise online, get tutorial help, and receive instant feedback.

How This Book Differs from Others

Microeconomics: Theory and Applications with Calculus differs from most other microeconomics texts in four main ways, all of which help professors teach and students learn. First, it uses a mixture of calculus, algebra, and graphs to define economic theory. Second, it integrates estimated, real-world examples throughout the exposition, in addition to offering extended Applications. Third, it places greater emphasis 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. Fourth, it employs a step-by-step approach that demonstrates how to use microeconomic theory to solve problems and analyze policy issues.

To improve student results, I recommend pairing the text content with MyLab Economics, which is the teaching and learning platform that empowers you to reach every student. By combining trusted author content with digital tools and a flexible platform, MyLab personalizes the learning experience and will help your students learn and retain key course concepts while developing skills that future employers are seeking in their candidates. MyLab Economics allows professors increased

flexibility in designing and teaching their courses. Learn more at www.pearson.com/mylab/economics.

Solving Teaching and Learning Challenges

In the features of the book and MyLab Economics, I show how to apply theory and analysis learned in the classroom to solving problems and understanding real-world market issues outside of class.

Using Calculus to Make Theory Clear to Students

Microeconomic theory is primarily the study of maximizing behavior. Calculus is particularly helpful in solving maximization problems, while graphs help illustrate how to maximize. This book combines calculus, algebra, graphs, and verbal arguments to make the theory as clear as possible.

Real-World Examples and Applications

To convince students that economics is practical and useful—not just a textbook exercise—this book presents theories using examples of real people and real firms based on actual market data rather than artificial examples. These real economic stories are integrated into the formal presentation of many economic theories, discussed in Applications, and analyzed in what-if policy discussions.

Integrated Real-World Examples. This book uses real-world examples throughout the narrative to illustrate many basic theories of microeconomics. Students learn the basic model of supply and demand using estimated supply-and-demand curves for corn and coffee. They analyze consumer choice by employing estimated indifference curves between live music and music tracks. They see estimates of the consumer welfare from UberX. They learn about production and cost functions using estimates from a wide variety of firms. Students see monopoly theory applied to a patented pharmaceutical, Botox. They use oligopoly theories to analyze the rivalry between United Airlines and American Airlines on the Chicago–Los Angeles route, and between Coke and Pepsi in the cola industry. They see Apple's monopoly pricing of iPads and learn about multimarket price discrimination through the use of data on how Tesla sets prices across countries.

Applications. The text includes many Applications at the end of sections that illustrate the versatility of microeconomic theory. The Applications focus on such diverse topics as:

- how 3D printing affects firms' decisions about scale and its flexibility over time and is undermining movie studios;
- the amount by which recipients value Christmas presents relative to the cost to gift givers;
- whether buying flight insurance makes sense;
- whether going to college pays.

APPLICATION

Welfare Effects of Delaying 5G Technology

The 5G cellular technology, the planned successor to 4G networks, promises faster internet speeds and the capacity to support more devices, both of which result in increased working productivity, improved social interactions, and better management of homes and businesses. By 2034, 5G could generate $2.2 trillion in GDP and $588 billion in tax revenue worldwide. South Korea, China, and the United States are the current world leaders in building and deploying this technology.

The rollout of 5G, however, has also caused many controversies. It requires installation of many more antennas in urban areas which raises health concerns. Switzerland, for example, has placed an indefinite moratorium on the use of 5G technology. The United Kingdom, on the other hand, like some other countries, has decided to ban Huawei, the leading global provider of ICT technology and smart devices, from its 5G According to a report commissioned by Huawei, this move would cause a welfare loss of over $23.5 billion in productivity benefits.

What-If Policy Analysis. This book uses economic models to probe the likely outcomes of changes in public policies. Students learn how to conduct what-if analyses of policies such as taxes, subsidies, barriers to entry, price floors and ceilings, quotas and tariffs, zoning, pollution controls, and licensing laws. The text analyzes the effects of taxes on virtually every type of market. The book also reveals the limits of economic theory for policy analysis. For example, to illustrate why attention to actual institutions is important, the text uses three different models to show how the effects of minimum wages vary across types of markets and institutions. Similarly, the text illustrates that a minimum wage law that is harmful in a competitive market may be desirable in certain noncompetitive markets.

Modern Theories

The first half of the book (Chapters 2–10) examines competitive markets and shows that competition has very desirable properties. The rest of the book (Chapters 11–19) concentrates on imperfectly competitive markets—in which firms have market power (the ability to profitably set price above the unit cost of production), firms and consumers are uncertain about the future and have limited information, a market has an externality, or a market fails to provide a public good. This book goes beyond basic microeconomic theory and looks at theories and applications from many important contemporary fields of economics. It extensively covers problems from resource economics, labor economics, international trade, public finance, and industrial organization. The book uses behavioral economics to discuss consumer choice, bandwagon effects on monopoly pricing over time, and the importance of time-varying discounting in explaining procrastination and in avoiding environmental disasters. This book differs from other microeconomics texts by using game theory throughout the second half rather than isolating the topic in a single chapter. The book introduces game theory in Chapter 13, analyzing both static games (such as the prisoners' dilemma) and multi-period games (such as collusion and preventing entry). Special attention is paid to auction strategies. Chapters 14, 16, 17, 18, and 19 employ game theory to analyze oligopoly behavior and many other topics. Unlike most texts,

this book covers pure and mixed strategies and analyzes both normal-form and extensive-form games. The last two chapters draw from modern contract theory to extensively analyze adverse selection and moral hazard, unlike other texts that mention these topics only in passing, if at all. The text covers lemons markets, signaling, shirking prevention, and revealing information (including through contract choice).

Step-by-Step Problem Solving

Many instructors report that their biggest challenge in teaching microeconomics is helping students learn to solve new problems. This book is based on the belief that the best way to teach this important skill is to demonstrate problem solving repeatedly and then to give students exercises to do on their own. Each chapter (after Chapter 1) provides several Solved Problems that show students how to answer qualitative and quantitative problems using a step-by-step approach. Rather than empty arithmetic exercises demanding no more of students than employing algebra or a memorized mathematical formula, the Solved Problems focus on important economic issues such as analyzing government policies and determining firms' optimal strategies.

One Solved Problem uses game theory to examine why Intel and AMD use different advertising strategies in the central processing unit (CPU) market. Another shows how a monopolistically competitive airline equilibrium would change if fixed costs (such as fees for landing slots) rise. Others examine why firms charge different prices at factory stores than elsewhere and when markets for lemons exist, among many other topics.

The Solved Problems illustrate how to approach the formal end-of-chapter exercises. Students can solve some of the exercises using graphs or verbal arguments, while others require math.

SOLVED PROBLEM 18.1

MyLab Economics Solved Problem

Suppose that everyone in our used-car example is risk neutral; potential car buyers value lemons at \$4,000 and good used cars at \$8,000; the reservation price of lemon owners is \$3,000; and the reservation price of owners of high-quality used cars is \$7,000. The share of current owners who have lemons is θ. (In our previous example, the share was $\theta = \frac{1}{2} = 1{,}000/[1{,}000 + 1{,}000]$). For what values of θ do all the potential sellers sell their used cars? Describe the equilibrium.

Answer

1. *Determine how much buyers are willing to pay if all cars are sold.* Because buyers are risk neutral, if they believe that the probability of getting a lemon is θ, the most they are willing to pay for a car of unknown quality is

$$p = [\$8{,}000 \times (1 - \theta)] + (\$4{,}000 \times \theta) = \$8{,}000 - (\$4{,}000 \times \theta). \quad (18.1)$$

For example, $p = \$6{,}000$ if $\theta = \frac{1}{2}$ and $p = \$7{,}000$ if $\theta = \frac{1}{4}$.

2. *Solve for the values of θ such that all the cars are sold, and describe the equilibrium.* All owners will sell if the market price equals or exceeds their reservation price, \$7,000. Using Equation 18.1, we know that the market (equilibrium) price is \$7,000 or more if a quarter or fewer of the used cars are lemons, $\theta \leq \frac{1}{4}$. Thus, for $\theta \leq \frac{1}{4}$, all the cars are sold at the price given in Equation 18.1.