

# CONTENTS

## Preface

xix

## 1 The Market

Constructing a Model 1 Optimization and Equilibrium 3 The Demand Curve 3 The Supply Curve 5 Market Equilibrium 7 Comparative Statics 9 Other Ways to Allocate Apartments 11 *The Discriminating Monopolist* • *The Ordinary Monopolist* • *Rent Control Which Way Is Best?* 14 Pareto Efficiency 15 Comparing Ways to Allocate Apartments 16 Equilibrium in the Long Run 17 Summary 18 Review Questions 19

## 2 Budget Constraint

The Budget Constraint 20 Two Goods Are Often Enough 21 Properties of the Budget Set 22 How the Budget Line Changes 24 The Numeraire 26 Taxes, Subsidies, and Rationing 26 *Example: The Food Stamp Program* Budget Line Changes 31 Summary 31 Review Questions 32

### 3 Preferences

Consumer Preferences **34** Assumptions about Preferences **35** Indifference Curves **36** Examples of Preferences **37** *Perfect Substitutes* • *Perfect Complements* • *Bads* • *Neutrals* • *Satiation* • *Discrete Goods* Well-Behaved Preferences **44** The Marginal Rate of Substitution **48** Other Interpretations of the MRS **50** Behavior of the MRS **51** Summary **52** Review Questions **52**

### 4 Utility

Cardinal Utility **57** Constructing a Utility Function **58** Some Examples of Utility Functions **59** *Example: Indifference Curves from Utility* • *Perfect Substitutes* • *Perfect Complements* • *Quasilinear Preferences* • *Cobb-Douglas Preferences* Marginal Utility **65** Marginal Utility and MRS **66** Utility for Commuting **67** Summary **69** Review Questions **70** Appendix **70** *Example: Cobb-Douglas Preferences*

### 5 Choice

Optimal Choice **73** Consumer Demand **78** Some Examples **78** *Perfect Substitutes* • *Perfect Complements* • *Neutrals and Bads* • *Discrete Goods* • *Concave Preferences* • *Cobb-Douglas Preferences* Estimating Utility Functions **83** Implications of the MRS Condition **85** Choosing Taxes **87** Summary **89** Review Questions **89** Appendix **90** *Example: Cobb-Douglas Demand Functions*

### 6 Demand

Normal and Inferior Goods **96** Income Offer Curves and Engel Curves **97** Some Examples **99** *Perfect Substitutes* • *Perfect Complements* • *Cobb-Douglas Preferences* • *Homothetic Preferences* • *Quasilinear Preferences* Ordinary Goods and Giffen Goods **104** The Price Offer Curve and the Demand Curve **106** Some Examples **107** *Perfect Substitutes* • *Perfect Complements* • *A Discrete Good* Substitutes and Complements **111** The Inverse Demand Function **112** Summary **114** Review Questions **115** Appendix **115**

## 7 Revealed Preference

The Idea of Revealed Preference **119** From Revealed Preference to Preference **120** Recovering Preferences **122** The Weak Axiom of Revealed Preference **124** Checking WARP **125** The Strong Axiom of Revealed Preference **128** How to Check SARP **129** Index Numbers **130** Price Indices **132** *Example: Indexing Social Security Payments* Summary **135** Review Questions **135**

## 8 Slutsky Equation

The Substitution Effect **137** *Example: Calculating the Substitution Effect* The Income Effect **141** *Example: Calculating the Income Effect* Sign of the Substitution Effect **142** The Total Change in Demand **143** Rates of Change **144** The Law of Demand **147** Examples of Income and Substitution Effects **147** *Example: Rebating a Tax* • *Example: Voluntary Real Time Pricing* Another Substitution Effect **153** Compensated Demand Curves **155** Summary **156** Review Questions **157** Appendix **157** *Example: Rebating a Small Tax*

## 9 Buying and Selling

Net and Gross Demands **160** The Budget Constraint **161** Changing the Endowment **163** Price Changes **164** Offer Curves and Demand Curves **167** The Slutsky Equation Revisited **168** Use of the Slutsky Equation **172** *Example: Calculating the Endowment Income Effect* Labor Supply **173** *The Budget Constraint* Comparative Statics of Labor Supply **174** *Example: Overtime and the Supply of Labor* Summary **178** Review Questions **179** Appendix **179**

## 10 Intertemporal Choice

The Budget Constraint **182** Preferences for Consumption **185** Comparative Statics **186** The Slutsky Equation and Intertemporal Choice **187** Inflation **189** Present Value: A Closer Look **191** Analyzing Present Value for Several Periods **193** Use of Present Value **194** *Example: Valuing a Stream of Payments* • *Example: The True Cost of a Credit Card* Bonds **197** *Example: Installment Loans* Taxes **199** *Example: Scholarships and Savings* Choice of the Interest Rate **200** Summary **201** Review Questions **201**

## 11 Asset Markets

Rates of Return **202** Arbitrage and Present Value **204** Adjustments for Differences among Assets **204** Assets with Consumption Returns **205** Taxation of Asset Returns **206** Applications **207** *Depletable Resources* • *When to Cut a Forest* • *Example: Gasoline Prices during the Gulf War* Financial Institutions **211** Summary **212** Review Questions **213** Appendix **213**

## 12 Uncertainty

Contingent Consumption **215** *Example: Catastrophe Bonds* Utility Functions and Probabilities **220** *Example: Some Examples of Utility Functions* Expected Utility **221** Why Expected Utility Is Reasonable **222** Risk Aversion **224** *Example: The Demand for Insurance* Diversification **228** Risk Spreading **228** Role of the Stock Market **229** Summary **230** Review Questions **230** Appendix **231** *Example: The Effect of Taxation on Investment in Risky Assets*

## 13 Risky Assets

Mean-Variance Utility **234** Measuring Risk **239** Equilibrium in a Market for Risky Assets **241** How Returns Adjust **242** *Example: Ranking Mutual Funds* Summary **246** Review Questions **246**

## 14 Consumer's Surplus

Demand for a Discrete Good **248** Constructing Utility from Demand **249** Other Interpretations of Consumer's Surplus **250** From Consumer's Surplus to Consumers' Surplus **251** Approximating a Continuous Demand **251** Quasilinear Utility **251** Interpreting the Change in Consumer's Surplus **252** *Example: The Change in Consumer's Surplus* Compensating and Equivalent Variation **254** *Example: Compensating and Equivalent Variations* • *Example: Compensating and Equivalent Variation for Quasilinear Preferences* Producer's Surplus **258** Benefit-Cost Analysis **260** *Rationing* Calculating Gains and Losses **262** Summary **263** Review Questions **263** Appendix **264** *Example: A Few Demand Functions* • *Example: CV, EV, and Consumer's Surplus*

## 15 Market Demand

From Individual to Market Demand **266** The Inverse Demand Function **268** *Example: Adding Up "Linear" Demand Curves* Discrete Goods **269** The Extensive and the Intensive Margin **269** Elasticity **270** *Example: The Elasticity of a Linear Demand Curve* Elasticity and Demand **272** Elasticity and Revenue **273** *Example: Strikes and Profits* Constant Elasticity Demands **276** Elasticity and Marginal Revenue **277** *Example: Setting a Price* Marginal Revenue Curves **279** Income Elasticity **280** Summary **281** Review Questions **282** Appendix **283** *Example: The Laffer Curve* • *Example: Another Expression for Elasticity*

## 16 Equilibrium

Supply **289** Market Equilibrium **289** Two Special Cases **290** Inverse Demand and Supply Curves **291** *Example: Equilibrium with Linear Curves* Comparative Statics **293** *Example: Shifting Both Curves* Taxes **294** *Example: Taxation with Linear Demand and Supply* Passing Along a Tax **298** The Deadweight Loss of a Tax **300** *Example: The Market for Loans* • *Example: Food Subsidies* Pareto Efficiency **306** *Example: Waiting in Line* Summary **308** Review Questions **309**

## 17 Auctions

Classification of Auctions **311**    *Bidding Rules* Auction Design **312**  
 Other Auction Forms **315**    Problems with Auctions **316**    The Winner's  
 Curse **317**    Summary **318**    Review Questions **318**

## 18 Technology

Inputs and Outputs **319**    Describing Technological Constraints **320**  
 Examples of Technology **321**    *Fixed Proportions* • *Perfect Substitutes*  
 • *Cobb-Douglas* Properties of Technology **323**    The Marginal Product  
**325**    The Technical Rate of Substitution **325**    Diminishing Marginal  
 Product **326**    Diminishing Technical Rate of Substitution **326**    The  
 Long Run and the Short Run **327**    Returns to Scale **327**    Summary  
**329**    Review Questions **330**

## 19 Profit Maximization

Profits **331**    The Organization of Firms **333**    Profits and Stock Market  
 Value **333**    Fixed and Variable Factors **335**    Short-Run Profit Max-  
 imization **335**    Comparative Statics **337**    Profit Maximization in the  
 Long Run **338**    Inverse Factor Demand Curves **339**    Profit Maximiza-  
 tion and Returns to Scale **340**    Revealed Profitability **341**    *Exam-  
 ple: How Do Farmers React to Price Supports?* Cost Minimization **345**  
 Summary **345**    Review Questions **346**    Appendix **347**

## 20 Cost Minimization

Cost Minimization **349**    *Example: Minimizing Costs for Specific Tech-  
 nologies* Revealed Cost Minimization **353**    Returns to Scale and the  
 Cost Function **354**    Long-Run and Short-Run Costs **356**    Fixed and  
 Quasi-Fixed Costs **358**    Sunk Costs **358**    Summary **359**    Review  
 Questions **359**    Appendix **360**

## 21 Cost Curves

Average Costs **363** Marginal Costs **365** Marginal Costs and Variable Costs **367** *Example: Specific Cost Curves* • *Example: Marginal Cost Curves for Two Plants* Long-Run Costs **371** Discrete Levels of Plant Size **373** Long-Run Marginal Costs **375** Summary **376** Review Questions **377** Appendix **377**

## 22 Firm Supply

Market Environments **379** Pure Competition **380** The Supply Decision of a Competitive Firm **382** An Exception **384** Another Exception **385** *Example: Pricing Operating Systems* The Inverse Supply Function **387** Profits and Producer's Surplus **387** *Example: The Supply Curve for a Specific Cost Function* The Long-Run Supply Curve of a Firm **391** Long-Run Constant Average Costs **393** Summary **394** Review Questions **395** Appendix **395**

## 23 Industry Supply

Short-Run Industry Supply **397** Industry Equilibrium in the Short Run **398** Industry Equilibrium in the Long Run **399** The Long-Run Supply Curve **401** *Example: Taxation in the Long Run and in the Short Run* The Meaning of Zero Profits **405** Fixed Factors and Economic Rent **406** *Example: Taxi Licenses in New York City* Economic Rent **408** Rental Rates and Prices **410** *Example: Liquor Licenses* The Politics of Rent **411** *Example: Farming the Government* Energy Policy **413** *Two-Tiered Oil Pricing* • *Price Controls* • *The Entitlement Program* Summary **417** Review Questions **418**

## 24 Monopoly

Maximizing Profits **420** Linear Demand Curve and Monopoly **421**  
 Markup Pricing **423** *Example: The Impact of Taxes on a Monopolist*  
 Inefficiency of Monopoly **425** Deadweight Loss of Monopoly **427**  
*Example: The Optimal Life of a Patent* Natural Monopoly **430** What  
 Causes Monopolies? **432** *Example: Diamonds Are Forever* • *Example: Pooling in Auction Markets*  
 Summary **435** Review Questions **436**  
 Appendix **437**

## 25 Monopoly Behavior

Price Discrimination **439** First-Degree Price Discrimination **439** Second-Degree Price Discrimination **441** *Example: Price Discrimination in Airfares*  
 Third-Degree Price Discrimination **445** *Example: Linear Demand Curves* • *Example: Calculating Optimal Price Discrimination*  
 • *Example: Price Discrimination in Academic Journals* Bundling **449**  
*Example: Software Suites* Two-Part Tariffs **451** Monopolistic Competition **453**  
 A Location Model of Product Differentiation **456** Product Differentiation **458**  
 More Vendors **458** Summary **459** Review Questions **460**

## 26 Factor Markets

Monopoly in the Output Market **461** Monopsony **464** *Example: The Minimum Wage*  
 Upstream and Downstream Monopolies **468** Summary **470**  
 Review Questions **471** Appendix **471**



## 27 Oligopoly

Choosing a Strategy **474** Quantity Leadership **474** *The Follower's Problem* • *The Leader's Problem* Price Leadership **480** Comparing Price Leadership and Quantity Leadership **482** Simultaneous Quantity Setting **482** An Example of Cournot Equilibrium **484** Adjustment to Equilibrium **486** Many Firms in Cournot Equilibrium **486** Simultaneous Price Setting **487** Collusion **488** Punishment Strategies **491** *Example: Price Matching and Competition* • *Example: Voluntary Export Restraints* Comparison of the Solutions **494** Summary **495** Review Questions **496**

## 28 Game Theory

The Payoff Matrix of a Game **497** Nash Equilibrium **499** Mixed Strategies **500** The Prisoner's Dilemma **501** Repeated Games **503** Enforcing a Cartel **505** *Example: Tit for Tat in Airline Pricing* Sequential Games **506** A Game of Entry Deterrence **509** Summary **510** Review Questions **511**

## 29 Game Applications

Best Response Curves **512** Mixed Strategies **514** Games of Coordination **516** *Battle of the Sexes* • *Prisoner's Dilemma* • *Assurance Games* • *Chicken* • *How to Coordinate* Games of Competition **520** Games of Coexistence **525** Games of Commitment **527** *The Frog and the Scorpion* • *The Kindly Kidnapper* • *When Strength Is Weakness* • *Savings and Social Security* • *Hold Up* Bargaining **535** *The Ultimatum Game* Summary **538** Review Questions **539**

## 30 Exchange

The Edgeworth Box **541** Trade **543** Pareto Efficient Allocations **544** Market Trade **546** The Algebra of Equilibrium **548** Walras' Law **550** Relative Prices **551** *Example: An Algebraic Example of Equilibrium* The Existence of Equilibrium **553** Equilibrium and Efficiency **554** The Algebra of Efficiency **555** *Example: Monopoly in the Edgeworth Box* Efficiency and Equilibrium **558** Implications of the First Welfare Theorem **560** Implications of the Second Welfare Theorem **562** Summary **564** Review Questions **565** Appendix **565**

## 31 Production

The Robinson Crusoe Economy **567** Crusoe, Inc. **569** The Firm **570** Robinson's Problem **571** Putting Them Together **571** Different Technologies **573** Production and the First Welfare Theorem **575** Production and the Second Welfare Theorem **576** Production Possibilities **576** Comparative Advantage **578** Pareto Efficiency **580** Castaways, Inc. **582** Robinson and Friday as Consumers **584** Decentralized Resource Allocation **585** Summary **586** Review Questions **586** Appendix **587**

## 32 Welfare

Aggregation of Preferences **590** Social Welfare Functions **592** Welfare Maximization **594** Individualistic Social Welfare Functions **596** Fair Allocations **597** Envy and Equity **598** Summary **600** Review Questions **600** Appendix **601**

## 33 Externalities

Smokers and Nonsmokers **603** Quasilinear Preferences and the Coase Theorem **606** Production Externalities **608** *Example: Pollution Vouchers* Interpretation of the Conditions **613** Market Signals **616** The Tragedy of the Commons **616** *Example: Overfishing* Automobile Pollution **620** Summary **621** Review Questions **622**

## 34 Information Technology

Systems Competition **624** The Problem of Complements **624** *Relationships among Complementors* Lock-In **628** *A Model of Competition with Switching Costs* Network Externalities **631** Markets with Network Externalities **631** Market Dynamics **633** *Example: Network Externalities in Computer Software* Implications of Network Externalities **637** Rights Management **637** *Example: Video Rental* Sharing Intellectual Property **639** Summary **641** Review Questions **642**

## 35 Public Goods

When to Provide a Public Good? **644** Private Provision of the Public Good **648** Free Riding **648** Different Levels of the Public Good **650** Quasilinear Preferences and Public Goods **652** *Example: Pollution Revisited* The Free Rider Problem **654** Comparison to Private Goods **656** Voting **657** *Example: Agenda Manipulation* Demand Revelation **660** *Example: An Example of the Clarke Tax* Problems with the Clarke Tax **664** Summary **665** Review Questions **665** Appendix **666**

## 36 Asymmetric Information

The Market for Lemons **668** Quality Choice **669** *Choosing the Quality* • Adverse Selection **671** Moral Hazard **673** Moral Hazard and Adverse Selection **674** Signaling **675** *Example: The Sheepskin Effect* Incentives **679** *Example: Voting Rights in the Corporation* • *Example: Chinese Economic Reforms* Asymmetric Information **684** *Example: Monitoring Costs* • *Example: The Grameen Bank* Summary **687** Review Questions **688**

## Mathematical Appendix

Functions **A1**   Graphs **A2**   Properties of Functions **A2**   Inverse  
Functions **A3**   Equations and Identities **A3**   Linear Functions **A4**  
Changes and Rates of Change **A4**   Slopes and Intercepts **A5**   Absolute  
Values and Logarithms **A6**   Derivatives **A6**   Second Derivatives **A7**  
The Product Rule and the Chain Rule **A8**   Partial Derivatives **A8**  
Optimization **A9**   Constrained Optimization **A10**

**Answers** **A11**

**Index** **A31**