Brief Contents

Preface xix PART ONE Introduction 1 **CHAPTER 1** Economic Models 3 **CHAPTER 2** Mathematics for Microeconomics 21 PART TWO Choice and Demand 83 CHAPTER 3 Preferences and Utility 85 **CHAPTER 4** Utility Maximization and Choice 109 CHAPTER 5 Income and Substitution Effects 133 **CHAPTER 6** Demand Relationships among Goods 169 PAR THREE Uncertainty and Strategy 187 CHAPTER 7 Uncertainty 189 **CHAPTER 8** Game Theory 225 PART FOUR Production and Supply 271 CHAPTER 9 Production Functions 273 **CHAPTER 10** Cost Functions 299 **CHAPTER 11** Profit Maximization 333 PART FIVE **Competitive Markets** 363 **CHAPTER 12** The Partial Equilibrium Competitive Model 365 **CHAPTER 13** General Equilibrium and Welfare 409 PAR Market Power 447 SIX **CHAPTER 14** Monopoly 449 **CHAPTER 15** Imperfect Competition 477 PAR SEVEN Pricing in Input Markets 519 **CHAPTER 16** Labor Markets 521 **CHAPTER 17** Capital and Time 547 PAR[®] Market Failure 577 EIGHT **CHAPTER 18** Asymmetric Information 579 **CHAPTER 19** Externalities and Public Goods 619 Extensions 649 Brief Answers to Queries 697 Solutions to Odd-Numbered Problems 707 Glossary of Frequently Used Terms 719

Index 729

ix

Contents

PART

ONE

Introduction

CHAPTER 1	
Economic Models	
Theoretical Models 3	
Verification of Economic Models 4	
General Features of Economic Models 5	
Development of the Economic Theory of Value 9	
Modern Developments 17	
Summary 18	
Suggestions for Further Reading 19	

CHAPTER 2

Mathematics for Microeconomics......21

Maximization of a Function of One Variable 21 Functions of Several Variables 26 Maximization of Functions of Several Variables 33 The Envelope Theorem 35 Constrained Maximization 39 Envelope Theorem in Constrained Maximization Problems 45 Inequality Constraints 46 Second-Order Conditions and Curvature 48 Homogeneous Functions 55 Integration 58 Dynamic Optimization 63 Mathematical Statistics 67 Summary 76 Problems 77 Suggestions for Further Reading 82

Two Choice and Demand

CHAPTER 3

Trades and Substitution 88 The Mathematics of Indifference Curves 95 98 **Utility Functions for Specific Preferences** The Many-Good Case 102 Summary 102 Problems 103 Suggestions for Further Reading 106 CHAPTER 4 Utility Maximization and Choice......109 An Initial Survey 110 The Two-Good Case: A Graphical Analysis 111 The n-Good Case 114 Indirect Utility Function 120 The Lump Sum Principle 121 Expenditure Minimization 123 Properties of Expenditure Functions 126 Summary 128 Problems 128 Suggestions for Further Reading 132 CHAPTER 5 **Demand Functions** 133 Changes in Income 135 Changes in a Good's Price 137 The Individual's Demand Curve 140 Compensated (Hicksian) Demand Curves and Functions 143 A Mathematical Development of Response to Price Changes 148 **Demand Elasticities** 151 Consumer Surplus 157 Revealed Preference and the Substitution Effect 162 Summary 164 Problems 165 Suggestions for Further Reading 168 CHAPTER 6 Demand Relationships among Goods......169 The Two-Good Case 169 Substitutes and Complements 171 Net (Hicksian) Substitutes and Complements 173 Substitutability with Many Goods 175 Composite Commodities 175

Home Production, Attributes of Goods, and Implicit Prices 179 Summary 182 Problems 182 Suggestions for Further Reading 185

PART Uncertainty and Strategy THREE

CHAPTER 7

Mathematical Statistics 189 Fair Gambles and the Expected Utility Hypothesis 190 Expected Utility 191 The von Neumann–Morgenstern Theorem 192 Risk Aversion 194 Measuring Risk Aversion 197 Methods for Reducing Uncertainty and Risk 202 Insurance 202 Diversification 203 Flexibility 204 Information 211 The State-Preference Approach to Choice Under Uncertainty 212 Asymmetry of Information 218 Summary 218 Problems 219 Suggestions for Further Reading 222

CHAPTER 8

Basic Concepts 225 Prisoners' Dilemma 226 228 Nash Equilibrium Mixed Strategies 234 239 Existence of Equilibrium Continuum of Actions 239 Sequential Games 242 248 Repeated Games Incomplete Information 251 252 Simultaneous Bayesian Games Signaling Games 256 Experimental Games 262 Evolutionary Games and Learning 264 Summary 264 Problems 265 Suggestions for Further Reading 269

FOUR Production and Supply

CHAPTER 9
Marginal Productivity 273
Isoquant Mans and the Bate of Technical Substitution 276
Beturns to Scale 280
The Elasticity of Substitution 283
Four Simple Production Functions 286
Technical Progress 290
Summary 294
Problems 295
Suggestions for Further Reading 298
CHAPTER 10
Cost Functions
Definitions of Costs 299
Cost-Minimizing Input Choices 302
Cost Functions 307
Cost Functions and Shifts in Cost Curves 311
Shephard's Lemma and the Elasticity of Substitution 321
Short-Run, Long-Run Distinction 321
Summary 328
Problems 329
Suggestions for Further Reading 332
CHAPTER 11
Profit Maximization
The Nature and Behavior of Firms 333
Profit Maximization 335
Marginal Revenue 337
Short-Run Supply by a Price-Taking Firm 342
Profit Functions 345
Profit Maximization and Input Demand 351
Summary 357
Problems 358 Supportions for Further Reading 262
Suggestions for Further neading 302
Competitive Markets

CHAPTER 12

PART FIVE

Short-Run Price Determination 371 Shifts in Supply and Demand Curves: A Graphical Analysis 375 Mathematical Model of Market Equilibrium 378 Long-Run Analysis 381 Long-Run Equilibrium: Constant Cost Case 382 Shape of the Long-Run Supply Curve 384 Long-Run Elasticity of Supply 387 Comparative Statics Analysis of Long-Run Equilibrium 387 Producer Surplus in the Long Run 391 Economic Efficiency and Welfare Analysis 394 Price Controls and Shortages 397 Tax Incidence Analysis 398 Summary 403 Problems 403 Suggestions for Further Reading 407

CHAPTER 13

Perfectly Competitive Price System 409 A Graphical Model of General Equilibrium with Two Goods 410 Comparative Statics Analysis 419 General Equilibrium Modeling and Factor Prices 421 A Mathematical Model of Exchange 423 A Mathematical Model of Production and Exchange 434 Computable General Equilibrium Models 437 Summary 441 Problems 442 Suggestions for Further Reading 446

Market Power

CHAPTER 14

 Monopoly
 449

 Barriers to Entry
 449

 Profit Maximization and Output Choice
 451

 Monopoly and Resource Allocation
 455

 Monopoly, Product Quality, and Durability
 458

 Price Discrimination
 461

 Second-Degree Price Discrimination through Price Schedules
 465

 Regulation of Monopoly
 467

 Dynamic Views of Monopoly
 471

 Summary
 471

 Problems
 472

 Suggestions for Further Reading
 475

CHAPTER 15

Short-Run Decisions: Pricing and Output 477 479 Bertrand Model Cournot Model 480 Capacity Constraints 486 487 Product Differentiation Tacit Collusion 493 Longer-Run Decisions: Investment, Entry, and Exit 497 Strategic Entry Deterrence 503 Signaling 505 How Many Firms Enter? 508 Innovation 512 Summarv 514 Problems 515 Suggestions for Further Reading 518

SEVEN Pricing in Input Markets

CHAPTER 16 Labor Markets Allocation of Time 521 A Mathematical Analysis of Labor Supply 524 Market Supply Curve for Labor 528 Labor Market Equilibrium 529 Wage Variation 531 Monopsony in the Labor Market 535 Labor Unions 538 Summary 541 Problems 541

545

CHAPTER 17

Suggestions for Further Reading

Capital and the Rate of Return 547 Determining the Rate of Return 549 556 The Firm's Demand for Capital Present Discounted Value Approach to Investment Decisions 558 Natural Resource Pricing 563 Summary 566 Problems 566 Suggestions for Further Reading 570

APPENDIX The Mathematics of Co	mpound Interest.	 11
Present Discounted Value	571	
Continuous Time 573		

Market Failure EIGHT

CHAPTER 18 579
Asymmetric Information
Complex Contracts as a Response to Asymmetric Information 5/9
Principal-Agent Model 580
Hidden Actions 583
Owner-Manager Relationship 584
Moral Hazard in Insurance 588
Hidden Types 593
Nonlinear Pricing 594
Adverse Selection in Insurance 601
Market Signaling 608
Auctions 610
Summary 614
Problems 614
Suggestions for Further Reading 617
CHAPTER 15 Externalities and Public Goods
Defining Externalities 619
Demining Externations of the Inofficiency 621
Externatives and Anotative memory of the

Solutions to the Externality Problem 625 Attributes of Public Goods 628 Public Goods and Resource Allocation 630 Lindahl Pricing of Public Goods 634 Voting and Resource Allocation 637 A Simple Political Model 639 Voting Mechanisms 642 Summary 644 Problems 644 Suggestions for Further Reading 647

Extensions: Second-Order Conditions and Matrix Algebra 649 Extensions: Special Preferences 652 Extensions: Budget Shares 655 Extensions: Demand Concepts and the Evaluation of Price Indices 658 Extensions: Simplifying Demand and Two-Stage Budgeting 662 Extensions: The Portfolio Problem 664

Extensions: Existence of Nash Equilibrium 669 Extensions: Many-Input Production Functions 672 Extensions: The Translog Cost Function 675 Extensions: Boundaries of the Firm 677 Extensions: Demand Aggregation and Estimation 681 Extensions: Computable General Equilibrium Models 684 Extensions: Optimal Linear Two-Part Tariffs 686 Extensions: Strategic Substitutes and Complements 688 Extensions: Nonlinear Pricing with a Continuum of Types 692 Extensions: Pollution Abatement 695

Brief Answers to Queries	697
Solutions to Odd-Numbered Problems	707
Glossary of Frequently Used Terms	719
Index	729