THE ECONOMICS OF HEALTH AND HEALTH CARE

Sherman Folland

Professor of Economics, Oakland University

Allen C. Goodman

Professor of Economics, Wayne State University

Miron Stano

Professor of Economics and Management, Oakland University

Prentice Hall

Boston Columbus Indianapolis New York San Francisco Upper Saddle River Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

BRIEF CONTENTS

PART I Bas	ic Economics Tools 1
Chapt	er 1 Introduction 2
Chapt	
Chapt	er 3 Statistical Tools for Health Economics 48
Chapt	er 4 Economic Efficiency and Cost-Benefit Analysis 64
PART II Suj	oply and Demand 85
Chapt	er 5 Production of Health 86
Chapt	3
Chapt	·
Chapt	3
Chapt	er 9 Consumer Choice and Demand 167
PART III Infe	ormation and Insurance Markets 189
Chapt	er 10 Asymmetric Information and Agency 190
Chapt	er 11 The Organization of Health Insurance Markets 204
Chapt	e r 12 Managed Care 230
Chapt	er 13 Nonprofit Firms 258
PART IV Ke	Players in the Health Care Sector 279
Chapt	er 14 Hospitals and Long-Term Care 280
Chapt	e r 15 The Physician's Practice 299
Chapt	er 16 Health Care Labor Markets and Professional Training 317
Chapt	er 17 The Pharmaceutical Industry 342
PART V Soc	ial Insurance 365
Chapt	er 18 Equity, Efficiency, and Need 366
Chapt	er 19 Government Intervention in Health Care Markets 389
Chapt	er 20 Government Regulation: Principal Regulatory Mechanisms 406
Chapt	e r 21 Social Insurance 436
Chapt	er 22 Comparative Health Care Systems 467
Chapt	er 23 Health System Reform 493
PART VI Spe	ecial Topics 511
Chapt	er 24 The Health Economics of Bads 512
Chapt	er 25 Epidemiology and Economics: HIV/AIDS in Africa 530

CONTENTS

Preface xix

Chapter

Part I Basic Economics Tools 1

1	Introduction 2	
	What Is Health Economics? 3	
	The Relevance of Health Economics 4	
	The Size and Scope of the Health Economy 4	
	Health Care's Share of GDP in the United States 5	
	Health Care Spending in Other Countries 6	
	Importance of the Health Economy in Personal Spending 7	
	Importance of Labor and Capital in the Health Economy 7	
	Time—The Ultimate Resource 8	
	The Importance Attached to Economic Problems of Health Care Delivery	9
	Inflation 10	
	Access 10	
	Quality 10	
	The Economic Side to Other Health Issues 10	
	Economic Methods and Examples of Analysis 10	
	Features of Economic Analysis 11	
	Examples of Health Economics Analysis 11	
	Does Economics Apply to Health and Health Care? 12	
	An Example: Does Price Matter? 13	
	Is Health Care Different? 14	
	Presence and Extent of Uncertainty 14	
	Prominence of Insurance 14	
	Problems of Information 15	
	Large Role of Nonprofit Firms 15	
	Restrictions on Competition 15	
	Role of Equity and Need 16	
	Government Subsidies and Public Provision 16	
	Conclusions 16	
	Summary 17 • Discussion Questions 18 • Exercises 18	

Chapter 2 Microeconomic Tools for Health Economics 20

Scarcity and the Production Possibilities Frontier 21
Practice with Supply and Demand 24
The Demand Curve and Demand Shifters 24
The Supply Curve and Supply Shifters 25
Equilibrium 25
Comparative Statistics 26

	Linear Functions 27 Demand Functions 27 Derived Demand 29 Consumer Theory: Ideas Rebind the Demand Cupys 29
	Utility 29 Indifference Curves 30 Budget Constraints 31 Consumer Equilibrium 32 Individual and Market Demands 33 Elasticities 34 Production and Market Supply 35 The Production Function 36 Production Functions 37 Isocost Curves 39 Cost Minimization or Output Maximization 40 Marginal and Average Cost Curves 40 The Firm Supply Curve Under Perfect Competition 41 Monopoly and Other Market Structures 43 Welfare Losses 44
	Conclusions 46 • Discussion Questions 47 • Exercises 47
Chapter 3	Statistical Tools for Health Economics 48 Hypothesis Testing 49 Difference of Means 50 The Variance of a Distribution 50 Standard Error of the Mean 51 Hypothesis and Inferences 52 Regression Analysis 54 Ordinary Least Squares (OLS) Regressions 55 A Demand Regression 56 Eliminating Elasticities 57 Multiple Regression Analysis 58 Interpreting Regression Coefficients 58 Dummy Variables 60 Statistical Inference in the Sciences and Social Sciences 61 Conclusions 61 Summary 61 • Discussion Questions 62 • Exercises 62
Chapter 4	Economic Efficiency and Cost-Benefit Analysis 64 Economic Efficiency 64 Cost-Benefit Analysis: Background 67 Cost-Benefit Analysis: Basic Principles 67 Measuring Costs 68

Risk Equity Versus Equality of Marginal Costs per Life Saved Marginal Analysis in CBA 69 Discounting 70 Risk Adjustment and CBA Distributional Adjustments 72 Inflation 73 Valuing Human Life 73 Willingness to Pay and Willingness to Accept Contingent Valuation 73 How Valuable Is the Last Year of Life? 74 Cost-Benefit Analyses of Heart Care Treatment 75 Cost-Effectiveness Analysis Advantages of CEA 77 Cost-Utility Analysis, QALYs, and DALYs 77 An ACE Inhibitor Application of Cost-Effectiveness Analysis 78 **OALYs Revisited: Praise and Criticism** Are QALYs Consistent with Standard Welfare Economics? Extra-Welfarism 79 Sen's Capability Approach and QALYs Linearity Versus What People Think 79 The Ageism Critique of QALYs 80 Conclusions 80 Summary 81 • Discussion Questions 82 • Exercises

Part II Supply and Demand 85

Chapter 5 Production of Health 86

The Production Function of Health The Historical Role of Medicine and Health Care 89 The Rising Population and the Role of Medicine 89 What Caused the Mortality Rate Declines? Was It Medicine? What Lessons Are Learned from the Medical Historian? The Production of Health in the Modern Day Preliminary Issues 95 The Contribution of Health Care to Population Health: The Modern Era 95 Is Health Care Worth It? Issues of Race and Gender Prenatal Care 96 The World's Pharmacies 98 Morbidity Studies 98 How Does Health Care Affect Other Measures of Health? On the Importance of Lifestyle and Environment Cigarettes, Exercise, and a Good Night's Sleep 100

91

The Family as Producer of Health 100 Social Capital and Health **Environmental Pollution** 101 Income and Health 102 The Role of Schooling 102 Two Theories About the Role of Schooling Empirical Studies on the Role of Schooling in Health 103 Conclusions Summary 103 • Discussion Questions 104 • Exercises 104 **Chapter 6** The Production, Cost, and Technology of Health Care 105 Production and the Possibilities for Substitution 106 Substitution 106 What Degree of Substitution Is Possible? **Elasticity of Substitution** 108 Estimates for Hospital Care Costs in Theory and Practice 109 Deriving the Cost Function 109 Cost Minimization 111 Economies of Scale and Scope 112 Why Would Economies of Scale and Scope Be Important? **Empirical Cost-Function Studies** Difficulties Faced by All Hospital Cost Studies Modern Results 116 Summary: Empirical Cost Studies and Economies of Scale Technical and Allocative Inefficiency 116 Technical Inefficiency 116 Allocative Inefficiency 117 Frontier Analysis 118 The Uses of Hospital Efficiency Studies 119 For-profit Versus Nonprofit Hospitals 120 **Efficiency and Hospital Quality** 120 120 Performance-Based Budgeting 121 **Technological Changes and Costs** Technological Change: Cost Increasing or Decreasing? 121 Health Care Price Increases When Technological Change Occurs 122 Diffusion of New Health Care Technologies Who Adopts and Why? 123 Other Factors That May Affect Adoption Rates Diffusion of Technology and Managed Care

Summary 126 • Discussion Questions 126 • Exercises 127

Conclusions

125

Chapter 7	Demand for Health Capital 128
	The Demand for Health 128
	The Consumer as Health Producer 128
	Time Spent Producing Health 129
	Labor–Leisure Trade-Offs 130
	Trading Leisure for Wages 131
	Preferences Between Leisure and Income 131
	The Investment/Consumption Aspects of Health 132
	Production of Healthy Days 132
	Production of Health and Home Goods 133
	Investment over Time 134
*	The Cost of Capital 134
	The Demand for Health Capital 135
	Marginal Efficiency of Investment and Rate of Return 135
	The Decreasing <i>MEI</i> 135
	Changes in Equilibrium: Age, Wage, Education, and Uncertainty 136
	Age 136
	Wage Rate 137
	Education 137
	Uncertainty 138
ক্ত	Empirical Analyses Using Grossman's Model 139 .
	Conclusions 140
	Summary 141 • Discussion Questions 141 • Exercises 142
	Sammary 111 Discussion Questions 111 Exercises 112
Chapter 8	Demand and Supply of Health Insurance 143
-	What Is Insurance? 143
	Insurance Versus Social Insurance 144
	Insurance Terminology 144
	Risk and Insurance 145
	Expected Value 145
	Marginal Utility of Wealth and Risk Aversion 146
	Purchasing Insurance 147
	The Demand for Insurance 148
	How Much Insurance? 148
	Changes in Premiums 150
	Changes in Expected Loss 150
	Changes in Wealth 151
	The Supply of Insurance 151
	Competition and Normal Profits 151
	The Case of Moral Hazard 154
	Demand for Care and Moral Hazard 154
	Effects of Coinsurance and Deductibles 156
	Health Insurance and the Efficient Allocation of Resources 157
	The Impact of Coinsurance 157

The Demand for Insurance and the Price of Care The Welfare Loss of Excess Health Insurance The Income Transfer Effects of Insurance 162 Conclusions 164 Summary 165 • Discussion Questions 165 • Exercises 166 **Chapter 9** Consumer Choice and Demand 167 Applying the Standard Budget Constraint Model The Consumer's Equilibrium 169 Demand Shifters 170 Health Status and Demand Two Additional Demand Shifters—Time and Coinsurance The Role of Time 172 The Role of Coinsurance Issues in Measuring Health Care Demand Individual and Market Demand Functions 176 Measurement and Definitions Differences in the Study Populations Data Sources 177 Experimental and Nonexperimental Data **Empirical Measurements of Demand Elasticities** Price Elasticities Individual Income Elasticities **Income Elasticities Across Countries** 180 Insurance Elasticities 181 Impacts of Insurance on Aggregate Expenditures 183 Other Variables Affecting Demand Ethnicity and Gender 183 Urban Versus Rural

Education 184

Age, Health Status, and Uncertainty

Conclusions 185

> Summary 186 • Discussion Questions 187 • Exercises 187

Part III Information and Insurance Markets 189

Chapter 10 Asymmetric Information and Agency 190

Overview of Information Issues

Asymmetric Information 191

On the Extent of Information Problems in the Health Sector 191 Asymmetric Information in the Used-Car Market:

The Lemons Principle 193

Application of the Lemons Principle: Health Insurance 194

Inefficiencies of Adverse Selection

Experience Rating and Adverse Selection

The Agency Relationship 197 Agency and Health Care 197 Consumer Information, Prices, and Quality 197 **Consumer Information and Prices** Consumer Information and Quality Other Quality Indicators Conclusions 201 Summary 202 • Discussion Questions 203 • Exercises 203 **Chapter 11** The Organization of Health Insurance Markets 204 Loading Costs and the Behavior of Insurance Firms Impacts of Loading Costs 205 Insurance for Heart Attacks and Hangnails Loading Costs and the Uninsured Employer Provision of Health Insurance: Who Pays? 206 Spousal Coverage: Who Pays? How the Tax System Influences Health Insurance Demand Who Pays the Compensating Differentials?—Empirical Tests Other Impacts of Employer Provision of Health Insurance Employer-Based Health Insurance and Labor Supply 213 Health Insurance and Retirement Health Insurance and Mobility The Market for Insurance 215 The Market for Private Insurance 215 Insurance Practices 215 The Past 30 Years 217 The Uninsured: An Analytical Framework The Working Uninsured 222 The Impacts of Mandated Coverage 223 Technological Change, Higher Costs, and Inflation 225 The Cost-Increasing Bias Hypothesis Goddeeris's Model—Innovative Change over Time 225 Evidence on Technological Change and Inflation Conclusions 227 Summary 228 • Discussion Questions 228 • Exercises 229 Managed Care 230 What Is the Organizational Structure? 231

Chapter 12

What Are the Economic Characteristics? 232 The Emergence of Managed Care Plans **Employer-Sponsored Managed Care** 234 Medicaid Managed Care Plans 235 Managed Care Contracts with Physicians 235 Managed Care Contracts with Hospitals 236

Development and Growth of Managed Care—Why Did It Take So Long? 237 Federal Policy and the Growth of Managed Care 238 The Economics of Managed Care Modeling Managed Care 239 Modeling Individual HMOs 240 How Much Care? 240 What Types of Care? Framework for Prediction 242 Where Managed Care Differs from FFS—Dumping. "Creaming, and Skimping 242 Equilibrium and Adverse Selection in a Market with HMOs 243 How Does Managed Care Differ?—Empirical Results Methodological Issues—Selection Bias and Quality of Care 245 Comparative Utilization and Costs 245 The RAND Study—A Randomized Experiment 246 The Most Recent Evidence 247 1 Growth in Spending Competitive Effects 250 Theoretical Issues 250 Managed Care Competition in Hospital Markets Managed Care Competition in Insurance Markets Managed Care and Technological Change The Managed Care Backlash Conclusions 255 Summary 255 • Discussion Questions 256 • Exercises 257

Chapter 13 Nonprofit Firms 258

An Introduction to Nonprofits 258

Why Nonprofits Exist and Why They Are Prevalent in Health Care Nonprofits as Providers of Unmet Demands for Public Goods 259 The Public Good-Private Good Aspect of Donations Relevance to Health Care Markets Nonprofits as a Response to Contract Failure Applications of Contract Failure to Nursing Home Care 263 Relevance of Contract Failure to Hospitals and Other Firms Financial Matters and the Nonprofit 264 Summary of the Reasons for the Prevalence of Nonprofits 264 Models of Nonprofit Hospital Behavior 264 The Quality-Quantity Nonprofit Theory The Profit-Deviating Nonprofit Hospital 266 The Hospital as a Physicians' Cooperative 267 Maximizing Net Revenue per Physician 268

A Comparison of the Quantity-Quality and the Physicians' Cooperative Theories 268 The Evidence: Do Nonprofit Hospitals Differ from For-Profit Hospitals? 270 Summary of Models of Hospital Behavior What Causes Conversion of Nonprofits into For-Profits? The Relative Efficiency of Nonprofits Versus For-Profits Property Rights Theory and Its Application to Nonprofits 274 Are Nonprofit Health Care Firms Less Efficient?—Hospitals and Nursing Home Studies 275 Conclusions 277 Summary 277 • Discussion Questions 278 • Exercises 278 **Key Players in the Health Care Sector** 279 Background and Overview of Hospitals 280

Part IV

Chapter 14 Hospitals and Long-Term Care

History 281

Organization 282

Regulation and Accreditation 283

Hospital Utilization and Costs 283

Competition and Costs 284

Closures, Mergers, and Restructuring 288

Quality of Care 290

Nursing Homes 291

Background and Costs

Ouality of Care 291

Excess Demand 292

Financing Long-Term Care 294

Hospice, Home Health, and Informal Care

Conclusions 296

Summary 297 • Discussion Questions 297 • Exercises 298

Chapter 15 The Physician's Practice

A Benchmark Model of the Physician's Practice 300

Do Physicians Respond to Financial Incentives? 302

Physician Agency and Suppler-Induced Demand

Modeling Supplier-Induced Demand

The Target Income Hypothesis

The Benchmark Model as a Synthesis 305

The Parallel Between Inducement and Marketing 306

What Do the Data Say About Supplier-Induced Demand? 306

Physician Fees, Fee Tests, and Fee Controls

Diffusion of Information and Small Area Variations 308

Contributions to These Variations

The Physician Practice Style Hypothesis

	Multiple Regression Approaches 310 SAV and the Social Cost of Inappropriate Utilization 311 Other SAV Applications 312 Other Physician Issues and Policy Puzzles 312 Physician Pricing and Price Discrimination 312 Paying for Outcomes 314 Conclusions 314 Summary 315 • Discussion Questions 315 • Exercises 316
Chapter 16	Health Care Labor Markets and Professional Training 317 The Demand for and Supply of Health Care Labor 317 Production Functions and Isoquants 318 Marginal Productivity of Labor 319 Factor Substitution and Labor Demand 320 The Supply of Labor 320 Factor Productivity and Substitution Among Factors 322 Measurement of Physician Productivity 322 The Efficient Utilization of Physician Assistants: Substitution Among
1987	Inputs 322 Health Manpower Availability and the Meaning of Shortages 323 Availability of Physicians 324 Economic Definitions of Shortages of Health Professionals 325 The Role of Monopsony Power: Shortages of Registered Nurses 328
	Medical Education Issues and the Question of Control 330 Sources of Medical School Revenues 330 Capital Market Imperfections Justify Subsidies 330 Teaching Hospitals, Medical Schools, and Joint Production 331 Foreign Medical School Graduates 332 The Control of Medical Education 332 Control over Entry 333 Another View: The Donor Preference Hypothesis 334
	Licensure and Monopoly Rents 334 Public Interest or Self-Interest 335 Licensure and Quality 336 Other Physician Labor Issues 337 Specialization 338
	Physician Income by Gender 338 Conclusions 339 Summary 340 • Discussion Questions 341 • Exercises 341
Chapter 17	The Pharmaceutical Industry 342 Structure and Regulation 344 Competition 344

Barriers to Entry 345 Regulation 346

Least-Cost Production 349 Insurance and Substitutability Technological Change 350 Drug Pricing and Profits 352 Monopoly Pricing 352 Price Discrimination 353 Monopsony Pricing and Price Controls 354 Competition and Generic Entry R&D and Innovation 355 Investment Decisions 356 R&D Spending 357 Firm Size and Innovation 358 Prices, Price Regulation, and Innovation 358 Cost Containment 359 Copayments 360 Generic Substitutes 361 Drug Formularies 361 Conclusions 362 Summary 363 • Discussion Questions 363 • Exercises 364 Part V Social Insurance 365 **Chapter 18** Equity, Efficiency, and Need 366 Efficiency and Competitive Markets The Concept of Pareto Efficiency (Optimality) 367 Trading Along the Budget Line The Competitive Equilibrium 369 The First Fundamental Theorem of Welfare Economics Redistribution of the Endowment 370 Price Discrimination 371 Trade-offs Between Equity and Efficiency 371 Deviations from the Competitive Model in the Health Care Sector 372 The Assumptions Under Perfect Competition Promoting Competition in the Health Care Sector 373 The Theorem of the Second Best 373 An Economic Efficiency Rationale for Social Health Insurance 374 Need and Need-Based Distributions 375 Health Care Needs and the Social Welfare Function 376 Norman Daniels's Concept of Health Care Need Economic Criticisms of Need-Based Distributions 381

Horizontal Equity and Need

The Production of Health and Substitutability

Theories of Social Justice 384 Utilitarianism 384 Rawls and Justice as Fairness 384 Liberalism, Classical and Modern 385 Conclusions 386 Summary 387 • Discussion Questions 387 • Exercises 388
Government Intervention in Health Care Markets Economic Rationale for Government Intervention 389 Monopoly Power 390 Public Goods 391 Externalities 393 Other Rationales for Government Intervention 393 Forms of Government Intervention 394 Commodity Taxes and Subsidies 394 Public Provision 395 Transfer Programs 395
Regulation 396 Government Involvement in Health Care Markets 396 Support of Hospitals 397 The Hill-Burton Act 397 The Veterans Administration and CHAMPUS 397 Food and Drug Administration 398 Mandated Health Insurance Benefits 398 Tax Policy 398 Public Health 398 Other Government Programs 399 Government Failure 399 Who Does the Regulator Represent? 401 Bureaucracy and Efficiency 402
Conclusions 404 Summary 404 • Discussion Questions 405 • Exercises 405
Government Regulation: Principal Regulatory Mechanisms 406 Do the Laws of Supply and Demand Apply? 406 Objectives of Regulation 408 Regulatory Policy 408 Regulatory Instruments in Health Care 408 Regulation of the Hospital Sector 409 Empirical Findings on Regulation 409
Prospective Payment 413

Chapter 19

Chapter 20

Description of PPS 413

The Theory of Yardstick Competition and DRGs 415 On the Effects of Medicare's Prospective Payment System 419 Prospective Payment: Recent Evidence Regulation of Physician Payment 424 UCR Reimbursement, Assignment, and Alternative Payment Mechanisms 425 Relative Value Scales 425 Antitrust 426 Enforcement 427-Exemptions 427 Measuring Monopoly Power 429 Antitrust Procedures 430 The Elzinga-Hogarty (EH) Criterion 431 Conclusions \$432 Summary 433 • Discussion Questions 433 • Exercises 434 Chapter 21 Social Insurance 436 Social Insurance and Social Programs 436 Program Features 437 Historical Roots of Social Insurance 438 European Beginnings 438 Early Experience in the United States 439 The Establishment of Medicare and Medicaid 439 Medicare and Medicaid in the United States 441 Medicare 441 Part D Prescription Drug Insurance Medicaid Medicaid Eligibility 446 The Medicaid-Medicare Relationship Medicare and Medicaid: Conflicting Incentives for Long-Term Care 449

for Long-Term Care 449

State Children's Health Insurance Program 450

Public Insurance and Health 451

The Effects of Medicare and Medicaid 454

The Effects of Medicare and Medicaid 454

Costs and Inflation 454

Health Status 459

Medicare: Recent Changes and Future Prospects 459

Criticisms of the U.S. Health Care System 462

Conclusions 464

Summary 465 • Discussion Questions 465 • Exercises 465

Chapter 22 Comparative Health Care Systems 467

Contemporary Health Care Systems 467
A Typology of Contemporary Health Care Systems 467

National Health Programs: United Kingdom and Germany 468
The United Kingdom: The National Health Service 470
Germany 473
The Canadian Health Care System 477
Background 477
Physician Fees and Quantity 479
Why Are Fees and Hospital Costs Lower in Canada? 480
Administrative Costs 480
A Comparison 482
Different Systems: The Public's Evaluation 485
Differences in Health Care Spending Across Countries 488

Conclusions 490

Summary 491 • Discussion Questions 492 • Exercises 492

Chapter 23 Health System Reform 493

Goals of Reform 493

Basic Issues in Reform 495

The Costs of Universal Coverage 495

A Model of Health Expenditure Sales

Ensuring Access to Care 496

Employer Versus Individual Mandates 496

Separation of Health Insurance from Employment 497

Single Payer Versus Multiple Insurers 497

Competitive Strategies 498

Development of Alternative Delivery Systems 499

Consumer-Drive Health Plans and Health Savings Accounts 499

Other Market Reforms 501

Representation of the Competitive Approach 502

Government Versus Markets: The Obama and McCain Proposals 503

Health System Reform and International Competitiveness 505

Quality of Care 506

Conclusions 508

Summary 508 • Discussion Questions 509 • Exercises 510

Part VI Special Topics 511

Chapter 24 The Health Economics of Bads 512

An Introduction to Bads 513

Models of Addiction 515

Imperfectly Rational Addiction Models 515

Myopic Addiction Models 515

Rational Addiction 515

Rationales for Public Intervention 518

Other Interventions 518

Advertising Restrictions on Cigarettes and Alcohol The Possible Effects of Brand Switching 521 Increased Demand or Brand Switching? 521 Advertising and Alcohol Consumption 522 Excise Taxes and Consumption of Cigarettes and Alcohol The Consumption-Reducing Effects of Excise Taxes in Theory 523 Excise Taxes and Cigarette Consumption in Practice **Excise Taxes and Alcohol Consumption** Conclusions 527 Summary 528 - Discussion Questions 528 • Exercises 528 **Chapter 25** Epidemiology and Economics: HIV/AIDS in Africa 530 Concepts from Epidemiology Economic Epidemiology Rational Epidemics 533 The Prevalence Elasticity of Demand for Prevention 533 The Economic Consequences of Epidemics The Difficulty of Eradicating Diseases Information 536 The Role of Government in Battling Epidemics Case Study: HIV/AIDS in Africa HIV/AIDS 537 Costs of AIDS in Forgone Productivity 538 Fighting AIDS 540 **Economic Theory and African Reality** 542 Conclusions 544 Summary 544 • Discussion Questions 545 • Exercises 545 Glossary 546 References 553 Index 589