

Economic Growth and Development

**An Analysis of Our Greatest Economic
Achievements and Our Most
Exciting Challenges**

University of Nebraska, Lincoln



C

Boston Burr Ridge, IL Dubuque, IA Madison, WI New York
San Francisco St. Louis Bangkok Bogota Caracas Kuala Lumpur
Lisbon London Madrid Mexico City Milan Montreal New Delhi
Santiago Seoul Singapore Sydney Taipei Toronto

Contents

Parti

Introduction to Economic Growth

1 The Importance of Economic Growth 2

- 1.1 The Incredible Nineteenth and Twentieth. Centuries 3
 - 1.1.1 Rapid Growth Began Only after 1800 4
 - 1.1.2 The Rate of Growth Accelerated in the Twentieth Century 5
 - 1.1.3 Summarizing the Recent Growth 6
- 1.2 Economic Growth Is Not Always Rapid and Consistent 7
 - 1.2.1 There Have Been Some Economic Disasters 7
 - 1.2.2 Growth Has Not Been Smooth or Consistent in Many Countries 7
 - 1.2.3 Different Growth Experiences Lead to Large Income Differences 8
- 1.3 Economic Growth and Human Welfare 10
 - 1.3.1 Economic Growth as an Improvement in Human Welfare 10
 - 1.3.2 Growth or Development? 11
- 1.4 Structural Change and Economic Growth 12
 - 1.4.1 Patterns of Structural Change 12
 - 1.4.2 Why Growth Changes the Structure of an Economy 13
 - 1.4.3 The Costs of Structural Change 14
- 1.5 Other Issues Often Divert Attention from Growth 15
 - 1.5.1 What Matters Most: Relative or Absolute Income? 15
 - 1.5.2 Economic Growth and Cyclical Variations in Output 16
 - 1.5.3 Short-Run Allocation versus Long-Run Growth 17
 - 1.5.4 The Power of Compounding 18
- Toolbox: The Production Possibilities Frontier as a Model of an Economy 19
 - 1.5.5 Human Happiness and Economic Growth 22
- 1.6 A Brief History of Growth Theory 22
 - 1.6.1 Early Interest in Growth Faded by the Late 1800s 22
 - 1.6.2 Development Economics and Growth Theory 23
 - 1.6.3 A Synthesis Has Developed 24
- 1.7 How Do Economies Grow? 26
- 1.8 Introduction to the Remainder of the Book 27

Summary	28
Suggested Reading	29
Internet Resources	30
Questions and Problems	33

2 Economic Growth throughout History 35

2.1	Measuring Real Output	37
2.1.1	Are National Accounts Data Comparable?	37
	Technical Note: From Nominal GDP Growth to Per Capita Real GDP Growth	38
2.1.2	Attempts to Compile Comparable Output Data	39
2.2	What the Output Data Tell Us about Economic Growth	40
2.2.1	Recent Economic Growth	42
	Case Study 2-1: Economic Miracles and Economic Disasters, 1820 to the Present	45
2.2.2	Are Standards of Living Becoming More Equal?	47
2.2.3	The Convergence Debate	47
2.3	Alternative Measures of Economic Growth	50
2.3.1	The Quality of Life in the World Today	50
2.3.2	Human Health throughout History	53
	Case Study 2-2: The Relationship between Output Growth and Health	55
2.3.3	Education and Human Welfare	56
2.3.4	Measures of Freedom	57
	Case Study 2-3: How the Former Indian Caste System Still Restricts Economic Freedom	60
2.3.5	The Value of Leisure	61
2.3.6	Is Human Welfare Diverging or Converging?	63
2.3.7	What Can We Conclude about Human Welfare?	63
2.4	Reflections on the Measurement of Economic Growth	65
2.4.1	Informal Activity and the Measurement of GDP	65
2.4.2	Welfare and GDP	66
2.4.3	Adjustments for Product Quality and Changing Consumption Patterns	67
2.4.4	Variety and the New Age of Mass Customization	68
2.4.5	Combining GDP and Life Expectancy to Measure Human Welfare	69
2.4.6	Conclusion: Use GDP Data with Care	70
2.5	The Mechanics of Economic Growth	72
2.5.1	The Power of Compounding	72
2.5.2	Calculating Doubling Time	72
2.5.3	Finding a Target Growth Rate	73
2.5.4	Some Interesting Insights	74
	Summary	75
	Suggested Reading	75
	Questions and Problems	76
	Appendix 2-1 Calculating Real per Capita GDP Growth Using Annual Data	78
	Appendix 2-2 Using a Spreadsheet to Experiment with the Mechanics of Economic Growth	80

Part II

How Economists Have Modeled Economic Growth

3	The Evolution of Growth Models: From Adam Smith to Harrod-Domar	84
3.1	Economic Models	85
3.1.1.	Defining an Economic Model	85
3.1.2	Why Economists Use Models	86
3.1.3	Models Come in Many Forms	86
3.2	Adam Smith's Model of Economic Growth	87
3.2.1	Partial Equilibrium and General Equilibrium Perspectives	87
3.2.2	Specialization and Exchange	88
3.2.3	Specialization and Technological Progress	89
3.2.4	The Importance of Institutions	90
Case Study 3-1:	Money in the Early Dutch Economy	90
3.2.5.	Transportation and Communications	91
3.2.6	National Welfare and the General Welfare of the Population	92
3.2.7	The Smithian Growth Model	93
3.2.8	Adam Smith's Legacy	94
3.3	Thomas Malthus and His "Dismal" Model	95
3.3.1	Diminishing Returns	95
3.3.2	An Example of Diminishing Returns	95
3.3.3	Improved Welfare Causes Population Growth	97
3.3.4	The Malthusian Equilibrium	97
3.3.5	Results That Are Even More Dismal	99
3.3.6	How Could Malthus Have Been So Wrong?	99
3.4	Schumpeter's Model of Innovation	101
3.4.1	The Process of Creative Destruction	102
Case Study 3-2:	Corporate Conglomerates and Creative Destruction	103
3.4.2	The Role of the Entrepreneur	103
3.4.3	Creative Destruction, Technological Progress, and Economic Growth	104
3.5	The Harrod-Domar Model	105
3.5.1	Harrod-Domar's Keynesian Heritage	106
3.5.2	The Formal Model	107
3.5.3	The Incremental Capital-Output Ratio	108
3.5.4	Some Further Reflections on the Harrod-Domar Model	109
	Summary	110
	Suggested Reading	111
	Questions and Problems	112
4	Solow's Neoclassical Growth Model	114
4.1	The Basic Solow Model	115
4.1.1	The Production Function.	115
4.1.2	The Consumption Function	116
4.1.3	The Stock of Capital	117
4.1.4	The Solow Growth Equilibrium,	118

4.2	The Rate of Saving and the Steady State	119
4.2.1	Comparative Statistics	120
4.2.2	Dynamic Analysis	121
4.2.3	What the Solow Model Has Told Us So Far	122
4.3	The Cobb-Douglas Production Function	122
4.3.1	The Convenient Cobb-Douglas Function	123
4.3.2	Constant Factor Shares	123
	Case Study 4-1: Using the Cobb-Douglas Function to Apply the Solow Model [^] to Thailand	124
4.3.3	The Capital Share and the Shape of the Production Function	125
4.4	The Optimal Level of Saving and Investment	126
4.5	Population Growth and the Solow Model	127
4.5.1	Population Growth Has Changed Frequently in the Last 200 Years	128
4.5.2	Adding Population Growth to the Solow Model	128
4.5.3	Population Growth Increases Total Output, Not Per Capita Output	129
4.6	Technological Progress and the Solow Model	130
4.6.1	How Technological Progress Affects the Steady State	130
4.6.2	Technological Progress Does Generate Permanent Growth	131
4.6.3	Understanding the Steady State with Technological Progress	131
4.6.4	Summarizing the Results of the Solow Model	133
	Case Study 4-2: The Asian "Economic Miracle"	134
4.7	The Solow Model and the Convergence Debate	136
4.7.1	Conditional Convergence	137
4.7.2	Long-Run Growth versus Transitional Growth	137
4.7.3	Technological Progress and Convergence in the Long Run	138
4.7.4	The Level of Technology and the Growth Path	140
4.7.5	Long-Run Convergence Requires Faster Technological Progress	142
	Case Study 4-3: The Soviet Union and the Solow Model	143
4.8	Rebelo's AK Model as a Special Case of the Solow Model	145
4.8.1	The Special Case of $a = 1$	145
4.8.2	Are All Factors Really Reproducible?	147
4.8.3	What Does the AK Model Tell Us?	148
4.9	Smith to Solow: Some Conclusions	148
	Summary	149
	Suggested Reading	150
	Questions and Problems	151
5	How Well Does Solow's Model Explain Economic Growth?	153
5.1	Statistical Analysis of Economic Growth	154
5.1.1	Are Incomes Converging?	154
5.1.2	Regression Analysis	155
5.1.3	Multiple Regression	157
5.1.4	Barro's Test for Conditional Convergence	157
5.2	A Direct Statistical Test of the Solow Model	160
5.2.1	Mankiw, Romer, and Weil's Test of the Solow Model	160
5.2.2	Adding Human Capital to the Model—A Second Test	162
5.2.3	Some Tentative Conclusions	163

5.3	Beyond Solow: More Evidence on the Causes of Growth	164
5.3.1	Using the Cobb-Douglas Function to Model Production	164
5.3.2	Adding Other Explanatory Variables	165
5.3.3	Inherent Weaknesses of Statistical Analysis	166
5.3.4	Using Learner's Sensitivity Analysis	167
5.3.5	Sala-i-Martin's Version of Sensitivity Analysis	168
5.3.6	Summary of the Statistical Evidence	168
5.4	Measuring Technological Progress	170
5.4.1	The Sources-of-Growth Equation Again	170
5.4.2	The Solow Residual	170
5.4.3	Further Estimates of the Solow Residual	171
5.4.4	The Broad Meaning of Technology	172
5.4.5	Some Difficulties in Measuring Inputs and Output	173
Case Study 5-1:	Denison's Estimates of the Sources of Economic Growth	175
5.4.6	Hall and Jones's Estimates of Labor-Augmenting Technology	176
5.4.7	The Importance of Technology—a Summary	177
I Case Study 5-2:	Singapore and Productivity	178
Case Study 5-3:	The Myth of the African Debacle	179
Toolbox:	Mathematical Representation of a Growth Process	183
Summary		184
Suggested Reading		186
Questions and Problems		187

6 Technological Progress 189

6.1	Technology and Technological Progress	190
6.1.1	The Black Box	190
6.1.2	The Diversity of Technological Progress	191
6.1.3	A Historical View of Technology	192
6.1.4	Ranking Technological Breakthroughs	194
6.2	The Characteristics of Technological Progress	196
6.2.1	The Continuous, but Gradual, Path of Technology	196
Case Study 6-1:	Electricity and Manufacturing	198
6.2.2	The Path-Dependency of Technological Change	200
Case Study 6-2:	The History of the Computer	201
6.2.3	Technology Is a Nonrival Good	201
6.2.4	Does Excludability Hamper Technological Progress?	202
6.2.5	Summarizing the Characteristics of Technology	203
6.3	Technological Progress and Investment	203
6.3.1	Technological Progress as an Externality to Investment	204
Case Study 6-3:	Equipment Investment and Technological Progress	205
6.3.2	Technology and Increasing Returns to Scale	206
6.4	Learning by Doing	207
6.4.1	Learning by Doing as a Source of Technological Progress	207
Case Study 6-4:	The Liberty Ship Program	208
6.4.2	The Level of Technology as a Function of Output	209
6.4.3	How Is Learning Related to Doing?	210
6.4.4	Summarizing the Learning-by-Doing Model	210
6.5	Growth as the Result of Costly Innovative Activity	211
6.5.1	Imperfect Competition, Profits and the Creation of Ideas	212
6.5.2	Innovation Requires Costly Resources	214

6.5.3	The Equilibrium Level of R&D Activity	215
6.5.4	Some Observations on the R&D Model of Endogenous Technological Progress	215
Case Study 6-5: Land-Grant Universities and Agricultural Extension Programs 217		
6.6	The Speed of Technological Progress	217
6.6.1	Measuring R&D Activity	218
6.6.2	How New Ideas Are Generated	220
6.6.3	The Growth of Knowledge as a Combinatoric Process	220
6.6.4	Keeping Up with the Growing Number of Opportunities	222
Case Study 6-6: Finding the Right Combinations in Peru 223		
6.7	Technology and Developing Economies	224
6.7.1	Endogenous Technological Progress and Convergence	224
6.7.2	The Nonrival Nature of Technology	225
6.7.3	Vernon's Product-Cycle Model	225
6.7.4	The Costs of Adaptation versus Original Discovery	226
6.7.5	Barriers to Technology Transfers	227
6.7.6	Can Technology Transfers Close the Income Gap?	227
Summary 229		
Suggested Reading 230		
Internet Resources 231		
Questions and Problems 231		
Appendix 6-1 Schumpeterian Model of Technological Progress 233		

Part III

Extensions of the Growth Models**7 Economic Growth and Population Growth 238**

7.1	The Two Opposing Views of Population Growth	239
7.1.1	Beware of the Definitional Relationship	240
7.1.2	Population Growth and Congestion	240
7.1.3	People as the Source of Technological Progress	240
7.1.4	Population Growth and Economies of Scale	241
7.1.5	Congestion as a Cause of Economic Growth	241
7.1.6	The Changing Relationship Between Population and Growth	242
7.1.7	Summarizing the Population Debate	243
7.2	A Brief History of the World's Population	243
7.2.1	Early History and the Agricultural Revolution	243
7.2.2	The Second Break: The Industrial Revolution	245
7.3	The Components of Population Growth	247
7.3.1	Some Historical Examples	248
7.3.2	A Cross-Section View of Demographics and Growth	250
7.3.3	The Demographic Transition	253
7.3.4	Summarizing the Observed Patterns of Population Growth	255
7.4	New Models to Explain the Complex Pattern	256
7.4.1	Kremer's Model of Long-Run Economic Growth	256
7.4.2	Galor and Weil's Model of Human Capital Accumulation	258

Case Study 7-1: Technological Progress and Family Size in India	259
7.4.3 Jones's Model of the Idea Production Function	260
7.4.4 Why Birth Rates Have Declined	261
7.4.5 Leibenstein's Model of the Marginal Child	261
7.5 The Medium-Run Effects of Shifts in Population Growth	263
7.5.1 The Population Profile	263
7.5.2 Demographic Change and the Dependency Ratio	264
7.5.3 The Importance of the Population Profile	266
Case Study 7-2: Forced Birth Control in China	267
7.6 How Important Is Immigration?	268
7.6.1 The History of Migration	268
7.6.2 Immigration Flows in the Twentieth Century	269
7.6.3 The Causes of Immigration	269
Summary	270
Suggested Reading	272
'Questions and Problems	273
I'	
8 Saving, Financial Markets, and Economic Growth	274
8.1 Observed Saving Behavior	275
8.2 A Simple Two-Period Model of Endogenous Saving	279
8.2.1 The Assumptions of the Model	279
8.2.2 Intertemporal Preferences and the Life-Cycle Model of Saving	280
8.2.3 Other Implications of the Model	282
8.2.4 The Population Profile Is an Important Determinant of Saving	282
8.2.5 Changing Population Profiles Imply Changing Saving Rates	284
8.3 The Cass-Koopmans-Ramsey Model	284
8.3.1 The Assumptions of the CKR Model	284
8.3.2 Solving the System	285
8.3.3 The Intuition behind the CKR Model	286
Case Study 8-1: Is Saving Too High in South Korea?	287
8.4 The Empirical Evidence on Saving	288
8.4.1 Early Evidence	288
8.4.2 Recent Studies Using the World Bank's Saving Database	289
8.4.3 What the Studies on Saving Do Not Tell Us	290
8.5 The Important Role of the Financial Sector	290
8.5.1 Not All Financial Sectors Are the Same"	291
8.5.2 Comparing Germany, Japan, and the United States	291
8.5.3 A Simple Model of the Financial Sector	292
8.5.4 Extending the Analysis to the Macroeconomy	293
8.6 Market Failures in the Financial Sector	294
8.6.1 The Possibility of Default	294
Case Study 8-2: The Failure to Enforce Contracts in Equatorial Guinea	295
Case Study 8-3: Successful Contract Enforcement in Taiwan	296
8.6.2 Enforceable Contracts Do Not Eliminate All Risk	297
8.6.3 The Adverse-Selection Problem	298
8.6.4 The Moral-Hazard Problem	299

Case Study 8-4: How the Grameen Bank of Bangladesh Monitors Borrowers	300
8.6.5 Government Can Also. Help Solve the Information Problem	301
8.6.6 Property Rights and Collateral: Another Role for Government	302
Case Study 8-5: Lending to the Pqor in Peru	302
8.6.7 Intermediaries Also Face Adverse Incentives	304
8.6.8 Why Financial Intermediaries Coexist with Financial Markets	304
8.7 Financial Repression	305
8.7.1 Interest-Rate Ceilings	306
8.7.2 Directed Investment	307
8.8 The Financial Sector and Economic Growth	307
8.8.1 The Financial Sector and the Solow Growth Model	307
8.8.2 Does Liberalization Increase Saving?	309
8.8.3 The Financial Sector and Long-Run Economic Growth	309
8.8.4 Empirical Evidence on the Role of Financial Markets	312
Summary	312
Suggested Reading	313
Questions and Problems	314
Appendix 8-1: The Cass-Koopmans-Ramsey Model	316

9 Globalization and Economic Growth 324

9.1' The Empirical Evidence on Trade and Growth	326
9.1.1 Open Economics versus Closed Economics	326
9.2 International Trade and the Solow Model	327
9.2.1 The Static Gains from Trade	328
9.2.2 The Similarity between Trade and Growth	330
9.2.3 The Gains from Trade and the Solow Model	330
9.2.4 Does It Matter What Type of Goods a Country Imports?	331
9.2.5 International Trade and Long-Run Growth	333
9.3 Endogenous Growth and-International Trade	334
9.3.1 The Externalities Models of Technological Progress	334
9.3.2 Learning by Exporting	334
Case Study 9-1: Enclaves, <i>Maquiladoras</i> , and Spillovers	336
9.3.3 International Trade and the R&D Model	338
9.4 International Trade and Technology Transfers	340
9.4.1 Recent Empirical Evidence	341
9.4.2 Kremer's- Population and Technology Model Again	342
9.4.3 Trade Helps Small Countries Most	343
9.5 The Sectoral Effects of International Trade	344
9.5.1 A Sectoral Learning-by-Doing Model	344
9.5.2 How Does Technological Progress Vary across Industries?	345
9.5.3 The Infant-Industry Argument	347
9.5.4 One More Argument for Protection: Import Substitution	348
Case Study 9-2: The Chilean Automobile Industry	350
9.5.5 An Explanation for Slow Technological Progress under IS Policies	352
9.6 Protectionism in Developed Countries	353
9.6.1 The Developed Economies' Defiance of Comparative Advantage	353
9.6.2 Is Developed-Country Protectionism Increasing?	354

9.7	International Investment and Technology	355
9.7.1	The Growth of Capital Flows to Emerging Markets	355
9.7.2	The Gains from International Capital Mobility	357
9.7.3	International Investment and R&D Activities	358
9.8	The Role of Foreign Aid	359
9.8.1	Why Foreign Aid Has Declined	359
9.8.2	Foreign Aid and Domestic Capabilities	361
9.8.3	Do Dictators and Corrupt Governments Receive Less Foreign Aid?	362
9.8.4	Foreign Aid: What Next?	362
	Summary	363
	Suggested Reading	366
	Questions and Problems	368

Part IV

Human Capital, Institutions, and Growth

10 Education, Human Capital, and Growth 371

10.1	How Does Education Influence Growth?	372
10.2	The State of Education in the World	373
10.2.1	The Correlation between Income and Education	373
10.2.2	Gender and Education	373
• 10.2.3	Convergence in Educational Opportunities	377
10.2.4	Summary of the State of Education in the World	378
10.3	The Costs and Benefits of Education	378
10.3.1	The Net Returns to Education	378
10.3.2	Private versus Social Returns to Education	380
10.3.3	Estimates of the Returns to Education	381
10.4	Empirical Evidence on Education and Economic Growth	384
10.4.1	The Conflicting Statistical Results	384
10.4.2	Further Studies on Education and Economic Growth	384
	Case Study 10-1: Vicious Cycles of Growth	386
10.5	Measuring Human Capital	388
10.6	Education in the Solow Growth Model	389
10.6.1	The Augmented Solow Model with Human Capital	390
10.6.2	Diminishing Returns to Education	391
10.7	Education and Technological Progress	392
10.7.1	Human Capital with External Effects	392
10.7.2	Education and R&D Activity	392
10.7.3	The Private Decision to Invest in Human Capital	393
10.8	Government Provision of Education	393
10.8.1	What Role for Government?	394
10.8.2	Determining the Optimal Education Policy	395
10.9	Child Labor	396
10.9.1	Child Labor throughout History	396
10.9.2	The Economics of Child Labor	397
10.9.3	What Is the Best Policy for Dealing with Child Labor?	398

Case Study 10-2: Recent Trends in Child Labor 399

10.10 The Brain Drain 400

10.10.1 Immigrants from Developing Countries Are Highly Educated 401

10.10.2 Worker Remittances 401

10.10.3 Unemployed University Graduates in Developing Economies 403

10.10.4 The Puzzling Flow of Human Capital to Capital-Rich Economies 404

Summary 404

Suggested Reading 406

Questions and Problems 407

Appendix 10-1 Lucas's Education Model 407

I 1 Institutions and Economic Growth 409

11.1 Rational Behavior and Economic Outcomes 410

11.1.1 Rationality Makes Human Behavior Predictable 410

11.1.2 Rational Behavior Does Not Imply Socially Optimal Behavior 411

11.1.3 Rational Behavior and Human Welfare 412

I 1.2 Institutions: Promoting Productive Activity and Growth 412

.2.1 Production or Transfers? 413

.2.2 The Role of Institutions 413

11.3 Institutions and Transaction Costs 415

.3.1 The Cost of Transactions and Economic Efficiency 415

11.3.2 The New Institutional Economics 417

11.3.3 Government Is Necessary, but Its Power Is Dangerous 418

Case Study 11-1: Reducing Transaction Costs with Internet Auctions 419

11.4 How Institutions Affect Economic Growth 420

11.4.1 The Importance of Institutions for Economic Growth 421

Case Study 11-2: Traditions, Customs, and Entrepreneurship 421

11.4.2 Growth-Enhancing Institutions Are Meta-Ideas 422

11.5 Empirical Studies of Institutions and Economic Growth 423

11.5.1 Finding the Right Z Variable to Represent Institutions 424

11.5.2 Economic Freedom and Economic Growth 425

11.5.3 The Importance of Stable Macroeconomic Policies 426

I 1.6 The Institution of Property Rights 426

11.6.1 The Pilgrims and Property Rights 427

Case Study 11-3: The *Ejido* and Rural Property Rights in Mexico 427

11.6.2 The Importance of Property Rights 429

11.6.3 Property Rights and Dependence 429

11.7 Intellectual Property Rights and Technology 430

11.7.1 The Patent as a Property Right to an Idea 431

11.7.2 The Cost of Protecting Intellectual Property Rights 432

11.7.3 International Protection of Intellectual Property Rights: The WTO 432

11.7.4 Patents: A Clash of Formal and Informal Incentives 433

11.7.5 Other Reasons for Opposing Intellectual Property Rights 435

Case Study 11-4: The Clash of Cultures 436

Summary 436

Suggested Reading	438
Questions and Problems	439

12 Government Institutions and Economic Growth 441

12.1	The Role of Government	442
12.1.1	Adam Smith's Three General Functions of Government	442
12.1.2	Externalities as a Justification for Government Policy	444
12.1.3	Monopoly	445
12.1.4	Traditions and Other Social and Religious Barriers to Markets	446
12.1.5	Intertemporal Decisions	447
12.1.6	Summarizing the Positive Role for Government	447
¹ 12.2	Government Failures	448
12.2.1	Why Government Fails	448
12.2.2	Rent-Seeking Activity	449
12.2.3	An Example of Rent and Rent Seeking	450
Case Study 12-1:	The Comparative Advantage of Government	453
12.3	Corruption	454
12.3.1	The Casual Evidence on Corruption	454
12.3.2	Measures of Worldwide Corruption	455
12.3.3	The Incentives for Corruption	457
12.3.4	How Can Corruption Be Reduced?	459
12.3.5	Mauro's Empirical Measure of the Effect of Corruption on Growth	460
12.4	Informal Activity: Making the Best of Bad Institutions	461
12.4.1	Informality Is a Common Phenomenon in Developing Economies	461
12.4.2	Informal Economic Activity Is Rent-Evading Behavior	462
12.4.3	Potential Costs of Informality	465
12.4.4	Estimates of Informal Economic Activity around the World	465
12.4.5	Why Informality Is More Prevalent in Developing Economies	466
12.4.6	The Informal Sector and Economic Growth	467
12.4.7	Summarizing the Consequences of Informality	468
12.5	Economic Growth, Democracy, and Freedom	469
Case Study 12-2:	China, Economic Growth, and Democracy?	470
Summary		471
Suggested Reading		473
Questions and Problems		475

Part V

Controversies and Challenges

13 The Costs of Economic Growth? 478

13.1	Luddites and Malthusians	479
13.1.1	Luddites: The Fear of Change and Failure	479
Case Study 13-1:	Preventing Failure in Germany	480

13.1.2	Malthusians: Are There Limits to Growth?	481
13.1.3	The Two Themes of the Opposition to Growth	481
13.1.4	Do the Luddites and Malthusians Have Legitimate Concerns?.	482
13.2	Economic Growth and Structural Change	482
13.2.1	How Growth Affects Demand	482
13.2.2	Unequal Growth of Factors	483
13.2.3	Biased Technological Progress	484
13.2.4	Unequal Income Elasticities of Demand	484
13.2.5	A Growing Economy Is a Changing Economy	487
13.2.6	The Costs of Structural Change	487
13.2.7	Deindustrialization: Structural Change in Developed Economies	488
13.2.8	The Theory of Asymptotic Stagnancy	488
13.3	The Distribution of Income	490
13.3.1	Measuring Income Inequality in the World	490
13.3.2	The Lorenz Curve	493
13.3.3	The Gini Coefficient	493
13.3.4	The Kuznets Curve	494
Case Study 13-2: The Distribution of Income throughout History 495		
13.4	Does Income Distribution Matter for Growth?	497
13.4.1	Wild (Mis)interpretations of Early Empirical Results	498
13.4.2	Further Studies of Income Distribution	498
13.4.3	Technological Progress and Income Inequality	500
13.5	What Is the Ideal Distribution of Income?	503
13.5.1	Distributional Policies and Economic Incentives	504
13.5.2	A Perfectly Equal Income Distribution Is Not Equitable	504
13.5.3	The Moral View of Economic Inequality	507
13.5.4	There Are Reasons for Concern about Distribution	507
13.5.5	Equal Opportunity Leads to Equal Outcomes	508
13.6	Poverty	509
13.6.1	Defining Poverty	509
13.6.2	Poverty in the World	511
Summary 511		
Suggested Reading 513		
Questions and Problems 514		

14 Are There Limits to Growth? 516

14.1	The Past as a Lesson for the Future	517
14.1.1	Technological Progress Has Reduced Scarcity	518
14.1.2	The Implicit Assumptions Made by the Malthusians	519
14.2	Are There Enough Resources for All Countries to Grow?	519
14.2.1	How to Split Up the Pie	519
14.2.2	The Malthusians Became Environmentalists	520
14.3	How Scarce Are Our Resources?	521
14.3.1	Estimates of Proven Reserves Have Always Been Wrong	521
14.3.2	Misinterpreting Short-Run Price Fluctuations	522
14.3.3	The Supply of Effective Resources	523
14.3.4	Examples of Increasing Effective Supplies	524

14.3.5	Further Examples: Effective Supply with Economic Growth	527
14.3.6	Which Example Is Most Realistic?	528
Case Study 14-1:	When Will We Run Out of Oil?	529
14.4	How Exhaustible Resources Are Priced	530
14.4.1	Present Price as Discounted Future Price	530
14.4.2	So What Do Falling Resource Prices Tell Us?	532
14.4.3	The Resource Price as Opportunity Cost	532
14.4.4	Evaluating the Cost of Resource Depletion	533
14.5	Should We Be Concerned about the Environment?	534
14.5.1	Sustainable Development	535
14.5.2	Sustainable Growth Requires Accurate Prices	535
14.5.3	Resource Pricing and Long-Run Economic Growth	536
14.5.4	Sustainable Growth Does Not Imply Slow Growth	536
14.5.5	Getting the Prices Right	537
Case Study 14-2:	Using Rationing Rather than Prices to Prevent Pollution	538
' ;	14.5.6 Economic Growth and the Environment"	542
Summary		542
Suggested Reading		543
Questions and Problems		544

15 The Future of Economic Growth 546

15.1	Explaining Economic Growth	547
15.1.1	The Causes of Technological Progress	547
15.1.2-	How Economists Have Modeled Technological Progress	548
15.1.3	The R&D Model of Costly Technological Progress	548
15.1.4	The Importance of Institutions	549
15.2	Explaining the Sudden Surge in Growth after 1800	549
15.2.1	The Race between Ideas and Diminishing Returns	549
15.2.2	Institutions Became More Favorable to Growth	551
Case Study 15-1:	Korea's Inadvertent Experiment in Institutional Change	552
15.2.3	Not All Twentieth-Century Technology Improved Human Welfare	554
15.2.4	An Encouraging End to the Twentieth Century	555
15.2.5	Potential Barriers to Economic Growth	555
15.3	Which Path Will We Choose?	556
15.3.1	The Decisive Factor Is Economic Freedom	557
15.3.2	The Precarious Balance between Coercion and Freedom	558
15.3.3	Economic Freedom, Economic Growth, and Personal Freedom	559
Summary		560
Suggested Reading		561
Questions and Problems		561

Glossary 563

Bibliography 576

Name Index 592

Subject Index 596