CONTENTS

PREFACE xiii

1 INTRODUCTION: THE FACTS OF ECONOMIC GROWTH 1

1.1 THE DATA OF GROWTH AND DEVELOPMENT 3
1.2 OTHER "STYLIZED FACTS" 13
1.3 THE REMAINDER OF THIS BOOK 17

2 THE SOLOW MODEL 20

2.1 THE BASIC SOLOW MODEL 22
2.1.1 Solving the Basic Solow Model 26
2.1.2 The Solow Diagram 28
2.1.3 Comparative Statics 30
2.1.4 Properties of the Steady State 32
2.1.5 Economic Growth in the Simple Model 33
2.2 TECHNOLOGY AND THE SOLOW MODEL 36
2.2.1 The Solow Diagram with Technology 38
2.2.2 Solving for the Steady State 39

2.3 EVALUATING THE SOLOW MODEL 43
2.4 GROWTH ACCOUNTING, THE PRODUCTIVITY SLOWDOWN, AND THE NEW ECONOMY 44
APPENDIX: CLOSED-FORM SOLUTION OF THE SOLOW MODEL 50
EXERCISES 51

3 EMPIRICAL APPLICATIONS OF NEOCLASSICAL GROWTH MODELS 54

3.1 THE SOLOW MODEL WITH HUMAN CAPITAL 54
3.2 CONVERGENCE AND EXPLAINING DIFFERENCES IN GROWTH RATES 63
3.3 THE EVOLUTION OF INCOME DISTRIBUTION 72
EXERCISES 75

4 THE ECONOMICS OF IDEAS 79

4.1 WHAT IS TECHNOLOGY? 80
4.2 THE ECONOMICS OF IDEAS 81
4.3 INTELLECTUAL PROPERTY RIGHTS AND THE INDUSTRIAL REVOLUTION 87
4.4 POPULATION AND IDEAS 90
4.5 DATA ON IDEAS 91
4.6 SUMMARY 95
EXERCISES 96

5 THE ENGINE OF GROWTH 97

5.1 THE BASIC ELEMENTS OF THE ROMER MODEL 98
5.1.1 Growth in the Romer Model 103
5.1.2 Growth Effects versus Level Effects 107
5.1.3 Comparative Statics: A Permanent Increase in the R&D Share 107

5.2 THE ECONOMICS OF THE ROMER MODEL 111
5.2.1 The Final-Goods Sector 112
5.2.2 The Intermediate-Goods Sector 114
5.2.3 The Research Sector 115
5.2.4 Solving the Model 117
5.3 GROWTH THROUGH CREATIVE DESTRUCTION 119
5.3.1 The Basic Elements of the Schumpeterian Model 120
5.3.2 Growth in the Schumpeterian Model 122
5.4 THE ECONOMICS OF SCHUMPETERIAN GROWTH 124
5.4.1 The Final-Goods Sector 125
5.4.2 The Intermediate-Goods Sector 126
5.4.3 The Research Sector 128
5.4.4 Solving the Model 130
5.4.5 Comparing the Romer and Schumpeterian Models 131
5.5 OPTIMAL R&D 133
5.6 SUMMARY 135
APPENDIX: SOLVING FOR THE R&D SHARE 137
EXERCISES 139

6 A SIMPLE MODEL OF GROWTH AND DEVELOPMENT 140

6.1 THE BASIC MODEL 140
6.2 STEADY-STATE ANALYSIS 143
6.3 TECHNOLOGY TRANSFER 146
6.4 GLOBALIZATION AND TRADE 148
6.5 UNDERSTANDING DIFFERENCES IN GROWTH RATES 152
EXERCISES 155

7 SOCIAL INFRASTRUCTURE AND LONG-RUN ECONOMIC PERFORMANCE 157

7.1 A BUSINESS INVESTMENT PROBLEM 158
7.2 DETERMINANTS OF F 160
7.3 DETERMINANTS OF Π 162

7.4 WHICH INVESTMENTS TO MAKE? 164
7.5 EMPIRICAL EVIDENCE 164
7.6 MISALLOCATION AND PRODUCTIVITY 169
7.7 THE CHOICE OF SOCIAL INFRASTRUCTURE 171
7.8 GROWTH MIRACLES AND DISASTERS 174
7.9 SUMMARY 178
EXERCISES 179

8 POPULATION AND THE ORIGIN OF SUSTAINED ECONOMIC GROWTH 181

8.1 POPULATION AND LIVING STANDARDS 182
8.1.1 The Malthusian Era 184
8.1.2 The Post-Malthusian Era 185
8.1.3 The Modern Growth Era 186
8.2 THE MALTHUSIAN ECONOMY 187
8.2.1 Production with a Fixed Factor 187
8.2.2 Technological Change 192
8.2.3 Continuous Technological Growth 193
8.2.4 Endogenous Technological Change 195
8.3 THE TRANSITION TO SUSTAINED GROWTH 198
8.3.1 Realistic Population Growth Rates 198
8.3.2 From Malthusian Stagnation to Sustained Growth 200
8.3.3 Structural Change during the Transition to Growth 202
8.4 THE ECONOMICS OF POPULATION GROWTH 205
8.5 COMPARATIVE DEVELOPMENT 210
8.6 SUMMARY 212
EXERCISES 212

9 ALTERNATIVE THEORIES OF ENDOGENOUS GROWTH 215

9.1 A SIMPLE ENDOGENOUS GROWTH MODEL: THE "AK" MODEL 216
9.2 INTUITION AND OTHER GROWTH MODELS 219

9.3 EXTERNALITIES AND AK MODELS 220
9.4 EVALUATING ENDOGENOUS GROWTH MODELS 223
9.5 WHAT IS ENDOGENOUS GROWTH? 226
EXERCISES 226

10 NATURAL RESOURCES AND ECONOMIC GROWTH 228

10.1 NONRENEWABLE RESOURCES 230
10.1.1 Setup 230
10.1.2 The Balanced Growth Path 232
10.2 QUANTIFYING THE IMPORTANCE OF NATURAL RESOURCES 235
10.3 PRICES AS INDICATORS OF SCARCITY 237
10.4 IMPLICATIONS AND EXPLANATIONS OF DECLINING FACTOR SHARES 243
10.5 GROWTH AND THE ENVIRONMENT 247
10.6 SUMMARY 253
EXERCISES 254

11 UNDERSTANDING ECONOMIC GROWTH 256

11.1 WHY ARE WE SO RICH AND THEY SO POOR? 257
11.2 WHAT IS THE ENGINE OF ECONOMIC GROWTH? 257
11.3 HOW DO WE UNDERSTAND GROWTH MIRACLES? 258
11.4 CONCLUSION 259

APPENDIX A MATHEMATICAL REVIEW 261

A.1 DERIVATIVES 261
A.1.1 What Does $\dot{K}$ Mean? 261
A.1.2 What Is a Growth Rate? 262
A.1.3 Growth Rates and Natural Logs 263

A.1.4 "Take Logs and Derivatives" 264
A.1.5 Ratios and Growth Rates 265
A.1.6 Δlog versus Percentage Change 265
A.2 INTEGRATION 266
A.2.1 An Important Rule of Integration 267
A.3 SIMPLE DIFFERENTIAL EQUATIONS 267
A.3.1 Compound Interest 269
A.4 MAXIMIZATION OF A FUNCTION 271
EXERCISES 273

APPENDIX B READINGS OF INTEREST 275

APPENDIX C DATA ON ECONOMIC GROWTH 277

BIBLIOGRAPHY 283

INDEX 293