
ENDOGENOUS GROWTH THEORY

Philippe Aghion and Peter Howitt

Problems and Solutions by Cecilia García-Peñalosa

Coordinated by Maxine Brant-Collett

The MIT Press
Cambridge, Massachusetts
London, England



Contents

	Acknowledgments	xi
	Introduction	1
	Change and Innovation	1
	Why This Book?	2
	Who Is the Book For?	9
1	Toward Endogenous Growth	11
	1.1 The Neoclassical Model of Exogenous Growth	11
	1.2 Extension: The Cass-Koopmans-Ramsey Model	17
	1.3 Initial Attempts to Endogenize Technology	22
	1.4 The AK Approach to Endogenous Growth	24
	1.5 The Solow-Swan Model versus the AK Approach: The Empirical Evidence	29
	1.6 Monopoly Rents as a Reward of Technological Progress	35
	Appendix: Dynamic Optimization in Continuous Time	39
	Problems	44
2	The Schumpeterian Approach	53
	2.1 A Basic Setup	53
	2.2 Steady-State Growth	57
	2.3 Welfare Analysis	61
	2.4 Uneven Growth	63
	2.5 Discussion	65
	2.6 Some Immediate Extensions of the Basic Schumpeterian Model	67
	2.7 Summary	78
	Problems	80
3	Innovation and Capital Accumulation	85
	3.1 Multisectors	85
	3.2 Introducing Capital	93
	3.3 Summary	113
	Appendix 1: The Invariant Cross-Sectoral Distribution of Relative Productivities	115
	Appendix 2: Research Arbitrage and Labor Market Equilibrium in the Multisector Economy	116
	Problems	116
4	Growth and Unemployment	123
	4.1 Two Opposite Effects of Growth on Unemployment	123
	4.2 The Effect of Intersector Complementarities	129
	4.3 Innovation-Driven Growth	133

	4.4 Learning by Doing	137
	4.5 Stochastic Matching	140
	4.6 Summary	142
	Appendix: Some Details of Stochastic Matching	144
	Problems	145
5	Endogenous Growth and Sustainable Development	151
	5.1 Optimal Growth in the AK and Schumpeterian Frameworks	152
	5.2 The Notion of Sustainable Development	155
	5.3 The Analysis of Sustainable Development	158
	5.4 Summary	164
	Appendix 1: Existence of Steady-State with Environmental Pollution	165
	Appendix 2: Existence of Steady-State with Nonrenewable Natural Resources	169
6	Learning by Doing and Secondary Innovations	173
	6.1 The Basic Model	175
	6.2 Internalized Learning by Doing	183
	6.3 Research and Development	187
	6.4 Preliminary Thoughts on Growth and the Organization of R&D	190
	6.5 Toward More Radical Fundamental Innovations	193
	6.6 Summary	193
	Problems	195
7	Market Structure	205
	7.1 Introduction	205
	7.2 Barriers to Entry in Research	206
	7.3 Introducing Agency Considerations	208
	7.4 From Leap-Frogging to Step-by-Step Technological Progress	216
	7.5 Research and Development	220
	7.6 Summary and Conclusions	223
	Problems	225
8	Growth and Cycles	233
	8.1 Introduction	233
	8.2 A Few Historical Benchmarks	234
	8.3 From Cycles to Growth	236
	8.4 From Growth to Business Cycles: Schumpeterian Waves Revisited	243
	8.5 Measurement Problems	266
	8.6 Summary	269
	Problems	270

9	Distribution and Political Economy	279
	9.1 The Effects of Inequality on Growth	280
	9.2 Technological Change as a Source of Inequality	298
	9.3 The Political Economy of Technological Change: Vested Interests as a Source of Stagnation	313
	9.4 Summary	316
	Appendix: Proof of Proposition 9.1	319
	Problems	321
10	Education	327
	10.1 The Lucas Approach	329
	10.2 The Nelson-Phelps Approach	338
	10.3 Microfoundations of Education Policy: An Informal Look at Some Preliminary Contributions	350
	10.4 Summary	354
	Problems	357
11	Growth in Open Economies	365
	11.1 Introduction	365
	11.2 Openness and Growth: An Overview	365
	11.3 Opening Up the Romer Model	372
	11.4 Dynamic Comparative Advantage	375
	11.5 Learning by Doing and Comparative Advantage	383
	11.6 Empirical Evidence	389
	11.7 Conclusion	392
	11.8 Summary	393
	Problems	396
12	Testing for Endogenous Growth	403
	12.1 Some Criticisms of Endogenous Growth Theory	404
	12.2 An Augmented Schumpeterian Model	407
	12.3 Back to the Empirical Critiques of Schumpeterian Growth Theory	415
	12.4 A Multicountry Model	420
	12.5 The Main Observational Implications of Schumpeterian Growth Theory	425
	12.6 A Preliminary Attempt at Testing the Schumpeterian Paradigm	431
	12.7 Summary	434
	Appendix: On Some Problems in Measuring Knowledge-Based Growth	435
	A.1 A Tentative Definition	436
	A.2 Measuring Output, Productivity, and Knowledge	437

	A.3 A Formal Model	442
	A.4 Conclusion	447
13	Organizing R&D I: The Private Management of Innovation	449
	13.1 Should Research Be Vertically Integrated?	450
	13.2 The Organization of Research within Integrated Firms	460
	13.3 Financing R&D	468
	13.4 Summary	472
	Appendix: Growth and the Decentralization of Activities within Firms	474
	A.1 Modeling the Allocation of Authority within an Organization	474
	A.2 The Basic Trade-off between the Principal's Loss of Control and the Agent's Initiative	476
	A.3 The Optimal Scope of Centralization Problems	477 480
14	Organizing R&D II: Public Aid to Innovation	485
	14.1 Targeted R&D Subsidies	486
	14.2 Untargeted Subsidy Policies	489
	14.3 Delegating the Financing of R&D Inputs to Industries	490
	14.4 Using the Existing Patent System to Optimally Reward R&D Output	491
	14.5 On the Design of Patent Legislation	494
	14.6 Summary	504
	Problems	507
	Solutions	515
	Chapter 1	515
	Chapter 2	536
	Chapter 3	545
	Chapter 4	554
	Chapter 6	562
	Chapter 7	574
	Chapter 8	581
	Chapter 9	598
	Chapter 10	607
	Chapter 11	622
	Chapter 13	632
	Chapter 14	642
	References	665
	Index	689