Contents

1 Growth and International Trade: Introduction and Stylized Facts ................................................................. 1
   1.1 Introduction and Motivation ................................................. 1
   1.2 Definition of Growth Magnitudes ........................................... 3
      1.2.1 Growth Rates of Products and Quotients ............................ 6
   1.3 Kaldor’s “Stylized Facts” .................................................. 7
   1.4 Kuznets’ Facts .................................................................. 13
   1.5 Internationalization Facts ................................................... 14
      1.5.1 World Trade Is Growing Faster Than World Output ............... 17
      1.5.2 Export and Import Ratios Increase Over Time ....................... 17
      1.5.3 Two-Thirds of Foreign Trade Takes Place Between Developed Countries ........................................... 18
      1.5.4 Neighboring Countries Trade More With Each Other Than Countries That Are Further Apart ............... 19
   1.6 Globalization Facts .............................................................. 21
      1.6.1 Foreign Direct Investment and Financial Investment ............... 22
      1.6.2 Asia Since the 1970s: “The” Dynamic Export Region .......... 22
   1.7 Summary and Conclusions .................................................... 23
   1.8 Exercises ..................................................................... 25
   References ..................................................................... 26

Part I Growth

2 Modeling the Growth of the World Economy: The Basic Overlapping Generations Model ........................................... 29
   2.1 Introduction and Motivation .................................................. 29
   2.2 The Set-Up of the Model Economy ......................................... 30
   2.3 The Macroeconomic Production Function and Its Per Capita Version ................................................... 32
   2.4 Structure of the Intertemporal Equilibrium ............................... 35
      2.4.1 Intertemporal Utility Maximization of Younger Households .................................................. 35
      2.4.2 Old Households ............................................................ 39
### Contents

2.4.3 A-Temporal Profit Maximization of Producers .......................... 39
2.4.4 Market Equilibrium in All Periods ....................................... 40

2.5 The Fundamental Equation of Motion of the Intertemporal Equilibrium .................................................. 41

2.6 Maximal Consumption and the “Golden Rule” of Capital Accumulation ................................................................. 44
2.7 Summary and Conclusion .......................................................... 46
2.8 Exercises ................................................................................. 47
Appendix ......................................................................................... 48
References .................................................................................... 52

3 Steady State, Factor Income, and Technological Progress .......... 55
3.1 Introduction and Motivation .......................................................... 55
3.2 The GDP Growth Rate in Intertemporal Equilibrium and in Steady State ................................................................. 57
3.3 Existence and Stability of the Long-Run Growth Equilibrium ... 58
3.4 Efficiency of the Steady State ...................................................... 62
3.5 Comparative Dynamics in the Basic OLG Model ...................... 64
3.5.1 Increase in the Time Discount Factor ....................................... 64
3.5.2 Reduction of the Population Growth Rate ............................... 66
3.5.3 Increase in the Rate of Technological Progress ...................... 66
3.6 Real Wage, Real Interest Rate and Income Shares .................. 66
3.6.1 Income Distribution along the Equilibrium Growth Path ........ 67
3.7 Technological Progress in Neoclassical Growth Theory .......... 70
3.7.1 Hicks-Neutral Technological Progress .................................... 71
3.7.2 Harrod-Neutral Technological Progress ................................. 73
3.7.3 Solow-Neutral Technological Progress ................................... 74
3.7.4 Résumé .............................................................................. 75
3.8 Growth Accounting ................................................................. 75
3.9 Summary and Conclusion .......................................................... 77
3.10 Exercises ................................................................................. 79
References .................................................................................... 79

4 Economic Growth and Public Debt in the World Economy ....... 81
4.1 Introduction and Motivation .......................................................... 81
4.2 European Debt Statistics ............................................................. 82
4.3 First-Order Conditions and Market Clearing .............................. 84
4.3.1 Market Equilibrium in All Periods .......................................... 87
4.4 Intertemporal Equilibrium Dynamics ........................................ 87
4.5 Existence and Stability of Steady States ..................................... 90
4.5.1 Existence of a Long-Term Growth Equilibrium ...................... 90
4.5.2 Stability of the Steady States .................................................. 93
4.5.3 Analytical Investigation of Dynamic Stability ....................... 96
4.6 Reducing Public Debt Under Dynamic Efficiency .................... 100
4.7 Summary and Conclusions ........................................................ 106
4.8 Exercises ................................................................................. 108
References .................................................................................... 108
5 “New” Growth Theory and Knowledge Externalities
in Capital Accumulation .................................................. 111
5.1 Introduction and Motivation ........................................... 111
  5.1.1 Empirical Shortcomings of the “Old” Growth Theory ... 111
  5.1.2 Theoretical Shortcomings of the “Old” Growth Theory .. 113
  5.1.3 Main Approaches of “New” Growth Theory ............. 114
  5.1.4 Aims of Explanation and Preview ..................... 116
5.2 Public-Good Characteristics of Knowledge Externalities .... 116
5.3 Knowledge Externalities in the Basic OLG Model .......... 117
  5.3.1 The Production Technology With Knowledge Externalities ............................................. 118
  5.3.2 Intertemporal Utility Maximization of Active Households ... 120
  5.3.3 Profit Maximization of Firms ............................... 120
  5.3.4 Market Clearing Conditions .................................. 121
  5.3.5 Structure of the Intertemporal Equilibrium .............. 121
5.4 The Shortcomings of the Old Growth Theory from the Perspective of Romer’s New Growth Model ............... 124
5.5 Public Debt and Net Deficit in Romer’s New Growth Model ... 126
  5.5.1 Government Budget Constraint, FOCs and Market Clearing ............................................. 126
  5.5.2 Intertemporal Equilibrium Dynamics ...................... 127
  5.5.3 Existence and Dynamic Stability of Balanced Growth .... 128
5.6 Business Cycles and Endogenous Growth ..................... 130
5.7 Summary and Conclusion ......................................... 132
5.8 Exercises .......................................................... 133
Appendix .......................................................................... 133
References ....................................................................... 135

6 Endogenous Technological Progress and Infinite Economic Growth ...................................................... 137
6.1 Introduction and Motivation ........................................... 137
6.2 Monopolistic Competition and Product Innovation in Intertemporal Equilibrium ............................................. 138
  6.2.1 Production Technologies and Innovation .................. 138
  6.2.2 Choice Problems and Market Clearing Conditions .... 139
  6.2.3 Structure of the Intertemporal Equilibrium .............. 141
6.3 Unbounded Economic Growth and Increasing Growth Rates ... 145
6.4 One-Period Versus Long-Duration Patents .................... 147
6.5 Summary and Conclusion ......................................... 149
6.6 Exercises .......................................................... 150
References ....................................................................... 150

7 Human Capital, Religion, and Economic Growth ................................................................. 151
7.1 Introduction and Motivation ........................................... 151
7.2 Human Capital Formation in the Basic OLG Model ......... 154
  7.2.1 FOCs for Profit and Intertemporal Utility
    Maximization .......................................................... 155
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.2 Market Clearing Conditions</td>
<td>157</td>
</tr>
<tr>
<td>7.2.3 The Structure of Intertemporal Equilibrium</td>
<td>158</td>
</tr>
<tr>
<td>7.3 Intertemporal Equilibrium Dynamics and Steady State</td>
<td>158</td>
</tr>
<tr>
<td>7.3.1 Intertemporal Equilibrium Dynamics</td>
<td>159</td>
</tr>
<tr>
<td>7.3.2 Steady State</td>
<td>160</td>
</tr>
<tr>
<td>7.3.3 Predictions of the Basic Human Capital Model</td>
<td>161</td>
</tr>
<tr>
<td>7.4 An OLG Model of Religion and Human Capital Formation</td>
<td>162</td>
</tr>
<tr>
<td>7.4.1 The OLG Set-Up</td>
<td>162</td>
</tr>
<tr>
<td>7.4.2 Religious Participation and Children’s Education</td>
<td>163</td>
</tr>
<tr>
<td>7.4.3 Religion as a Steady-State Phenomenon</td>
<td>165</td>
</tr>
<tr>
<td>7.5 Summary and Conclusion</td>
<td>165</td>
</tr>
<tr>
<td>7.6 Exercises</td>
<td>166</td>
</tr>
<tr>
<td>References</td>
<td>167</td>
</tr>
<tr>
<td>8 Economic Growth With Bubbles</td>
<td>169</td>
</tr>
<tr>
<td>8.1 Introduction and Motivation</td>
<td>169</td>
</tr>
<tr>
<td>8.2 Stylized Bubble Facts</td>
<td>170</td>
</tr>
<tr>
<td>8.3 Bubbles in the Basic OLG Growth Model</td>
<td>175</td>
</tr>
<tr>
<td>8.3.1 Equilibrium with Bubbles and Without Financial Frictions</td>
<td>176</td>
</tr>
<tr>
<td>8.3.2 Equilibrium With Bubbles and Financial Frictions</td>
<td>179</td>
</tr>
<tr>
<td>8.3.3 Where Is the Market for Bubbles?</td>
<td>184</td>
</tr>
<tr>
<td>8.4 Summary</td>
<td>186</td>
</tr>
<tr>
<td>8.5 Exercises</td>
<td>187</td>
</tr>
<tr>
<td>References</td>
<td>188</td>
</tr>
<tr>
<td>Part II International Trade</td>
<td></td>
</tr>
<tr>
<td>9 International Parity Conditions in a Two-Country OLG Model Under Free Trade</td>
<td></td>
</tr>
<tr>
<td>9.1 Introduction and Motivation</td>
<td>191</td>
</tr>
<tr>
<td>9.3 Young Household’s Choice and International Parity Conditions</td>
<td>193</td>
</tr>
<tr>
<td>9.3.1 Domestic and Foreign Households in the International Equilibrium</td>
<td>193</td>
</tr>
<tr>
<td>9.3.2 Choice-Based Consumer Price Indices (“Ideal” Deflators) and Real Consumption Expenditures</td>
<td>195</td>
</tr>
<tr>
<td>9.3.3 Purchasing Power Parity in Its Absolute and Relative Version</td>
<td>197</td>
</tr>
<tr>
<td>9.3.4 The Household’s Choice Problem Using the Deflator and Real Consumption Expenditure</td>
<td>200</td>
</tr>
<tr>
<td>9.4 The Neoclassical Model of International Commodity Trade</td>
<td>203</td>
</tr>
<tr>
<td>9.4.1 Domestic and Foreign Producers in the Intertemporal World Market Equilibrium</td>
<td>203</td>
</tr>
</tbody>
</table>
Contents

9.4.2 Domestic and Foreign Households in the Intertemporal World Market Equilibrium ............................................. 203
9.4.3 Terms of Trade (TOT) in the Neoclassical Basic Model . . 204
9.4.4 Market-Clearing Conditions and Current Account Balance ................................................................. 205
9.5 Summary ........................................................................................................................................ 209
9.6 Exercises ........................................................................................................................................ 210
Mathematical Appendix ......................................................................................................................... 210
References ........................................................................................................................................ 213

10 Factor Proportion, Inter-Sectoral Trade, and Product Life Cycle ............................................................................... 215
10.1 Introduction and Motivation .................................................................................................................. 215
10.2 Production-Based Equilibrium Conditions in Autarky ......................................................................... 216
10.3 Equalization of Factor Prices in the World Market Equilibrium ........................................................... 220
10.4 Factor Proportions of Inter-Industrial Trade in the World Market Equilibrium ....................................... 223
10.5 The Leontief Paradox and the Neo-factor-proportion Theory ........................................................................ 227
10.6 The “Product Life Cycle” and the Dynamics of Comparative Advantages .................................................. 229
10.7 Summary ........................................................................................................................................ 231
10.8 Exercises ........................................................................................................................................ 232
References ........................................................................................................................................ 233

11 Product Differentiation, Decreasing Costs, and Intra-sectoral Trade ........................................................................... 235
11.1 Introduction and Motivation .................................................................................................................. 235
11.2 Linder’s Demand-Based Trade Theory .................................................................................................. 239
11.3 Monopolistic Competition and Product Differentiation in a Closed Economy ........................................... 240
11.3.1 Utility Maximization of Households and the Demand for Differentiated Goods ................................... 241
11.3.2 Profit Maximization of Producers and Short-Term Equilibrium .......................................................... 244
11.3.3 The Long-Term Market Equilibrium .................................................................................................. 246
11.4 Intra-industry Trade under Monopolistic Competition ........................................................................... 247
11.4.1 Price Elasticity of Demand Is Independent of the Number of Variants ............................................... 248
11.4.2 Price Elasticity of Demand Depending on the Number of Variants .................................................... 251
11.5 Summary ........................................................................................................................................ 253
11.6 Exercises ........................................................................................................................................ 254
Mathematical Appendix .............................................................................................................................. 254
References ........................................................................................................................................ 256
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 Globalization, Capital Accumulation, and Terms of Trade</strong></td>
<td>259</td>
</tr>
<tr>
<td>12.1 Introduction and Motivation</td>
<td>259</td>
</tr>
<tr>
<td>12.2 Causes and Consequences of the Globalization of Commodity Markets</td>
<td>261</td>
</tr>
<tr>
<td>12.3 Globalization of Commodity Markets: A Comparative-Static Analysis</td>
<td>262</td>
</tr>
<tr>
<td>12.4 Dynamics of the Region-Specific Capital Intensities and of the Terms of Trade</td>
<td>265</td>
</tr>
<tr>
<td>12.5 Globalization and Inequality Between Nations</td>
<td>269</td>
</tr>
<tr>
<td>12.6 Summary</td>
<td>275</td>
</tr>
<tr>
<td>12.7 Exercises</td>
<td>276</td>
</tr>
<tr>
<td>References</td>
<td>276</td>
</tr>
<tr>
<td><strong>13 Innovation, Growth and Trade in a Two-Country OLG Model</strong></td>
<td>279</td>
</tr>
<tr>
<td>13.1 Introduction and Motivation</td>
<td>279</td>
</tr>
<tr>
<td>13.2 Intermediate Products in the Two-Country OLG Model</td>
<td>281</td>
</tr>
<tr>
<td>13.3 Agents’ Choice Problems and Market-Clearing Conditions with Intra-sectoral Trade in Intermediates</td>
<td>281</td>
</tr>
<tr>
<td>13.4 Producers’ First-Order Conditions</td>
<td>285</td>
</tr>
<tr>
<td>13.5 The Structure of Intermediate Product Prices and Quantities</td>
<td>287</td>
</tr>
<tr>
<td>13.6 Cost Minimization of Final Good Producers and the Prices of Final Goods in the Industry Equilibrium</td>
<td>289</td>
</tr>
<tr>
<td>13.7 The Growth Rate of Intermediate Product Innovations in the International Equilibrium Versus in Autarky</td>
<td>292</td>
</tr>
<tr>
<td>13.8 Integration, Efficiency and Economic Growth: Some Comments</td>
<td>295</td>
</tr>
<tr>
<td>13.9 Summary</td>
<td>297</td>
</tr>
<tr>
<td>13.10 Exercises</td>
<td>298</td>
</tr>
<tr>
<td>References</td>
<td>298</td>
</tr>
<tr>
<td><strong>14 Real Exchange Rate and Public Debt in a Two-Advanced-Country OLG Model</strong></td>
<td>301</td>
</tr>
<tr>
<td>14.1 Introduction and Motivation</td>
<td>301</td>
</tr>
<tr>
<td>14.2 Literature Review and Preview</td>
<td>302</td>
</tr>
<tr>
<td>14.3 The Two-Good, Two-Country OLG Model</td>
<td>305</td>
</tr>
<tr>
<td>14.4 Intertemporal Equilibrium Dynamics and Existence of Steady States</td>
<td>309</td>
</tr>
<tr>
<td>14.5 Stability of Steady States and Steady-State Effects of Public Debt Shocks</td>
<td>314</td>
</tr>
<tr>
<td>14.6 Transitional Impacts of Shocks in Home’s Sustainable Public Debt</td>
<td>317</td>
</tr>
<tr>
<td>14.7 Summary and Conclusions</td>
<td>321</td>
</tr>
<tr>
<td>14.8 Exercises</td>
<td>323</td>
</tr>
<tr>
<td>Mathematical Appendix</td>
<td>324</td>
</tr>
<tr>
<td>References</td>
<td>330</td>
</tr>
</tbody>
</table>
15 Public Debt Reduction in Advanced Countries and Its Impacts on Emerging Countries ............................................. 333
  15.1 Introduction and Motivation ..................................... 333
  15.2 Literature Review .................................................. 334
  15.3 Firm FOCs and Intertemporal Equilibrium in a Two-Country OLG Model with Unequal Technologies ......................... 336
  15.4 Existence, Dynamic Stability and Comparative Statics of Steady States ......................................................... 337
  15.5 Steady State Welfare Effects of a Unilateral Reduction of Public Debt in Home .............................................. 343
    15.5.1 Steady-State Welfare Effects of Unilateral Debt Reduction in Home ......................................................... 344
    15.5.2 Numerical Illustrations of Welfare Effects for the Leading US-China Case ................................................ 348
  15.6 Summary and Conclusions .............................................. 350
  15.7 Exercises ............................................................. 352
Mathematical Appendix .................................................. 353
References ........................................................................... 359

16 External Balance, Dynamic Efficiency and Welfare Effects of National Climate Policies .................................................. 361
  16.1 Introduction and Motivation .......................................... 361
  16.2 Literature Review and Preview ...................................... 362
  16.3 The Two-Good, Two-Country OLG Model with Nationally Tradable Emission Permits ................................................. 364
    16.3.1 Firms ................................................................. 364
    16.3.2 Households and Governments ................................ 366
    16.3.3 Market Clearing and International Trade .................. 368
  16.4 The Steady State and Unilateral Permit Policy .................... 369
    16.4.1 Intertemporal Equilibrium Dynamics ......................... 369
    16.4.2 Characterization of Steady States .............................. 370
    16.4.3 Steady State Effects of Unilateral Permit Policies ........ 371
  16.5 The Steady-State Welfare Effects of Different Permit Policies ................................................................. 373
    16.5.1 Derivation of Welfare Effects .................................... 373
    16.5.2 Comparison of Global Welfare Effects of Unilateral Permit Policies in Home and in Foreign ......................... 376
    16.5.3 Comparison of Welfare Effects of a Unilateral Domestic and a Multilateral Permit Policy ................................. 377
    16.5.4 Comparison of Welfare Effects of a Unilateral Foreign and a Multilateral Permit Policy ........................................ 378
  16.6 Summary and Conclusions .............................................. 379
  16.7 Exercises ............................................................. 381
Mathematical Appendix .................................................. 381
References ........................................................................... 389
Growth and International Trade
An Introduction to the Overlapping Generations Approach
Farmer, K.; Schelnast, M.
2013, XV, 443 p. 90 illus., Hardcover
ISBN: 978-3-642-33668-3