Complex Evolutionary Dynamics in Urban-Regional and Ecologic-Economic Systems

From Catastrophe to Chaos and Beyond

Springer
1 Discontinuous Evolution of Urban Historical Forms .......................... 1
   1.1 Introduction .................................................. 1
   1.2 Agglomeration and the Formation and Sudden Growth of Cities .......... 4
      1.2.1 The Debate ................................................. 4
      1.2.2 Instability and Agglomeration ............................... 5
   1.3 Long-Distance Trade and Instability .................................... 13
      1.3.1 Another View: Open Versus Closed Cities .................... 13
      1.3.2 The Mees Version of Pirenne's Hypothesis .................. 14
      1.3.3 Comparative Advantage and City Size ....................... 16
      1.3.4 Logistical Networks and Long-Distance Trade ................. 17
   1.4 A Possible Synthesis: The Role of Technological Change ............. 18
      1.4.1 Agglomeration, Logistical Networks, and Technology .......... 18
      1.4.2 Rome Was Not Built in a Day ............................... 20

Notes ................................................................. 22

2 The New Economic Geography Approach and Other Views ................... 23
   2.1 The Setting ...................................................... 23
   2.2 The Three Returns to Scale ...................................... 26
   2.3 The Dixit-Stiglitz Model of Monopolistic Competition ................ 28
   2.4 Bifurcations of the NEG Core–Periphery Model ..................... 30
   2.5 The Core–Periphery Model at the Global Level ..................... 34
   2.6 Chaotic Dynamics in a Discrete Version of the Core–Periphery Model . 36
   2.7 Criticisms of the New Economic Geography .......................... 38

Notes ................................................................. 41

3 Discontinuities in Intraurban Systems ...................................... 43
   3.1 Some General Remarks ............................................ 43
   3.2 The Role of Transportation in Urban Structural Bifurcations .......... 44
      3.2.1 Modal Choice in Transportation .............................. 44
      3.2.2 Urban Retail Structure ...................................... 46
   3.3 An Ecological View ................................................ 48
      3.3.1 Density–Rent Cycles ......................................... 48
      3.3.2 Intraurban Lotka–Volterra Instability ....................... 50
3.4 Static and Dynamic Boundary Discontinuities ............... 52
  3.4.1 Neighborhood Boundary Dynamics .................. 52
  3.4.2 Land Use Boundaries ............................... 56
Notes .................................................. 61

4 Morphogenesis of Regional Systems .......................... 63
  4.1 The Continuous Flow Model ............................... 63
    4.1.1 Linear and Nonlinear Variations .................. 63
    4.1.2 Structural Change of the Flow Pattern .............. 65
    4.1.3 Wave Patterns in the Continuous Flow Model ......... 67
    4.1.4 Multiplier–Accelerator Cycles in the
          Continuous Flow Model ............................ 67
  4.2 Evolution of Urban and Regional Systems ................. 69
    4.2.1 Predator–Prey Cycles in Single Cities ............. 69
    4.2.2 Interregional Predator–Prey Cycles ................. 71
    4.2.3 The Emergence of Chaotic Dynamics ................. 74
  4.3 Self-Organizing Regional Morphogenesis ................... 76
    4.3.1 Order Through Fluctuations ....................... 76
    4.3.2 Time Scales and Slaves ............................ 78
    4.3.3 A Fractal Synergesis .............................. 80
Notes .................................................. 82

5 Complex Dynamics in Spatial Systems ........................ 85
  5.1 Complexity and Socioeconomic Spatial Systems .......... 85
  5.2 The Generality of the Schelling Model ................. 86
  5.3 An Evolutionary Game Theoretic View of the Schelling Model 88
  5.4 Network Analysis of the Schelling Model ............... 89
  5.5 Zipf’s Law and Urban Hierarchy ....................... 93
  5.6 Urban Hierarchy with Discrete Levels .................. 97
  5.7 Bottom-Up or Top-Down Development of Urban Hierarchies? 100
Notes .................................................. 104

6 Perspectives on Economic and Ecologic Evolution ............. 107
  6.1 Historical Perspectives ............................... 107
    6.1.1 Origins .......................................... 107
    6.1.2 Dialectical Difficulties ......................... 108
    6.1.3 Evolution and the Equilibrium Concept ............. 110
    6.1.4 Cycles and Chaos ............................... 111
  6.2 Continuous Versus Discontinuous Theories of Evolution .. 112
    6.2.1 Gradualism ...................................... 112
    6.2.2 Saltationalism ................................... 113
  6.3 Hypercyclic Morphogenesis of Higher-Level Structures .... 115
Notes .................................................. 117

7 Evolution and Complexity .................................... 121
  7.1 The Ups and Downs of the Darwinian View of Evolution ... 121
  7.2 The Ups and Downs of Darwinian Evolutionary Economics .. 126