

Contents

Part I Introduction

1 Introduction	3
1.1 Modeling Dynamic Systems.....	3
1.1.1 Model Building.....	3
1.1.2 Static, Comparative Static, and Dynamic Models.....	5
1.1.3 Model Components.....	7
1.1.4 Modeling in STELLA.....	9
1.1.5 Modeling Principles.....	18
1.1.6 Model Confirmation.....	20
1.1.7 Modeling of Natural Resource Use.....	22
1.1.8 Extending the Modeling Approach.....	24
1.1.9 Basic Fish Model Equations.....	26
References.....	26
2 Disaggregation of Stocks	29
2.1 Promotion Within the Firm.....	29
2.2 Disaggregated Stocks Model Equations.....	32

Part II Methods for Dynamic Modeling

3 System Boundaries in Space and Time	35
3.1 Introduction.....	35
3.2 Energy Cost of Production at the Level of the Firm.....	36
3.3 Firm-Level Energy Cost Model Equations.....	40
3.4 Extending the System Boundaries.....	40
3.5 Extended System Boundary Model Equations.....	46
3.6 Sensitivity Analysis.....	47
3.7 Sensitivity Analysis Model Equations.....	52

- 4 Scheduling Flows** 53
 - 4.1 Conveyors, Queues, and Ovens 53
 - 4.2 Modeling Discrete Flows in Space and Time 54
 - 4.3 Store Model Equations 58
 - 4.4 Optimizing Traffic Flow 59
 - 4.5 Traffic Flow Model Equations 66
- 5 Positive Feedback in the Economy** 71
 - 5.1 Feedback in the Economy 71
 - 5.2 Positive Feedback 72
 - 5.3 Positive Feedback Model Equations 75
 - Reference 76
- 6 Derivatives and Lags** 77
 - 6.1 Introduction 77
 - 6.2 Integration Model Equations 81
 - 6.3 Derivatives and Lags: Some Applications 81
 - 6.3.1 Single-Output Firm 81
 - 6.3.2 Single-Output Firm 82
 - 6.3.3 Two-Output Firm 83
 - 6.3.4 Two-Output Firm 85

Part III Microeconomic Models of Firms

- 7 Introduction to Modeling Economic Processes** 89
 - 7.1 Core Principles of Economics 89
 - Reference 90
- 8 Substitution of Inputs in Production** 91
 - 8.1 Trade-Off Possibility Frontiers 91
 - 8.2 Trade-Off Possibilities Frontier Model Equations 94
 - 8.3 Profit Maximization with Several Inputs 94
 - 8.4 Competitive Firm with Substitution Model Equations 97
- 9 Time Value** 99
 - 9.1 Current and Present Value Calculation 99
 - 9.1.1 Time Value Model Equations 103
 - 9.2 Cost–Benefit Analysis 104
 - 9.3 Cost–Benefit Model Equations 107
 - Reference 107
- 10 Opportunity Cost** 109
 - 10.1 Managing an Inventory 109
 - 10.2 Opportunity Cost Model Equations 115
 - Reference 116

- 11 The Profit-Maximizing Competitive Firm**..... 117
 - 11.1 Optimizing Behavior of the Competitive Firm 117
 - 11.2 Competitive Firm Model Equations..... 122
- 12 The Profit-Maximizing Monopoly**..... 123
 - 12.1 Introduction 123
 - 12.2 Monopoly Model Equations 127
 - 12.3 Effects of Taxes on Monopolistic Output and Price 127
 - 12.4 Monopoly with Taxes Model Equations 131
 - 12.5 Monopolistic Production and Pollution 131
 - 12.6 Monopolistic Production and Pollution Model Equations 136
- 13 Monopolistic Collusion**..... 137
 - 13.1 Joint Management of Two Monopolists..... 137
 - 13.2 Monopolistic Collusion Model Equations..... 142
- 14 Quasi-Competitive Equilibrium**..... 143
 - 14.1 Finding the Number of Profit-Maximizing Competitors..... 143
 - 14.2 Quasi-Competitive Equilibrium Model Equations 147
- 15 Modeling Economic Games**..... 149
 - 15.1 Arms Race 149
 - 15.2 Arms Race Model Equations 152
 - 15.3 Barter Economy 152
 - 15.4 Barter Economy Model Equations 155
 - 15.5 Sealed-Bid, Second-Price Auction Game 155
 - 15.6 Sealed-Bid Second-Price Auction Game..... 161
 - References..... 163

Part IV Modeling Optimal Use of Nonrenewable Resources

- 16 Competitive Scarcity** 167
 - 16.1 Basic Model..... 167
 - 16.2 Basic Competitive Scarcity Model Equations..... 176
 - 16.3 Competitive Scarcity with Various DT 176
 - 16.4 Competitive Scarcity with Various DT Model Equations 178
 - References..... 178
- 17 Competitive Scarcity with Substitution**..... 179
 - 17.1 Price Effects 179
 - 17.2 Competitive Scarcity with Price Effect Model Equations 182
 - 17.3 Sudden Demand Shift 182
 - 17.4 Sudden Demand Shift Model Equations 184
 - 17.5 S-Shaped Substitution Model..... 185
 - 17.6 S-Shaped Substitution Model Equations 189

18 Competitive Scarcity with Cost Dependent on Production Rate and Resource Size 191

18.1 Production Rate and Resource Size Effects 191

18.2 Production Rate and Resource Size Effects Model Equations 195

Reference..... 195

19 Competitive Scarcity with Technical Change 197

19.1 Introduction 197

19.2 A Basic Model of Competitive Scarcity with Technical Change 198

19.3 Competitive Scarcity with Endogenous Technical Change Model Equations..... 202

References..... 202

20 Competitive Scarcity with Exploration 203

20.1 Scarcity and Exploration 203

20.2 Competitive Scarcity with Exploration Model Equations 208

21 Monopoly Scarcity..... 209

21.1 Nonrenewable Resource Extraction in a Monopoly 209

21.2 Monopolistic Scarcity 214

22 Monopoly Scarcity with Variable Interest Rate 217

22.1 Introduction 217

22.2 Monopoly, Scarcity, and Variable Interest Rates 218

22.3 Monopoly Scarcity with Variable Interest Rate Model Equations..... 221

Reference..... 222

23 Monopoly Scarcity with Cost Dependent on Production Rate and Resource Size 223

23.1 Production Rate and Resource Size Influences on Monopolistic Resource Extraction 223

23.2 Production Rate and Resource Size Influences on Monopolistic Resource Extraction Model Equations..... 226

Part V Modeling Optimal Use of Renewable Resources

24 Optimal Timber Harvest..... 229

24.1 Introduction 229

24.2 Optimal Harvest Time and Internal Rate of Return..... 233

24.3 Internal Rate of Return Model Equations 235

References..... 235

25 Managing Open Access Resources 237

25.1 Tragedy of the Commons..... 237

25.2 Open Access Resources Model Equations 247

26 Optimal Catch from Fisheries 249

 26.1 Optimal Fisheries Model 249

 26.2 Optimal Catch Model Equations 257

27 Predator–Prey Models of Fisheries 259

 27.1 Basic Fisheries Model 259

 27.2 Basic Fisheries Model Equations..... 263

 27.3 Fishing with Nonmalleable Capital 264

 27.4 Nonmalleable Capital Stock Model Equations..... 269

 References..... 269

28 Spatial Fishery Model..... 271

 28.1 Basic Model..... 271

 28.2 Spatial Fisheries Model Equations 280

 28.3 Management of a Multiregion Fishery 282

 28.4 Multiregion Fisheries Model Equations 285

 References..... 287

Part VI Chaos in Economic Models

29 Preference Cycles and Chaos..... 291

 29.1 Introduction 291

 29.2 Modeling Preference Cycles..... 292

 29.3 Preference Cycle Model Equations..... 297

 References..... 297

30 Nonmonotonic Demand and Supply Curves 299

 30.1 Introduction 299

 30.2 Nonmonotonic Supply 300

 30.3 Nonmonotonic Supply Model Equations..... 304

 Reference..... 304

31 Price Expectation and Production Lags 305

 31.1 Chaos with Price Expectations and Production Lags 305

 31.2 Price Expectations and Production Lag Model Equations 310

 Reference..... 310

32 Chaos in Macroeconomic Models 311

 32.1 Macroeconomic Chaos 311

 32.2 Macroeconomics Chaos Model Equations 315

 Reference..... 315

Part VII Conclusion

33 Building a Modeling Community 319

Index..... 321



<http://www.springer.com/978-1-4614-2208-2>

Modeling Dynamic Economic Systems

Ruth, M.; Hannon, B.

2012, XVII, 326 p., Hardcover

ISBN: 978-1-4614-2208-2