

Contents

Foreword	V
----------------	---

Part I. An Overview

1 Evolutionary Computation in Economics and Finance: An Overview of the Book	3
<i>Shu-Heng Chen</i>	
1.1 The Birth of this Volume	3
1.2 Playing Games: 1987	4
1.3 Exploring Agent-Based Artificial Stock Markets: 1988	6
1.4 Probing Econometrics and Financial Engineering: 1992	18
1.5 Conclusions	25
References	25

Part II. Games

2 Playing Games with Genetic Algorithms	31
<i>Robert E. Marks</i>	
2.1 Introduction	31
2.2 Deductive Versus Evolutionary Approaches to Game Theory	32
2.3 The Repeated Prisoner's Dilemma	32
2.4 Boundedly Rational Players	32
2.5 Game-Playing Automata	33
2.6 Co-Evolution of Automata	34
2.7 Learning	35
2.8 Replicator Dynamics	36
2.9 Other Refinements	38
2.10 Empirical Games	38
2.11 Conclusion	39
References	40
3 Genetic Algorithm Learning and Economic Evolution	45
<i>Thomas Riechmann</i>	
3.1 Introduction	45
3.2 The Standard Genetic Algorithm	46
3.3 Genetic Algorithms as Evolutionary Processes	47
3.4 Populations as Near Nash Equilibria	50
3.5 Evolutionary Stability of Genetic Populations	51
3.6 Evolutionary Dynamics	54

3.7 Modified Genetic Operators and Their Impact on Stability	56
3.8 Summary	58
References	58
4 Using Symbolic Regression to Infer Strategies from Experimental Data	61
<i>John Duffy, Jim Engle-Warnick</i>	
4.1 Introduction	61
4.2 Symbolic Regression Using Genetic Programming	62
4.3 An Illustration	64
4.4 The Regression Model	65
4.5 The Algorithm	71
4.6 Parameters and Fitness Specification	71
4.7 Regression Results for the Ultimatum Game	72
4.8 Summary and Conclusions	81
References	82

Part III. Agent-Based Computation Economics

5 The Efficiency of an Artificial Double Auction Stock Market with Neural Learning Agents	85
<i>Jing Yang</i>	
5.1 Motivation and Introduction	85
5.2 Market Structure	87
5.3 Experiment Design	94
5.4 Computational Results	95
5.5 Conclusions and Directions for Future Research	101
A Appendix	102
References	103
6 On AIE-ASM: Software to Simulate Artificial Stock Markets with Genetic Programming	107
<i>Shu-Heng Chen, Chia-Husan Yeh, Chung-Chih Liao</i>	
6.1 Introduction	107
6.2 AIE-ASM, Version 2: A User's Guide	108
6.3 Search Process without Business School	115
6.4 An Example	117
6.5 A Summary of AIE-ASM Publications	121
References	122
7 Exchange Rate Volatility in the Artificial Foreign Exchange Market	123
<i>Jasmina Arifovic</i>	
7.1 Introduction	123
7.2 Description of the Model	124

7.3 Description of the Artificial Foreign Exchange Market 126

7.4 Further Research 131

References 134

**8 Using an Artificial Market Approach
to Analyze Exchange Rate Scenarios 135**
Kiyoshi Izumi, Kazuhiro Ueda

8.1 Introduction 135

8.2 Problems with Conventional Approaches 136

8.3 Framework of the Artificial Market Approach 136

8.4 Observation in the Field 137

8.5 Construction of a Multi-agent Model 142

8.6 Scenario Analysis 151

8.7 Conclusion 156

References 156

**9 Emulating Trade in Emissions Permits: An Application of
Genetic Algorithms 159**
Rosalyn Bell, Stephen Beare

9.1 Background 159

9.2 Model Construction and Use of GAs 161

9.3 Simulation Results 167

9.4 Concluding Remarks 170

9.5 Symbol Listing 172

References 173

10 Cooperative Computation with Market Mechanism 175
Masayuki Ishinishi, Hiroshi Sato, Akira Namatame

10.1 Introduction 175

10.2 A Model of Economic Agents and Definition of Equilibrium
Solutions 177

10.3 The Competitive Adaptation Using Market Prices 180

10.4 Social Rules that Induce Implicit Cooperation 182

10.5 Simulation Results 184

10.6 Conclusion 186

References 187

**11 Hysteresis in an Evolutionary Labor Market with
Adaptive Search 189**
Leigh Tesfatsion

11.1 Introduction 189

11.2 Labor Market Framework 194

11.3 Descriptive Statistics 199

11.4 Experimental Design 202

11.5 Experimental Findings 204

11.6 Concluding Remarks 209

References	210
12 Computable Learning, Neural Networks and Institutions	211
<i>Francesco Luna</i>	
12.1 Introduction	211
12.2 The Theoretical Reference Point	213
12.3 Neural Nets and Institutions	214
12.4 Memory, Confidence and Psychological Addiction	219
12.5 Physical Effectiveness and Structural Sclerosis	223
12.6 Psychological Addiction and Innovation	225
12.7 Structural Sclerosis and Innovation	227
12.8 Social Learning	228
12.9 Conclusions	231
References	231
13 On Two Types of GA-Learning	233
<i>Nicolaas J. Vriend</i>	
13.1 Introduction	233
13.2 An Example	234
13.3 Analysis	238
13.4 Discussion	240
A Appendix	242
References	243
14 Evolutionary Computation and Economic Models: Sensitivity and Unintended Consequences	245
<i>David B. Fogel, Kumar Chellapilla, Peter J. Angelino</i>	
14.1 Introduction	245
14.2 The El Farol Problem	247
14.3 The Iterated Prisoner's Dilemma	253
14.4 Discussion	264
References	267

Part IV. Financial Engineering

15 Tinkering with Genetic Algorithms: Forecasting and Data Mining in Finance and Economics	273
<i>George G. Szpiro</i>	
15.1 Introduction	273
15.2 A Primer on Genetic Algorithms	274
15.3 Performance Boosters	277
15.4 Other Problems and Suggestions for Future Research	281
15.5 Concluding Remarks	284
References	284

16 Forecasting Ability But No Profitability: An Empirical Evaluation of Genetic Algorithm-Optimised Technical Trading Rules 287
Robert Pereira

16.1 Introduction 287

16.2 Technical Trading Rules 289

16.3 Genetic Algorithm Methodology 293

16.4 Performance Evaluation 299

16.5 An Empirical Application 302

16.6 Conclusion 308

References 308

17 Evolutionary Induction of Trading Models 311
Siddhartha Bhattacharyya, Kumar Mehta

17.1 Introduction 311

17.2 Representation of Trading Models 313

17.3 Fitness Function 317

17.4 Experimental Study 321

17.5 Discussion 326

References 329

18 Optimizing Technical Trading Strategies with Split Search Genetic Algorithms 333
Raymond Tsang, Paul Lajbcygier

18.1 Introduction 333

18.2 GAs and Mutation 334

18.3 The SSGA Explained 336

18.4 Preliminary Testing 338

18.5 Preliminary Results 340

18.6 Financial Application: Technical Trading Strategies 343

18.7 Conclusion 354

References 357

19 GP Forecasts of Stock Prices for Profitable Trading 359
Mahmoud Kaboudan

19.1 Introduction 359

19.2 SDTS 361

19.3 The Data 364

19.4 GEMs and Their Price Forecasts 365

19.5 Trading Profits 372

19.6 Remarks 376

References 377

20 Option Pricing Via Genetic Programming	383
<i>Nemmara Chidambaran, Joaquin Triqueros, Chi-Wen Jevons Lee</i>	
20.1 Introduction	383
20.2 Genetic Programming - A Brief Overview	385
20.3 Performance Analysis in a Jump-Diffusion World	386
20.4 Application in the Real World	392
20.5 Conclusion	395
References	396
21 Evolutionary Computation in Option Pricing: Determining Implied Volatilities Based on American Put Options	399
<i>Christian Keber</i>	
21.1 Introduction	399
21.2 The Implied Volatility Model	401
21.3 Genetic Programming	403
21.4 Genetic Determination of Implied Volatilities	404
21.5 Experimental Results	406
21.6 Concluding Remarks	413
References	414

Part V. Bibliography

22 Evolutionary Computation in Economics and Finance: A Bibliography	419
<i>Shu-Heng Chen, Tzu-Wen Kuo</i>	
22.1 Introduction	419
22.2 Publications by Application Domains	419
22.3 Publications by Journals	426
22.4 Publications by Conference Proceedings	427
22.5 Useful Websites	428
22.6 Software	429
References	429
Index	457