

Table of Contents

Preface	VII
I Formal Models in Economics	1
1 A chaotic process with slow feed back: The case of business cycles	3
<i>by Tõnu Puu</i>	
1.1 A first model	3
1.1.1 Investments	3
1.1.2 Consumption	4
1.2 The cubic iterative map	5
1.2.1 Fixed points, cycles and chaos	5
1.2.2 Formal analysis of chaotic dynamics	12
1.2.3 Symbolic dynamics	15
1.3 “Brownian random walk”	15
1.4 Digression on order and disorder	18
1.5 The general model	19
1.5.1 Relaxation cycles	20
1.5.2 Other cycles	26
1.5.3 The Slow Feed Back	26
1.6 Conclusion	33
2 Nonlinear Interactions in the Economy	35
<i>by Erik Mosekilde, Jesper S. Thomsen, and John Sterman</i>	
2.1 Introduction	35
2.2 The Long Wave Model	38
2.3 Mode-Locking and Chaos	45
2.4 Conclusion	54
3 Fast and Slow Processes of Economic Evolution	62
<i>by Åke E. Andersson</i>	
3.1 Introduction and Background	62
3.2 The Problems of Economic Development Theory	63
3.3 Synergetic Development Economics — Some Basic Concepts	64

3.4	The Arena	65
3.5	Rules of the Game	66
3.6	Networks	66
3.7	Knowledge As Networks and Knowledge On Networks	67
3.8	Communication and Creativity — some Historical Evidence	68
3.9	Creativity and Communications — Econometric Results	69
3.10	The Inverted Explanation	70
3.11	The Destruction of the Industrial Society	72
3.12	The New Economic Structure	73
4	A stochastic model of technological evolution	75
	<i>by W. Ebeling, M.A. Jiménez-Montaño, E. Bruckner, and A. Scharnhorst</i>	
4.1	Introduction	75
4.2	A Substitution Model	78
4.3	Application of a general evolutionary model to technological change	82
4.4	Discussion	86
5	Evolution of Production Processes	96
	<i>by Klaus G. Troitzsch</i>	
5.1	Introduction	96
5.2	Basic Assumptions	97
5.3	Formalization	97
5.4	Chernenko's Results	99
5.5	An alternative macro model	100
5.6	Simulation results	101
5.7	Modeling evolution on the individual level	104
	5.7.1 Simulation run with total extinction	105
	5.7.2 Simulation run without extinction	110
5.8	Conclusions	112
6	Innovation Diffusion through Schumpeterian Competition	115
	<i>by Michael Sonis</i>	
6.1	Introduction: From "Homo Economicus" to "Homo Socialis": Innovation diffusion as a collective socio-ecological dynamic choice process.	115
6.2	Analytical basis of Schumpeterian Competition: Collective choice and relative socio-spatial dynamics	119
6.3	Explicit analytical presentation of the innovation diffusion dynamics: Dynamic choice models.	122
6.4	Intervention of an active environment: Generation of innovation adoption niches.	123
6.5	Temporal innovation diffusion process	125
	6.5.1 Qualitative analysis of the Schumpeter competition cycles for Clusters of competitive innovations	128
	6.5.2 Variational principle of meso-level collective choice behaviour	134
6.6	Concluding Remark	137

7	Nonlinear Threshold Dynamics: Further Examples for Chaos in Social Sciences	141
	<i>by Gustav Feichtinger</i>	
7.1	Introduction	141
7.2	A Short Course into Chaos	142
7.3	How Addictive Behaviour and Threshold Adjustment May Imply Chaos	143
7.4	How Asymmetric Investment Behaviour of Two Competing Firms Generates Chaos	146
7.5	Concluding Remarks	153
II	Formal Models in Geography	155
8	Geography, Physics and Synergetics	157
	<i>by Denise Pumain</i>	
8.1	Introduction	157
8.2	Models of geographical interactions	158
8.2.1	Polarization and gravitation	158
8.2.2	Reformulations of the gravity model	160
8.2.3	The entropy maximizing approach	162
8.2.4	About men and particles	163
8.3	Models of geographical structures	163
8.3.1	The relativity of geographical space	164
8.3.2	Fractality of geographical space	164
8.3.3	Space-time convergence	166
8.3.4	The example of urban hierarchies	169
8.3.5	Processes and geographical forms	171
8.4	Conclusion	173
9	Chaotic Behaviour in Spatial Systems and Forecasting	176
	<i>by Günter Haag</i>	
9.1	Introduction	176
9.2	An Example for Chaotic Evolution: Migratory Systems	178
9.2.1	A Numerical Simulation	181
9.3	Estimation of Trend Parameters	185
9.4	The Estimation Procedure	185
9.5	Forecasting for Systems with Chaotic Evolution	186
9.5.1	Step I: Confidence Limits on Model Parameters by Monte Carlo Estimation	187
9.5.2	Step II: Monte Carlo Simulation of Systems Trajectories	187
10	Model Identification for Estimating Missing Values in Space-Time Data Series: Monthly Inflation in the US Urban System, 1977-1990	192
	<i>by Daniel A. Griffith</i>	
10.1	Introduction	192
10.2	Background	193

10.3	Update of individual urban area ARIMA models	194
10.4	Jackknife results for New York and Los Angeles	196
10.5	Transfer function interpolation	198
10.6	Implications	200
11	Explanation of Residential Segregation in one City. The Case of Cologne	219
	<i>by Jörg Blasius</i>	
11.1	Introduction	219
11.2	Measuring Segregation	220
11.3	Data	223
11.4	The Index of Inequality	224
11.5	Solutions	225
11.6	Statistical Explanation	229
11.7	Discussion	230
12	Determinants of Remigrant Behavior: An Application of the Grouped Cox Model	234
	<i>by Beatrix Brecht</i>	
12.1	Introduction	234
12.2	Migrants in Germany	235
12.3	Foundations of the Survival Analysis	238
12.4	The Grouped Cox Model	242
12.5	Results	249
	12.5.1 Estimations with the Total Sample	249
	12.5.2 Estimations with a Subsample (20% CensoredData)	250
12.6	Conclusion	252
III	Formal Models in Demography	255
13	Birth Control as a Social Dilemma	257
	<i>by Ulrich Mueller</i>	
13.1	Introduction	257
	13.1.1 Purpose	257
13.2	Method	264
13.3	Results	265
13.4	Discussion	278
14	Sex-Ratio, divorce, and labor force participation — An analysis of international aggregate data	283
	<i>by Andreas Diekmann</i>	
14.1	Introduction	283
14.2	Data and measurement of variables	286
14.3	Results	287
14.4	Conclusion	292

15 Some Aspects of Competing Risks in Demography	294
<i>by Harald Schmidbauer</i>	
15.1 Introduction	294
15.2 The Latent Failure Model	295
15.3 The Problem of Nonidentifiability	296
15.3.1 Inclusion of covariates (regressors)	297
15.3.2 Bounds on net probabilities	297
15.3.3 Functional form assumptions about S	297
15.3.4 The postulate of independence	298
15.4 A Discrete-Time Model of Risk Elimination	298
15.5 Example	302
15.6 Conclusions	304
16 Dynamic Structural Equations in Discrete and Continuous Time	306
<i>by Hermann Singer</i>	
16.1 Introduction	306
16.2 Dynamic State Space Models	307
16.3 Maximum Likelihood Parameter Estimation with Continuous Measure- ments	308
16.4 Maximum Likelihood Parameter Estimation with Discrete Measurements	312
16.5 Conclusion	316
17 Recursive Probability Estimators for Count Data	321
<i>by Rainer Winkelmann and Klaus F. Zimmermann</i>	
17.1 Introduction	321
17.2 Katz Family	322
17.3 Separability and the A.L.D.P.	324
17.4 Application	326
18 A Mathematical Model for Behavioral Changes by Pair Interactions	330
<i>by Dirk Helbing</i>	
18.1 Introduction	330
18.2 The master equation	331
18.3 Most probable behavioral distribution	333
18.4 Kinds of pair interactions	334
18.4.1 Computer simulations	336
18.5 Game dynamical equations	340
18.5.1 Connection between BOLTZMANN-like and game dynamical equa- tions	341
18.5.2 Stochastic version of the game dynamical equations	342
18.5.3 Selforganization of behavioral conventions by competition be- tween equivalent strategies	343
18.6 Summary and Conclusions	346

19	Employment and Education as Non-Linear Network-Populations, Part I: Theory, Categorization and Methodology	349
	<i>by Günter Haag and Karl H. Müller</i>	
19.1	Self-organization Models	352
19.2	Classification Stabilities	356
19.3	Methodolgy Considerations	361
19.3.1	Model Selection	364
19.3.2	Basic Assumptions	365
19.3.3	Micro-Macro-Relations	367
19.4	Systems Couplings	373
20	Employment and Education as Non-Linear Network Populations. Part II: Model Structures, Estimations, and Scenarios	377
	<i>by Günter Haag and Karl H. Müller</i>	
20.1	The Explanatory Framework	379
20.1.1	The Explanation Scheme for the Master Equation Framework	379
20.1.2	Five Different Designs for Factor Selections	383
20.2	Model Structures	386
20.2.1	The Employment Model	386
20.2.2	Equations of Motion	389
20.2.3	The Education Model	390
20.3	Estimation Results	399
20.4	Scenario Results	399
20.5	Scenario - Dimensions	399
20.6	Future Perspectives	407