

# Contents

## Part I Economic Gene Mapping in China by Electricity Economics

<b>1</b>	<b>China's Electricity Economy</b>	<b>3</b>
1.1	Electricity Economics	4
1.1.1	The Characteristics of Electricity Data	4
1.1.2	Production Functions with Electricity	7
1.1.3	Stages of Economic Development in Terms of Electricity Consumption	10
1.1.4	The Characteristics of Gene in an Economy	12
1.2	Review of the Economic Development in China by Electricity Economics	15
1.2.1	Economic Activities of Three Industries	16
1.2.2	National Economic Development	29
1.2.3	Stages of Economic Development in China	34
1.3	Review of China's Economy in Global Crisis	38
1.3.1	Electricity Growths of Secondary and Tertiary Industries	39
1.3.2	Electricity Growths for Some Sectors	40
1.3.3	Electricity Growth Trends	42
1.3.4	Employment Analysis	46
	References	47
<b>2</b>	<b>Challenge–Opportunity and Mutations in China's Economy</b>	<b>49</b>
2.1	Review of Electricity and Energy Supply in China	50
2.1.1	Electric Power Supply	50
2.1.2	Coal Production and Consumption	56
2.1.3	Oil Production and Consumption	62
2.1.4	Natural Gas Production and Consumption	64

2.1.5	Hydro-, Nuclear, and Wind Power Production and Consumption . . . . .	66
2.1.6	Total Energy Production and Consumption . . . . .	66
2.2	Emissions . . . . .	71
2.2.1	Air Pollutions . . . . .	71
2.2.2	Water Pollutions . . . . .	73
2.2.3	People's Health Problems . . . . .	73
2.3	Economic Mutation . . . . .	78
2.3.1	Mutations of the Economy in the USA . . . . .	79
2.3.2	Mutations of the Economy in Japan . . . . .	82
2.3.3	Mutations of the Economy in China . . . . .	87
2.4	Findings . . . . .	88
	References . . . . .	89
<b>3</b>	<b>Economic Gene Mapping of China . . . . .</b>	<b>91</b>
3.1	Gene Mapping of an Economy . . . . .	92
3.1.1	Economic Gene Mapping . . . . .	92
3.1.2	Economic Gene Maps of the USA . . . . .	93
3.1.3	Economic Gene Maps of Japan . . . . .	94
3.2	Economic Simulation in China (BAU Scenario) . . . . .	95
3.2.1	Production Growths of 42 Sectors . . . . .	98
3.2.2	Value-Added Growths of Three Industries . . . . .	105
3.2.3	Energy Demand and Supply . . . . .	106
3.3	Economic Simulation of Fiscal and Monetary Policy (Policy Scenario) . . . . .	108
3.3.1	Production Growths of 42 Sectors . . . . .	109
3.3.2	Value-Added Growths of Three Industries . . . . .	116
3.3.3	Energy Demand and Supply . . . . .	118
3.4	Economic Gene Mapping of China . . . . .	120
3.4.1	Economic Gene Maps of China's National Economy . . . . .	120
3.4.2	Economic Gene Maps for Three Industries . . . . .	123
3.4.3	Economic Gene Maps for Sectors . . . . .	127
3.5	Comparison of Gene Maps of China and Japan . . . . .	131
3.5.1	Economic Development Stage . . . . .	133
3.5.2	A Negative Mutation in the Economic Stage . . . . .	134
3.5.3	Similarities and Differences of Gene Maps of China and Japan . . . . .	137
3.6	Findings . . . . .	138
	References . . . . .	140
<b>Part II Methodology of Agent Response Equilibrium</b>		
<b>4</b>	<b>Review of Economic Modeling . . . . .</b>	<b>143</b>
4.1	Economic Activities . . . . .	143
4.2	Input-Output Table . . . . .	145

4.3	Computable General Equilibrium Model . . . . .	149
4.3.1	Social Accounting Matrix . . . . .	149
4.3.2	Introduction of the CGE Model . . . . .	150
4.3.3	Applications of the CGE Model . . . . .	151
4.4	Intelligent Agent and Simulation . . . . .	153
4.5	Agent-Based Computational Economics . . . . .	156
4.5.1	Introduction of the ACE Model . . . . .	156
4.5.2	Applications of the ACE Model . . . . .	157
	References . . . . .	160
<b>5</b>	<b>Introduction of Intelligent Engineering . . . . .</b>	<b>163</b>
5.1	Introduction . . . . .	163
5.2	Generalized Model . . . . .	166
5.2.1	Mathematical Model . . . . .	167
5.2.2	Rule-Based Model . . . . .	168
5.2.3	Fuzzy Inference Model . . . . .	169
5.2.4	Neural Network Model . . . . .	169
5.2.5	Hybrid Model . . . . .	170
5.3	Intelligent Space . . . . .	171
5.3.1	Concepts . . . . .	171
5.3.2	Problem $B_1$ . . . . .	176
5.3.3	Problem $B_2$ . . . . .	178
	References . . . . .	179
<b>6</b>	<b>Agent Response Equilibrium Model . . . . .</b>	<b>181</b>
6.1	Agent . . . . .	181
6.1.1	Definition . . . . .	181
6.1.2	Classification . . . . .	182
6.1.3	Features . . . . .	183
6.1.4	Self-Learning . . . . .	184
6.2	Multi-agent Model . . . . .	184
6.2.1	Multi-agent System . . . . .	184
6.2.2	Multi-agent Model . . . . .	184
6.3	Introduction to ARE Model . . . . .	185
6.3.1	ARE Model . . . . .	185
6.3.2	ARE Model Framework . . . . .	186
6.3.3	Functions of Agents . . . . .	187
6.3.4	Features of ARE Model . . . . .	189
6.4	Design of ARE Model . . . . .	189
6.4.1	Model Structure . . . . .	189
6.4.2	Interaction Mechanism Assumptions . . . . .	190
6.4.3	Assumptions . . . . .	191
6.4.4	Database Design . . . . .	192
6.4.5	Rule Base Design . . . . .	192
6.4.6	Self-Learning Rules of Agents . . . . .	193

6.4.7	Communication Mechanism . . . . .	194
6.4.8	Energy Consumption Calculation . . . . .	196
References . . . . .		198
<b>7</b>	<b>Individual Agent Functions and Computer Programming . . . . .</b>	<b>199</b>
7.1	Individual Agent . . . . .	199
7.1.1	Sector Agent . . . . .	199
7.1.2	Market Agent . . . . .	204
7.1.3	International Commodity Market Agent . . . . .	206
7.1.4	Government Agent . . . . .	207
7.1.5	Central Bank Agent . . . . .	208
7.1.6	Commercial Bank Agent . . . . .	209
7.1.7	Resident Agent . . . . .	210
7.2	Computer Program of ARE Model . . . . .	211
7.2.1	The Computer Program Flowchart . . . . .	211
7.2.2	Computer Programming Environment . . . . .	211
7.2.3	Typical Statements of the Computer Program . . . . .	214
7.3	Input Data of ARE Model . . . . .	217
7.3.1	IO Data Input . . . . .	217
7.3.2	Financial Data Input . . . . .	222
7.3.3	Labor Data Input . . . . .	223
7.3.4	Production Function Data Input . . . . .	224
7.3.5	Tax Data Input . . . . .	225
7.4	Parameters . . . . .	228
7.4.1	Elasticity . . . . .	228
7.4.2	Monetary Parameters . . . . .	230
References . . . . .		230
<b>Part III</b>	<b>China's Economic Simulations by Agents Response Equilibrium</b>	
<b>8</b>	<b>China's Economic Simulation for the Period of Global Crisis . . . . .</b>	<b>233</b>
8.1	Evaluation Rules of Economic Simulation by the ARE Model . . . . .	234
8.2	Review of China's Economy in 2007 . . . . .	235
8.3	Economic Simulation for 2008 . . . . .	242
8.3.1	Assumptions . . . . .	242
8.3.2	Results . . . . .	243
8.3.3	Calibrations . . . . .	251
8.4	Economic Simulation for 2009 . . . . .	253
8.4.1	Assumptions . . . . .	253
8.4.2	Results . . . . .	253
8.4.3	Calibrations . . . . .	259

8.5	Economic Simulation for 2010 . . . . .	262
8.5.1	Assumptions . . . . .	262
8.5.2	Results . . . . .	263
8.5.3	Calibrations . . . . .	269
8.6	Update of Input–Output Table . . . . .	272
<b>9</b>	<b>China’s Economic Simulations in 2011–2014 by Agent Response Equilibrium Model . . . . .</b>	<b>275</b>
9.1	Summary of Evaluation Rules on Economic Simulation of ARE Model . . . . .	275
9.2	Economic Simulation for 2011 by ARE Model . . . . .	276
9.2.1	Fiscal and Monetary Policies . . . . .	276
9.2.2	Simulation Results . . . . .	277
9.2.3	Error Analysis . . . . .	284
9.3	Economic Simulation for 2012 by ARE Model . . . . .	285
9.3.1	Fiscal and Monetary Policies . . . . .	285
9.3.2	Simulation Results . . . . .	285
9.3.3	Error Analysis . . . . .	294
9.4	Economic Simulation for 2013 by ARE Model . . . . .	296
9.4.1	Fiscal and Monetary Policies . . . . .	296
9.4.2	Simulation Results . . . . .	296
9.4.3	Error Analysis . . . . .	304
9.5	Economic Simulation for 2014 by ARE Model . . . . .	305
9.5.1	Fiscal and Monetary Policies . . . . .	305
9.5.2	Simulation Results . . . . .	306
9.5.3	Error Analysis . . . . .	314
9.6	Summary and Conclusion . . . . .	315
<b>10</b>	<b>China’s Input–Output Tables of 2011–2025 Simulated by ARE . . . . .</b>	<b>317</b>
10.1	Input–Output Tables of 2011–2014 in China . . . . .	317
10.1.1	Input–Output Tables . . . . .	319
10.1.2	Analysis . . . . .	319
10.2	Input–Output Tables of 2015–2025 (BAU Scenario) . . . . .	345
10.2.1	Input–Output Tables . . . . .	345
10.2.2	Analysis . . . . .	412
10.3	Input–Output Tables of 2015–2025 (Policy Scenario) . . . . .	418
10.3.1	Input–Output Tables . . . . .	418
10.3.2	Analysis . . . . .	486