

Contents

1	Introduction	1
1.1	The Revolution of Economics Needs a Revolution	4
1.1.1	Agent-Based Modeling: The State-of-the-Art	4
1.1.2	Agent-Based Modeling: Perspectives	6
1.1.3	Microstructure of Financial Markets	7
1.1.4	Non-financial Proxies	7
1.2	Economic Complexity: From Finance to Economics	8
1.2.1	Country Competitiveness and Product Complexity	8
1.3	General Frame of this Thesis	11
1.4	Instructions for the Reader	12
	References	15
2	Stylized Facts	19
2.1	Absence of Simple Arbitrage	19
2.2	Fat-Tailed Distribution of Returns	20
2.3	Volatility Clustering	21
2.4	Other Stylized Facts	23
2.5	Stationarity and Time-Scales	23
	References	24
Part I Agent-Based Modeling		
3	Critical Review of Agent-Based Models	29
3.1	Introduction	29
3.1.1	Classical Theory of Economics	29
3.1.2	Towards Complexity	31
3.1.3	Why Agent-Based Models	32
3.2	Standard Economic Theory	32

3.3	Agent-Based Models	35
3.3.1	Kim and Markowitz Model: An Attempt to Explain the Black Monday.	35
3.3.2	Santa Fe Artificial Stock Market	38
3.3.3	Minority Game.	40
3.3.4	Caldarelli, Marsili and Zhang: A Prototype of Stock Exchange	43
3.3.5	Lux and Marchesi Model.	46
3.3.6	Giardina and Bouchaud Model.	48
3.4	Summary and Perspectives	50
	References	52
4	A Minimal Agent-Based Model and Self-Organization of Financial Markets	55
4.1	Definition of a Minimal ABM with Fundamentalists and Chartists	56
4.2	Herding Dynamics	60
4.2.1	Symmetric Case	60
4.2.2	Asymmetric Case	61
4.2.3	Finite Size Effects	63
4.3	Stylized Facts from the Model	66
4.3.1	Single Agent	66
4.3.2	Many Statistically Equivalent Agents ($N = 100$)	67
4.3.3	Many Heterogeneous Agents	69
4.4	Microscopic Origin of the Stylized Facts.	69
4.5	Self-Organized Intermittency	72
4.6	Generalization of the Models	75
4.6.1	Multiplicative Dynamics	75
4.6.2	Robustness of the Self-Organized Intermittency	80
	References	85
 Part II Financial Market Dynamics: Order Book and Data Analysis		
5	Order Book: Introduction and Main Statistical Evidences	89
5.1	Order Books in a Nutshell.	89
5.2	Order Books' Stylized Facts	90
5.2.1	Static Properties of Order Books	91
5.2.2	Subtle Diffusive Behavior of Prices	94
5.2.3	Price Response to Orders.	95
	References	96

6	Zero Intelligence Model for the Order Book Dynamics	99
6.1	Definition of the Model.	99
6.1.1	Order Deposition	100
6.2	Calibration of Parameters and Preliminary Results	101
6.3	Operational Estimator of the Granularity	103
6.4	Price Impact Surface.	106
6.4.1	Price Impact Surface in the Direction of ω	106
6.4.2	Price Impact Surface in the Direction of g .	107
6.4.3	Factorization of the Price Surface Impact	109
6.5	Summary and Perspectives	109
	References	110
7	Evidences of Strategic Placements of Orders	113
7.1	Empirical Evidences	113
7.2	A Model for Limit Order Deposition: Uniform Case.	114
7.3	Data Analysis.	115
7.4	A Model for Limit Order Deposition: Non-uniform Case	117
7.5	The Effects of the Strategic Deposition of Orders.	119
7.6	Spread Relaxation: Role of the Strategic Order Placement.	124
7.7	Summary and Perspectives	126
	References	126
8	Quantitative Analysis of Technical Trading	127
8.1	Technical Analysis	127
8.1.1	The Classical and the Technical Approaches	127
8.1.2	Supports and Resistances.	128
8.2	Supports and Resistances: Quantitative Definition	129
8.3	Empirical Evidence of Memory Effects.	131
8.4	Long Memory of the Price	134
8.4.1	Empirical Evidence of the Anticorrelation.	134
8.5	Features of the Bounces	134
8.6	Summary and Perspectives	137
	References	139
9	Universal Relation Between Skewness and Kurtosis in Complex Dynamics	141
9.1	Introduction: Skewness and Kurtosis.	141
9.2	Empirical Results: Parabolic and 4/3 Regime.	142
9.2.1	Parabolic Regime	144
9.2.2	The 4/3 Regime	145
9.3	Conclusions and Perspectives.	148
	References	149

10	Web Queries Can Predict Stock Market Volumes	151
10.1	Empirical Evidences	153
10.2	Users' Behavior	157
10.3	Summary and Perspectives	158
	References	160
 Part III A Metrics for the Economic Complexity		
11	Theory of Economic Growth	165
11.1	Adam Smith's Theory and Specialization of the Productive System	165
11.1.1	Evidences Against Specialization	165
11.2	Classical Explanation of Countries' Patterns of Specialization	168
	References	169
12	Beyond Classical Theory of Economic Growth	171
12.1	Method of Reflections	172
12.1.1	Binary Matrix and Revealed Comparative Advantage	174
12.1.2	Main Results	175
12.2	Random Walks on a Graph: An Interpretation of the Method of Reflections	178
12.2.1	Spectral Properties	180
12.3	Criticisms to the Method of Reflections	182
12.3.1	Variable Meaning Depends on the Iteration	182
12.3.2	Toy Model 1: $k_c^{(n)}$ are not Correlated with Countries' Capabilities	182
12.3.3	Toy Model 2: Shrinkage of Information	184
12.3.4	Asymptotic Iteration and $k^{(odd)}$ vs $k^{(even)}$	186
12.3.5	Locality of Regressions	187
12.4	Summary and Perspectives	187
	References	188
13	A New Metric for the Competitiveness of Countries and the Quality of Products	189
13.1	A New Metric: Country Fitness and Product Quality	189
13.1.1	Intensive Case	190
13.1.2	Extensive Case	192
13.1.3	Some Remarks About Databases	193
13.1.4	Results	193

13.2	Predictive Power: Economic Growth and Financial Applications.	198
13.3	Summary and Perspectives	203
	References	203
	Appendix A: There Is More Than a Power Law in Zipf	205
	About the Author	215

Complexity in Financial Markets
Modeling Psychological Behavior in Agent-Based Models
and Order Book Models

Cristelli, M.

2014, XIX, 216 p., Hardcover

ISBN: 978-3-319-00722-9