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Econophysics of Order-Driven Markets
New Perspectives and Challenges in Econophysics and Sociophysics

BRYANT ANDREWS

Nonlinear Phenomena in Complex Systems: From Nano to Macro Scale Cambridge University Press
Econophysics is an emerging interdisciplinary field that takes advantage of the concepts and methods of statistical physics to analyse economic phenomena. This book expands the explanatory scope of econophysics to the real economy by using methods from statistical physics to analyse the success and failure of companies. Using large data sets of companies and income-earners in Japan and Europe, a distinguished team of researchers show how these methods allow us to analyse companies, from huge corporations to small firms, as heterogeneous agents interacting at multiple layers of complex networks. They then show how successful this approach is in explaining a wide range of recent findings relating to the dynamics of companies. With mathematics kept to a minimum, the book is not only a lively introduction to the field of econophysics but also provides fresh insights into company behaviour.
Sociophysics Oxford University Press, USA
This book presents the Proceedings of the 54th Winter School of Theoretical Physics on Simplicity of Complexity in Economic and Social Systems, held in Lądek Zdrój, Poland, from 18 to 24 February 2018. The purpose of the book is to introduce the new interdisciplinary research that links statistical physics, and particular attention is given to link physics of complex systems, with financial analysis and sociology. The main tools used in these areas are numerical simulation of agents behavior and the interpretation of results with the help of complexity methods, therefore a background in statistical physics and in physics of phase transition is necessary to take the first steps towards these research fields called econophysics and sociophysics. In this perspective, the book is intended to graduated students and young researchers who want to begin the study of this established new area, which connects physicists, economists, sociologists and IT professionals, to better understand complexity phenomena existing not only in physics but also in complex systems being seemingly far from traditional view at physics.
The Story of Econophysics Cambridge University Press
A limit order book is essentially a file on a computer that contains all orders sent to the market, along with their characteristics such as the sign of the order, price, quantity and a timestamp. The majority of organized electronic markets rely on limit order books to store the list of interests of market participants on their central computer. A limit order book contains all the information available on a specific market and it reflects the way the market moves under the influence of its participants. This book discusses several models of limit order books. It begins by discussing the data to assess their empirical properties, and then moves on to mathematical models in order to reproduce the observed properties. Finally, the book presents a framework for numerical simulations. It also covers important modelling techniques including agent-based modelling, and advanced modelling of limit order books based on Hawkes processes. The book also provides in-depth coverage of simulation techniques and introduces general, flexible, open source library concepts useful to readers studying trading strategies in order-driven markets.
Econophysics Elsevier Inc. Chapters
The concepts of statistical physics and big data play an important role in the evidence-based analysis and interpretation of macroeconomic principles. The techniques of complex networks, big data, and statistical physics are useful to understand theories of economic systems, and the authors have applied these to understand the intricacies of complex macroeconomic problems. Recent research work using tools and techniques of big data, statistical physics, complex networks, and statistical science is covered, and basic graph algorithms and statistical measures of complex networks are described. The application of big data and statistical physics tools to assess price dynamics, inflation, systemic risks, and productivity is discussed. Chapter-end summary and numerical problems are provided to reinforce understanding of concepts.
Econophysics and Physical Economics Springer
This book is a course in methods and models rooted in physics and used in modelling economic and social phenomena. It covers the discipline of econophysics, which creates an interface between physics and economics. Besides the main theme, it touches on the theory of complex networks and simulations of social phenomena in general. After a brief historical introduction, the book starts with a list of basic empirical data and proceeds to thorough investigation of mathematical and computer models. Many of the models are based on hypotheses of the behaviour of simplified agents. These comprise strategic thinking, imitation, herding, and the gem of econophysics, the so-called minority game. At the same time, many other models view the economic processes as interactions of inanimate particles. Here, the methods of physics are especially useful. Examples of systems modelled in such a way include books of stock-market orders, and redistribution of wealth among individuals. Network effects are investigated in the interaction of economic agents. The book also describes how to model phenomena like cooperation and emergence of consensus. The book will be of benefit to graduate students and researchers in both Physics and Economics.
Sociophysics Cambridge University Press
Using tricks to handle coupled nonlinear dynamical many-body systems, several advancements have already been made in understanding the behavior of markets/economic/social systems and their dynamics. The book intends to provide the reader with updated reviews on such major developments in both econophysics and sociophysics, by leading experts in the respective fields. This is the first book providing a panoramic view of these developments in the last decade.
Econophysics and Sociophysics: Recent Progress and Future Directions Elsevier Inc. Chapters
This book presents the proceedings from ECONOPHYS-2015, an international workshop held in New Delhi, India, on the interrelated fields of “econophysics” and “sociophysics”, which have emerged from the application of statistical physics to economics and sociology. Leading researchers from

varied communities, including economists, sociologists, financial analysts, mathematicians, physicists, statisticians, and others, report on their recent work, discuss topical issues, and review the relevant contemporary literature. A society can be described as a group of people who inhabit the same geographical or social territory and are mutually involved through their shared participation in different aspects of life. It is possible to observe and characterize average behaviors of members of a society, an example being voting behavior. Moreover, the dynamic nature of interaction within any economic sector comprising numerous cooperatively interacting agents has many features in common with the interacting systems of statistical physics. It is on these bases that interest has grown in the application within sociology and economics of the tools of statistical mechanics. This book will be of value for all with an interest in this flourishing field.

Econophysics Springer

This book summarises progress in the understanding of financial markets and economics based on the established methodology of statistical physics. It offers a new approach to the fundamentals of economics that offers the potential for increased insight and understanding. It should be of interest to all serious students of the subject.

An Introduction to Socio-Finance Cambridge University Press

The proceedings of the international conference “SMSEC2014”, a joint conference of the first “Social Modeling and Simulations” and the 10th “Econophysics Colloquium”, held in Kobe in November 2014 with 174 participants, are gathered herein. Cutting edge scientific researches on various social phenomena are reviewed. New methods for analysis of big data such as financial markets, automobile traffics, epidemic spreading, world-trades and social media communications are provided to clarify complex interaction and distributions underlying in these social phenomena. Robustness and fragility of social systems are discussed based on agent models and complex network models. Techniques about high performance computers are introduced for simulation of complicated social phenomena. Readers will feel the researchers minds that deep and quantitative understanding will make it possible to realize comprehensive simulations of our whole society in the near future, which will contribute to wide fields of industry also to scientific policy decision.

Simplicity of Complexity in Economic and Social Systems Oxford University Press

The first monograph in econophysics focussed on the analyses and modelling of these distributions, ideal for physicists and economists.

Finitary Probabilistic Methods in Econophysics Cambridge University Press

This book presents the Proceedings of the 54th Winter School of Theoretical Physics on Simplicity of Complexity in Economic and Social Systems, held in Lądek Zdrój, Poland, from 18 to 24 February 2018. The purpose of the book is to introduce the new interdisciplinary research that links statistical physics, and particular attention is given to link physics of complex systems, with financial analysis and sociology. The main tools used in these areas are numerical simulation of agents behavior and the interpretation of results with the help of complexity methods, therefore a background in statistical physics and in physics of phase transition is necessary to take the first steps towards these research fields called econophysics and sociophysics. In this perspective, the book is intended to graduated students and young researchers who want to begin the study of this established new area, which connects physicists, economists, sociologists and IT professionals, to better understand complexity phenomena existing not only in physics but also in complex systems being seemingly far from traditional view at physics.

Physics of society: econophysics and sociophysics CRC Press

This book provides the first extensive analytic comparison between models and results from econophysics and financial economics in an accessible and common vocabulary. Unlike other publications dedicated to econophysics, it situates this field in the evolution of financial economics by laying the foundations for common theoretical framework and models.

Limit Order Books Oxford University Press, USA

Econophysics applies the methodology of physics to the study of economics. However, whilst physicists have good understanding of statistical physics, they may be unfamiliar with recent advances in statistical conjectures, including Bayesian and predictive methods. Equally, economists with knowledge of probabilities do not have a background in statistical physics and agent-based models. Proposing a unified view for a dynamic probabilistic approach, this book is useful for advanced undergraduate and graduate students as well as researchers in physics, economics and finance. The book takes a finitary approach to the subject, discussing the essentials of applied probability, and covering finite Markov chain theory and its applications to real systems. Each chapter ends with a summary, suggestions for further reading, and exercises with solutions at the end of the book.

Introduction to Econophysics Cambridge University Press

Topics of complex system physics and their interdisciplinary applications to different problems in seismology, biology, economy, sociology, energy and nanotechnology are covered in this new work from renowned experts in their fields. In particular, contributed papers contain original results on network science, earthquake dynamics, econophysics, sociophysics, nanoscience and biological physics. Most of the papers use interdisciplinary approaches based on statistical physics, quantum physics and other topics of complex system physics. Papers on econophysics and sociophysics are focussed on societal aspects of physics such as, opinion dynamics, public debates and financial and economic stability. This work will be of interest to statistical physicists, economists, biologists, seismologists and all scientists working in interdisciplinary topics of complexity.

Econophysics and Sociophysics RED'SHINE Publication. Pvt. Ltd

a multi-disciplinary 2007 book on network theory for graduate students and researchers in sociology and econophysics.

Non-Equilibrium Social Science and Policy Springer

This book sets out to address some basic questions drawing from classical political economy and information theory and using an econophysics methodology: What is information? Why is it valuable? What is the relationship between money and information?

Econophysics and Financial Economics Springer

Experimental Econophysics describes the method of controlled human experiments, which is developed by physicists to study some problems in economics or finance, namely, stylized facts, fluctuation phenomena, herd behavior, contrarian behavior, hedge behavior, cooperation, business cycles, partial information, risk management, and stock prediction. Experimental econophysics together with empirical econophysics are two branches of the field of econophysics. The latter one

has been extensively discussed in the existing books, while the former one has been seldom touched. In this book, the author will focus on the branch of experimental econophysics. Empirical econophysics is based on the analysis of data in real markets by using some statistical tools borrowed from traditional statistical physics. Differently, inspired by the role of controlled experiments and system modelling (for computer simulations and/or analytical theory) in developing modern physics, experimental econophysics specially relies on controlled human experiments in the laboratory (producing data for analysis) together with agent-based modelling (for computer simulations and/or analytical theory), with an aim at revealing the general cause-effect relationship between specific parameters and emergent properties of real economic/financial markets. This book covers the basic concepts, experimental methods, modelling approaches, and latest progress in the field of experimental econophysics.

Interactive Macroeconomics Springer Science & Business Media

Econophysics explores the parallels between physics and economics and is an exciting topic that is attracting increasing attention. However there is a lack of literature that explains the topic from a broad perspective. This book introduces advanced undergraduates and graduate students in physics and engineering to the topic from this outlook, and is accompanied by rigorous mathematics which ensures that this will also be a good guide for established researchers in the field as well as researchers from other fields, such as mathematics and statistics, who are interested in the topic. Key features: Presents a multidisciplinary approach that will be of interest to students and researchers from physics, engineering, mathematics, statistics, and other physical sciences Accompanied by Python code with further learning opportunities, available for readers to download from the CRC Press website. Accessible to both students and researchers Carlo R. da Cunha is an associate professor of physics and engineering physics at the Universidade Federal do Rio Grande do Sul (Brazil) and has been since 2011. Dr. da Cunha received his M.Sc. Degree from the West Virginia University in 2001 and his Ph.D. degree from Arizona State University in 2005. He was a postdoctoral researcher at McGill University in Canada in 2006 and an assistant professor of engineering at the University Federal de Santa Catarina between 2007 and 2011. He has been a guest professor at the Technische Universität Wien (Austria), Chiba University (Japan) and Arizona State University (US). His research revolves around the physics of complex systems where he has been drawing parallels between physical and economic systems from quantum to social levels. To access additional resources, such as python code, please take a look here.

Econophysics Springer Science & Business Media

The remarkable evolution of econophysics research has brought the deep synthesis of ideas derived from economics and physics to subjects as diverse as education, banking, finance, and the administration of large institutions. The original papers in this collection present a broad summary of these advances, written by interdisciplinary specialists. Included are studies on subjects in the development of econophysics; on the perspectives offered by econophysics on large problems in economics and finance, including the 2008-9 financial crisis; and on higher education and group decision making. The introductions and insights they provide will benefit everyone interested in applications of this new transdisciplinary science. Ten papers present an updated version of the origins, issues, and applications of econophysics Economics and finance chapters consider lessons learned from the 2008-9 financial crisis Sociophysics chapters propose new thinking on educational reforms and group decision making

Simplicity of Complexity in Economic and Social Systems Springer

This book presents the latest perspectives and challenges within the interrelated fields of econophysics and sociophysics, which have emerged from the application of statistical physics to economics and sociology. Economic and financial markets appear to be in a permanent state of flux. Billions of agents interact with each other, giving rise to complex dynamics of economic quantities at the micro and macro levels. With the availability of huge data sets, researchers can address questions at a much more granular level than was previously possible. Fundamental questions regarding the aggregation of actions and information and the coordination, complexity, and evolution of economic and financial networks are currently receiving much attention in the econophysics research agenda. In parallel, the sociophysics literature has focused on large-scale social data and their interrelations. In this book, leading researchers from different communities – economists, sociologists, financial analysts, mathematicians, physicists, statisticians, and others – report on their recent work and their analyses of economic and social behavior.

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