

Models With Heterogeneous Agents Introduction

Economic application of nonlinear dynamics, microscopic agent-based modelling, and the use of artificial intelligence techniques as learning devices of boundedly rational actors are among the most exciting interdisciplinary ventures of economic theory over the past decade. This volume provides us with a most fascinating series of examples on "complexity in action" exemplifying the scope and explanatory power of these innovative approaches.

Microeconomic Modeling in Urban Science proposes an interdisciplinary framework for the analysis of urban systems. It portrays agents as rational beings modeled under the framework of random utility behavior and interacting in a complex market of location auctions, location externalities, agglomeration economies, transport accessibility attributes, and planning regulations and incentives. Francisco Javier Martinez Concha considers the optimal planning of cities as he explores interactions between citizens and between citizens and firms, the mesoscopic agglomeration of firms and the segregation of agents' socioeconomic clusters, and the emergence of city-level scale laws. Its unified model of city life is relevant to micro-, meso- and macro-scale interactions. Presents a unified, coherent and realistic framework able to simulate complete urban systems Describes the use of discrete-choice and stochastic behavior models in the auction spatial-equilibrium market Includes computing outputs from Cube-Land modeling using GIS

Handbook of Computational Economics: Heterogeneous Agent Modeling, Volume Four, focuses on heterogeneous agent models, emphasizing recent advances in macroeconomics (including DSGE), finance, empirical validation and experiments, networks and related applications. Capturing the advances made since the publication of Volume Two (Tesfatsion & Judd, 2006), it provides high-level literature with sections devoted to Macroeconomics, Finance, Empirical Validation and Experiments, Networks, and other applications, including Innovation Diffusion in Heterogeneous Populations, Market Design and Electricity Markets, and a final section on Perspectives on Heterogeneity. Helps readers fully understand the dynamic properties of realistically rendered economic systems Emphasizes detailed specifications of structural conditions, institutional arrangements and behavioral dispositions Provides broad assessments that can lead researchers to recognize new synergies and opportunities

This book offers a practical guide to Agent Based economic modeling, adopting a "learning by doing" approach to help the reader master the fundamental tools needed to create and analyze Agent Based models. After providing them with a basic "toolkit" for Agent Based modeling, it present and discusses didactic models of real financial and economic systems in detail. While stressing the main features and advantages of the bottom-up perspective inherent to this approach, the book also highlights the logic and practical steps that characterize the model building procedure. A detailed description of the underlying codes, developed using R and C, is also provided. In addition, each didactic model is accompanied by exercises and applications designed to promote active learning on the part of the reader. Following the same approach, the book also presents several complementary tools required for the analysis and validation of the models, such as sensitivity experiments, calibration exercises, economic network and statistical distributions analysis. By the end of the book, the reader will have gained a deeper understanding of the Agent Based methodology and be prepared to use the fundamental techniques required to start developing their own economic models. Accordingly, "Economics with Heterogeneous Interacting Agents" will be of particular interest to graduate and postgraduate students, as well as to academic institutions and lecturers interested in including an overview of the AB approach to economic modeling in their courses.

This book constitutes the refereed proceedings of the International Conference on Artificial Neural Networks, ICANN 2001, held in Vienna, Austria in August 2001. The 171 revised papers presented together with three invited contributions were carefully reviewed and selected from around 300 submissions. The papers are organized in topical sections on data analysis and pattern recognition, theory, kernel methods, topographic mapping, independent component analysis, signal processing, time series processing, agent-based economic modeling, selforganization and dynamical systems, robotics and control, vision and image processing, computational neuroscience, and connectionist and cognitive science.

In Chapter 2 we extend the heterogeneous discounting model introduced in Marín-Solano and Patxot (2012) to a stochastic environment. Our main contribution in this chapter is to derive the DPE providing time-consistent solution for both the discrete and continuous time case. For the continuous time problem we derive the DPE following the two different procedures described above: the formal limiting procedure and the variational approach. However, an important limitation of these approaches is that the DPE obtained is a functional equation with a nonlocal term. As a consequence, it becomes very complicated to find solutions, not only analytically, but also numerically. For this reason, we also derive a set of two coupled partial differential equations which allows us to compute (analytically or numerically) the solutions for different economic problems. In particular, we are interested in analyzing how time-inconsistent preferences with heterogeneous discounting modify the classical consumption and portfolio rules (Merton (1971)). The introduction of stochastic terminal time is also discussed. In Chapter 3, the results of Chapter 2 are extended in several ways. First, we consider that the decision maker is subject to a mortality risk. Within this context, we derive the optimal consumption, investment and life insurance rules for an agent whose concern about both the bequest left to her descendants and her wealth at retirement increases with time. To this end we depart from the model in Pliska and Ye (2007) generalizing the individual time preferences by incorporating heterogeneous discount functions. In addition, following Kraft (2003), we derive the wealth process in terms of the portfolio elasticity with respect to the traded assets. This approach allows us to introduce options in the investment opportunity set as well as to enlarge it by any number of contingent claims while maintaining the analytical tractability of the model. Finally, we analyze how the standard solutions are modified depending on the attitude of the agent towards her changing preferences, showing the differences with some numerical illustrations. In Chapter 4 we extend the heterogeneous discount framework to the study of differential games with heterogeneous agents, i.e., agents who exhibit different instantaneous utility functions and different (but constant) discount rates of time preference. In fact, although the non-standard models have usually focused on individual agents, the framework has proved to be useful in the study of cooperative solutions for some standard discounting differential games. Our main contribution in this chapter is to provide a set of DPE in discrete and continuous time in order to obtain time-consistent cooperative solutions for N -person differential games with heterogeneous agents. The results are applied to the study of a cake eating problem describing the management of a common property exhaustible natural resource. The extension to a simple common renewable natural resource in infinite horizon is also discussed. Finally, in Chapter 5, we present a summary of the main results of the thesis.

The goal of this paper is to simultaneously unbundle two interacting reduced-form building blocks of traditional macroeconomic models: the representative agent and the aggregate production function. We introduce a broad class of disaggregated general equilibrium models with Heterogeneous Agents and Input-Output networks (HA-IO). We elucidate their properties through two sets of results describing the propagation and aggregation of shocks. First, we characterize how shocks affect prices and quantities of goods and factors. Even with purely microeconomic shocks, the mapping from structural primitives to observed effects is complicated by "local" general equilibrium forces. Our framework shows how to account for these forces, and helps interpret IV-based cross-sectional regression results. We also uncover a surprising property of a large class of efficient representative agent models: they feature symmetric propagation in that a shock to producer i affects the sales of producer j in exactly the same way that a shock to j affects the sales of i . This improbable symmetry breaks in the presence of heterogeneous agents or distortions. Second, we provide aggregation results characterizing the responses of industry-level variables such as markups and productivity. The behavior of these aggregates is particularly delicate in inefficient economies: they respond to microeconomic shocks outside of the industry; and they can give rise to fallacies of composition whereby aggregates move in the opposite direction of their microeconomic counterparts. Our results shed light on many seemingly disparate applied questions, such as: sectoral co-movement in business cycles; factor-biased technical change in task-based models; structural transformation; the effects of corporate taxation; and the dependence of fiscal multipliers on the composition of government spending.

We introduce a generic simulation framework suitable for agent-based simulations featuring the support of heterogeneous agents, hierarchical scheduling and flexible specification of design parameters. One key aspect of this framework is the design specification: we use an XML-based format which is simple-structured yet still enables the design of flexible models. Another issue in agent-based simulations, especially when ready-made components are used, is the heterogeneity arising from both the agents' implementations and the underlying platforms. To tackle these kind of obstacles, we introduce a wrapper technique for mapping the functionality of agents living in an interpreter-based environment to a standardized JAVA interface, thus facilitating the task for any control mechanism (like a simulation manager) because it has to handle only one set of commands for all agents involved. Again, this mapping is made by an XML-based definition format. We demonstrate the technique by applying it to a simple sample simulation of two mass marketing firms operating in an artificial consumer environment. (author's abstract).

This book offers a thorough introduction to the highly promising complex agent-based approach to economics, in which agent-based models (ABMs) are used to represent economic systems as complex and evolving systems composed of heterogeneous agents of limited rationality who interact with each other, generating the system's emergent properties in the process. This approach represents a response to the limitations of the dominant theory in economics, which does not consider the possibility of a major crisis, and to the inability of dynamic stochastic general equilibrium theory to generate empirically falsifiable propositions. In the new perspective, the focus is on identifying the elements of instability rather than the triggering event. As the theory of complexity demonstrates, the interactions of heterogeneous agents produce non-linearity: this puts an end to the age of certainties. With ABMs, the methodology is "from the bottom up". The individual parameters and their distribution are estimated, and then evaluated to verify whether aggregate regularities emerge on the whole. In short, not only micro, but also meso and macro empirical validation are employed. Moreover, it shows that the mantra of growth should be supplanted by the concept of a growth?. Given its depth of coverage, the book will enable students at the undergraduate and Master's level to gain a firm grasp of this important emerging approach.

"This book is flower blossomed by one of the two greatest Italian economists." Bruce Greenwald, Columbia University
"The author's - the ABM prophet's - thoughts on economics have been at the forefront of the world. Without a firm belief in and dedication to human society, it is impossible to write such a book. This is a work of high academic value, which can help readers quickly understand the history and current situation of complex economic theory. In particular, we can understand the basic viewpoints, academic status, advantages and shortcomings of various schools of economic theory." Jie Wu, Guangzhou Milestone Software Co., China

Introduction to Agent-Based Economics describes the principal elements of agent-based computational economics (ACE). It illustrates ACE's theoretical foundations, which are rooted in the application of the concept of complexity to the social sciences, and it depicts its growth and development from a non-linear out-of-equilibrium approach to a state-of-the-art agent-based macroeconomics. The book helps readers gain a better understanding of the limits and perspectives of the ACE models and their capacity to reproduce economic phenomena and empirical patterns. Reviews the literature of agent-based computational economics Analyzes approaches to agents' expectations Covers one of the few large macroeconomic agent-based models, the Modellaccio Illustrates both analytical and computational methodologies for producing tractable solutions of macro ACE models Describes diffusion and amplification mechanisms Depicts macroeconomic experiments related to ACE implementations

Heterogeneous Agent ModelingElsevier

Matthias Müller makes a case for the particular role of the demand side in research on innovation. Based on a complex agent-based simulation model, he analyzes the versatile mutual relationships between consumers and producers within the innovation process. Instead of oversimplifying the demand side, the book aims to apply important aspects which too often are only applied to the supply side, e.g., the heterogeneity and bounded rationality of economic actors embedded in networks. The results offer a new perspective on the innovation process, proving that the demand side and consumers are important drivers of innovation, which must be included in future research for a full picture.

This accessible introduction to the mathematical underpinnings of finance concentrates on the probabilistic theory of continuous arbitrage pricing of financial derivatives. It includes a solved example for every new technique presented, numerous exercises, and a Further Reading list in each chapter.

Handbook of Computational Economics summarizes recent advances in economic thought, revealing some of the potential offered by modern computational methods. With computational power increasing in hardware and algorithms, many economists are closing the gap between economic practice and the frontiers of computational mathematics. In their

efforts to accelerate the incorporation of computational power into mainstream research, contributors to this volume update the improvements in algorithms that have sharpened econometric tools, solution methods for dynamic optimization and equilibrium models, and applications to public finance, macroeconomics, and auctions. They also cover the switch to massive parallelism in the creation of more powerful computers, with advances in the development of high-power and high-throughput computing. Much more can be done to expand the value of computational modeling in economics. In conjunction with volume one (1996) and volume two (2006), this volume offers a remarkable picture of the recent development of economics as a science as well as an exciting preview of its future potential. Samples different styles and approaches, reflecting the breadth of computational economics as practiced today Focuses on problems with few well-developed solutions in the literature of other disciplines Emphasizes the potential for increasing the value of computational modeling in economics

In contrast to mainstream economics, complexity theory conceives the economy as a complex system of heterogeneous interacting agents characterised by limited information and bounded rationality. Agent Based Models (ABMs) are the analytical and computational tools developed by the proponents of this emerging methodology. Aimed at students and scholars of contemporary economics, this book includes a comprehensive toolkit for agent-based computational economics, now quickly becoming the new way to study evolving economic systems. Leading scholars in the field explain how ABMs can be applied fruitfully to many real-world economic examples and represent a great advancement over mainstream approaches. The essays discuss the methodological bases of agent-based approaches and demonstrate step-by-step how to build, simulate and analyse ABMs and how to validate their outputs empirically using the data. They also present a wide set of applications of these models to key economic topics, including the business cycle, labour markets, and economic growth.

Nonlinearity, Bifurcation and Chaos - Theory and Application is an edited book focused on introducing both theoretical and application oriented approaches in science and engineering. It contains 12 chapters, and is recommended for university teachers, scientists, researchers, engineers, as well as graduate and post-graduate students either working or interested in the field of nonlinearity, bifurcation and chaos.

Agent-based modeling and social simulation have emerged as an interdisciplinary area of social science that includes computational economics, organizational science, social dynamics, and complex systems. This area contributes to enriching our understanding of the fundamental processes of social phenomena caused by complex interactions among agents. Bringing together diverse approaches to social simulation and research agendas, this book presents a unique collection of contributions from the Second World Congress on Social Simulation, held in 2008 at George Mason University in Washington DC, USA. This book in particular includes articles on norms, diffusion, social networks, economy, markets and organizations, computational modeling, and programming environments, providing new hypotheses and theories, new simulation experiments compared with various data sets, and new methods for model design and development. These works emerged from a global and interdisciplinary scientific community of the three regional scientific associations for social simulation: the North American Association for Computational Social and Organizational Science (NAACSOS; now the Computational Social Science Society, CSSS), the European Social Simulation Association (ESSA), and the Pacific Asian Association for Agent-based Approach in Social Systems Sciences (PAAA).

Many problems in theoretical economics are mathematically formalized as dynamical systems of difference and differential equations. In recent years a truly open approach to studying the dynamical behavior of these models has begun to make its way into the mainstream. That is, economists formulate their hypotheses and study the dynamics of the resulting models rather than formulating the dynamics and studying hypotheses that could lead to models with such dynamics. This is a great progress over using linear models, or using nonlinear models with a linear approach, or even squeezing economic models into well-studied nonlinear systems from other fields. There are today a number of economic journals open to publishing this type of work and some of these have become important. There are several societies which have annual meetings on the subject and participation at these has been growing at a good rate. And of course there are methods and techniques available to a more general audience, as well as a greater availability of software for numerical and graphical analysis that makes this type of research even more exciting. The lecturers for the Advanced School on Nonlinear Dynamical Systems in Economics, who represent a wide selection of the research areas to which the theory has been applied, agree on the importance of simulations and computer-based analysis. The School emphasized computer applications of models and methods, and all contributors ran computer lab sessions.

"We present in the paper an extension of the model of Bloch and Dutta (2009) where we introduce agent's heterogeneity. We characterize Nash stable and efficient networks in this setting." [source : résumé].

Risk is the main source of uncertainty for investors, debtholders, corporate managers and other stakeholders. For all these actors, it is vital to focus on identifying and managing risk before making decisions. The success of their businesses depends on the relevance of their decisions and consequently, on their ability to manage and deal with the different types of risk. Accordingly, the main objective of this book is to promote scientific research in the different areas of risk management, aiming at being transversal and dealing with different aspects of risk management related to corporate finance as well as market finance. Thus, this book should provide useful insights for academics as well as professionals to better understand and assess the different types of risk. Liquid markets generate hundreds or thousands of ticks (the minimum change in price a security can have, either up or down) every business day. Data vendors such as Reuters transmit more than 275,000 prices per day for foreign exchange spot rates alone. Thus, high-frequency data can be a fundamental object of study, as traders make decisions by observing high-frequency or tick-by-tick data. Yet most studies published in financial literature deal with low frequency, regularly spaced data. For a variety of reasons, high-frequency data are becoming a way for understanding market microstructure. This book discusses the best mathematical models and tools for dealing with such vast amounts of data. This book provides a framework for the analysis, modeling, and inference of high frequency financial time series. With particular emphasis on foreign exchange markets, as well as currency, interest rate, and bond futures markets, this unified view of high frequency time series methods investigates the price formation process and concludes by reviewing techniques for constructing systematic trading models for financial assets. The only single-source guide to understanding, using, adapting, and designing state-of-the-art agent-based modelling of tax

evasion A computational method for simulating the behavior of individuals or groups and their effects on an entire system, agent-based modeling has proven itself to be a powerful new tool for detecting tax fraud. While interdisciplinary groups and individuals working in the tax domain have published numerous articles in diverse peer-reviewed journals and have presented their findings at international conferences, until *Agent-based Modelling of Tax Evasion* there was no authoritative, single-source guide to state-of-the-art agent-based tax evasion modeling techniques and technologies. Featuring contributions from distinguished experts in the field from around the globe, *Agent-Based Modelling of Tax Evasion* provides in-depth coverage of an array of field tested agent-based tax evasion models. Models are presented in a unified format so as to enable readers to systematically work their way through the various modeling alternatives available to them. Three main components of each agent-based model are explored in accordance with the Overview, Design Concepts, and Details (ODD) protocol, each section of which contains several sub elements that help to illustrate the model clearly and that assist readers in replicating the modeling results described. Presents models in a unified and structured manner to provide a point of reference for readers interested in agent-based modelling of tax evasion Explores the theoretical aspects and diversity of agent-based modeling through the example of tax evasion Provides an overview of the characteristics of more than thirty agent-based tax evasion frameworks Functions as a solid foundation for lectures and seminars on agent-based modelling of tax evasion The only comprehensive treatment of agent-based tax evasion models and their applications, this book is an indispensable working resource for practitioners and tax evasion modelers both in the agent-based computational domain and using other methodologies. It is also an excellent pedagogical resource for teaching tax evasion modeling and/or agent-based modeling generally.

Modern business cycle theory and growth theory uses stochastic dynamic general equilibrium models. In order to solve these models, economists need to use many mathematical tools. This book presents various methods in order to compute the dynamics of general equilibrium models. In part I, the representative-agent stochastic growth model is solved with the help of value function iteration, linear and linear quadratic approximation methods, parameterised expectations and projection methods. In order to apply these methods, fundamentals from numerical analysis are reviewed in detail. In particular, the book discusses issues that are often neglected in existing work on computational methods, e.g. how to find a good initial value. In part II, the authors discuss methods in order to solve heterogeneous-agent economies. In such economies, the distribution of the individual state variables is endogenous. This part of the book also serves as an introduction to the modern theory of distribution economics. Applications include the dynamics of the income distribution over the business cycle or the overlapping-generations model. In an accompanying home page to this book, computer codes to all applications can be downloaded.

This book contains extended versions of the best papers presented at the 13th International Conference on Information and Communication Technologies in Education, Research, and Industrial Applications, ICTERI 2017, held in Kyiv, Ukraine, in May 2017. The 11 revised full papers included in this volume were carefully reviewed and selected from 151 initial submissions during several rounds of reviewing. The papers are organized in the following topical sections: modeling and theoretical frameworks; ICT in teaching, learning, and education management; and ICT evaluation and applications.

The book presents new developments in the dynamic modeling and optimization methods in environmental economics and provides a huge range of applications dealing with the economics of natural resources, the impacts of climate change and of environmental pollution, and respective policy measures. The interrelationship between economic activities and environmental quality, the development of cleaner technologies, the switch from fossil to renewable resources and the proper use of policy instruments play an important role along the path towards a sustainable future. Biological, physical and economic processes are naturally involved in the subject, and postulate the main modelling, simulation and decision-making tools: the methods of dynamic optimization and dynamic games.

This second book on financial and economic simulations in Swarm marks the continued progress by a group of researchers to incorporate agent-based computer models as an important tool within their discipline. It is encouraging to see such a clear example of Swarm helping to foster a community of users who rely on the Swarm framework for their own analyses. Swarm aims at legitimizing agent-based computer models as a tool for the study of complex systems. A further goal is that a common base framework will lead to the growth of user communities in specific areas of application. By providing an organizing framework to guide the development of more problem-specific structures, and by dealing with a whole range of issues that affect their fundamental correctness and their ability to be developed and reused, Swarm has sought to make the use of agent-based models a legitimate tool of scientific investigation that also meets the practical needs of investigators within a community.

'International Handbook on the Economics of Integration edited by Miroslav Jovanović provides timely and rich academic contributions to considerations of the widest array of integration-related issues. European integration has been providing an inspiration to a number of academics and researchers. The Handbook is a recognition of the dynamic and strong solidarity of European integration. At the same time, the European Union often provided an example for integration schemes throughout the world which spread enormously since the mid-1990s. Leading experts from all continents contributed to this Handbook which will be a valuable input into academic and policy-making discussions and actions.' - José Manuel Barroso, President of the European Commission

Recognising that the economy is a complex system with boundedly rational interacting agents, applies complexity modelling to economics and finance.

The goal of this paper is to simultaneously unbundle two interacting reduced-form building blocks of traditional macroeconomic models: the representative agent and the aggregate production function. We introduce a broad class of disaggregated general equilibrium models with Heterogeneous Agents and Input-Output networks (HA-IO). We characterize their properties through two sets of results describing the propagation and the aggregation of shocks. Our results shed light on many seemingly disparate applied questions, such as: sectoral comovement in business cycles; factor-biased technical change in task-based models; structural transformation; the effects of corporate taxation; and the dependence of fiscal multipliers on the composition of government spending.

In this article we extend the agent-based model of firms' formation and growth proposed in [4]. In [4] the firms' creation, expansion or contraction results from the interaction of heterogeneous utility maximizers. While the original model was able to replicate the power law distribution in the firms' sizes agents in the model set their utility maximizing effort levels completely freely and undetected. This led to the emergence of free riding and influenced the overall dynamics of the model. Therefore we decided to extend the original model by introducing the monitoring which is seen in the economic literature, besides

for example the proper incentive scheme ([18]), as a possible way how to make employees work harder. Our motivation is to compare the extended model with both to the original case without monitoring and empirical data about firms & sizes distribution. -- monitoring ; firms' size ; power law ; agent-based model ; simulation ; heterogeneous agents

This book represents an ongoing research agenda the aim of which is to contribute to the Keynesian paradigm in macroeconomics. It examines the Dynamic General Equilibrium (DGE) model, the assumption of intertemporal optimizing behavior of economic agents, competitive markets and price mediated market clearing through flexible wages and prices.

This introduction to modern business cycle theory uses a neoclassical growth framework to study the economic fluctuations associated with the business cycle. Presenting advances in dynamic economic theory and computational methods, it applies concepts to t

The explosive growth in computational power over the past several decades offers new tools and opportunities for economists. This handbook volume surveys recent research on Agent-based Computational Economics (ACE), the computational study of economic processes modeled as dynamic systems of interacting agents. Empirical referents for "agents" in ACE models can range from individuals or social groups with learning capabilities to physical world features with no cognitive function. Topics covered include: learning; empirical validation; network economics; social dynamics; financial markets; innovation and technological change; organizations; market design; automated markets and trading agents; political economy; social-ecological systems; computational laboratory development; and general methodological issues. *Every volume contains contributions from leading researchers *Each Handbook presents an accurate, self-contained survey of a particular topic *The series provides comprehensive and accessible surveys

One of the major problems of macroeconomic theory is the way in which the people exchange goods in decentralized market economies. There are major disagreements among macroeconomists regarding tools to influence required outcomes. Since the mainstream efficient market theory fails to provide an internal coherent framework, there is a need for an alternative theory. The book provides an innovative approach for the analysis of agent based models, populated by the heterogeneous and interacting agents in the field of financial fragility. The text is divided in two parts; the first presents analytical developments of stochastic aggregation and macro-dynamics inference methods. The second part introduces macroeconomic models of financial fragility for complex systems populated by heterogeneous and interacting agents. The concepts of financial fragility and macroeconomic dynamics are explained in detail in separate chapters. The statistical physics approach is applied to explain theories of macroeconomic modelling and inference.

Introduction to Quantitative Macroeconomics Using Julia: From Basic to State-of-the-Art Computational Techniques facilitates access to fundamental techniques in computational and quantitative macroeconomics. It focuses on the recent and very promising software, Julia, which offers a MATLAB-like language at speeds comparable to C/Fortran, also discussing modeling challenges that make quantitative macroeconomics dynamic, a key feature that few books on the topic include for macroeconomists who need the basic tools to build, solve and simulate macroeconomic models. This book neatly fills the gap between intermediate macroeconomic books and modern DSGE models used in research. Combines an introduction to Julia, with the specific needs of macroeconomic students who are interested in DSGE models and PhD students and researchers interested in building DSGE models Teaches fundamental techniques in quantitative macroeconomics by introducing theoretical elements of key macroeconomic models and their potential algorithmic implementations Exposes researchers working in macroeconomics to state-of-the-art computational techniques for simulating and solving DSGE models

This volume contains a collection of papers suggested by the Scientific Committee that includes the best papers presented in the 2nd International Conference (CHAOS2009) on Chaotic Modeling, Simulation and Applications, that was held in Chania, Crete, Greece, June 15, 2009. The aim of the conference was to invite and bring together people working in interesting topics of chaotic modeling, nonlinear and dynamical systems and chaotic simulation. The volume presents theoretical and applied contributions on chaotic systems. Papers from several nonlinear analysis and chaotic fields are included and new and very important results are presented. Emphasis was given to the selection of works that have significant impact in the chaotic field and open new horizons to further develop related topics and subjects. Even more the selected papers are addressed to an interdisciplinary audience aiming at the broad dissemination of the theory and practice of chaotic modeling and simulation and nonlinear science.

In this paper we study the dynamics of a simple asset pricing model describing the trading activity of heterogeneous agents in a "stylized" market. The economy in the model contains two assets: a bond with risk-less return and a dividend paying stock. The price of the stock is determined through market clearing condition. Traders are speculators described as expected utility maximizers with heterogeneous beliefs about future stock price and with heterogeneous estimation of risk. In particular, we consider traders who base their investment decision on different time horizons and we analyze the effect of these differences on the price dynamics. Under suitable parameterization, the stock no-arbitrage "fundamental" price can emerge as a stable fixed point of the model dynamics. For different parameterizations, however, the market shows cyclical or chaotic price dynamics with speculative bubbles and crashes. We find that the sole heterogeneity of agents with respect to their time horizons is not enough to guarantee the instability of the fundamental price and the emergence of non-trivial price dynamics. However, if different groups of agents are characterized by different trading behaviors, the introduction of heterogeneous investment horizons can help to decrease the stability region of the "fundamental" fixed point. The role of time horizons turns out to be different for different trade behaviors and, in general, depends on the whole ecology of agents' beliefs. We demonstrate this effect discussing a case in which the increase of fundamentalists time horizons can lead to cyclical or chaotic price behavior, while the same increase for the chartists helps to stabilize the fundamental price. -- Asset pricing ; Heterogenous beliefs ; Investment horizons

This title brings together frontier research on complex economic systems, heterogeneous interacting agents, bounded

rationality, and nonlinear dynamics in economics. The book contains the proceedings of the CEF2015 (21st Computing in Economics in Finance), held 20-22 June 2015 in Taipei, Taiwan, and addresses some of the important driving forces for various emergent properties in economies, when viewed as complex systems. The breakthroughs reported in this book are a result of an interdisciplinary approach and simulation remains the unifying theme for these papers as they deal with a wide range of topics in economics. The text is a valuable addition to the efforts in promoting the complex systems view in economic science. The computational experiments reported in the book are both transparent and replicable. Complex System Modeling and Simulation in Economics and Finance is useful for graduate courses of complex systems, with particular focus on economics and finance. At the same time it serves as a good overview for researchers who are interested in the topic.

Over the past two decades, the issue of equilibrium indeterminacy has been one of the major research concerns in macroeconomic dynamics. Growth and Business Cycles with Equilibrium Indeterminacy discusses the main topics in this literature. Based on comprehensive surveys and the author's original research, this book explores sunspot-driven fluctuations in real business cycle models, multiple equilibria in endogenous growth models, and the stabilization effects of fiscal and monetary policy rules. The book also considers equilibrium indeterminacy in open economy models.

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