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# Economics with Heterogeneous Interacting Agents

A Practical Guide to  
Agent-Based Modeling

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 Springer

# Economics With Heterogeneous Interacting Agents

**Mauro Gallegati, Antonio  
Palestrini, Alberto Russo**



## **Economics With Heterogeneous Interacting Agents:**

*Economics with Heterogeneous Interacting Agents* Alessandro Caiani, Alberto Russo, Antonio Palestrini, Mauro Gallegati, 2016-09-21 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 *4th Workshop on Economics with Heterogeneous Interacting Agents*, 1999 *Economics with Heterogeneous Interacting Agents* Alan Kirman, Jean-Benoit Zimmermann, 2001-06-01 This book analyses situations in which individual agents who might be different from each other interact and produce behaviour on the aggregate level which does not correspond to that of the average actor This leads to aggregate outcomes which would be impossible to explain in a more standard approach Aggregation generates structure and as a result interaction and heterogeneity can be handled and we no longer have to rely on the over simplified reduction of the behaviour of the economy to that of a rational individual Special Issue on the 16th Workshop on Economics and Heterogeneous Interacting Agents, 2011, 2013 **Heterogenous Agents, Interactions and Economic Performance** Robin Cowan, Nicolas Jonard, 2012-12-06 In traditional economics models of perfect competition agent s interactions are all mediated through the market Interactions are anonymous global and indirect This is a powerful model but we see many instances in which one and sometimes all of the previous characteristics fail to hold true The type of agent you are or your identity can affect the type of interaction we have and most surely the relationship between micro behaviour and macro phenomena in non trivial ways This book contains a selection of papers presented at the 6th Workshop on Economics with Heterogenous Interacting Agents WEHIA The contributions show that work done in other fields like evolutionary biology statistical mechanics social network theory and others help us to understand the way in which economic systems operate Virtually all of the papers presented in this volume draw on some aspect or other of these varied approaches to related

problems      **Special Issue on the 17th Workshop on Economics and Heterogeneous Interacting Agents, 2012**  
,2015      *Nonlinear Dynamics and Heterogeneous Interacting Agents* Thomas Lux, Stefan Reitz, Eleni Samanidou, 2009-09-02  
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      *Papers of the Workshop on Economics and Heterogeneous Interacting Agents Held on 30 May - 1 June 2002 at Trieste, Italy*, 2002      **The Complex Dynamics of Economic Interaction** Mauro Gallegati, Alan P. Kirman, Matteo Marsili, 2012-12-06 This volume contains a selection of contributions presented at the WEHIA02 Workshop on Economies with Heterogeneous Interacting Agents which was held at the Abdus Salam International Centre for Physics of Trieste Italy on May 29 31 under the auspices of Exystence Complex System network of excellence WEHIA02 is the 7th edition of a workshop which was held for the first time at the University of Ancona Italy on 1996 1 as a one week series of seminars for the Italian PhD program Ancona hosted the event in the years 1997 and 1998 2 before it moved to Genoa 1999 3 Marseille 2000 4 Maastricht 2001 5 and finally to Trieste 2002 The 2003 workshop was held in Kid Germany while the next editions will be in Kyoto Japan 2004 and Essex UK 2005 The full list of participants titles of the invited lectures papers and posters of WEHIA can be found in <http://econ.dea.it/wehia2> The workshop has been always very informal aiming to put together scholars of different disciplines working on interaction of heterogeneous so thing economists physicists biologists To facilitate participation there has not been conference fee It aimed to be a locus for communicate and exchange results and experiences Several collaborations started with the Workshop and it is not without pride that the organizers claim such a result The WEHIA has had two parts a pars desiruous and a pars adestruens      *Agent-Based Approaches in Economic and Social Complex Systems V* Takao Terano, Hajime Kita, Shingo Takahashi, Hiroshi Deguchi, 2009-04-14 Agent based modeling simulation is an emergent approach to the analysis of social and economic systems It provides a bottom up experimental method to be applied to social sciences such as economics management sociology and politics as well as some engineering fields dealing with social activities This book includes selected papers presented at the Fifth International Workshop on Agent Based Approaches in Economic and Social Complex Systems held in Tokyo in 2007 It contains two invited papers given as the plenary and invited talks in the workshop and 21 papers presented in the six regular sessions Organization and Management Fundamentals of Agent Based and Evolutionary Approaches Production Services and Urban Systems Agent Based Approaches to Social Systems and Market and Economics I and II The research presented here shows the state of the art in this rapidly growing field      **Agent-Based Methods in Economics and Finance** Francesco Luna, Alessandro Perrone, 2012-12-06 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.

**Introduction to Agent-Based Economics** Mauro Gallegati, Antonio Palestrini, Alberto Russo, 2017-08-03. 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.

**Complex Agent-Based Models** Mauro Gallegati, 2018-09-19. 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      Network Theory and Agent-Based Modeling in Economics and Finance Anindya S. Chakrabarti,Lukáš Pichl,Taisei Kaizoji,2019-10-23 This book presents the latest findings on network theory and agent based modeling of economic and financial phenomena In this context the economy is depicted as a complex system consisting of heterogeneous agents that interact through evolving networks the aggregate behavior of the economy arises out of billions of small scale interactions that take place via countless economic agents The book focuses on analytical modeling and on the econometric and statistical analysis of the properties emerging from microscopic interactions In particular it highlights the latest empirical and theoretical advances helping readers understand economic and financial networks as well as new work on modeling behavior using rich agent based frameworks Innovatively the book combines observational and theoretical insights in the form of networks and agent based models both of which have proved to be extremely valuable in understanding non linear and evolving complex systems Given its scope the book will capture the interest of graduate students and researchers from various disciplines e g economics computer science physics and applied mathematics whose work involves the domain of complexity theory      New Frontiers in the Economics of Innovation and New Technology Cristiano Antonelli,Dominique Foray,Bronwyn H. Hall,W. Edward Steinmueller,2006-01-01 This Festschrift explores the truly exceptional breadth and depth of Paul David s work focusing upon his contributions to the topics of path dependence the economics of knowledge and the diffusion of technology The book consists of 15 papers plus an introduction by the editors and an entertaining postscript by Dominique Foray For economic historians the papers on path dependence assembled in this book and particularly the conceptual paper by Antonelli should be essential reading Nikolaus Wolf Economic History Review Recent research on the economics of innovation has acknowledged the importance of path dependence and networks in the evolution of economies and the diffusion of new techniques products and processes These are topics pioneered by Paul A David one of the world s leading scholars in the economics of innovation This outstanding collection provides a fitting tribute to the diversity and depth of Paul David s contributions The papers included range from simulation models of the evolution of market structure in the presence of innovation through historical investigations of knowledge networks and empirical analysis of contemporary networks to the analysis of the diffusion of innovations using simulation and analytic models and of the diffusion of knowledge using patent data With an emphasis on simulation models data analysis and historical evidence this book will be required reading for researchers in innovation economics and regional development as well as economists sociologists and historians of innovation and intellectual property      Agent-Based Models in Economics Domenico Delli Gatti,Giorgio Fagiolo,Mauro Gallegati,2018-03-22 The first step by step introduction to the methodology of agent based

models in economics their mathematical and statistical analysis and real world applications

**The Oxford Handbook of Computational Economics and Finance** Shu-Heng Chen, Mak Kaboudan, Ye-Rong Du, 2018 The Oxford Handbook of Computational Economics and Finance provides a survey of both the foundations of and recent advances in the frontiers of analysis and action It is both historically and interdisciplinarily rich and also tightly connected to the rise of digital society It begins with the conventional view of computational economics including recent algorithmic development in computing rational expectations volatility and general equilibrium It then moves from traditional computing in economics and finance to recent developments in natural computing including applications of nature inspired intelligence genetic programming swarm intelligence and fuzzy logic Also examined are recent developments of network and agent based computing in economics How these approaches are applied is examined in chapters on such subjects as trading robots and automated markets The last part deals with the epistemology of simulation in its trinity form with the integration of simulation computation and dynamics Distinctive is the focus on natural computationalism and the examination of the implications of intelligent machines for the future of computational economics and finance Not merely individual robots but whole integrated systems are extending their immigration to the world of Homo sapiens or symbiogenesis

**Agent-based Approaches in Economic and Social Complex Systems** Akira Namatame, Takao Terano, Koichi Kurumatani, 2002 This volume explores the field of artificial intelligence and features in depth coverage of important theoretical areas including computational organization computational economics computational approaches in social science and game theory The conception of the multi agent system is particularly attractive as it promises autonomy based on the conceptual speciality of a rational agent as well as collective behaviour through interactions

**Analytical Political Economy** Roberto Veneziani, Luca Zamparelli, 2018-06-11 Offering a unique picture of recent developments in a range of non conventional theoretical approaches in economics this book introduces readers to the study of Analytical Political Economy and the changes within the subject Includes a wide range of topics and theoretical approaches that are critically and thoroughly reviewed Contributions within the book are written according to the highest standards of rigor and clarity that characterize academic work Provides comprehensive and well organized surveys of cutting edge empirical and theoretical work covering an exceptionally wide range of areas and fields Topics include macroeconomic theories of growth and distribution agent based and stock flow consistent models financialization and Marxian price and value theory Investigates exploitation theory trade theory the role of expectations and animal spirits on macroeconomic performance as well as empirical research in Marxian economics

**Interactive Macroeconomics** Corrado Di Guilmi, Simone Landini, Mauro Gallegati, 2017-04-04 This book describes the analysis of macroeconomic agent based models using the tools of statistical mechanics

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