
Models With Heterogeneous Agents Introduction

Introduction to Agent-Based Economics
Macroeconomics with Heterogeneous Agents and Input-Output Networks
13th International Conference, ICTERI 2017, Kyiv, Ukraine, May 15-18, 2017, Revised Selected Papers
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Agent-based Modeling of Tax Evasion
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Introduction to Agent-Based Economics Springer

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

Macroeconomics with Heterogeneous Agents and Input-Output Networks Cambridge University Press

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. 13th International Conference, ICTERI 2017, Kyiv, Ukraine, May 15-18, 2017, Revised Selected Papers Elsevier

This book provides an accessible, undergraduate-level introduction to computable general equilibrium (CGE) models, a class of model that has come to play an important role in government policy decisions. The book uses a graphical approach to explain the economic theory that underlies a CGE model, and provides results from simple, small-scale CGE models to illustrate the links between theory and model outcomes. The book includes eleven guided, hands-on exercises that introduce modeling techniques that are applied to real-world economic problems. Students will learn how to integrate their separate fields of economic study into a comprehensive, general equilibrium perspective as they develop their skills as producers or consumers of CGE-based analysis.

Asset Pricing Model with Heterogeneous Investment Horizons Princeton University Press

This User's Guide is a resource for investigators and stakeholders who develop and review observational comparative effectiveness research protocols. It explains how to (1) identify key considerations and best practices for research design; (2) build a protocol based on these standards and best practices; and (3) judge the adequacy and completeness of a protocol. Eleven chapters cover all aspects of research design, including: developing study objectives, defining and refining study questions, addressing the heterogeneity of treatment effect, characterizing exposure, selecting a comparator, defining and measuring outcomes, and identifying optimal data sources. Checklists of guidance and key considerations for protocols are provided at the end of each chapter. The User's Guide was created by researchers affiliated with AHRQ's Effective Health Care Program, particularly those who participated in AHRQ's DECIDE (Developing Evidence to Inform Decisions About Effectiveness) program. Chapters were subject to multiple internal and external independent reviews. More more information, please consult the Agency website:

www.effectivehealthcare.ahrq.gov)

Computational Methods and Applications MIT Press

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.

Information and Communication Technologies in Education, Research, and Industrial Applications Springer Science & Business Media

Macroeconomics increasingly uses stochastic dynamic general equilibrium models to understand theoretical and policy issues. Unless very strong assumptions are made, understanding the

properties of particular models requires solving the model using a computer. This volume brings together leading contributors in the field who explain in detail how to implement the computational techniques needed to solve dynamic economics models. A broad spread of techniques are covered, and their application in a wide range of subjects discussed. The book provides the basics of a toolkit which researchers and graduate students can use to solve and analyse their own theoretical models.

Two Simple Case Studies Springer Science & Business Media

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

Cambridge University Press

Heterogeneous agents models have become the norm in modern macroeconomics as the limitations of the representative-agent paradigm and the importance of studying household heterogeneity grow in recognition. Agent heterogeneity may not only be important to accurately capture the description of an aggregate equilibrium. Also, the representative agent assumption may hide many distributional effects and therefore could change the answer to many normative questions usually given by representative agent models. This dissertation contains three chapters exemplifying ways in which the consideration of heterogeneous agents in the modelling of macroeconomic phenomena has important repercussions for the predictions of the model and its normative implications. Chapters 1 and 2 show the importance of accounting for worker heterogeneity in the analysis of labor markets. Chapter 1 presents a search and matching model of unemployment with heterogeneous workers which's main features, are ex-ante worker heterogeneity and undirected search. These features enable the model to replicate the empirical correlations between labor

market outcomes and proxy variables for worker productivity. The model displays job rationing, which makes it useful to understand the high levels of unemployment observed in deep recessions. It also constitutes a versatile tool for the analysis of several labor-market aspects in which worker heterogeneity could play an important role, such as the impact of employment policies that are believed to have asymmetric effects across the labor force. Chapter 2 provides an example of such applications by analyzing the effects of increments of a minimum wage. It explores theoretically and empirically the notion that minimum wages affect low-skill workers asymmetrically due to productivity differences. Using the model presented in chapter 1, with the incorporation of endogenous search intensity to account for the effects that minimum wages could have on worker participation, I show that a rising minimum wage lowers the employment and labor force participation of low-productivity workers by pricing them out of the market, while it increases the employment, participation, and wages of more productive workers that remain hireable. Chapter 2 also contains an empirical analysis that investigates and ultimately validates the model's predictions of changes in the minimum wage. Within the labor market for low-education (high school or lower) workers, increments in the minimum wage have diametrically opposed effects: they reduce the employment and labor force participation of teenagers with less than high school education, while increasing the employment and labor force participation of mature workers with high school educational attainment. A calibrated version of the model targeting the low-education labor market shows that, despite its opposite effects across the labor force, an increase in the minimum wage negatively impacts aggregate employment, labor force participation, and social welfare. Chapter 3 investigates the existence of complex dynamics in the behavior of exchange rates due to heterogeneity in the expectations of their future value. A simple model of exchange rate dynamics featuring traders with heterogeneous expectations is introduced. The model is based on the asset pricing model in Brock and Hommes (1998) and features the BNN dynamic presented in Brown et al. (1950), a dynamic with desirable properties absent in other dynamics used in the literature. The chapter shows that even this simple model can easily generate complex and even chaotic dynamics in the exchange rate because of the interaction of traders with different beliefs. An important implication is that long-term exchange rate prediction is, in theory, difficult.

A Practical Guide to Agent-Based Modeling Springer

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.

From Basic to State-of-the-Art Computational Techniques Springer

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).

Reexamining the Role of Heterogeneous Agents in Stock Markets, Labor Markets, and Tax Policy Cambridge University Press

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.

A Toolkit Government Printing Office

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

Theoretical Aspects and Computational Simulations BoD – Books on Demand

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.

An Introduction to Agent-Based Modeling Elsevier

'International Handbook on the Economics of Integration edited by Miroslav Jovanovi? 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

Developing a Protocol for Observational Comparative Effectiveness Research: A User's Guide Princeton University Press

This book is a definitive introduction to models of computation for the design of complex, heterogeneous systems. It has a particular focus on cyber-physical systems, which integrate computing, networking, and physical dynamics. The book captures more than twenty years of experience in the Ptolemy Project at UC Berkeley, which pioneered many design, modeling, and simulation techniques that are now in widespread use. All of the methods covered in the book are realized in the open source Ptolemy II modeling framework and are available for experimentation through links provided in the book. The book is suitable for engineers, scientists, researchers, and managers who wish to understand the rich possibilities offered by modern modeling techniques. The goal of the book is to equip the reader with a breadth of experience that will help in understanding the role that such techniques can play in design.

[Agent-Based Computational Economics](#) John Wiley & Sons

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.

Nonlinearity, Bifurcation and Chaos Cambridge University Press

An introductory overview of the methods, models and interdisciplinary links of artificial economics. Addresses the differences between the assumptions and methods of artificial economics and those of mainstream economics. This is one of the first books to fully address, in an intuitive and conceptual form, this new way of doing economics.

Time Consistency in Investment and Insurance Models Academic Press

Dynamic stochastic general equilibrium (DSGE) models have become one of the workhorses of modern macroeconomics and are extensively used for academic research as well as forecasting and policy analysis at central banks. This book introduces readers to state-of-the-art computational techniques used in the Bayesian analysis of DSGE models. The book covers Markov chain Monte Carlo techniques for linearized DSGE models, novel sequential Monte Carlo methods that can be

used for parameter inference, and the estimation of nonlinear DSGE models based on particle filter approximations of the likelihood function. The theoretical foundations of the algorithms are discussed in depth, and detailed empirical applications and numerical illustrations are provided. The book also gives invaluable advice on how to tailor these algorithms to specific applications and assess the accuracy and reliability of the computations. Bayesian Estimation of DSGE Models is essential reading for graduate students, academic researchers, and practitioners at policy institutions.

[Unbundling Macroeconomics Via Heterogeneous Agents and Input-Output Networks](#) Edward Elgar Publishing

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.

Essays on Agent Heterogeneity in Macroeconomics Springer

In this article we extend the agent-based model of firms & rsquo; formation and growth proposed in [4]. In [4] the firms & rsquo; 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 & rsquo; 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 & rsquo; sizes distribution. -- monitoring ; firms' size ; power law ; agent-based model ; simulation ; heterogeneous agents

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