
Models With Heterogeneous Agents Introduction

w49. Solving the Heterogeneous-Agent Model Oliver Pfäuti: \"A Behavioral Heterogeneous Agent New Keynesian Model\" Lecture 9: Heterogeneous agents models and methods Heterogeneous Agents Models in Macroeconomics Heterogeneous Agent DSGE Models in Julia at the FRBNY | Rebecca Sarfati | JuliaCon 2019 w43. Matching in the Heterogeneous-Agent Model w44. Consumption and Saving in the Heterogeneous-Agent Model Open Source Tools for 'Heterogeneous Agent' Modeling | SciPy 2018 | Carroll and White Part I: Heterogeneous Agent Models with Financial Frictions, A Continuous Time Approach Dynare 3 2019 TutORial: Structural Economic Models Introduction to general linear models Introduction To Agent-Based Models by Andrew Crooks and Sara Metcalf Solving Heterogeneous Estimating Equations Using Forest Based Algorithms Modeling Heterogeneous Preferences (old) Nobel Symposium Ellen Mcgrattan Modern DSGE models: Theory and evidence Using MATLAB to Develop Macroeconomic Models Module 9 Lecture: General and Generalized Linear Models 4 - How To Use CGE Models for Gender-aware Economic Analysis - Part 1 2011 Methods Lecture, Jesús Fernández-Villaverde, \"Heterogeneous Agents Models\" Macroeconomic stabilization with heterogeneous agents, with Morten Ravn Davide Debortoli (UPF): \"Monetary Policy with Heterogeneous Agents: Insights from TANK models\" Constrained efficiency in a model with sovereign default and heterogeneous agents - Guillermo Santos Introduction to ABM/Corrado DI GUILMI Part 3: Heterogeneous Agent Models with Financial Frictions, A Continuous Time Approach 2012 Methods Lecture, Ariel Pakes, \"The Primitives of Static Demand Models\" Part 2: Heterogeneous Agent Models with Financial Frictions, A Continuous Time Approach Optimal Monetary Policy with Heterogeneous Agents : A Timeless Ramsey Approach Estimating Non-Linear Macroeconomic Models at the New York Fed | M Cai | JuliaCon 2018

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Nonlinear Dynamics and Heterogeneous Interacting Agents

Government Printing Office

"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].

Reexamining the Role of Heterogeneous Agents in Stock Markets, Labor Markets, and Tax Policy Springer Science & Business Media
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.

BEHAVIORAL RATIONALITY AND HETEROGENEOUS EXPECTATIONS IN COMPLEX ECONOMIC SYSTEMS

Springer

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 presents 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.

ESSAYS ON AGENT HETEROGENEITY IN MACROECONOMICS

Springer

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.

Competition, Spatial Location of Economic Activity and Financial Issues Springer

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

[Macroeconomics with Heterogeneous Agents and Input-Output Networks](#) 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

THEORETICAL ASPECTS AND COMPUTATIONAL SIMULATIONS

Springer Science & Business Media

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.

Artificial Economics Cambridge University Press

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.

An Introduction to High-Frequency Finance Edward Elgar Publishing

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

System Design, Modeling, and Simulation Using Ptolemy II Newnes

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

Theory and Applications, Ninth World Congress Elsevier

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.

Two Simple Case Studies Princeton University Press

A comprehensive and hands-on introduction to the core concepts, methods, and applications of agent-based modeling, including detailed NetLogo examples. The advent of widespread fast computing has enabled us to work on more complex problems and to build and analyze more complex models. This book provides an introduction to one of the primary methodologies for research in this new field of knowledge. Agent-based modeling (ABM) offers a new way of doing science: by conducting computer-based experiments. ABM is applicable to complex systems embedded in natural, social, and engineered contexts, across domains that range from engineering to ecology. An Introduction to Agent-Based Modeling offers a comprehensive description of the core concepts, methods, and applications of ABM. Its hands-on approach—with hundreds of examples and exercises using NetLogo—enables readers to begin constructing models immediately, regardless of experience or discipline. The book first describes the nature and rationale of agent-based modeling, then presents the methodology for designing and building ABMs, and finally discusses how to utilize ABMs to answer complex questions. Features in each chapter include step-by-step guides to developing models in the main text; text boxes with additional information and concepts; end-of-chapter explorations; and references and lists of relevant reading. There is also an accompanying website with all the models and code. A Practical Guide to Agent-Based Modeling John Wiley & Sons 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.

Bayesian Estimation of DSGE Models BoD – Books on Demand
 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

Heterogeneous Agent Models Introduction to Agent-Based Economics

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.

A Simulation Framework for Heterogeneous Agents Springer

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.

INTRODUCTION TO COMPUTABLE GENERAL EQUILIBRIUM MODELS

Princeton University Press

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.

Handbook of Computational Economics Academic Press
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

ECONOMICS WITH HETEROGENEOUS INTERACTING AGENTS

Lee & Seshia

The first step-by-step introduction to the methodology of agent-based models in economics, their mathematical and statistical analysis, and real-world applications.

Nonlinearity, Bifurcation and Chaos Cambridge University Press

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.

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