Preface

Research at the intersection of economics and computer science has remarkably grown in recent years and it has become a source of interest and innovation for both disciplines. The flow of knowledge and ideas between computer science and economics is traveling in both directions. From one side, many aspects of our most important information networks, such as Internet, might be better understood, managed, and improved when viewed as economic systems rather than as purely technological ones. On the other way around, economists have begun to apply the insights and methods of computer science in order to face new and old problems in economics[1].

Most of the interaction between economics and computer science turns around the concept of complexity. In economics, complexity is not simply a matter of things being "complicated", although some may view it this way, but it is referred to markets that exhibit and share some specific characteristics that are used to define complexity. The concept of complexity in economics emerged historically in the fields of game theory and financial markets, where the "nearly archetypal example" can be considered the artificial stock market model created by the Santa Fe Institute in 1989. We borrow from Durlauf and Lane[2] a tentative list of features that characterize complexity in economics: the presence of dispersed interaction among heterogeneous agents acting locally among each other in some space; the presence of mechanisms of competition and coordination between agents without a global entity (fictitious auctioneer) that controls interactions in the economy; a cross-cutting hierarchical organization with many tangled interactions; continual adaptation by learning and evolving agents; perpetual innovation as new markets, technologies, behaviors, and institutions create new niches in the ecology of the system; out-of-equilibrium dynamics with either zero or many equilibria existing and the system unlikely to be near a global optimum.

Market models that incorporate such characteristics often involve many interacting agents and, consequently, they constitute high-dimensional mathematical models that lead to complex large scale computations. In recent years, computer scientists have

[1] For more details see Michael Kearns, "Economics, Computer Science, and Policy", *Issues in Science and Technology*, 21(2), 2005.

[2] Brian Arthur, Steven Durlauf and David A. Lane, "Introduction: Process and Emergence in the Economy", *The Economy as an Evolving Complex System II*, Addison-Wesley, 1997.

been examining new ways of representing or encoding such high-dimensional models and we can now undertake the construction and algorithmic manipulation of numerical economic models whose complexity greatly exceeds those one could have contemplated a decade ago.

Since 2005, the Artificial Economics conference is building a bridge between these two disciplines, facilitating the meeting of people working on different topics in economics and computer science, in order to encourage a structured multi-disciplinary approach to social sciences. The VIII edition of Artificial Economics, held in Castellón de la Plana (Spain), followed the traditional 2-days meeting format, including the presentation of 20 selected speakers, whose contributions are collected in this volume, and the talks of three invited scholars: Silvano Cincotti (University of Genoa), Giovanni Dosi (Sant'Anna School of Advanced Studies in Pisa) and Cars Hommes (University of Amsterdam). All three researchers have extensively contributed to the development of agent-based techniques and the application of computational methods to various fields of economics, such as macroeconomics, industrial organization, finance and experimental economics.

In the last decade the cross-fertilization between Economics and Computer Science gave rise to novel relevant results in traditional fields in economics such as macroeconomics, the analysis of networks, finance and theory of firms. Just as an example, we can mention the Eurace project[3], headed by Prof. Silvano Cincotti, that brings together computer scientist and economists to create a simulation platform to study the behavior of agents and the performance of the economy in a complex environment. Within the traditional field of Industrial Organization, methods from Artificial Economics have been successfully applied to the analysis of firms' dynamics by Prof. Giovanni Dosi, who developed a simulator that allows studying the process of creation and diffusion of innovation and its impact on the sustainability of economic growth. Additionally to the application of Artificial Economics methods to traditional fields, we find also some novel and original applications as in the case of the complementary use of artificial methods and laboratory experiments. Prof. Cars Hommes has shown the effectiveness of such approach by applying artificial evolving agents to reproduce the behavior of human subjects in simple laboratory financial markets.

In this volume we collect the most recent research in the various branches of Artificial Economics. In the field of Networks Diedrich and Beltrán present an agent-based model to study whether the traditional paradigm of network neutrality is an appropriate framework in managing internet traffic. Hollander, Garibay, O'Neal introduce an agent-based computational model to quantify the impact of the characteristics of the underlying production network on macroeconomic output. The architecture of credit networks among banks and its role on financial contagion are the main topics of the contribution of Provenzano. Lopolito, Morone and Taylor focus attention on the diffusion of new technologies as a function of the characteristics of a network composed by institutional advisors and firms.

[3] Eurace is the acronym of "An agent-based software platform for European economic policy design with heterogeneous interacting agents: new insights from a bottom up approach to economic modeling and simulation", EU IST FP6 STREP grant: 035086.

In the part of the volume devoted to Macroeconomics, Chen and Inoue appliy methods of statistical physics to deal with the matching problem in the labor market. Erlingsson, Raberto, Stefánsson, and Sturluson implement an housing-market into an agent-based macroeconomic model characterized by heterogeneous households, banks and the presence of a central bank.

Regarding Finance, Fischer studies the dynamical properties of a market populated by N heterogeneous consumers in the presence of financial markets allowing for saving and lending, within an agent-based framework. Brandouy, Mathieu, and Veryzhenko introduce an agent-based model of heterogeneous financial investors analyzing the impact of their risk attitudes on the long-run stability of their investment strategies. Stanciu-Viziteu introduces a simple game to model the bounded-rational behavior of investors in a prototypical financial market.

Among the contributions focusing in Industrial organization, Radivojevíc, Anselmi and Scalas present a stylized model of a continuous double auction, deriving the conditions for its statistical equilibrium. Cruciani, Moretti and Pellizzari syudy the determinants of cooperation using an agent-based framework. An agent-based model of electricity market is introduced by Guerci and Rastegar. Kopányi describes the convergence properties of a Bertrand competition market with agents having different learning methods.

In the part of the volume devoted to the field of Management, LiCalzi and Milone introduce a model of a team problem-solving with heterogeneous bounded rational agents. Osinga, Kramer, Hofstede and Beulens introduce an agent-based model to study the choices of heterogeneous farmers. Schouten, Polman, Westerhof and Kuhlman offer an agent-based perspective model to deal with agricultural policy issues. Leitner implement a statistical analysis of managing accounting systems.

The final part of the volume includes some methodological questions to be addressed in order to give a more structured framework to the discipline of Artificial Economics. Diks and Makarewicz present an application of artificial intelligence in modelling data generated by laboratory experiments with human subjects. Grazzini, Richiardi and Sella estimate the main parameters of a simple agent-based model of innovation diffusion.

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