# Preface

In 2000, when Levy, Levy, and Solomon published their book *Microscopic Simulation of Financial Markets*, Harry Markowitz noted in the blurb that numerical simulations point "us towards the future of financial economics. If we restrict ourselves to models which can be solved analytically, we will be modeling for our mutual entertainment, not to maximize explanatory or predictive power." At that time most economists were quite sceptical about the new techniques and thus a statement like this was encouraging for the Artificial Economics community. Since 2000, things have changed tremendously. Agent-based modeling, computer simulations, and artificial economics have become broadly accepted tools in social sciences by now. For a large number of problems they are the only reliable techniques to arrive at nontrivial results.

Neoclassical economics is usually split up into a micro and a macro analysis, the first dealing with the individual decision-maker (consumer, firm, investor etc.), and the second with economic aggregates such as aggregate demand and aggregate supply (labor, consumption, capital, etc.). The link, if there is any, between both levels is the representative agent, that is the assumption that either all agents are of the same type or that they act in such a way that the sum of their choices is mathematically equivalent to the decisions of identical, prototypical individuals. In such a world neither the problem of imperfect rationality nor the problem of disparate and diverse information can be addressed; the latter is not even the case if you allow for only two disparate levels of information, let us say informed and non-informed individuals.

What happens in the real world is an outcome of the interaction of numerous individuals, each of whom may have different preferences, different information levels and different attitudes. A system with a set of autonomous decision-makers (agents) who individually assess their situation and exhibit repetitive interactions based upon their idiosyncratic rules is called a multi-agent-model; it can give us valuable insights into the nature of the real system it attempts to emulate. If, as often has been formulated, a market is an open complex adaptive system with endogenous evolution, the only chance to get a deeper understanding of how it works will be to look at its dynamics, driven by individual decision making. If we do so, we possibly will capture emergent behavioral patterns which are the result of interaction and which are decoupled from the behavior of the individuals: the whole is more than its parts.

The 2008 meeting of researchers in Artificial Economics takes place in Innsbruck (Austria). The most distinguished scholar of our school was Eugen Ritter von Böhm-Bawerk, one of the protagonists of the so-called Austrian School of Economics. Agent-based modeling and complexity economics draw a lot of inspiration from and give a lot of inspiration to Austrian Economics. Central to this school of thought is the uncompromising use of methodological individualism and

subjectivism: whatever happens in society has to be explained by going back to the actions of individuals; these individuals need not be perfectly rational, but they are assumed to exhibit at least meaningful and selfish decisions (as opposed to irrational agents, noise traders etc.). Austrian Economics always deals with 'human action' (Mises): It must be possible to explain why people do what they do. A theory, e.g. efficient markets theory, where in the end nobody has an incentive to do anything, is a sterile intellectual gimmick. In a perfect equilibrium as a result of competition, nobody competes; such theories are rather theories of human non-action than of human action. We are happy that some of the papers presented in the workshop will fit very well in the Böhm-Bawerk-tradition of Austrian Economics.

At the Innsbruck University School of Management agent-based modeling has quite a long tradition. The first paper of an artificial stock market with heterogeneously informed agents was published in 1997: it tried to resolve the famous information-paradox (Grossman/Stiglitz) without referring to market imperfections or to irrational decision making (as noise-traders) and showed that in a stock market you may be better off if you have less information than others (a typical result emerging from an agent-based approach). A lot of further work has been done in this field, partly using computer simulations and partly adopting an experimental approach. With respect to the objective of learning more about the dynamics of complex systems such as a market, both approaches have their merits, but also their shortcomings. Both stem from the dominant role of heterogeneous agents making individual decisions. If we want to gain reliable knowledge of how real human beings view their decision problems, which factors they take into account, how they deal with information overloads and other items, experimental economics with real people will be the more appropriate approach. If, however, we try to understand the underlying properties of a complex system, computer simulations will do better: with artificial agents we get economically 'pure' results which are not blurred by the bounded rationality of real agents. In both cases, however, macro phenomena grow on the sound ground of methodological individualism with autonomous agents; that is what counts.

All papers in this book have been selected in a double-blind reviewing process. They cover various topics within the area indicated in the title "Complexity and Artificial Markets".

The papers in Part I use agent-based simulations to deal with market mechanisms. The main concern of the *LiCalzi/Pellizzari*-paper is the market microstructure: how does resampling affect allocational efficiency in different market protocols? *Giulioni/Bucciarelli* observe the Pescara wholesale fish market with respect to its price dynamics. *Milone* studies the consequences of pre-trade quote disclosure on the market performance in different scenarios.

Part II is devoted to evolution and is decision making. *Anufriev and Hommes* show in an experimental study how different forecasting strategies perform in an evolutionary switching mechanism. *Raberto, Teglio, and Cincotti* focus on households' beliefs formation and financial preferences, based on concepts from prospect theory. *Fernández-de-Córdoba and Navas* present an evolutionary model and show under which conditions a Walrasian equilibrium is likely to emerge in an economy.

*Garabedian* presents an agent-based consumption model that is applied to the purchase decision for ethical goods.

Part III deals with information economics in a broad understanding. *Hule and Lawrenz* investigate the impact of information quality and the intensity of interaction on some stylized facts in financial markets. *Hofstede, Jonker, and Verwaart* create an agent-based model emphasizing the micro-dynamics of trust in a long-term trade relationship. Combining experimental economics and agent-based computational models *López-Paredes, Posada, Hernández, and Pajares* explain individual behavior of agents in a signaling game.

In Part IV, methodological issues prevail. *Livet, Phan, and Sanders* start from an ontological view and study the relationship between a given problem, experimental design, and modeling individual choice in different types of agent-based computational economics. *Van-der-Hoog, Deissenberg, and Dawid* present some new developments in the well-known agent-based model of the European economy called EURACE. *Grevers and Veen* compare the two main methodological approaches in social sciences, the systems approach and the individual-based approach, with special emphasis on agent-based computational economics.

It is almost a tradition of the Artificial Economics meetings to bring together people from computer science, natural sciences, philosophy, cognitive sciences, economics and finance, and other areas. The two invited speakers give evidence of this basically interdisciplinary approach. *Peter Henning*, coming from theoretical quantum physics, visited the world of financial markets at the Deutsche Börse AG, switched to computer science and, for the time being, teaches informatics, economics, e-learning and related fields. He, too, has a strong relationship to Tyrol as he supported for years the 'Bozner Treffen', an annual meeting of scientists coming from various disciplines. *Peter's* paper deals with different types of evolutionary processes: under which conditions can evolution serve as a bridge between biology and economics? *Alan Kirman* comes from neoclassical economics, but studying the link between micro and macro behavior he was a pioneer in agent-based computational economics; at an early stage he understood that economic activity is better viewed as the product of a complex self-organizing system than of corresponding to the behavior of an individual maximizer; with Innsbruck he is familiar as one of the speakers in the famous 'Böhm-Bawerk-lecture' given annually by some of the most distinguished economists from all over the world. *Alan* teaches at the Université de la Méditerranée near Marseille. His paper deals with rationality and organization in artificial markets.

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