

## *Foreword*

The last fifteen or twenty years have been marked by fundamental advances in the sources of complex behavior in micro- and macro-economics, in the practical and methodological implications of such behavior, and in the methods and tools appropriate to cope with it. Much of these developments have been driven by the recognition and acceptance by economists of approaches initiated in other fields—such as non-linear dynamics, statistical physics, network theory, biology, computer science, and the use of computational methods as problem-solving tools—giving rise to important and innovative impulses to economic thinking.

The sixteen chapters in this book—the fourteenth volume in the series *International Symposia in Economic Theory and Econometrics*—reflect from various perspectives this recent evolution. They are the outgrow from a selection of communications presented at the COMPLEXITY2000 workshop held in Aix en Provence, France, 4–6 May 2000. All chapters were strictly refereed in the intended tradition of the series: to provide journal quality collections of research papers of unusual importance in areas of currently highly visible activity within the economics profession.

The workshop brought together, from twenty-two nations, almost seventy economists, mathematicians, biologists and physicists interested in complex phenomena, with the aim to reinforce or establish the dialogue among them, to provide an opportunity to exchange know-how and to discuss the problems encountered, to highlight the links between different areas of research, and to promote cross-fertilization. This, among others, by accommodating the participants in secluded surroundings and letting them interact without the strict time constraints usually imposed in international conferences.

The COMPLEXITY2000 workshop was organized by Christophe Deissenberg from the Université de la Méditerranée at Aix-Marseille, Gustav Feichtinger from the Technische Universität Wien, Suresh Sethi from the University of Texas at Dallas, and Klaus-Peter Kistner from the Universität Bielefeld. The workshop was held under the patronage of the *Special Interest Group on Economics Dynamics* of the *Society for Computational Economics*. Financial support from the French *Centre National pour la Recherche Scientifique*, from the *Université de la Méditerranée*, from the *Conseil Général*

*des Bouches du Rhône*, and from the *Mairie d'Aix en Provence* is gratefully acknowledged.

The COMPLEXITY workshop is now becoming a perennial event. Its second edition took place in May 2003, as before in Aix en Provence. A third workshop is planned for May 2006.

With its selection of articles, the book presents an overview of advanced contributions to complexity in economics and social system, such as chaotic dynamics and multiple equilibria, agent-based models, applications of genetic algorithms, non-equilibrium macro-dynamics, information transmission, learning mechanisms. Although the chapters address economic problems, the authorship and the perspectives presented are interdisciplinary and provide therefore a number of innovative insights and perspectives on classical or new questions. We would like to address at this place our most special thanks to the numerous referees, who did not shy accompanying the authors through several rounds of painstaking revisions.

The chapters have been thematically organized in three sections: 1. Complex dynamics in non-linear aggregated models; 2. Multi-agent economies; and 3. Tâtonnement, forecasting, and learning.

The first section centers on the properties of the state dynamics in aggregated models described by low-dimensional difference or differential equations. Its first chapter demonstrates an important but previously largely neglected mechanism for explaining endogenous chaotic business cycles. The second chapter explores the complex implications of relaxing the perfect substitutability and foresight assumptions in a benchmark model of real-financial interaction. The third contribution outlines the potential sources and forms of hysteresis, and analyses their theoretical and practical implications. The fourth delineates the mechanisms leading to multiple equilibria in efficient intertemporal optimization models, classifies these equilibria and presents several methods for the numerical computation of the separating thresholds.

The second section focuses on the consequences of interactions between heterogeneous agents. The first chapter investigates the complexity of self-organization through information contagion. The second analyzes the impact of costs in information transmission within a hierarchical structure. The third studies landscape model of a chain-store in which the different individual stores are engaged in similar markets and thus do not need to solve their optimization problem independently but can share their experiences. It is followed by a study of consumption behavior in an asymmetric network of heterogeneous agents within the framework of discrete choice models with stochastic decision rules. A further chapter uses a mean field model to

investigate the role of non-price interactions in investment decisions as a rationalization of empirical properties found in modern economies. The last two contributions provide alternative explanations of major stylized facts in finance, based on a chartist-fundamentalists-noise traders distinction in one case, on simple linear-strategies with stochastic traders in the other.

The third section places particular emphasis on the processes by which socio-economic agents purposefully adapt their anticipations and decisions, and on the consequences of the corresponding mechanisms. Thus, a first chapter investigates the potential welfare effects of the price instability generated by restricted tâtonnement mechanisms. Another contribution is concerned with the macro-dynamics generated by non-tâtonnement with stochastic rationing. The third chapter investigates the existence of forecasting rules that generates perfect forecasts along all possible orbits of an economic system. The fourth evidences the potentially highly complex dynamics that can be generated even by a homogenous population of agents following very simple learning rules. The last chapter applies genetic learning to the determination of policy options in a illicit drug market with boundedly rational dealers and enforcement officers.

The workshop and these proceedings are dedicated to Siegmund Stöppler, a most estimated colleague and friend who pioneered in Germany numerical methods, dynamic optimization, and agent-based modeling until his untimely death. He doubtlessly would have keenly contributed to the current interdisciplinary discussion. Associating his name to the current research efforts in economic complexity is a modest token for our scientific appreciation and personal affection.

William A. Barnett,  
Christophe Deissenberg, and  
Gustav Feichtinger