Foreword

Modeling the behavior of complex systems has advanced considerably in both the physiochemical and biological domains over the past two decades. However, it is only recently that comparatively significant advances have been made in modeling the behavior of the kinds of complex adaptive systems that we see in the social and economic domains. This has been, in part, due to the fact that mainstream economics has continued to espouse analytical frameworks we can label as "neoclassical." This kind of analysis either builds up from deductions concerning a representative agent engaged in constrained optimization under quite restrictive assumptions, or from game theoretic deductions concerning the strategic interactions of two, or sometimes three, individual decision makers, again under restrictive assumptions. Modern macroeconomists tend to adopt the former analytics and microeconomists the latter.

Although there is no doubt that these kinds of analytical approaches to obtaining equilibrium solutions through deduction have been useful in many economic settings, they cannot capture the actual behavior that we observe in history in any general way. Recent advances in the expanding field of behavioral economics, using experimental methods, have made this very clear. Also, it has proved to be very difficult to integrate approaches to economic analysis, based upon the constrained optimization of individuals, into interdisciplinary research concerning economic, political, and social interactions. For these reasons, economists have become increasingly interested in analytical approaches that deal, explicitly, with complex adaptive economic systems engaging in behavior that takes place in a historical continuum that has economic, social, and political dimensions. Furthermore, we now see other social scientists, and even physicists, offering new approaches to understanding

economic behavior. An integrated social science, for so long an impractical notion, now seems a possibility as complex adaptive systems science develops.

The core of this new science lies in agent-based modeling, which enables both natural and social scientists to engage in theorizing that is not deductive and does not require equilibrium solutions. Simulation experiments can be conducted, starting with stylized facts concerning aspects of the real world. The availability of modern computing power combined with a new understanding of how networks operate, developed mainly by sociologists such as Duncan Watts in social science settings, can permit exhaustive explorations of agent interactions. Calibrations on real data can be conducted; although it is fair to say that the methodologies involved remain in the early stages of development in the social sciences.

A large and important research program is now evolving and the contributions in this book provide excellent examples of the advances in understanding that are being made, both within and beyond the social sciences. These contributions are what we expect in the early stages of a scientific revolution: they are wide ranging in focus, they are adventurous in scope, and they reflect the excitement of participating in a frontier field of research. All of the main fields of complex adaptive modeling are represented here and both social and natural science applications are considered. Each author has taken care to introduce his or her field in a way that is comprehensible to the non-expert before offering their particular contribution. For anyone looking to gain an understanding of what the new field of complex adaptive system modeling is about, this book will constitute an excellent starting point. While, at the same time, experts in the field will find perspectives, approaches, techniques, and methodological discussions that are novel and important.

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