The sciences of complexity, nonlinear dynamics, and chaos are ever more popular in all fields of research, because of their ability to describe in mathematical terms phenomena resulting from the interaction of various kinds of “individuals” or “agents.” In turn, these individuals or agents may be simple or complex systems themselves; i.e. their structure may be elementary and capable only of simple operations and interactions with their neighbors and their environment, or may consist of internal degrees of freedom, elaborately interacting with each other. In principle, there is no limit to the number of hierarchical levels which can be found within each individual or agent, each of which can be separately treated as a complex, nonlinear, or chaotic system. Needless to say, all phenomena familiar to us appear to be complex, from this point of view, and resulting from an intricate network of interactions, which may amount to cooperation, competition, or both. The most familiar and complex system of this kind is our brain: neurons exchange electrical signals with each other, via synaptic connections. The underlying mechanism appears relatively simple: the electrical signals may be viewed like the dashes and points of the Morse code, of the old telegraphists. Yet, the fact that a very large number of neurons are connected with each other, and each of them is connected indeed with a considerable number of other neurons, the collective behavior is exceedingly complex and, indeed, it allows amazing operations, such as controlling motion of our hands, sight, voice, et cetera. Further analysis shows that neurons themselves are, separately, complex systems.

The world economy in its present global form is undoubtedly an analogous kind of complex system, in which goods are exchanged instead of electrical impulses. Therefore, the technical vocabulary of the sciences of complexity is ever more commonly used in circles interested in understanding, and possibly controlling the huge daily worldwide exchanges of stocks, money, and products of all sorts. As each single market, or single national economy are themselves very complex structures, consisting of many individuals interacting with each other, the investigation can be performed at the national level, rather than the world level. But each component of a national economy is in turn the result of the cooperation and competition of regional economies, and so on. It is hard to imagine or characterize the degree of complexity which is entailed by the economic and financial universe, especially to tame its paradigmatically unpredictable temporal evolution. At the same time, the tensions and crises which are currently experienced in many parts of the world make evident that tackling this kinds of complexity is absolutely necessary.

The mathematical arsenal developed so far to describe a very vast range of phenomena evolving in time consists of nonlinear ordinary or partial differential equations as well as of nonlinear space and time discrete iterative processes. Coupled with the power of modern computers, these tools have been very successful used in correctly describing many phenomena, ranging from natural sciences, to medicine,
architecture, and urban planning, to mention only a few examples. It seems appropriate, then, to have recourse to the same techniques, with suitable adjustments, to investigate the economic and financial phenomenon.

Indeed, similarly to other phenomena, the economic and financial one requires measurements of the initial situation, which are typically affected by a large or small uncertainties which, in turn, often propagate in time, growing for instance exponentially, a situation known as sensitive dependence on initial conditions, and suggestively called chaos. Feedback loops, in which a given entity affects the behavior of others, which in turn affect that entity, are clearly very common and generally their evolution can be described by nonlinear equations. In all cases, the resulting effect is hardly predictable, especially in the long term.

The present collection of chapters takes a practical stand, by addressing the various issues in the form of self contained introductory essays. The investigated matter mainly includes issues of socio-economical interest, such as chaos and complexity in finance, organization and leadership; stock and commodity indices; control of complexity in management; complexity in risk and cognitive management; cognitive capacities under stress; urban and territorial planning; demoscopo-physics, i.e. a technique meant to improve predictions of election results. This volume, nevertheless, also contains contributions concerning technological questions, such as power management.

All these topics are of current interest. Hence, I think that the present volume is as timely as it could possibly be, and I am sure that it will constitute a valuable tool to help both experts as well as graduate students, in developing their studies and interest in the rapidly evolving and important field of research in economy and finance.

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