

NEW ECONOMIC WINDOWS

Marisa Faggini • Thomas Lux (Eds.)

Coping with the Complexity of Economics

 Springer

New Economic Windows

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Preface

Throughout the history of economics, a variety of analytical tools have been borrowed from the so-called exact sciences. As Schoeffler (1955) puts it: “They have taken their mathematics and their deductive techniques from physics, their statistics from genetics and agronomy, their systems of classification from taxonomy and chemistry, their model-construction techniques from astronomy and mechanics, and their methods of analysis of the consequences of actions from engineering”. The possibility of similarities of structure in mathematical models of economic and physical systems has been an important factor in the development of neoclassical theory. To treat the state of an economy as an equilibrium, analogous to the equilibrium of a mechanical system has been a key concept in economics ever since it became a mathematically formalized science. Adopting a Newtonian paradigm neoclassical economics often is based on three fundamental concepts. Firstly, the representative agent who is a scale model of the whole society with extraordinary capacities, particularly concerning her capability of information processing and computation. Of course, this is a problematic reduction as agents are both heterogeneous and boundedly rational and limited in their cognitive capabilities. Secondly, it often confined itself to study systems in a state of equilibrium. But this concept is not adequate to describe and to support phenomena in perpetual motion. As it soon turned out, the equilibrium paths of even very standard economic models are much richer than the saddle-point variety initially favored by neoclassical theory allows for. In fact a dynamic economic system might not approach a steady state, but could end in limit cycles, in which variables endlessly repeat cyclical movements, or even in chaotic paths of a highly irregular kind. Lastly, linear models or at least the linearization of models in the neighborhood of an

equilibrium have been traditionally preferred by economists. But linear models do not appropriately cover the asymmetries of phenomena like depressions and recessionary periods, stock market price bubbles and corresponding crashes, persistent exchange rate movements, or the occurrence of regular and irregular business cycles. Furthermore, the mechanical character of many economic models does not allow them to treat evolution or structural changes in the systems. More fundamentally, the reductionist approach, applied by traditional economic theory, often overlooks the dependencies or interconnections among elements and their influence upon macroeconomic behaviour. Its focus is not to study the unfolding of the patterns its agents create, but rather to simplify its questions in order to seek analytical solutions. As progress has been made in the exact sciences and new mathematical and statistical tools have become available, it has become impossible for the economists to ignore that many important and interesting economic phenomena cannot be understood using the approach of traditional linear representative agent models. Economies are complex adaptive systems, that is, composed of a large number of interacting components and of the relationships between them. “The goal of complex systems research is to explain in a multidisciplinary way how complex and adaptive behaviour can arise in systems composed of large numbers of relatively simple components, with no central control, and with complicated interactions” (Mitchell 1998; Crutchfield 1994). This awareness and consequently the requirement of more realistic models have led to powerful new concepts and tools to detect, analyze and cope with them. The new perspective opened by non-equilibrium thermodynamics and the advances in nonlinear dynamic systems theory has spawned significant changes in mainstream economic theory. Economists have begun to study the general emergence of structures and unfolding of patterns in the economy, recognizing the complexity of economics and applying insights gained from Complexity Theory. Admittedly, the notion of Complexity Theory offers a diverse set of new conceptual tools to help explain the diversity of and change of economic systems and so far lacks a unifying framework. This book collects some of these approaches trying to give the reader an overview of recent developments in theory and empirical research that view economic systems as complex phenomena whose aggregate dynamics can often not be inferred from its microscopic (microeconomic) building blocks. This volume covers a collection of peer-reviewed papers on various facets of economic complexity selected from the presentations at the Ecople Conference 2006. It is dedicated to the memory of Massimo Salzano, who has been such a

fervent and eloquent advocate of the complexity approach, and a most enjoyable companion and amiable colleague.

July 2008

Marisa Faggini
Thomas Lux

Dedication to Massimo Salzano

July 2nd 1946 - October 13rd 2007

Advocates of the complex systems approach to economics are comfortable with the proposition that human social systems are rarely, if ever, in equilibrium. This acceptance of the permanence of change makes us no more immune to emotional shock than other human beings, however, as we realised when we received the unexpected news of the death of one of complexity's champions, Massimo Salzano. Someone we always thought would be with us was suddenly gone. It did not seem fair-and it was not. Massimo's intellectual dynamism and outstanding personal bonhomie helped establish many of the intellectual partnerships in modern econophysics. He should have lived a long life to enjoy seeing that research take economics on a new, dynamic and realistic path. Unfortunately, this was not to be, and we are left only with the memory of a generous man who did much to foster a sense of unity of purpose amongst European researchers into complexity. Massimo had a long and distinguished career in Italian public economics before his interest in the then nascent field of complexity brought him to international prominence, when he organized the "New Economic Windows" conference in Salerno in September 2001. He had a knack for knowing which economists would be receptive to the very different techniques of physicists. Whereas previous meetings of economists and physicists were frequently characterized by cognitive dissonance between the two camps-as with the famous meeting at Sante Fe-NEW 2001 was marked by harmony, and plans for future collaboration. Those plans came to fruition, again thanks to Massimo's organization skills and infectious vitality. He established a European Masters in complexity program, played an important role in the development of the COST P10 Action "The Physics of Risk", edited the New Economic Windows Series for Springer-Verlag, and all the while lived life to the full- and

encouraged those about him to do likewise. His personal contributions to complexity analysis were notable, though tragically cut short by his early death. Massimo's starting position on the relevance of complexity for economic theory was that the multiple, often unstable equilibria of complex systems "does not allow one to use the tool of optimization employed in the traditional [economic] approach to the decision theory" (Massimo Salzano 2007, "Economic Policy Hints from Heterogeneous Agent-Based Simulation", in Colander, D. & Salzano, M, [eds.] *Complexity and Policy Analysis*, Springer Verlag, Berlin, pp. 244-271, p. 246). His primary passions in complexity was for heterogeneous agent modelling-in contrast to the "Representative Agent" fiction that dominates modern neoclassical economics-and network theory. Both these approaches necessarily involved the rejection of the "micro-macro" distinction that has become synonymous with conventional economic theory. His work of the interaction of heterogeneous agents in macroeconomic also challenged the conventional policy focus on optimality, arguing instead that "in the case of complex systems, we need to obtain economic policies that are "robust" rather than "optimal" as the concept of optimality is illogical for such systems" (ibid, p. 270). "Robust" itself is an appropriate word to associate with Massimo, and his engagement with the world; we only regret that his robust humanity and intellect were cut short by the vicissitudes of health. Massimo will be fondly remembered for his role in nurturing econophysics and the complex systems approach to economics, and lamented for not being with us to celebrate both its maturity, and life itself. Extracts of messages on the news of Massimo's death "We'll miss his volcanic attitude toward life." Mauro Gallegati "With the clear image of Massimo's vital personality in my mind, it appears hard to believe in the message of his death. I have very lively memories of last year's 60th birthday celebration at Capri and his intoxicating engagement for our research field. Marisa and I am about to finish the editorial process of the proceedings volume for the Capri meeting. We will dedicate it to Massimo's memory as someone who devoted so much energy to complexity research." (Thomas Lux); "I will miss Massimo very much. I will miss in particular his open and reassuring smile notwithstanding the complexity of life that he rightly urged us to study" (Alessandro Roncaglia); "I thought he was indestructible and will miss him" (Alan Kirman); "What a shock.. He was one of the most alive people I ever met... I am missing him already" (Sorin Solomon); "Many of us recall meeting Massimo, at various professional meetings, across Europe. One in particular that some of us recall vividly was organised in Capri where we

celebrated in some style, with a truly magnificent display of fireworks, his 60th birthday. A truly amazing event! Most recently, in May I had the privilege to visiting Salerno to give a seminar to the students in his department. Massimo was always enthusiastic and supportive of his young students and during the seminar he made active contributions not only of a technical nature but also to ensure that those whose English was not always the best understood what I was saying.”(Peter Richmond) “In 9/2004 Massimo was the first economist to give me a forum to express my views before a gathering of other economists. I liked him and remain grateful to him.”(Joe McCauley) “Mauro is right, volcanic”. I would say “a force of nature,”uno forza natura, just to slaughter some Italian. We especially remember the second complexity conference he hosted at Salerno and the dramatic evening he provided for so many of us at the ruined Greek temples at Paestum. There will be no replacing this volcanic force of nature.”(Barkley Rosser) “We are quite shocked about his much too early death at the age of 61. We will miss him and his summer conference, which he planned again for 2008. We had told him that we are performing Giuseppe Verdi’s Requiem in Paderborn next weekend, he liked it very much. Now we will sing it for him.”(Juergen and Etta Mimkes)

Steve Keen

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Evolution of Economic Systems