Large events analysis and tools for economic policy.

M. Salzano
Dipartimento Scienze Economiche e Statistiche
Università di Salerno,
Ponte don Melillo, 1 Fisciano - Salerno Italia
salzano@unisa.it

Abstract

"Although large power events are comparatively rare, events can and do happen on all scales, with no different mechanism needed to explain the rare large events than that which explains the smaller, more common ones (Bak, 1996)."

"Selvam et al. (1996) have argued that the inverse power-law form for power spectra is ubiquitous to real-world dynamical systems and is identified as a signature of SOC or deterministic chaos."

In recent years the ergodic theory of differentiable dynamical systems has played a prominent role in the description of chaotic physical systems. They are based on "crispy" values. In some case topological methods will certainly play an important role. Topological signatures and ergodic measures usually present different aspects of the same dynamical system. "The metric properties of a dynamical system are invariant under coordinate transformations; however, they are not generally stable under bifurcations that occur during parameter changes. Topological invariants, on the other hand, can be stable under parameter changes and therefore are useful in identifying the same dynamical system at different parameter values".[Nicholas B. Tufillaro, Jeremiah Reilly, and Tyler Abbott (1992)].

As G. Klir highlighted in many works "uncertainty" and not risk is a better tool for when we are dealing with complex systems [Klir (1994 & 2005 & 2006)]. But, if this is true, we cannot make use of traditional tools of statistical mechanics, like ergodic measures. Vice versa, we need some more adeguate instrument in which the initial values are fuzzy. This is especially true for economics if we consider it as a complex system [Klir (2002)]. Many efforts have been centred on the possibility of developing systems adequate to deal with fuzzy chaotic systems. Less interest have been obtained by the fact that even Power law must be considered on the base of a fuzzy system when economics and other social or financial complex systems are under the spot. The power law are of ubiquitous nature in economics and correlated area as the recent approach of econophysics is demonstrating day after day. Of course, if the real systems are characterised by "uncertainty" and not by risk, any possibility to have correct predictions about their future evolution based on "crispy" maths is too optimistic.

Starting from the works by Li, Zhong; Halang, Wolfgang A.; Chen, Guanrong (Eds.) (2006), we will consider what kind of new results could be obtained when we consider the effect of the existence of Fuzzy Power Law for the insurgence of "cascade synergic effects" able to modify the economic, social or financial system structure. In this respect, while in general the econophysics and economic approaches consider only the effect on evolution in term of net growth we will try to consider separately the positive and negative part of this phenomenon as they seem originated by two different effect. Metaphorically, they could be considered similar to birth and dead respectively. It is only their difference that give rise to growth. The distinct consideration of their law of evolution could help for a better understanding of the motivation of reversal in growth. In fact, phenomena like epidemics could be at the base of dead of firms or speculative bubbles in some market, while at the same time normal trends could be the rule for other sectors of the system. The first kind of phenomena follow a power law statistics and show synergistic dynamics in the sense that event propagation takes on the character of an avalanche, while the second does not. What is changing in this process is the structure of the system. According to the deterministic linear approach this sort of phenomena should be infinitely rare. Vice versa, they are not so rare and their appearance have a strong impact on the structure of the system. It is possible to consider that the

kind of network or the structure of interrelation is central to this mechanism. In fact, if a large exogenous event co-involves a central hub that has positive interrelations with the other nodes, all the network will be co-involved, and the event will be amplified. Generally this impact is not reversible as the network features will be modified. It seems possible to study how policy could help to design more robust networks for this kind of event. Analysis and possible policies must take into account this mutating scenario whose rules of changing are fuzzy by their construction.

The usual tools used for forecasting seem inadequate. Therefore, reference will be made to the works by Bankes (1993 & 2002) with an extension to fuzzy values.

Extending the approach of applying Fuzzy Chaos to Fuzzy Simulation by Buckley & Hayashi (1998), we will try to analyse the possibility to develop an agent simulation based on fuzzy chaos. These A. demonstrate the possibility to obtain a better forecasting. Therefore, a better validation of the model seems possible.

Bak, P. (1996) How nature works: the science of self-organized criticality. Copernicus, New York, 212 pp.

Bankes S. (2002): Tools and techniques for developing policies for complex and uncertain systems; PNAS-May 14, 2002, vol. 99, suppl. 3, 7263-7266;www. pnas. org/cgi/doi/10.1073/pnas.092081399

Bankes, S. (1993): Exploratory Modelling for Policy Analysis ; Oper. Res. 41, 435-449

Buckley & Hayashi (1998): Application of Fuzzy Chaos to Fuzzy Simulation, Fuzzy Sets and Systems p. 151-157

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Klir G. (1994): "Uncertainty as a resource for managing complexity." In: From Statistical Physics to Statistical Inference and Back, ed. by P. Grassberger and J.-P. Nadal, Kluwer, Boston, pp.139-153.

Klir G. (2002): "Uncertainty in economics: The heritage of G.L.S. Shackle." Fuzzy Economic Review, VII(2), pp. 3-21.

Klir G. (2005): "Uncertainty and information: Emergence of vast new territories", in Systemics of Emergence: Research and Development, edited by G. Minati, E. Pessa, and M. Abram. Springer, New York, pp. 3-28.

Klir G. (2006): Uncertainty and Information: Foundations of Generalized Information Theory, John Wiley, Hoboken, NJ.

Selvam, A. M., Pethkar, J. S., and Kulkarni, M. K., and Vijayakumar, R. (1996) Signatures of a universal spectrum for interannual variability in COADS surface pressure time series, Int. J. Climatol., 16, 393-404.

Tufillaro N.. , Reilly J. , and Abbott T. (1992): An experimental approach to nonlinear dynamics and chaos; Addison-Wesley 1992; http://www.drchaos.net/drchaos/Book/node136.html

Li, Zhong; Halang, Wolfgang A.; Chen, Guanrong (Eds.) (2006): Integration of Fuzzy Logic and Chaos Theory Series: Studies in Fuzziness and Soft Computing, Vol. 187