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Hideaki Aoyama, Yoshi Fujiwara, Yuchi Ikeda, Hiroshi Iyetomi and Wataru Souma, *Econophysics and Companies—Statistical Life and Death in Complex Business Networks,* 2011, New York, USA: Cambridge University Press, 234 pp., $114.

Corporate Physics

While the term 'econophysics' is relatively new having been coined in the 1990s by the famous physicist Eugene Stanley, there are already quite a few books that deal with some aspects or the other of this new discipline. What makes the present title interesting is that the authors have focussed on applying the insights of statistical physics to business firms and their decision making. The book begins with an interesting prologue which is a parody of the first day interlocutions between Salviati, Sagredo and Simplicio (Chapter 1). This prepares the reader with the perspective and indicates the creation of a scientific view which is likely to stir as much opposition from the conservatives (read traditional economists) as Galileo did.

The authors start by building motivation for the new science. They endeavour to show the approach and methodology of natural sciences. The chapters on size distribution of firms and company growth as fluctuations revisit some well known concepts in economics like Pareto's law, Gini coefficient, Lorenz Curve, the Robin Hood or Hoover index and Gibrat's Law. But all these they bring in with a new perspective. They essentially highlight the importance of power laws and their distributions in explaining industry clusters and growth. To the credit of the authors, not only do they present evidence from the literature but also uses empirical analysis of original data to drive their point home. Interesting topics like phase transition and cupolas throw new lights on the power of statistical physics in explaining economic phenomena. However, the relation between econophysics and the elaborate discussion on well-known traditional economic concepts like Cobb-Douglas and CES production function or economic region of production is not so clear. Though the 'ridge theory' does provide an analytic solution to the profit maximisation problem with respect to the space of (L, K), the analogy with physics is not clear.

The discussion on complex business networks is a completely fresh perspective on the economics of firms. The sidebars on Global clustering coefficient and Poisson random network and other network measures are immensely helpful to the readers. The authors use extensive data from Japanese industry to model and investigate the network characteristics of the firms on several dimensions like shareholders, directors, transactions and innovation. The authors have studied various parameters that determine the characteristics and efficiency of the network. The comparative analyses of different large corporations based on network parameters reveal certain interesting pictures. The empirical analysis again points out to power law distribution and thus reinforces the same. This chapter presents the most elaborate and extensive original work done by the authors. The network correlation analysis brought out some startling conclusions but as the authors themselves agree, the same may be due to inappropriate sample or model mis-specification. Overall, the methodology looks very promising although the results show that a lot more modification and extension still needs to be done. Another question that strikes one's mind is the universality of such models as their validation was entirely based on a specific sample.

One of the most important developments in the field of complexity is the creation of agent based models, which these days form an important area of econophysics. In the chapter on agent based modelling, the authors give a thorough overview of the modelling process. Using data from Japanese market they investigate several economic behavioural aspects through agent based models. Reproducing the results of network analysis of Japanese firms it is possible to understand the behavioural aspects of firm that led

to such network statistics. While building the agents the authors have given proper emphasis on building rule sets that reasonably represents the constraints and parameters governing the actual decision making of the business firms. One important assumption is the delay in information which the authors claim to be one of the causes of bankruptcy. The intuitive justification of such delay in information in a networked economy is a little difficult to establish. Their model shows the dependency of evolution of corporations on use of available information. However, it does not clearly establish how informational inefficiency may creep up in the product market. The traditional theories on bankruptcy (Brander & Lewis, 1986, 1988) are not pitted against the proposed models, which certainly would have made the findings more acceptable. However, this section does bring out the power of agent based modelling in explaining some basic economic phenomena rather well.

The last section, which deals with perspectives for practical applications, may arouse maximum curiosity amongst the business practitioners and consultants. Since this book is meant for an open audience (meaning researchers from physics background without a formal training on management science as well as management researchers/practitioners without a background of physics) the job of aligning all the interested groups has been rather difficult for the authors. For this reason some space has been dedicated to explaining the basics on both principles of management/economics as well as physics. In the last section a lot of space has been devoted to standard corporate finance theories, some of which appear a little disjoint when compared to the rest of the book. The later part of the chapter also does not integrate this traditional theories with the new approach either. But to the credit of the authors they have brought forward certain possibilities of applying these new approaches to find business solutions.

In the end, one must observe that while the book provides an excellent insight into the various methods and approaches of statistical physics that can be applied to corporate finance and economics, it does so in a normative frame work. The power of agent based models or other econophysics tools in replacing existing positive economics are yet to be seen. However, to be fair to the authors as well as the discipline of econophysics, it is only about a decade and a half old and already there are promises galore. Also, in our almost puritan obsession with 'perfect' theories of positive economics we should not ignore the power of alternate methodologies that capture the reality rather well, albeit without being grounded on perfect theory.

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Appetizer without Main Course

Econophysics: Background and Applications in Economics, Finance, and Sociophysics is a collection of 10 chapters by six different contributors. The first part of the book consisting of two chapters lays down the philosophy of econophysics. Both economics and physics employ reductionist thinking. However, there are fundamental differences in their approach which is highlighted in the first chapter. Economists are largely concerned about positing a model of human behaviour focusing primarily on its rational aspect; physicists occupy themselves with describing the natural phenomena in empirical terms. In this background, history of econophysics is extension of physicists' attempt towards gaining understanding of human economic phenomena.

An apparent criticism to the approach pursued by econophysics and to complexity studies in general concern the multidisciplinary approach of the discipline. Multidisciplinary studies are viewed as conceptually confusing and characteristically shallow by their critics (Benson, 1985). Votaries of a multidisciplinary approach submit their defence to such criticisms in the second chapter. Philosophy of science is based upon representing reality through a model. The scope and construction of model differs between various disciplines, depending upon the form of abstraction that particular discipline emphasizes upon. This limits the power of unidisciplinary modelling in developing understanding of complex systems about which