

Review of: *Macro-Econophysics: New Studies on Economic Networks and Synchronization*. By Hideaki Aoyama, Yoshi Fujiwara, Yuichi Ikeda, Hiroshi Iyetomi, Wataru Souma, Hiroshi Yoshikawa. Cambridge University Press 2017. Pp. Xxxi, 404. ISBN 978-107-19895-1.

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This book aims at providing a new “method”, macro-econophysics, which is econophysics applied to macroeconomic phenomena and topics. As economists, this book deserves our attention not only because it provides new theoretical and empirical perspectives, but also because it participates to the profitable dialogue between economists and econophysicists. Econophysicists study economic phenomena by using models, methods, and concepts imported from statistical physics. While econophysics has already contributed to changed practices and has provided numerous models, this discipline is still largely ignored by economists.

This book presents macro-econophysics models and studies several applications in its 9 chapters. The 2 first chapters present the analytical framework, the following chapters analyze three kinds of applications: fat-tailed distributions (chapters 3 and 4), comovement analysis in time series (chapters 5, 6 and 7), and network analysis (chapters 8 and 9).

Chapter 1 presents the general project. While econophysics has provided most of its results in finance, this book shows that it is useful to analyze a large number of macroeconomic phenomena and topics. An important element is that econophysicists are driven by a more phenomenological method than economists. One telling characteristic of this approach is to put “equal importance on theory and on empirical findings” (p.1). Chapter 2 introduces the main concepts and methods of statistical physics used.

Chapter 3 deals with fat-tailed distributions of income and firm-size. The first section provides a very clear presentation of the analytical framework, presenting the different distribution functions that can be used for explaining empirical fat-tails, and the links between them. Then two sections discuss the applications to personal income and firm size. These topics have been largely studied in the literature, and the presentation doesn't provide many details (2 pages for the firm-size). By contrast, chapter 4 is very stimulating, showing how econophysics' phenomenological approach provides new results on the labor productivity of which empirical distribution follows a power-law. It also provides a model for explaining the movements of workers between sectors of an economy and identifying sectors with an excess capacity.

Chapters 5, 6 and 7 introduce a new method of extracting comovements hidden in time series and apply it to several empirical examples. Chapter 5 introduces the method, which looks promising and isn't used in economics yet, except in finance in which econophysicists have used it for 20 years. The empirical application in this chapter deals precisely with finance and shows that foreign exchange markets, which follow similar movements, can be used for predicting some market evolutions and also national stock market performances. Chapter 6 discusses the application of this method to business cycles, comparing its results to the economic real business cycle theory. The model uses production, shipments and inventory data for identifying business cycles (40 and 60-month periods for Japan) and the lead-lag relations between these three factors. Chapter 7 applies the method to price dynamics and inflation/deflation. This application identifies some relevant correlations between the variables that influence price variations. It shows in particular that movements of prices are not correlated with money.

The two last chapters deal with complex networks. It is not econophysics per se; although network science is an inter-disciplinary field, drawing on tools from a variety of disciplines including statistical physics as well as economics (economics of networks has existed for decades). Chapter 8 provides an extensive presentation of this approach. Chapter 9 applies it to systemic risks. It extends the DebtRank methodology, which was developed for modeling financial systemic risks, to the inter-firm interactions and then to the bank and firm interactions in order to monitor systemic risk in the Japanese economy. The analysis allows identifying the most vulnerable sectors of the economy when a crisis rises, and how the diffusion of such vulnerability from sectors to the others occurs.

The book constitutes a good introduction to econophysics dedicated to macroeconomic topics. The agenda of the authors is clearly ambitious and provocative: it aims at "reconstructing Macroeconomics" because "mainstream economics ... does not really meet the criteria to be called a natural science yet" (foreword), while macro-econophysics, by "following the spirit of physics and other natural sciences", is supposed to do it (p.1). This book makes some remarkable efforts for addressing its results and models to economists. One of its interests is to point out some limits to the economists' empirical investigations; it also gives some clues for going forward. In this perspective, this book works as a mirror allowing a discussion about economists' practices. However, its reading could create some frustrations.

Firstly, like many other publications about econophysics, this book claims that econophysics provides better results than economics, but formal proofs (like comparisons based on same data) are missing. A comparative analysis of the results from the two approaches would have been useful in order to appreciate the opportunity for using macro-econophysics' models.

Secondly, some criticisms regarding economics' hypotheses are too simplistic. Like (too) many econophysics publications, the book criticizes (sometimes very forcefully) the theoretical framework of economics mainstream, while frequently ignoring non-

mainstream economics' contributions. The comparisons made between the models and results from economics and those in this book could create some frustrations for economist readers.

Thirdly, the book stays silent on theoretical constraints econophysicists have to deal with (for instance the issues of the validation of the power-law distribution by existing tests). We can regret that the limits of the models and the tests used (which are often visual) aren't discussed. In the same vein, more robust theoretical framework for explaining fat-tails and other empirical observations would have been appreciated.

Despite these limits, any economist will find in this book useful materials, models and results, as well as stimulating issues and new avenues for their research.