

it is imperative to narrow the search process between errors identified and the problems underlying those errors.

In Chapter 14, Hirofumi Tatsumoto, Koichi Ogawa and Takahiro Fujimoto, in “The effects of technological platforms on the international division of labor: a case study of Intel’s Platform business in the PC industry”, discuss the effects of technological platforms on the international division of labor. This chapter explores variables such as the characteristics of the platform, the mechanism through which the platform is diffused, and the effects it has on the international division of labor through an architectural analysis of the case of Intel’s platform business in Taiwan in the 1990s. With the fast diffusion of technology, the adoption of a platform leads to a rapid expansion of products produced by firms in developing countries. The cost reductions in these firms can create huge global market trading such as BRIC (Brazil, Russia, India and China) by bring about reasonable prices. As a result, the platform fundamentally changes the international division of labor by strengthening the new model of economic collaboration between developing and developed countries. The growth of the platform destroys the advantages of established firms in developed countries and encourages entry into the market by new firms in developing countries.

The platforms, whether used inside firms or across supply chains, impact industry dynamics, create new forms of competition, and reveal new forms of collaborative innovation across companies today. This timely book is the first of its kind dedicated to the emerging field of platform research. The 24 expert contributors across the USA, Europe and Asia in the fields of strategy, economics, innovation, organizations and knowledge management in this book provide an empirical-based understanding of the nature of platforms and the implications the emergence of platforms hold for the evolution of industrial innovation. They present an overview of platforms and discuss governance, management, design and knowledge issues. With a multidisciplinary approach, this book will be an excellent reference for students, scholars and company managers in various disciplines including management of technology, business

strategy, industrial engineering and design, economics of technological change and innovation, as well as innovation policy. Readers will learn a lot about the mysterious nature of platforms and the important role that platforms play in business, society and our everyday lives.

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Econophysics and Companies Statistical Life and Death in Complex Business Networks, Hideaki Aoyama, Yoshi Fujiwara, Hiroshi Iyetomi, & Wataru Souma, Cambridge University Press (2011), ISBN: 978-1-107-40348-2

Introduction

It is interesting that authors of *Econophysics and Companies* have been working in the areas of natural science or engineering and hold Ph.D. degrees in physics. Hideaki Aoyama, the first author, is a professor of physics at Kyoto University; Yoshi Fujiwara is a research fellow at Advanced Telecommunication Research Institute International (ATR); Yuichi Ikeda is a senior researcher at Hitachi Research Laboratory; and Hiroshi Iyetomi is a professor of physics at Niigata University.

As readers can infer from the authors’ affiliations and the book’s title, econophysics is an interdisciplinary field which applies statistical methods more commonly used in physics to economic data. Regarding the relationship between physicists and economics, the authors give somewhat brave remarks in their book, as follows:

“Economics has in fact mimicked physics since the nineteenth century. This is particularly true of those who developed modern economics,

the 'neoclassical' economist. The old master such as Alfred Marshall and Léon Walras all drew inspiration from Newtonian mechanics. The fundamental concept of 'equilibrium', known to all students of the subject is, of course, borrowed from physical science" (p. xix).

Seemingly, this remark can hurt the pride of more traditional economists. However, the remark also obviously shows the interdisciplinary characteristics of economics. Economics cannot stand alone. It has been taking advantage of other academic areas including mathematics, statistics and psychology, as well as physics, to analyze economic problems and predict the future. As the authors of this book suggest, economics borrows several key concepts from physics, so the appearance of a field known as "econophysics" may have been unavoidable.

If the appearance of econophysics really is unavoidable, how should we value it? Should it be considered a derivate of economics or a convergence of two close subjects? Both perspectives can be correct. Up to now, econophysics is closer to the former than the latter. Proponents of econophysics have been applying methodologies used in physics to economic phenomena for a decade, suggesting that economic phenomena conform to physical laws.

However, if we consider the fact that econophysics has been evolving rapidly for a decade and physics has various and strong tools of analysis, econophysics can be called a new academic field. Especially in the era of Big Data, large-scale data sets can be used in the analysis of the stock market, for example, which may lead to breakthroughs in economics and other fields.

Main content

This book is composed of six chapters. Chapter 1, an introduction, describes the background of econophysics and some aspects of the contemporary situation in economics. It gives a brief explanation of distribution analysis and complex networks, and it outlines the Japanese electrical, electronics and

automotive industries.

Chapter 2 explains a curious and somewhat mysterious pattern in the rise-and-fall dynamics of the size distribution of firms. A normal distribution with a bell shape is quite common, but the size distribution of firms exhibits striking properties: it is right-skewed with a long tail. When firm size and probability are converted to logarithmic values, their relationship becomes linear, implying that this distribution obeys a power law. Of course, a number of natural phenomena obey the power-law distribution, for instance the magnitude of an earthquake, the size of craters on the moon, the strength of solar flares, and the sizes of fragments of shattered objects. Meanwhile, the power-law distributions are easily observed in several economic phenomena including personal income and the size of cities, not just the size distribution of firms. A power-law distribution should be distinguished from Pareto's 80-20 rule.¹⁾ Those two concepts both assume that small-to-medium values of x and large values of x behave differently, but the power-law distribution does not guarantee the ratios. A power-law distribution is more general than Pareto's 80-20 rule.

Chapter 3 provides interesting results regarding fluctuation in company size. First, Gibrat's law²⁾ is phenomenologically valid in large data sets regarding European and Japanese companies, and stability in the growth of companies, called *detailed balance*, is observed. This can relate Gibrat's law (dynamics) to Pareto's law (statics). Moreover, the *copula* method is employed as an alternative to growth rate when measuring the correlation between variables. Although personal income distribution also follows Gibrat's law, this law can break down under abnormal situations in a nation's economy, such as the collapse of the so-called Japanese 'bubble economy' in 1990.

Chapter 4 introduces a somewhat different topic, network science. The origin of network science is graph theory in mathematics, social network analysis in sociology, and statistical mechanics in physics and computer science. Network science can describe

1) For example, 80% of sales are to 20% of consumers, 80% of crime is committed by 20% of the population, or 80% of marriages involve 20% of the population with a history of divorce.

2) Gibrat's law assumes that the size of a firm follows a random walk (Gibrat, 1931). A firm's expected growth rate should be independent of its size, rebutting the law of proportionate effect regarding growth rate.

a network of shareholders, a corporate board or a director's network, or even a network of joint applications for patents. As well as taking a graphical approach, network indices such as degree of centrality, shortest path length, clustering coefficient, and the betweenness centrality of nodes, can describe the characteristics of the network as a single number. Moreover, intertemporal analysis of two approaches shows dynamic change in a network. This chapter elucidates how companies are interconnected through transaction relations, shareholdings, and even cooperative filing of patents, thus resulting in the formation of a complex network.

Chapter 5 introduces recent studies on *agent-based simulation* that describe the dynamics of how companies interact. Economic phenomena can be regarded as many-body systems where a number of agents interact, and each agent has properties such as autonomy (acting with its own will), social nature (collaborating with another) and adaptability (making itself fit to its surroundings). Economic agents are the actors and the stage is a network connecting those agents. Under a number of assumptions, the system composed of many agents is modelled and the results are presented in the form of game theory.

Lastly, Chapter 6 explains three practical applications of econophysics: the methodology for developing a business strategy, the management of the propagation of credit risk, and the encouragement of innovation in business models.

Concluding remarks

David J. Hand, a professor of statistics in the Department of Mathematics at Imperial College in London, suggests that econophysics is closer to

econostatistics than to any other field because the phenomena it describes are really basic statistical or stochastic phenomena (Hand, 2010). Furthermore, he says relating the phenomena to physics seems far-fetched (Hand, 2010). This criticism seems to be related to the fact that econophysics is mostly led by groups of physicists. They are well aware of methodologies and can generate various statistics and graphs; however, it is hard to find links between their results, analysis, and economic theories. However, economic analysis should strive to explain economic phenomena based on economic theory and is typically used to forecast the future. To be established as an independent academic field, econophysics should be developed to the point that its methodologies converge more clearly with economic theories.

Econophysics and Companies is expected to be able to expand the scope of econophysics and to convince many researchers that econophysics has a lot of potential as an academic field, even though analysis of its results needs to be improved further. If we consider that unceasing trials to converge various subjects have been triggering the appearance of breakthrough academic fields, this book plays an important role in such a process. And such a process will likely result in the necessary development of an exciting new field that is becoming more well-known by the public.

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