APFA5

5th International Conference
June 29 - July 1 2006
Torino, Italy

Applications of Physics in Financial Analysis

Abstracts
and
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Corso Duca degli Abruzzi 24, Torino – Italy.

Supporting Institutions

European Physical Society
Regione Piemonte

Venue

Villa Gualino
Viale Settimio Severo 63
Torino – Italy.

ECA 30F
ISBN 2-914771-37-1

Preface

This volume contains the abstracts of all the contributions presented at the 5^{th} International Conference on Applications of Physics in Financial Analysis Torino, June 29 to July 1, 2006.
The presentations are about 130. The Conference is organized in plenary sessions, parallel symposia and poster sessions. It provides a forum for updating and reviewing a wide range of subjects in the field of Statistical Physics with specific applications in Economics and Finance. The aim of the conference is to bring together scientists, both economists and physicists, interested in problems in economics and finance. Previous meetings (Dublin 1999, Liege 2000, London 2001 and Warsaw 2003) have served to build the community and foster links with disciplines such as econometrics and statistics. A wide range of topics has been covered including, for example, analysis of time series, option pricing, agent models and game theory. It is now increasingly recognized by both the physics and economic communities that a number of conceptual and methodological approaches based on tools of statistical mechanics may be employed to understand particular economic phenomena in terms of the underlying direct interaction of agents and to model the dynamics of heterogeneous populations of economic agents. In addition to traditional economic notions of coordination via the price system and strategic interaction, models of collective phenomena are now making their appearance in many branches of microeconomics to describe, for example, herding behavior in financial markets. Other instances of the complexity approaches, familiar to physicists, appear in evolutionary game theory, demand theory, behavioral economics and social economics. In macroeconomics and econometrics, there is a new appreciation of the role of individual heterogeneity which has provided new insights into economic aggregation. New models of the theory of growth, based on non-linear and stochastic processes have emerged and are being tested against real data. In finance, the analysis of time series, distributions of asset prices and price returns with attendant phenomena, such as scaling and universality, is leading to radically new insights and new questions, both theoretical and empirical, about the functioning of financial markets. All these approaches employ analytical and numerical tools from what has become known as the science of complexity, a new interdisciplinary approach, initially used for the analysis of systems with strongly interacting subunits in physics, biology, engineering.

Complex economic systems structural organization modelling.

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One of the well-known results of the theory of management is the fact, that multi-stage hierarchical organization of management is unstable. Hence, the ideas expressed in a number of works by Don Tapscott (see, for example, [1]) on advantages of network organization of businesses over vertically integrated ones is clear. While studying the basic tendencies of business organization in the conditions of globalization, computerization and internetization of the society and the results of the financial activities of the well-known companies, the authors arrive at the conclusion, that such companies, as IBM, Boeing, Mercedes-Benz and some others companies have not been engaged in their traditional business for a long time. Their partner networks performs this function instead of them. The companies themselves perform the function of system integrators.
The Tapscott's idea finds its confirmation within the framework of a new powerful direction of the development of the modern interdisciplinary science – the theory of the complex networks (CN) [2]. CN-s are multifractal objects, the loss of multifractality being the indicator of the system transition from more complex state into more simple state. We tested the multifractal properties of the data using the wavelet transform modulus maxima approach in order to analyze scaling properties of our company. Comparative analysis of the singularity spectrum$f(\alpha)$, namely, the difference between maximum and minimum values of α ($\Delta = \alpha_{\max} - \alpha_{\min}$) shows that IBM company is considerably more fractal in comparison with Apple Computer. Really, for it the value of Δ is equal to 0.3, while for the vertically integrated company Apple it only makes 0.06 – 5 times less. The comparison of other companies shows that this dependence is of general character. Taking into consideration the fact that network organization of business has become dominant in the last 5-10 years, we carried out research for the selected companies in the earliest possible period of time which was determined by the availability of data in the Internet, or by historically later beginning of stock trade of computer companies. A singularity spectrum of the first group of companies turned out to be considerably narrower, or shifted toward the smaller values of α in the pre-network period. The latter means that dynamic series were antipersistant**.** That is, these companies‘ management was rigidly controlled while the impact of market mechanisms was minimized. In the second group of companies if even the situation did changed it did not change for the better. In addition, we discuss applications to the construction of portfolios of stock that have a stable ratio of risk to return.

[1] Tapscott D., Williams A., Digital 4Sight Inc **1** (2003), 2.
[2] Newman M.E.J. SIAM Review, **45** (2003), 167.

Importance of positive feedbacks and over-confidence in a self-fulfilling Ising model of financial markets.

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We study a model of financial price dynamics resulting from the collective aggregate decisions of agents. This model incorporates imitation, the impact of external news and private information. It has the structure of a dynamical Ising model in which agents have two opinions (buy or sell) with coupling coefficients which evolve in time with a memory of how past news have explained realized market returns. We study two versions of the model, which differ on how the agents interpret the predictive power of news. We show that the stylized facts of financial markets are reproduced only when agents are over-confident and mis-attribute the success of news to predict return to herding effects, thereby providing positive feedbacks leading to the model functioning close to the critical point. Our model exhibits a rich multifractal structure characterized by a continuous spectrum of exponents of the power law relaxation of endogenous bursts of volatility, in good agreement with previous analytical predictions obtained with the multifractal random walk model and with empirical facts.

[1] D. Sornette and W.-X. Zhou, *Importance of Positive Feedbacks and Over-confidence in a Self-Fulfilling Ising Model of Financial Markets, submitted to Journal of Economic Behavior and Organization*, arXiv:cond-mat/0503607.
[2] W.-X. Zhou and D. Sornette, *Self-fulfilling Ising Model of Financial Markets, submitted to Physical Review Letters*, arXiv:physics/0503230.

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