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Applications of Physics in Financial Analysis

Abstracts
and
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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.

of many agents acting in parallel, constantly acting and reacting to what the other agents are doing. If there is to be any coherent behavior in the system, it has to arise from competition and cooperation among the agents themselves. The overall behavior of the system is the result of a huge number of decisions made every moment by many individual agents.
Thus, due to the absence of market-clearing mechanisms the economy is characterized by the contemporaneous presence of persistent involuntary unemployment, unsold production and excess individual demand.
The sequence of events occurring in each period runs as follows: Starting from the demand it expects to face, each operating firm determines the amount of output to be produced, the amount of labor to be hired and the amount of credit to be borrowed. Expectations on future demand are updated adaptively. A fully decentralized labor market opens. Firms set their wage bids (actually each of them sets a maximum wage, as a function of its own financial soundness), and post their vacancies on the basis of their labor demand. Workers, in turn, accept a job only if the wage they are offered is higher than their individual "satisficing" wage. A sequential matching procedure determines whether unfilled vacancies and unemployed workers remain after the labor market has closed. If internal financial resources are in short supply for paying wages, firms can borrow on the credit market. Individual demand for credit is a straight line up to a maximum rate she can afford. The supply of loan of each bank is also a straight line above a minimum rate of interest the bank sets as a function of the expected inflation, the rate of discount and the bank financial conditions. The individual supply is proportional to bank's capital. The borrowers' demand are ranked according to firms' financial conditions. After production is completed, the market for goods opens. Firms post their offer price, while consumers are allowed to muddle through searching for a satisfying deal. If a firm ends up with excess supply, it gets rid of the unsold goods at zero costs.
An empirical analysis on European data closes the paper.

Cross correlations and multifractal properties of ukraine stock market.

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Recently the statistical characterizations of financial markets based on physics concepts and methods attract considerable attentions. The correlation matrix formalism and concept of multifractality are used to study temporal aspects of the Ukraine Stock Market evolution. Random matrix theory (RMT) is carried out using daily returns of 431 stocks extracted from database time series of prices the First Stock Trade System index (www.kinto.com) for the ten-year period 1997-2006. We find that a majority of the eigenvalues of C fall within the RMT bounds for the eigenvalues of random correlation matrices. We test the eigenvalues of C within the RMT bound for universal properties of random matrices and find good agreement with the results for the Gaussian orthogonal ensemble of random matrices—implying a large degree of randomness in the measured cross-correlation coefficients. Further, we find that the distribution of eigenvector components for the eigenvectors corresponding to the eigenvalues outside the RMT bound display systematic deviations from the RMT prediction. We analyze the components of the deviating eigenvectors and find that the largest eigenvalue corresponds to an influence common to all stocks. Our analysis of the remaining deviating eigenvectors shows distinct groups, whose identities correspond to conventionally identified business sectors. Comparison with the Mantegna minimum spanning trees method gives a satisfactory consent. The found out the pseudoeffects related to the artificial unchanging areas of price series come into question
We used two possible procedures of analyzing multifractal properties of a time series. The first one uses the continuous wavelet transform and extracts scaling exponents from the wavelet transform amplitudes over all scales. The second method is the multifractal version of the detrended fluctuation analysis method (MF-DFA). The multifractality of a time series we analysed by means of the difference of values singularity stregth (or Holder exponent) $\alpha_{\max}$ and $\alpha_{\min}$ as a suitable way to characterise multifractality. Singularity spectrum calculated from daily returns using a sliding 250 day time window in discrete steps of $1 \ldots 10$ days. We discovered that changes in the multifractal spectrum display distinctive pattern around significant "drawdowns". Finally, we discuss applications to the construction of crushes precursors at the financial markets.

Network analysis of the World Trade Web.

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We report an empirical analysis and a theoretical investigation of the topological and dynamical properties of the *World Trade Web* (WTW), the network defined by the in-

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