Book of Abstracts

Fifth Polish Symposium on Econo and Sociophysics

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Published November 2010, ISBN 83-89585-31-6

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Revision: 37.0.17, 2010-11-22 13:55 GMT

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Welcome

Applications of methods and techniques first developed in physics (especially in statistical physics) to multitude of problems emerging in various branches of economics and social sciences are focusing still increasing amount of attention. Effectiveness of physical approach is the fact of life, generally acknowledged even in circles reluctant to any form of quantitative analysis.

Econophysics is genuinely interdisciplinary activity gathering together researchers from physics, economy, finance, and social sciences as well as practitioners. Despite being already an established part of science, there is a big chance, that due to complexity and importance of contemporary stock and exchange markets, derivative instruments, forecasting of economical and financial time series, risk assessment, modeling and analysis, decision making, and many other activities, econophysics will also become an indispensable tool for leaders and analysts from modern firms and businesses.

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Programme

Thursday, 25 November

REGISTRATION/COFFEE
Thursday afternoon, 25 November, 12:00
b.34 A.IV

OPENING SESSION
Thursday afternoon, 25 November, 14:00

PLENARY SESSION
Thursday afternoon, 25 November, 14:15
b.34 A.IV
Chair: Dariusz Grech

14:15 Invited oral

The Lehman Brothers Effect and Bankruptcy Cascades

Paweł Sieczka[1], Didier Sornette[2], Janusz A. Hołyst[1], Agnieszka Czaplicka[3]

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Inspired by the bankruptcy of Lehman Brothers and its consequences on the global financial system, we develop a simple model in which the Lehman default event is quantified as having an almost immediate effect in worsening the credit worthiness of all financial institutions in the economic network. In our stylized description, all properties of a given firm are captured by its effective credit rating, which follows a simple dynamics of co-evolution with the credit ratings of the other firms in our economic network. The dynamics resembles the evolution of Potts spin-glass with external global field corresponding to a panic effect in the economy. The existence of a global phase transition , between paramagnetic and ferromagnetic phase, explains the large susceptibility of the system to negative shocks. We show that bailing out the first few defaulting firms does not solve the problem, but does have the effect of alleviating considerably the global shock, as measured by the fraction of firms that are not defaulting as a consequence. This beneficial effect is the counterpart of the large vulnerability of the system of coupled firms, which are both the direct consequences of the collective self-organized endogenous behaviors of the credit ratings of the firms in our economic network.

15:00 Invited oral

Prices and Volumes on the Stock Market

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We present new results regarding relationships between prices and volumes on the Polish stock and exchange markets. To perform such analysis some variables describing investor memory are introduced. Our conclusions are discussed in a context of market maturity and compared to results obtained by other methods including Granger causality and the Hurst exponent.

COFFEE BREAK
Thursday afternoon, 25 November, 15:45

PLENARY SESSION
Thursday afternoon, 25 November, 16:20
b.34 A.IV
Chair: Arkadiusz Orłowski

16:20 Oral

Behaviour of exchange rates, and logarithmic returns: long memory and cointegration

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We study behaviour of time series of daily closing values for USD and EURO vs. PLN exchange rates and their returns. It is known that financial data series are characterized by changing volatility, excess kurtosis and assymetry of their probability density, and that they show signs of long memory. Due to volatility clustering, can be modelled with use of ARCH and GARCH type models, in which first equation -- describing expected value of the series -- can be of ARMA type, second equation describes conditional variance. It has been shown that additional explanatory variables in the expected value equation can improve quality of modelling and of forecasts. For bilateral exchange rates models such additional variables can be stock indices of corresponding countries. Cointegration analysis of exchange rates and stock indices is performed to check whether there is a stable dynamic economic equlibrium between them. The tools applied in such research stem originally from technical if not physical applications: the Hurst exponent, from hydrological study of 1950's; the ARMA models, from Box and Jenkins fundamental monograph of 1970's; cointegration analysis, from Engle and Granger concepts of equlibrium path as stable attractor; the Hansen stability tests and time-varying-parameter cointegration analysis uses methods of spectral analysis to estimate in semiparametric way long-run variance matrix.

16:40 Oral

On the Zipf strategy for short-time investments in WIG 20 futures

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We apply Zipf power law to financial time series of WIG 20 index daily changes (open-close). Thanks to translation of time series signal into the sequence of 2k+1 "spin-like" states, where k=0, 1/2, 1, 3/2, ... one is able to discretise any time series increaments with almost arbitrary accuracy. This procedure leads in the simplest non-trivial case (k = 1/2) to binary data projection but more sophisticated projections are also possible. The formalism allows then to use Zipf power law to describe the intrinsic structure of time series. The fast algorithm for this implementation was constructed from Matlab^{TM} software. The method, called Zipf strategy, is then applied in the simplest case k = 1/2 to WIG 20 open and close daily data to make short-time predictions.The results of forecast effectiveness with respect to different time window sizes and partition divisions (word lengths in Zipf language) are presented. The various investment strategies improving ROI (return of investment) for WIG 20 futures are revealed. We show that the Zipf strategy is the appropriate and effective tool to make short term predictions and therefore, to evaluate short term investments on the basis of historical stock index data. Our findings support also the existence of long memory in financial data.

17:00 Oral

Asymmetric noises on a stock exchange.

Marzena Kozłowska, Ryszard Kutner

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We study the bessa and hossa concerning the recent global financial crash (or peak). By applying our own detrended fluctuation analysis, based on well suited trend in the form of a Mittag-Leffler function superposed with some oscillations [1], we obtained for some stock market indices the asymmetric noises. We even found more global asymmetry as for some indices the asymmetry is connected only with a single side of the peak namely, one side has asymmetric noise but other side not. We plan to study these observations by tools developed, for example, in [2] as well as by using a microscopic approach based on stochastic dynamics of individual agents.

[1] M. Kozłowska, A. Kasprzak, R. Kutner, Int. J. Modern Phys. 19 (2008), 453.

[2] M. Załuska-Kotur, K. Karpio, A. Orłowski, Acta Phys. Pol. B 37 (2006), 3187.

17:20 Oral

Causality in financial mathematics

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Methods of describing physical processes which use Green functions in natural way lead to the causality. It occurs that similiar approach can be applied to time dependence of money because in financial mathematics accumulation of capital can be treated as a solution of the first order differential equation. Amost always the time denpendence of money is not continuous, so equations must be solved in the space of distributions. It is only one step towards Green functions and it is done in this paper. It is shown that retarted and advanced functions appear in the cosiderations. Their interpretations in terms of debit balance and deposit are given. Starting from simple examples author goes to more complicated cases showing benefits of presented formalism to financial mathematics. In the final considerations some remarks on the application of defference are done.

17:40 Oral

Characteristics of distributions for the stock returns and trading volumes

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The statistics of the returns and the trading volumes distributions is one of the most characteristics for financial dynamical system. Moreover, one of the fundamental question is the relationship between the power law fat-tailed distribution of trading volumes and returns.

We present a systematic study of the Polish stock market return distributions and identify consistency of those distributions with the inverse cubic power law for the shortest time scales available. In order to verify the degree of convergence towards a Gaussian distribution [1] we extend this study to the time lags of increasing length and, as a result, we report a fast departure from the inverse cubic power-law. For several stocks we in parallel study the distribution of fluctuations of the volume traded and find that it also develops the power-law tails whose scaling indices are consistently about a factor of 2 smaller (tails thicker) than the ones describing the corresponding distributions of returns. Such a correspondence was originally postulated in the context of the inverse cubic power-law [2]. A particularly vital result of the present contribution is that this relation remains preserved even for the larger time lags when the departure from the inverse cubic power-law in the direction of thinner tails is sizeable. This observation opens room for giving a firmer ground to

the model introduced in [2] and for extending its range of significance. The above analysis has been systematically performed using the formalism of the q-Gaussians as it follows from the concept of the nonextensive entropy [3]. This functional form allows to consistently describe the whole range of fluctuations, its asymptotics is power-law type and the corresponding scaling index is uniquely determined by the nonextensivity parameter *q*.

[1] S.Drożdż, M.Forczek, J.Kwapień, P.Oświęciimka, R.Rak, S*tock market return distributions: from past to present*, Physica A, 383, 2007, 59.
[2] X.Gabaix, P.Gopikrishnan, V.Plerou, H.E.Stanley, *A theory of power-law distributions in financial market fuctuations*, Nature, 423, 2003, 267.
[3] R. Rak, S. Drożdż, J. Kwapień, *Nonextensive features of the Polish stock market fuctuations*, Physica A, 374, 2007, 315.

POSTER SESSION Chair: Maciej Janowicz

Thursday evening, 25 November, 18:00

18:00 Poster 1

The non-gaussian continuous-time random walk analisys of the option dynamics

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We discuss a novel formula for probability density function describing log-returns dynamics on financial markets and corresponding novel pricing formula for European call option derived in [1]. Both formulas were derived within the Continuous-Time Random Walk formalism. We compared predictions of formulas with several data sets obtained from stock markets of small , middle and large sizes observing a good agreement. Our project is to describe obtained results within a microscopic dynamics defined, for example, by the threshold model of Sieczka and Hołyst [2].

[1] A. Jurlewicz, A. Wołamańska, and P. Żebrowski, Acta Phys. Pol. A 114 (2008) 629.

[2] P. Sieczka and J. A. Hołyst, Acta Phys. Pol. A 114 (2008) 525.

18:00 Poster 2

Observations of extreme events at Warsaw Stock Market

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Time series from Warsaw Stock Market have been investigated. We have found that the distribution of maximal values of returns for WIG-20 index is close to Gumbel distribution in its central part. For larger returns the observed data follow a fat tail while for small values the Gumbel distribution overestimates the observed maximal returns. We have studied also the effect of finite observation time on the distribution of maximal ranges in the model of a random walker.

18:00 Poster 3

Emotional Agents at the Square Lattice

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We introduce and investigate by numerical simulations a number of models of emotional agents at the square lattice. Our models describe the most general features of emotions such as the spontaneous emotional arousal, emotional relaxation, and transfers of emotions between different agents. Group emotions in the considered models are periodically fluctuating between two opposite valency levels and as result the mean value of such group emotions is zero. The oscillations amplitude depends strongly on probability p_s of the individual spontaneous arousal. For small values of relaxation times τ we observed a stochastic resonance, i.e. the signal to noise ratio *SNR* is maximal for a non-zero p_s parameter. The amplitude increases with the probability p of local affective interactions while the mean oscillations period increases with the relaxation time τ and is only weakly dependent on other system parameters. Presence of emotional antenna can enhance positive or negative emotions and for the optimal transition probability the antenna can change agents emotions at longer distances. The stochastic resonance was also observed for the influence of emotions on task execution efficiency.

18:00 Poster 4

Cooperation model with costly punishment

Tomasz M. Gradowski[1], Maciej J. Mrowiński[1], Robert A. Kosiński[1,2]

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In recent years the issue of costly punishment in systems where free-riding problem occurs has been a subject of extensive research in the field of game theory. This issue is present in many areas of human activities like paying taxes, using public transport, wireless Internet or p2p networks. It is one of the most common dilemmas in modern societies.

In this work we present a simple model of cooperation with three possible strategies (cooperate, defeat or punish). In the model players explore the available strategies according to their interactions with other players. We introduce two groups of parameters of the model. The first group is sociological-like and it describes the social acceptance for the free-riding behaviour. The other group of the parameters describes economical aspects of the system - cost and ef-

ficiency of the punishers. Using differential equations approach, as well as agent based model, we look for equilibrium properties of the system.

18:00 Poster 5

Stability of the Cournot-Nash equilibrium in standard oligopoly models

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The 19c. physics is a cognitive archetype of contemporary economics, where static, linear, closed systems that head for thermodynamic equilibrium were of great importance. In this standard of scientific knowledge were included selfish aspirations of agents, which served to prove stability of market equilibrium. The strive of entrepreneurs after profit maximization brings economic systems to a stable Cournot-Nash state of equilibrium, which is determined by the point of crossing of reaction curves. This type of reasoning still sets standards for education of microeconomics. Meanwhile, numerical explorations of simple, standard, nonlinear models of oligopoly prove that Cournot-Nash points are stable only over shortest periods. These are periods in which variables are changing (production values), and parameters (marginal costs) remain constant. According to a convention adopted in economics, in short periods various kinds of costs can change, including marginal costs. The only unchanging category in these periods are fixed costs. The postulate of profit maximization induces entrepreneurs to lower marginal costs. It provokes drifting of markets along short-term equilibrium states towards states of higher complexity. States far from equilibrium are natural market states. It contradicts the basics of traditional microeconomics. Selfish aspirations of agents do not guarantee stability of market equilibrium.

18:00 Poster 6

Non-Gaussian statistics on the Forex

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We compare the dynamics of the Forex in the vicinity of a crash and far from it. We found that in both cases the stochastic dynamics of exchange rates is strongly non-Gaussian. For example, we observed that EUR/USD rate statistics obeys almost a cubic law with Pareto index increasing toward the crash. Our study is supported by analysis of the most probable losses, which increase toward the crash as it was expected. Our project is to consider the rate dynamics on the basic of more microscopic models, which produce tails fatter than the Levy algebraic tail.

18:00 Poster 7

Bounded confidence model: addressed information maintain diversity of opinions

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A community of agents is subject to a stream of messages, which are represented as points on a plane of issues. Messages are sent by media and by agents themselves. Messages from media shape the public opinion. They are unbiased, i.e. positive and negative opinions on a given issue appear with equal frequencies. In our previous work, the only criterion to receive a message by an agent is if the distance between this message and the ones received earlier does not exceed the given value of the tolerance parameter. Here we introduce a possibility to address a message to a given neighbour. We show that this option reduces the unanimity effect, what improves the collective performance.

18:00 Poster 8

Models of pedestrian evacuation based on cellular automata

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The problem of pedestrian evacuation has attracted a lot of attention in the last few years. Scientists from many different fields used various mathematical and physical approaches to model and study this phenomenon. Such studies are very important and may lead to an increase in safety and better understanding of the dangers pedestrians face during evacuation.

We study two models of pedestrian evacuation based on cellular automata and intelligent agents. We use the static floor field approach and augment it with additional transition rules (random movement and preservation of personal space) in order to model various aspects of human behaviour. Through numerical simulations we investigate pedestrian evacuation from rooms with various geometries (e.g. empty room, classroom). Using heatmaps (density diagrams of pedestrians), average evacuation times, velocity and other parameters we study the effectiveness of evacuation and potential dangers pedestrians may encounter.

18:00 Poster 9

Analysis and simulation of emotional states in Internet communities

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Because of continues growth of the Internet a common need for understanding the rules that govern the Internet communities has risen. In thiswork an analysis of SnEA Blogs06 dataset was performed. It is a collection of 1215 distinct time series - discussion threads which consists of 240592 comments. The text in the comments was classified by Naive Bayes Classifier which has given a pair of observables: subjective probability P_{sub} and positive probability P_{pos}.

The first aim of this work was to verify the quality of the data and rejection of hypothesis which assumed that the signal is a statistical noise of a badly trained classifier. In order to achieve it, the time series were treated as a Markov chain, the transition Matrix was studied using the Pointwise Mutual Information definition. This analysis clearly indicated that there is a distinct, non-trivial signal structure in the time series which is induced by strong correlations. After that the mean observable values of threads were calculated and compared to a model that assumed a pure randomness of the signal (global shuffling procedure), there was no relation between two distributions. It was also observed that in most cases threads with given mean observable value give a very narrow range of variance. The conclusion was that there are groups, classes of threads in which threads have the same or very similar observable distributions. The last aim of the analysis was to determine if the signal in the thread is stationary, the results were positive. These conclusions led to creating a model which was used to simulate the time series, studies performed showed that the theoretical approach is highly correlated with the original data. Presented models are able to precisely define the observable distribution in each of the time series by using the n first comments. The conclusions that arise from the simulation data were used to propose few rules, named emotional interaction which determines the observable distribution in a thread.

18:00 Poster 10

External bias in the model of isolation of communities

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We extend a model of community isolation in the d-dimensional lattice onto the case with an imposed imbalance between birth rates of competing communities. We give analytical and numerical evidences that in the asymmetric two-specie model there exists a well defined value of the asymmetry parameter when the emergence of the isolated (blocked) subgroups is the fastest, i.e. the characteristic time t_c is minimal. This critical value of the parameter depends only on the lattice dimensionality and is independent from the system size. Similar phenomenon was observed in the multi-specie case with a geometric distribution of the birth rates. We also show that blocked subgroups in the multi-specie case are absent or very rare when either there is a strictly dominant specie that outnumbers the others or when there is a large diversity of species. The number of blocked species of different kinds decreases with the dimension of the multi-specie system.

18:00 Poster 11

Applying Free Random Variables to the Analysis of Temporal Correlations in Real Complex Systems

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Spatio-temporal structure of correlations and optimal forecasts of future correlations is a task of major importance. However, the information about cross-correlations and their temporal dynamics is usually inferred from historical (past) observations, which are inevitably contaminated by measurement noise and it is a constant challenge to unscramble signal from noise. The main purpose of this thesis is to study the dynamical properties of real complex systems such as e.g. economy and/or financial market by looking at their spectral properties eg. density of eigenvalues under umbrella of Free Random Variables Calculus and Random Matrix Theory.

18:00 Poster 12

Fractal properties of Linux self-organized kernel maps

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Many different measures were proposed to describe the problem of possible software complexity. Among them there are: the number of lines of code sometimes reffered as source lines of code (SLOC), Halstead's volume V, McCabe cyclomatic number $V(G)$, etc. However, any of them don't take into account the possible fractal properties of software code developement.

One of the most popular measures of software complexity is the number of source lines of code (SLOC). This measure gives the size of software program by counting the number of lines in the text of program's source code. It helps to predict the amount of effort that will be required to develop the program. Usually this number is big and it can even achieve 10^7 lines. However, this measure has got many disadvantages, for example the lack of accountability, the lack of counting standards, the problems with multiple languages, etc. Bill Gates said that: "*Measuring programming progress by lines of code is like measuring aircraft building progress by weight*". Despite that, this quantity is quite often given, because it can help imagine how dificult was the developement of software and how this software is "*big*".

A self-organiation is one of the most amazing properties in the case of many complex systems. It can be considered as a process in which the internal organization of a system (usually it's an open system), increases in complexity without management by an outside source. Systems that self-organize typically display many emergent properties.

In the case of mathematics and computer science this phenomenon is usually connected with the ideas of cellular automata, graphs (especially in complex networks like "small worlds" and scale-free networks), and some instances of evolutionary computation and artificial life. In the field of multi-agent systems a very active research area is the problem how to engineer such systems that will be capable of presenting the self-organized behavior. In this paper we will show that there are also other fields where the self-organization can appear. Such a field is the cooperation (maybe sometimes independent) of many programmers that leads to the developement of software.

The paper will show the property of system self-organization in the case of succesive Linux OS kernels. The presented visualisations will indicate how the OS kernels can be complex through their self-similar structure. The succesive Linux kernel distributions are commonly used operating systems that are developed and tested by many enthusiasts. For each stable Linux kernel visualization there will be also calculated the fractal dimension basing on box dimension method.

18:00 Poster 13

Student's t-distribution versus Zeldovich-Kompaneets solution of diffusion problem

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It has been proposed a long time ago that t-distribution is a good candidate for describibg heavy tails of stock markets distributions [1]. Student's distribution arises in estimating the parameters of a normally distributed data when the sample size is small. Formally it can be written in the form similar to the Gaussian distribution, in which -however - a binomial expression instead of exponential function appears. Similar binomial form has the Zeldovich-Kompaneets solution of a subdiffusion problem [2]. These two distribution will be compared.

[1]. P. D. Praetz, The distribution of share prices, J. Business 45, 49-55 (1972)

[2]. R. Wojnar, Subdiffusion with external time modulation, Acta Phys. Polon. A 114, 607-611 (2008)

18:00 Poster 14

Modele agentów emocjonalnych

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Niniejsza praca miała na celu zbadanie za pomocą symulacji numerycznych modeli agentów emocjionalnych na siatce kwadratowej. Modele te opisują ogólne cechy emocji jak spontaniczne pobudzenie emocjonalne, relaksację emocji i przekaz emocji między jednostkami. Omawiane w kolejnych rozdziałach wyniki numeryczne jak i ich wizualizacja zostały samodzielnie zrealizowane przez autorkę. Emocja grupy w rozważanych modelach zmienia periodycznie swoją polaryzację między dwoma przeciwnymi stanami (pozytywnym i negatywnym) w rezultacie czego jej uśredniona w czasie wartość jest bliska zeru. Amplituda tych oscylacji silnie zależy od prawdopodobieństwa spontanicznego pobudzenia ps i prawdopodobieństwa oddziaływania między agentami p, zaś na ich częstotliwość wyraźny wpływ ma czas relaksacji τ . Dla małych wartości τ obserwuje się zjawisko przypominające rezonans stochastyczny, tzn. współczynnik określający stosunek sygnału do szumu (ang. signal-to-noise ratio) SNR osiąga maksimum dla niezerowej wartości parametru ps. obecność anteny emocjonalnej (agenta o preferencyjnych regułach oddziaływania) może wywierać pozytywny bądź negatywny wpływ na pole lokalne i przy pewnych optymalnych wartościach prawdopodobieństwa przekazu emocji między agentami p, zasięg jej oddziaływania na otoczenie jest większy niż ten wynikający z określonych w modelu reguł oddziaływania agentów z otoczeniem. Zjawisko rezonansowe zaobserwowano także dla problemu wpływu emocji na efektywność wykonywania zadań przez agentów. Praca składa się z czterech rozdziałów, które mają zapoznać czytelnika z wynikami badań autorki nad modelami agentów emocjonalnych. W kolejnych rozdziałach omówiono podstawy teoretyczne pracy, reguły dynamiki rządzącej zachowaniem agentów oraz wyniki symulacji numerycznych dla rozważanych kolejno problemów. Pracę kończy rozdział podsumowujący zestawione wcześniej rezultaty. Wyniki na podstawie których powstała ta praca, zostały opublikowane w artykule naukowym.

18:00 Poster 15

Badanie zamożności gospodarstw domowych w Polsce metodami egzotycznej i tradycyjnej fizyki statystycznej.

Maciej Jagielski

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W niniejszej pracy omówiłem modele opisujące rozkłady skumulowane dochodów ludności.
Zaprezentowałem zarówno wczesne modele dystrybucji dochodów (prawa Pareto, Prawo Efektów Proporcjonalnych, model stochastyczny Champernowne'a), jak i bardziej zaawansowane met-

ody modelowania (uogólniony model Lotka–Volterra, modele zderzeń). Przedstawiłem również analizę empirycznych skumulowanych rozkładów rocznych dochodów gospodarstw domowych w Polsce w latach 2000, 2003 i 2006. Rozkłady te porównałem z przewidywaniami wspomnianych modeli. Okazało się, że dochody średniozamożnych i najbogatszych polskich gospodarstw domowych opisywane są bardzo dobrze przez skumulowane rozkłady Pareto, różniące się wartością wykładnika Pareto. Z kolei dochody ubogich gospodarstw opisane są przez skumulowany rozkład log-normalny.

18:00 Poster 16

Proste modele epidemiologiczne

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W mojej pracy magisterskiej przedstawiłem różne podejścia do modelowania epidemiologicznego (od równań różniczkowych, przez automaty komórkowe do modeli agentowych). Co ciekawe udało mi się odkryć, że model Bernouliego (prawdopodobnie pierwszy matematyczny model epidemii) został wykalibrowany na przykładzie rozprzestrzeniania się czarnej ospy we Wrocławiu (w tym samym mieście jako ostatnim w Europie pojawiła się epidemia tej choroby zanim została oficjalnie erygowana z listy chorób występujących naturalnie). Opis tego modelu, jak i wielu innych przedstawiłem w rozdziałach teoretycznych mojej pracy, ale ważniejsze są jednak te części, gdzie pod opieką szwedzkich epidemiologów uczestniczyłem w analizie isteniejącego modoelu na potrzeby rządu szwedzkiego (wirus H1N1) a przede wszystkim mój autorski pomysł na wykorzystanie sieci społecznych kontaktów w problemie rozprzestranienia się gronkowca złocistego(MRSA) w szpitalach. Problemem jaki został mi postawiony przez lekarzy z Karolinska Institutet, było znalezienie najbardziej prawdopodobnych ścieżek przekazywania choroby. W pierwszym etapie badań stworzyłem stacjonarną miacierz prawdopodobieństw przekazania choroby, a w drugim zająłem się dynamiczymi macierzami i wyliczeniem dynamicznych prawdopodbieństw zakażenia, przy wykorzystaniu koncepcji modelu Isinga i metody MCMC. Chciałbym zaznaczyć, że poza Szwecją miałem już możliwość przedyskutowania moich wyników z lekarzami i epidemiologami w Holenderskim Instytucie Kontroli Chorób Zakaźnych (RIVM, Bilthovem,Nl, maj 2010), Gdańskim Uniwersytecie Medycznym (GUM, Gdańsk,Pl, czerwiec 2010) oraz Uniwersitecie w Bristolu (Statworks, Bristol,UK, lipiec 2010) i zamierzam kontynuować badania na studiach doktoranckich z fizyki UJ.

18:00 Poster 17

Złamanie symetrii w modelu izolacji grup społecznych

Grzegorz Siudem

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Tematem niniejszej pracy jest złamanie symetrii w modelu izolacji grup społecznych,czyli socjofizycznym modelu opisującym zjawisko współzawodnictwa i konkurencji. Pracę rozpoczyna wstęp literaturowy, ukazujący miejsce rozważanej tematyki w nauce i motywację do budowy modeli dynamiki układów społecznych przez fizyków. Następnie zaprezentowano symetryczny przypadek modelu izolowanych grup społecznych.
W dalszej części przedstawiono analityczne i numeryczne wyniki analizy niesymetrycznego wariantu modelu izolowanych grup społecznych na łańcuchu i siatce kwadratowej, a także rozważania analityczne dla dowolnej sieci regularnej. Ponadto, praca zawiera opis programu VoSGIM, będącego wizualizacj¡ modelu izolowanych grup społecznych.
Wkład własny autora niniejszej pracy polegał na opisie analitycznym złamania symetrii w modelu izolowanych grup społecznych. Wiązało się to z wyznaczeniem szeregu parametrów opisujących ewolucję układu (czasów charakterystycznych, liczby zablokowanych węzłów, etc.). Ponadto, autor sprawdził teoretyczne rozważania przy pomocy symulacji numerycznych. Odrębną część pracy stanowiło stworzenie programu wizualizacyjnego, umożliwiającego prezentację złamania symetrii w modelu izolowanych społeczności.

18:00 Poster 18

Analiza autokorelacji krótkookresowych w finansowych szeregach czasowych.

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Korelacje krótkookresowe są powszechnie obserwowane w giełdowych szeregach czasowych. W mojej pracy przedstawiam wyniki ich analizy za pomocą modelu błądzenia przypadkowego w czasie ciągłym z jednokrokową pamięcią, co więcej prezentuję wyniki, jakie otrzymałam dla największych spółek na GPW. Omawiam również metody wyznaczenia parametrów modelu oraz to, jak zmieniają się one dla poszczególnych spółek na przestrzeni lat. Na koniec porównuję model teoretyczny z otrzymanymi danymi empirycznymi oraz zamieszczam wnioski.

18:00 Poster 19

Uogólniony i zreinterpretowany model materiałów lepkosprężystych jako narzędzie badania dynamiki wybranych indeksów giełdowych

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Celem mojej rozprawy doktorskiej była analiza dynamiki wybranych indeksów giełdowych, w szczególności analiza lokalnych w czasie pików tych indeksów, występujących w szeregach czasowych dziennych danych empirycznych. W ramach zaproponowanego w pracy modelu, który nazwałam Reologicznym Modelem Fraktalnej

Dynamiki Rynku Finansowego (RMFDRF) odtworzyłam wznoszące i opadające zbocza wspomnianych indeksów giełdowych traktowanych jako dwa niezależne procesy. RMFDRF stanowi zreinterpretowanie i uogólnienie, kluczowego dla tradycyjnej reologii, Standardowego Modelu Zenera czyli Modelu Zenera Ciała Stałego (Plastycznego). Uzyskane przeze mnie rozwiązanie podstawowego, fraktalnego równania modelu jest proste, gdyż jest sumą ważoną zależnego od czasu uogólnionego eksponensa Mittag- Lefflera oraz części oscylującej.
Za pomocą tego wyrażenia udało się dobrze opisać zbocza wybranych indeksów WIG, WIG20, DAX, DJIA, NASDAQ. Jako przykład porównania teorii z danymi teoretycznymi przedstawiam wykres sporządzony dla ostatniego lokalnego piku indeksu WIG, dla danych z horyzontu czasowego od 06.02.2004 do 18.05.2009.

18:00 Poster 20

Time-dependent statistical analysis of the Polish stock market index WIG20

Ewa Ślesińska[1], Maciej W. Janowicz[1], Arkadiusz J. Orłowski[2,3]

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Dynamics of the Warsaw stock market index WIG20 has been investigated using the methods of econophysics. The dependence of the distribution function, kurtosis, scewness and volatility on time has been investigated, and the fluctuation analysis has been performed. Partial comparisons with analogous results for Dax as well as FTSE indices have been given. It is shown that the dependence of volatility on the logarithm of time appears to have a negative exponent for large times, and the linear depedendence of log(v) on log(t) breaks down. This seems to be in contranst with the analogous dependence in the case of more mature markets. Weakly multifractal character of the time series generated by the index WIG20 has also been found.

Friday, 26 November

COFFEE
Friday morning, 26 November, 8:30

PLENARY SESSION
Friday morning, 26 November, 9:00
b.34 A.IV
Chair: Czesław Mesjasz

9:00 Invited oral

World markets development from log-periodic perspective

Stanisław Drożdż[1,2], Jarosław Kwapień[1], Paweł Oświęcimka[1]

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Detecting potential deterministic patterns in the financial dynamics and identifying their origin is a great intellectual as well as practical challenge. In this context the suggestion that financial dynamics may be governed by phenomena analogous to criticality in the statistical physics sense and, especially, the related subtle concept of log-periodicity proves promising but at the same time it still appears somewhat controversial. Based on our related "finance-prediction-oriented" methodology [1] which involves such elements as log-periodic self-similarity [2], the universal preferred scaling factor, and allows a phenomenon of the "super-bubble" [3] we analyze the leading world stock markets (represented by the S&P500, DAX, WIG and some Asian markets) and the commodity - especially oil [4] and precious metal - markets development over the past several years. This analysis involves both the bull as well as the bear markets phases. We emphasize the subtleties of the related description and present some of our successful predictions as documented on the public fora [5] and/or placed at [6]. Some other publicly documented examples of our previous successful predictions include the oil trend reversal in early July 2008 and some local trend reversals in the gold market (December 2009 and May 2010). In the present contribution we elaborate on the related methodology and on the current world market status. We also present some further forecasting scenarios for the world stock market, for the oil and for the precious metals markets.

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[4] S. Drożdż, J. Kwapień, P. Oświęcimka, *Criticality characteristics of current oil price dynamics*, Acta Phys. Pol. A 114 (2008) 702

[5] http://wojciechbialek.blox.pl/html (in Polish)

[6] http://picasaweb.google.com/finpredict

9:45 Invited oral

Backward jump Continuous-Time Random Walk on a stock market. What is the true origin of the autocorrelation on the market?

Tomasz Gubiec, Alicja I. Zalewska, Ryszard Kutner

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We present backward jump modification of the Continuous-Time Random Walk model or the version of the model driven by the negative feedback [1]. In the frame of the model we describe the stochastic evolution of a typical share price on a stock exchange within a high-frequency time scale.
In the context of the market trading the backward price jump is a reminiscence of such a bid-ask bounce phenomenon where consecutive jumps have the same or almost the same lengths, but opposite signs. We suggested that this correlation dominated the dynamics of a stock market on the tick-by-tick timescale.
The model was validated by satisfactory agreement of the theoretical velocity autocorrelation function with its empirical counterpart. It should be noted that parameters of the model were obtained from separate data sets, so as the comparison of the theoretical velocity autocorrelation function with corresponding empirical curve has no free parameters.
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COFFEE BREAK

Friday morning, 26 November, 10:30

PLENARY SESSION

Friday morning, 26 November, 11:00
b.34 A.IV
Chair: Stanisław Drożdż

11:00 Oral

Non extensive Cross-Entropy approach to balancing a Polish National Matrix of Economy including Ecological Aspects

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The present article applies the Tsallis cross entropy approach for estimating and balancing economic flows of an initially non balanced National Matrix of Economy including Ecological Aspects(NAMEE). In fact, respective rows and columns of such a usually square matrix are never balanced, contrary to double entry bookkeeping principle on the bottom of which it is constructed. The main raison stands from different and contradictory sources of used statistical information for its building. This is particularly truth in the case of ecological accounts being presently characterised by relatively lower precision than usual accounts owing to the1993 international system of national accounts(SNA93). Because the number of unknowns is generally much higher than known parameters, such matrix is “ill-behaved” and traditional statistical methods can’t be applied unless risky hypotheses are added. A few approaches have been proposed to balance such class of matrices. Among many others, Shannon Kullback Leibler based minimum entropy has been applied under non ergodicity hypothesis(eg. Golan, Miller,Judge, 1996) . This article extends the approach to the Tsallis non extensive cross entropy(NECE) principle. At the same time it proposes inferential statistics and comment on ergodic properties of the model through the q-value.

In terms of economics, preliminary out puts confined within the new balanced matrix seem to be conform to our economic intuition.

11:20 Oral

One-switch utility functions with annuity payments

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One of the most important steps in decision analysis is determining the decisions maker's utility function. Several authors have presented methods to derive the functional form of a utility function based on the change in valuation of a lottery as the decision maker's wealth increases. In particular, it is well known that if the decision maker's preferences between any two uncertain and uni-period lotteries does not change as the decision maker's initial wealth changes, then he must have either a linear or an exponential utility function. In 1988 D. Bell introduced the idea of characterizing a utility function based on the maximum number of switches that may occur between any two lotteries as the decision maker's wealth increases. It happens that in many cases that arise in practice, a decision maker may face multi-period and uncertain cash flows. In [1] and [2] we have derive the functional forms of multiattribute
utility functions that lead to zero-switch change in preferences between multi-period cash flows when a decision maker's initial wealth increases through an annuity that pays a constant amount every time period. In the present talk we investigate the functional forms of multiattribute utility functions that lead to a maximum of one-switch change in preferences.

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[2] J. Chudziak, On a class of multiattribute utility functions invariant under shift transformations, Acta Phys. Polon. A 117 (2010), 673-675.

11:40 Oral

Does pop music exist? Hierarchical structure in phonographic market.

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I find a topological arrangement of assets traded in a phonographic market which has associated a meaningful economic taxonomy. I continue using the Minimal Spanning Tree and the Lifetime Of Correlations between assets, but now outside the stock markets. This is the first attempt to use these methods on phonographic market where we have artists instead of stocks. The value of an artist is defined by record sales. The graph is obtained starting from the matrix of correlations coefficient computed between the world's most popular 30 artists by considering the synchronous time evolution of the difference of the logaritm of weekly record sales. This method provides the hierarchical structure of phonographic market and information on which music genre is meaningful according to customers.

12:00 Oral

Accuracy analysis of the box counting algorithm

Andrzej Z. Górski[1], Stanisław Drożdż[1,2], Agnieszka Mokrzycka[3], Jakub Pawlik[3]

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Accuracy of the box counting algorithm for numerical computation of the fractal exponents is investigated. To this end several sample mathematical fractal sets are analyzed. It is shown that the standard deviation obtained for the fit of the fractal scaling in the log-log plot strongly underestimates the actual error. The computational error was found to have power scaling with the number of data point in the sample (n_{tot}). Also, the error is larger for higher dimensional fractal sets. Obtained formula can give more realistic estimates for the computed fractal exponents' accuracy.

12:20 Oral

Long-range dependences in natural language

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Natural language is an emergent phenomenon formed during the process of historical (and personal) self-organization of human brain. It is intuitively expected that properties of natural language reflect to some extent the properties of the brain, especially its methods of information processing and its ability to create messages. However, since this at present cannot be observed directly, one has to select and inspect observables which are easier to analyze. Among such observables related to language are texts.
In order to faciliate studies, the texts can be transformed into symbolic sequences using various mappings like, e.g., lengths of words, number of words in sentences, frequency ranks of words etc. Such sequences can then be studied with standard techniques of time series analysis. Here we look for the nonlinear long-range correlations in literary works of different authors and written in different languages. Literary texts are the ones which can be expected to express human thoughts in the richest manner. Thus, the correlations - if present - should primarily be detectable just there. We apply both the nonlinear variants of autocorrelation function and the multifractal formalism to identify such correlations and review some of the preliminary results of our study.

12:40 Oral

Notes on line dependent coefficient and multiaverage

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In this paper we talk about new statistic tools, which enable more precise economics data analysis. Firstly, we define line dependent coefficient as a cosine of angle made of the cross of regression lines. It is the base, thanks to which we can define other nonlinear coefficients. Just like the classic correlation coefficien, line dependent coefficient is also asymptotically normal. The second part of this article is about multiaverage, generalization of the classic expected value of the random variable idea. The average may be considered as root-mean-square approximation of the random variable with one point. Multiaverage is approximation of the variable with more than just one point at the same time (which is important, when we talk about random variables, which distributions are mixtures, or about

multimodal densities). While defining multiaverage we use standard moments method.

LUNCH

Friday afternoon, 26 November, 13:00

PLENARY SESSION

Friday afternoon, 26 November, 14:00
b.34 A.IV
Chair: Ryszard Kutner

14:00 Oral

Multifractal Estimators of Long Range Dependences

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Multifractal approach is a generalization of fractal techniques. It offers an attractive and compact frame to qualify and quantify multiscaling aspects immersed in any system represented by time series. A lot of simulations were performed to validate numerical procedures (Abry *et al.*, Stoev *et al.,* Oświęcimka *et al.*, Lashermes *et al.*, Makowiec *et al.* 2009, Makowiec *et al.* 2010). However available tools still seem to be not powerful enough to discern reliably all specificity of the real data organization. One can find a lot of advice how to overcome possible traps. For example, it is advised to investigate series that are long enough (Oświęcimka *et al.)*, to use parallelly tools which are of different numerical origin (Kantelhardt). As a good rule of thumb is to question results if a multifractal spectrum is concentrated at $h=1$ or $h=0$ (Gao *et al.)*. Finally, it is said that specific knowledge about the phenomenon from which a signal is analyzed should be carefully taken into account (Veitch *et al.*, Stoev *et al.)*. Therefore multifractal estimates demand special protocols describing how to proceed with systematic errors of numerical methods used, and how to extract reliable fractal characterization of a given data.

We want to present the method which consists in working together on two multifractal spectra received numerically from a given signal. The first spectrum describes the signal itself while the second spectrum is calculated for the integrated signal. By such approach each signal is analyzed twice: if it is a stochastic walk (a direct signal), and if it is a noise (when integrated). Moreover, the scaling options for the partition functions are kept firmly within the particular time interval to detect phenomena related to that time interval. Our proposition bases ob wide simulation experiments in which the software of Physionet (i.e., *multifractal.c* and *dfa.c* modified to receive the multifractal scaling) was applied to synthetic data.

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14:20 Oral

Multifractal background of monofractal finite signals with long memory

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We investigate the presence of multifractal residual background effect for pre-assumed monofractal signals, appearing due to the finite length of the signal and (or) due to the long memory the signal reveals. This phenomenon is investigated numerically for time series artificially generated with various methods. Next, analytical formulae enabling to describe their multifractal content are provided. Final results are shown as the function of time series length and the long memory exponent in two frequently used multifractal languages, i.e.: generalized Hurst exponent h(q) and Holder multifractal spectrum width scenario. The obtained results may be significant in any practical application of multifractality, including financial data analysis, because the "true" multifractal effect can be clearly separated from the so called "multifractal noise". This way one may easy decide whether we do deal with the signal of multifractal origin or not.

14:40 Oral

Financial extreme events with negative fractal dimensions.

Paweł Oświęcimka[1], Stanisław Drożdż[1,2], Jarosław Kwapień[1], Rafał Rak[2]

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From statistical point of view, many physical phenomena are characterized by non-gaussian p.d.f. with slowly declining tails. Those tails contain information about statistics of extreme events, i.e. fluctuations which greatly deviate from the distribution's mean.
In the case of financial markets the most extreme events are observed for the foreign exchange market - Forex. They are especially pronounced in a context of the so-called triangular relation, coupling the mutual exchange rates of each currency triple as required by the no-arbitrage condition. Here we consider high-frequency time series of deviations from the perfect triangle
relation expressed by a sum of the coupled exchange rate returns. The distribution of deviations in this case is distinguished by the tails which are exceptionally "fat" as compared with other financial data. This suggests that within a triangle the balance between currency quotations can be significantly violated, indicating an arbitrage opportunity.
The situation is even more intriguing when one considers the temporal organization of such time series. The Hurst-type analysis shows that the deviations possess strongly antipersistent behaviour and, moreover, both the Hoelder exponents and the fractal dimensions take negative values. Such a result may seem rather strange at first glance, but this kind of anomalies have already been discussed earlier, e.g. by B. Mandelbrot, in a context of some variant of the multifractal cascade: the two-valued canonical multifractal. According to our knowledge, in the case of financial data these
anomalous fractal characterictics are observed for the first time.
It is worth noting that such singular behaviour of both the distributions and the multifractal spectra indicates that dynamics of the considered processes goes beyond the standard multifractal formalism and should rather be approached within the framework of broad multifractals, proposed by Mandelbrot.

15:00 Oral

Time series distance measures

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In the analysis of stocks markets, particularly in the investigations of the stocks market structure most of the researches use the Ultrametric Distance (UD) defined in [1]. This distance was derived from the portfolio analysis. In the paper the weak points and limitations of UD are discussed. The alternative time series distance based on the Manhattan Distance (MD) is constructed and its properties are analyzed. It is shown that MD allows to introduce an equivalence classes of the correlations between time series. The properties of the considered time series distances are illustrated on shares quoted on Warsaw Stocks Exchange and New York Stocks Exchange.

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15:20 Oral

Study of households' income in Poland and European Union by using the statistical physics approach

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It was in the end of XIX century when Vilfredo Pareto as a first made a trial to analytically describe how the wealth and income is distributed in society. Following this pattern, the Generalized Lotka-Volterra model is shortly presented. Moreover, by using Polish empirical data for annual income of households for year 2006, the comparison with theoretical predictions was made (with Laws of Pareto, Rules of Proportionate Growth, and with Generalized Lotka-Volterra model). Studies are cross-cutting, referring to various categories of income (e.g. income from self-employment, household disposable income, etc.), its differences in territorial terms (e.g. in region and size of the city) as well characteristics of individuals and households (e.g. of gender, marital status, education, and number of persons in household). The numerical models of enrichment for societies based on computer simulations are also presented and compared with analitycal predictions.

15:40 Oral

Influence of super-extreme events on a Weierstrass-Mandelbrot Continuous-Time Random Walk

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Two key utmost cases of influence of super-extreme events on the velocity autocorrelation function (VAF) were considered. The VAF itself was derived within the hierarchical Weierstrass-Mandelbrot Continuous-Time Random Walk (WM-CTRW) formalism which is able to cover a broad spectrum of continuous-time random walks. Firstly, we studied a super-extreme event in a form of the sustained one, whose duration time is much longer than that of all other events. Secondly, we considered a super-extreme event in the form of a shock with the size and velocity much larger than those corresponding to any other event. We found that the appearance of the super-extreme event substantially changes the resulting VAF; in each case considered, these changes are quite different.

COFFEE BREAK
Friday afternoon, 26 November, 16:00

PLENARY SESSION

Friday afternoon, 26 November, 16:30
b.34 A.IV
Chair: Ewa Syczewska

16:30 Oral

Microeconomic evolution model with technology diffusion

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The model discussed in this paper is a modification of the model of macroeconomic evolution in stable regionally dependent fields, developed by Ausloos, Clippe and Pękalski in 2004 (Physica A 337 (2004) 269-287; cond-mat/0401144). Like in the original model, firms exist on a square lattice and can move, merge, adapt and create spin-offs. However, in the new model the firms are described by a scalar parameter identified with their level of technology and by their weight (size). The probability of survival of a firm depends on the relation between the firm's technology level and the level of the technological frontier. The model incorporates two mechanisms of technology diffusion - inner (resulting from the cooperation between firms and the creation of spin-offs) and outer (interaction with the technological frontier). In this way, we obtain a model of technological progress with technology diffusion. We investigate the properties of this model and perform empirical analysis for a group of OECD countries.

16:50 Oral

Vortex stabilization of market equilibrium in theory and in practice of economics

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Rotary movements of the object around the position of equilibrium is the most common type of dynamics in nature. The way of plotting trajectory resembles winding a line onto a cone of revolution or some other solid of revolution. The state of equilibrium, which is usually not reached by the system, is marked with the cone axis. The trajectory can move away from the state of equilibrium, or get closer to it. A similar behavior is observed in many two-dimensional economic models, both linear, and nonlinear. The simplest example is a linear cobweb model, where – depending on slopes of linear demand function and linear function of supply – price and quantity make a broken line with a growing, constant or decreasing amplitude around the equilibrium point. In nonlinear models, trajectories are more realistic. A natural space for exploring spiral trajectories is a three-dimensional space. Usually, it requires magnifying the model's dimension by one. Economic vortexes are made up by economic vectors of three constituents. It may be price, quantity, and time. Apparently, flat zigzags that can be seen on two-dimensional graphs of cobweb models are orthogonal projections of spinning trajectories. Vortexes created by nonlinear models are much smoother than the vortexes created by linear models. The real economic vectors create smooth spiral trajectories, which indicates necessity to employ nonlinear dynamics in economic modeling. The basis for rotary movements are surface areas of solids of revolution of the second degree. The kinematics of solids indicated by market shows that they also rotate in three-dimensional space. It resembles precession movements. In economic dynamics we have at least a double rotation. What rotates are both economic vectors as well as the solids created by them.

17:10 Oral

Bayesian Value-at-Risk and Expected Shortfall for a portfolio (multi- and univariate approaches)

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Bayesian assessments of Value-at-Risk (VaR) and Expected Shortfall (ES) for a given portfolio of dimension n can be based either on the n-variate predictive distribution of future returns of individual assets, or on the univariate model for portfolio volatility. In both cases, the Bayesian VaR and ES fully take into account parameter uncertainty and non-linear relationship between ordinary and logarithmic returns. For large portfolios we use the n-variate type I MSF – scalar BEKK(1,1) volatility model proposed specially to cope with large n. We compare empirical results obtained using this (more demanding) multivariate approach and the much simpler univariate approach based on modelling volatility of the whole portfolio (of a given structure).

17:30 Oral

On the empirical importance of the orthogonal transformation in copula-based M-GARCH models. bayesian comparison

Mateusz Pipień

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In the paper a novel class of the conditional distributions of the Copula-based M-GARCH models is studied. Initially we consider the multivariate distribution, defined as a product of independent univariate skewed Student-t components. Then, an orthogonal transformation is applied in order to model heavy tails and asymmetry along free set of coordinate axes. We apply the Bayesian approach to model comparison and check the empirical importance of proposed generalisations. Also the posterior inference about some bivariate processes on the Warsaw Stock Exchange is presented.

17:50 Oral

The methods of funding the improvement of financial situation in households and the factors determining their choice

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The paper addresses the reasons for decisions taken to improve the financial situation in a household through saving or taking credits. The study consists of a theoretical part describing economic definitions of saving and taking credits and an empiric part which discusses the results of logistic regression model. The model uses data obtained in the survey Living conditions of Polish Society – problems and strategies, carried out by the Public Opinion Research Center.

BREAK
Friday evening, 26 November, 18:10

CONFERENCE DINNER
Friday evening, 26 November, 19:00

Saturday, 27 November

COFFEE
Saturday morning, 27 November, 8:30

POSTER SESSION - CONTINUATION Chair: Danuta Makowiec
Saturday morning, 27 November, 9:00

PLENARY SESSION
Saturday morning, 27 November, 10:00
b.34 A.IV
Chair: Janusz Hołyst

10:00 Invited oral

A line graph as a model of a social network

Małgorzata Krawczyk[1], Lev Muchnik[2], Anna Mańka-Krasoń, Krzysztof Kułakowski[1]

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Take a graph and substitute links by new nodes. Remove old nodes. Add new links: two new nodes are connected if they shared a node in the initial graph. In this way we obtain a line graph. Now suppose that a society is a network, where nodes are families, groups of friends, school classes, small companies etc. Two nodes are connected if two groups share a member. A line graph formed on this social network is a conventional network, where persons are nodes. The goals of this construction are: social networks are clusterized and assortative, as it is observed in the network of LiveJournal of $8x10^6$ nodes (arXiv:1010.2460, submitted to publication).

10:45 Invited oral

Can physics help in improving prediction of social phenomena?

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The impact of physics on broadly defined social sciences, including also economics, management and finance, has been one of decisive factors of development of the latter. What is less known, as Philip Mirowski showed, the influence was sometimes mutual. In the recent years thanks to econophysics, the links between physics and finance have achieved a new level. Econophysics shows that the transfer of concepts from physics to finance is explicitly and implicitly aiming at improvement of prediction (forecasting) by supplementing "classical" methods of economics/finance with concepts associated with non-linear systems, or broadly defined complex systems. The expectations of enhancing predictive capability concern not only economics and finance. In management expectations towards enhancing predictive capability of behavior of complex social structures also can be found. Although this new symbiosis of physics and social sciences have brought about a rank of interesting results, e.g. deepened understanding of uncertainty and risk in finance or applications of scale-free networks in modeling dynamics of social systems, it may be stated that a deepened understanding of limitations and possibilities of enhancing predictive capability of social sciences with methods drawn from physics has not been developed yet. The aim of the paper is to show what are the limitations and possibilities of applying models from physics in prediction/ forecasting in broadly defined social sciences. Firstly, a survey of interpretations of prediction in physics will be presented, with an exception of quantum mechanics, as not relevant to application in modeling of social phenomena. Subsequently the examples of barriers of prediction in social sciences will be presented. Thirdly, explanations how models taken from physics could enhance prediction in social sciences or how they could help in better understanding limitations of prediction of social phenomena will be developed. The examples taken from social sciences will include cases from financial markets – power law, rare phenomena, etc. Possibilities and limitations of prediction of functioning of organizations at various levels of societal hierarchy – macro and micro will be illustrated with models taken from thermodynamics and complex systems studies, with a special stress put on applications of network models.

COFFEE BREAK
Saturday morning, 27 November, 11:30

PLENARY SESSION

Saturday afternoon, 27 November, 12:00
b.34 A.IV
Chair: Krzysztof Kułakowski

12:00 Oral

Negative emotions as a fuel for discussion in cyber communities

Anna Chmiel[1,2], Julian M. Sienkiewicz[1,2], Georgios Paltoglou[3], Kevan Buckley[3], Mike Thelwall[3], Janusz A. Hołyst[1,2]

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We focus on the influence of emotion on the behavior of Internet forum users and the vitality of online debates. We collected a large set of records describing comments expressed in diverse cyber communities such as blogs, fora and the Digg community. The text was then evaluated using classifiers that were able to estimate emotional valence values. We show that affective interactions do exist in Internet communities and they lead to attractive forces. As a result of collective behaviour there are clusters of comments possessing a similar level of emotional valence that are much longer than they would be if they were created by a random process. The presence of longer clusters of coherent emotional expressions therefore increases the possibility of attaching to this cluster a comment with the same emotion. In this sense there is homophily between participants expressing the same emotional valence. Moreover, we show that emotions are important for community life since the level of the initial emotional valence determines the total length of discussion. The majority of comments possess a negative emotional valence and threads starting from a larger number of negative comments last longer so negative emotions can be treated as a kind of discussion fuel. In the course of time the density of negative comments usually decays and for longer discussions the difference between the emotional level in the beginning and at the end is larger. Since the BBC Forum consists of a number of threads, we can also observe the local activity of a user in a specific thread and his/her average local emotion expressed in this thread. Users can take part in many threads, thus their local and global activities and corresponding emotions can be very different. One can ask: how are a user's emotions expressed in a thread connected to their willingness to be active in a given discussion? We show that an increase in activity in the discussion of a particular thread is connected with more negative emotions from the user in the thread.

12:20 Oral

Statistics, emotions and opinions in Digg.com website

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We performed statistical analysis on data from the Digg.com website, which enables its users to express their opinion on news stories by taking part in forum-like discussions as well as directly evaluate previous posts and stories by assigning so called "diggs". The results of the distribution of the discussions (thread) give evidence of behaviour directly connected to the circadian rhythm. Moreover, there is also power-law behaviour both in the comments and user activity histograms. On the other hand the distribution of diggs seems to have its origin in two, quite different processes: preferential attachment for small and medium numbers of diggs, leading to a power-law and random selection for large numbers of diggs, resulting in a Gaussian-like shape.
Owing to fact that the content of each post has been annotated with its emotional value, apart from the strictly structural properties, the study also includes an analysis of the average emotional response of the posts commenting the main story. While analysing correlations at the story level, an interesting relationship between the number of diggs and the number of comments received by a story was found. The correlation between the two quantities is high for data where small threads dominate and consistently decreases for longer threads. However, while the correlation of the number of diggs and the average emotional response tends to grow for longer threads, correlations between numbers of comments and the average emotional response are almost zero. We also show that the initial set of comments given to a story has a substantial impact on the further "life" of the discussion: high negative average emotions in the first 10 comments lead to longer threads while the opposite situation results in shorter discussions.

12:40 Oral

Social networks and MRSA spreading in hospitals

Andrzej Jarynowski[1,2], Fredrik Liljeros[3]

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The bacterium meticillin resistant Staphylococcus aureus (MRSA) is known to be the largest care related the infection problem. We investigated the Common Care Registry containing information about all patient visits within Stockholm County during the outbreak peri-

od with registry over diagnosed MRSA cases. Methods to analyze the contact network of persons visiting the same care unit is developed within the project as well as methods to analyze in what way network structure affects the transmission of MRSA. We study matrixes of disease transition in hospitals population(infected versus people, who could sent infection). In stationary case: (a) We have matrixes of estimators of that probabilities and other statisical properties of contact networks. In time evolution case: (b) We divided outbreak in smaller, periodical intervals and looked at how MRSA was spreading in time. Quasi-MCMC(Markov chain Monte Carlo) method and artificial networks(main parameter is number of contacts during specific time interval) help us to understand real- and simulated-paths of disease transition. Matrices of probabilities (b) were used to find mechanism of change states (vectors of all population 0-health or 1-ill) and we can run quasi-MCMC to get most likely paths.

13:00 Oral

Structural stochastic multiresonance in systems with a structure of hierarchical networks

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Systems with a structure of hierarchical networks, consisting of simple units placed in the nodes and interacting along the edges of the network, are ubiquitous in modern society and economy. The problem of signal detection and transmission in such systems in the presence of noise is analyzed from a point of view of stochastic resonance. It is shown that stochastic multiresonance is often observed, a phenomenon characterized by the presence of two or more maxima of the output signal-to-noise ratio as a function of the input noise intensity. The
origin of the additional maxima, which occur for small noise intensities, can be related to the structure of the interactions, thus the observed phenomenon is an example of structural stochastic multiresonance.

13:20 Oral

Time lags in evacuation in the social force model

Przemysław Gawroński, Krzysztof Kułakowski

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The social force model (D. Helbing et al, Nature 407 (2000) 487) is used to simulate an evacuation of N=1000 persons from a room with a small exit. At the initial state, the exit is closed and the people are crowded. The desired velocity is chosen to be 3 m/s, i.e. higher than its optimal value. During the simulation, the data are gathered on the time lags between instants when subsequent persons cross the exit. We observe at least two phases of the evacuation process, where the mean length of these time lags initially decreases with the number of people in the room, then increases. This can be interpreted as a crossover between a clogged phase and a laminar phase. In the clogged phase, the probability distribution of the time lags shows a maximum near 0.3 s and a power-like tail.

13:40 Oral

Dilbert-Peter model of organization effectiveness: computer simulations

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We present a computer model of general effectiveness of a hierarchical organization depending on two main aspects: effects of promotion to managerial levels and efforts to self-promote of individual employees, reducing their actual productivity.

It is shown in the simulations that the combination of Peter Principle (which states that people are promoted to their level of incompetence) and Dilbert Principle (which postulates that promotions are based on appearance of competence rather than true competence itself) results in fast declines in effectiveness of the organization.

We discuss the correspondence of model parameters to specific class of organization, namely sales structures in large commercial organizations. Despite the apparent ease of measurement of effectiveness of salespeople through actual sales results, use of differing metrics may lead to different degree of self-promotion. It is shown that improving organization resiliency to self-promotion and continuity of individual productiveness after a promotion can greatly improve the overall organization effectiveness.

We also discuss similarity to biology, where so called `costly signalling' mechanisms have evolved to avoid the trap of Dilbertian judgment by appearance.

LUNCH

Saturday afternoon, 27 November, 14:00

ANNOUNCEMENT ON COMPETITION RESULTS & FINAL REMARKS

Saturday afternoon, 27 November, 15:00

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