SOE 25: Poster session

Time: Thursday 17:15–19:00 Location: Poster C

Please note: Posters can and should be on display all day.

SOE 25.1 Thu 17:15 Poster C

Quantum Monetary Science — •Stephen I. Ternyik — POB.201, D82043Munich

The physics of monetary systems is badly understood in the economics profession and the discipline lacks a scientific basis. In an advanced monetary production economy, all human needs are reduced into the need for money and the monetary quantum drives the dynamic efficiency of economic productivity.In this economic state, the typical working of the monetary body is the interplay of fiat credit from private banks via minimized fractional reserves and the emission of fiat money without the growth of economic productivity via public monetary police. This banking system is a violation of the physical or natural laws of economic production as the monetary sytem is a physical process of higher order, i.e. the global financial crisis is the result methodical monetary mischief; some economic alternatives to this systemic error shall be presented.

SOE 25.2 Thu 17:15 Poster C

The Calibration of the Extreme Value Equity Risk in the Solvency II Standard Model: An empirical Analysis — •Magda Schiegl — University of Applied Sciences, Landshut, Germany

The EU - project "Solvency II" aims to rule the regulatory capital requirements of all European insurance companies. A so called "Standard Model" has been developed that should calculate the individual, risk adequate capital every company should hold in order to survive a one in two hundred year event. In addition to the model the EU published the calibration methods as well as the calibrated values for the Standard Model's parameters. We focus in our work on the extreme value calibration of the equity risk. This part of the risk model aims to quantify the risk of equity-portfolio losses for insurance companies in the case of extreme market events. We compare the results of the EU calibration paper with empirical market data analysis and discuss the consequences.

SOE 25.3 Thu 17:15 Poster C

Dynamical Models of Dyadic Interactions with Delay — •Tadeusz Płatkowski, Natalia Bielczyk, and Urszula Foryś — Department of Mathematics, Informatics and Mechanics, Warsaw, Banacha 2

When interpersonal interactions between individuals are described by dynamical systems, the interactions are usually assumed to be instantaneous. In reality, a time delay should be included in the corresponding models. We investigate linear models of dyadic interactions with a discrete time delay. We prove that in such models the changes of stability of the stationary states from instability to stability or vice versa occur for various intervals of the parameters that determine the strengths of interactions. The analytical results indicate importance of deliberation in maintaining the stability of the relationship. The results also suggest that the joint strength of the reactions of the actors to the partner's state, described by the product of the strength of reactions of both partners, has greater impact on the dynamics of relationships than the joint strength of the reactions to their own states. The conditions guaranteeing arbitrary number of the changes of stability of the stationary state of the relationship are formulated and the relevant theorems are proved. The dynamics of interactions depend both on the strength of reactions of partners on their own emotional states as well as on the partner's state. Moreover, we have found that multiple stability switches are possible only when one of the partners reacts with delay to their own state. We also propose a generalization to triadic interactions.

SOE 25.4 Thu 17:15 Poster C

On the robustness of in- and out-components in a temporal network of animal trade — •Philipp Hövel[1,2,3], Mario Konschake[1,4], Hartmut Lentz[4,5], and Thomas Selhorst[5] — [1]Institut für Theoretische Physik, Technische Universität Berlin — [2]Bernstein Center for Computational Neuroscience Berlin — [3]Center for Complex Network Research, Northeastern University, Boston — [4]Friedrich-Loeffler-Institut, Wusterhausen — [5]Institut für Physik, Humboldt-Universität zu Berlin

Many networks exhibit time-dependent topologies, where an edge only exists during a certain period of time. In this work, we focus on the propagation properties of infectious diseases in time-dependent networks. In particular, we analyze a dataset containing livestock trade movements. The corresponding networks are known to be a major route for the spread of animal diseases and the chronology of contacts is crucial.

We find that a time-aggregated approach might fail to identify epidemiologically relevant nodes. Hence, we explore the adaptability of the concept of centrality of nodes to temporal networks using a data-driven approach on the example of animal trade. We utilize the size of the in- and out-component of nodes as centrality measures. We show that a ranking of nodes according to their component sizes is reasonably stable for a wide range of infectious periods. Samples based on this ranking are robust enough against varying disease parameters and hence are promising tools for disease control.

SOE 25.5 Thu 17:15 Poster C

City size distributions of urban clusters near the percolation transition: a global perspective — •Anselmo García Cantú Ros, Till Fluschnik, Steffen Kriewald, and Diego Rybski — Potsdam Institute for Climate Impact Research

Building on high resolution global land cover data we study the area and population size distribution of all cities above 100,000 worldwide. This task is accomplished by applying a percolation based city clustering algorithm. The latter also allows one to first identify a distance to the percolation threshold for clusters of cities and second to study how the proximity to percolation influences the characteristic exponent of city size distributions. Last, but not least, we study the allometric aspects of the area/population relation for the whole set of cities under scope.

SOE 25.6 Thu 17:15 Poster C

Vulnerability of proximity graphs to failure and attacks — •Christoph Norrenbrock, Oliver Melchert, and Alexander K. Hartmann — Carl-von-Ossietzky Universität Oldenburg

We study numerically [1] different proximity graphs (Delaunay-Triangulation, Gabriel graph, relative neighborhood graph, minimum-radius graph) that are discussed as "backbones" of ad-hoc communication networks. Ad-hoc networks represent, e.g., collections of radio-devices without fixed infrastructure. Typically, remote devices are seldom linked directly to each other, but connected indirectly via several paths composed of multiple nodes and edges. This motivates the question how structure and information-transmission efficiency of these graphs are affected by a failure of a given fraction of nodes. Therefore, we study and compare the influence of different node–removal strategies by considering systems up to $N = 4 \cdot 10^4$ and determine, using finite-size scaling techniques, the fraction of nodes (for each strategy) that yields a breakup of the respective graph in the thermodynamic limit.

[1] Hartmann, A. K., Practical guide to computer simulations (World Scientific, 2009)

SOE 25.7 Thu 17:15 Poster C

Correlations of optimized stocks portfolios in different market phases — •Alexander Eckrot[1], Jan Jurczyk[1], Johannes Schneider[2], and Ingo Morgenstern[1] — [1]Uni Regensburg, Regensburg, Germany — [2]Uni Mainz, Mainz, Germany

We investigate the correlations of optimized stocks portfolios in different market phases. These portfolios were created by means of Johannes Schneider's algorithm, maximizing the return and minimizing the risk. The correlations of the stocks portfolios are analyzed using methods of the Random Matrix Theory. We divide the data into three different market phases: A stable market around 2005, before the financial crisis. The climax of the crash at 2008. And this financial crisis' aftermath, we are facing in the very recent years.

SOE 25.8 Thu 17:15 Poster C

Indications of an upcoming financial breakdown — •Jan Jurczyk[1], Johannes Schneider[2], Ingo Morgenstern[1], and

Manuel Miedl[1] — [1]Faculty of Physics, University of Regensburg, 93040 Regensburg, Germany — [2]Department of Physics, Mathematics, and Computer Science, Johannes Gutenberg University of Mainz, 55099 Mainz, Germany

The financial crisis in 2008 showed the weakness of traditional risk evaluation for private investors. In the beginning of 2008 well known financial newspapers and rating firms underestimated the growing risks within the stock market. Therefore the private investor was made to believe that there is no risk within such a system. But the similarities between the spin glass behaviour of the portfolio selection problem, already shown by Markowitz, reveal that the risk is an important observable for recognizing a financial breakdown.

The physical formulation of the portfolio selection problem makes it easier to unveil the risk for a private investor by introducing a simple indicator, which is derived from the idea that ground states of the optimization problem are very sensitive to changes in the solution space and suggests a phase transition.

SOE 25.9 Thu 17:15 Poster C

Modeling the spread of sexually transmitted diseases in Poland and Sweden — •Andrzej Jarynowski[1,2] and Ana Serafimovic[2] — [1]Smoluchowski Institute, Jagiellonian University, Cracow, Poland — [2]Stockholm University, Sweden

The aim of the project is to supplement the knowledge of the spread of sexually transmitted diseases in the first part of the project in Swidish and Polish society through computer simulations with the theoretical discussion about sexual, temporal network (who with whom, when and how often). The model has aggregated the most important paths of infection (the main heterosexual population, sex workers and men who have sex with men) for the most important pathogens. The main goal is the authoritative analysis of the costs and losses of potential epidemiological control strategies and identifies potential problems that health care will have to face in the future. In the second part, the purpose is to understand the structure of the network and the temporal aspects of sexual relationships of humans and the possibility of using this structure in the epidemiological control. Modeling the spread of sexually transmitted diseases in Poland contains: (1) Adjust various parameters of the epidemiology of pathogens based on medical reports from around the world; (2) Simulations of epidemiology of pathogens and associated diseases with control optimization problem in terms of medical and financial metrics. Constructed model describes the spread of pathogens and could indicate an effective tool in the fight against infectious diseases (vaccination, screaming of preventing programs). It would helped with verification of hypotheses on empirical analysis.

SOE 25.10 Thu 17:15 Poster C

Controllability of power fluctuations with variable pricing schemes — Stefan Börries, •Sebastian M. Krause, and Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen, Hochschulring 18, D-28359 Bremen

Power markets including fluctuating energy sources as, e.g. windmills, face the challenge to satisfy the continuous demand for electricity. One possibility is to use time-varying pricing schemes that shift power consumption for activities as, e.g. washing and heating to times with excess supply.

We use an agent based model to investigate the behavior of power consumers faced with variable pricing schemes and analyze the statistical reaction of the market on an aggregate level. To answer the question, if the time-dependent power consumption can be controlled, we search for a reliable demand curve. By discussing the shape of the demand curve, as well as fluctuations and saturation effects, we hint at possible emergent effects.

SOE 25.11 Thu 17:15 Poster C

Social temperature and fear in an opinion formation model of markets — •Sebastian M. Krause and Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen, Hochschulring 18, D-28359 Bremen

In the growing field of behavioral finance, market participants are characterized using psychological and sociological criteria. Two considerable effects among investors are herding behavior and a varying market temperature culminating in periods with panic-like behavior.

We incorporate both effects in an agent based model and study its statistical properties [1]. The herding behavior is captured with a model from the family of opinion formation models which are broadly discussed in the physics literature. Showing tunable social temperatures, these models show emergent behavior like phase transitions. With the introduction of a feedback acting on the temperature [2], the social temperature reacts to market imbalances and thus becomes time dependent. The system shows alternating metastable phases: (a) fluctuations around fixed points connected to a non-equilibrium phase transition, as well as: (b) ordered states of low temperature.

[1] S. M. Krause, S. Bornholdt, Opinion formation model for markets with a social temperature and fear, Phys. Rev. E 86 (2012) 056106.

[2] S. M. Krause and S. Bornholdt, Spin models as microfoundation of macroscopic financial market models (2011) arXiv:1103.5345v1.

SOE 25.12 Thu 17:15 Poster C

Inter-burst times of the empirical high-frequency financial market data and non-linear stochastic models — •Aleksejus Kononovicius and Vygintas Gontis — Institute of Theoretical Physics, Vilnius University, Vilnius, Lithuania

Recently we have proposed a non-linear stochastic model of return and trading activity in financial markets reproducing power law probability and spectral densities [1]. The reproduced statistical properties are in agreement with the high frequency empirical data. The proposed class of nonlinear stochastic differential equations is also known to exhibit power law bursting behavior [2,3], while similar behavior is also observed in the empirical data of financial markets [3]. In this contribution we will extend our previous approaches to the burst statistics by considerably more detailed analyses of the modelic and empirical inter-burst time durations.

[1] V. Gontis, J. Ruseckas and A. Kononovicius (2010): A Nonlinear Stochastic Model of Return in Financial Markets, in: Stochastic Control, ed. C. Myers, Intech.

[2] B. Kaulakys, M. Alaburda and V. Gontis (2009): Modeling scaled processes and clustering of events by the nonlinear stochastic differential equations, AIP Conference Proceedings 1129.

[3] V. Gontis, A. Kononovicius and S. Reimann (2012): The class of nonlinear stochastic models as a background for the bursty behavior in financial markets, Advances in Complex Systems 15 (supp01).

SOE 25.13 Thu 17:15 Poster C

The generalized voter model as a kinetic Ising model — Sebastian M. Krause, •Philipp Böttcher, and Stefan Bornholdt — Institut für Theoretische Phsik, Universität Bremen, Hochschulring 18, D-28359 Bremen, Germany

Opinion formation models have sparked considerable interest in the physics community. A prominent model is the voter model which displays interesting features (i.e absorbing states), is analytically solvable and displays critical behaviour on a 2D-lattice. Variants introduce a social temperature, to tune between persuasiveness and non-conformity. These models display a non-equilibrium phase transition and define a new universality class, the generalized voter-model-class.
Here we investigate a kinetic Ising model on a two-dimensional torus without bulk noise and with a social temperature. The proposed model has a close relationship to the voter model, which is included at the critical social temperature, and the Sznajd model, in which persuasiveness also increases with growing number of proponents. It displays mean-field-like behaviour, absorbing states and an abrupt phase transition with critical convergences, and can be found in the generalized voter-model-class. Finally, we use a Fokker-Planck description and compare its results to mean-field calculations in order to investigate the phase transition, finite-size effects and effects of the absorbing states.

[1] S.Krause, P.Böttcher, and S.Bornholdt, Physical Review E 85, 031126 (2012)

SOE 25.14 Thu 17:15 Poster C

The impact of attractions on pedestrian flow — •Jaeyoung Kwak[1], Hang-Hyun Jo[2], Iisakki Kosonen[1], and Tapio Luttinen[1] — [1]Department of Civil and Environmental Engineering, Aalto University School of Engineering, Espoo, Finland — [2]Department of Biomedical Engineering and Computational Science, Aalto University School of Science, Espoo, Finland

Self-organized pattern formation of pedestrian crowds, such as lane formation, turbulent movement, and human trails, has been subject to interest of various disciplines. The microscopic pedestrian flow models have described the pedestrian motions in terms of driving, repulsive, and attractive forces. However, little attention has been paid to attractive interactions between pedestrians and objects including shopping displays and museum exhibits. In reality, such attractive interactions may lead to impulse stop behavior; pedestrian stop walking to destinations and join the attractions for certain amount of time. This study

investigates the impact of attractive force on pedestrian flow by devising the social force model with attractive forces. Changing attractive force parameters yields radical transition between two distinct aggregate patterns. Relaxed pedestrian flow is observed when attractive interaction is weak. On the other hand, strong attractive interaction reveals clustering around the attractive objects, although pedestrians intended to walk to destinations with their desired speed. The proposed approach provides a useful framework to improve pedestrian facilities in shopping centers and museums.

SOE 25.15 Thu 17:15 Poster C

Fluctuation-dissipation relations in physiological data collected during emotional stimulation — •Jan Chołoniewski, Anna Chmiel, and Janusz Hołyst — Faculty of Physics, Center of Excellence for Complex Systems Research, Warsaw Univeristy of Technology, Poland

We present results of our search for fluctuation-dissipation relations in physiological data (i.e. phasic skin conductance, facial EMG). Data comes from experiments that were performed in the frame of Cyberemotions project [1] and concerned people's emotions observed during experiencing emotional stimuli (i.a. IAPS images). For the sake of this study, we also tried out several approaches for quantifying response function and fluctuations in physiological signals. Because of signals' nonlinearity and non-stationarity part of fluctuations analysis was based on time-frequency methods and signals decomposition (such as Empirical Mode Decomposition, Discrete Wavelet Transform).

[1] www.cyberemotions.eu

SOE 25.16 Thu 17:15 Poster C

Dynamic Nonlinearities in Financial Time Series — •Christoph Raeth — Max-Planck-Institut fuer extraterrestrische Physik

The investigation of financial times series by means of nonlinear data analysis is attracting more and more attention in statistical physics. The characteristic fat tails in the probability distribution of the returns are one example of the so-called stylized facts of the fluctuations of price indices. Many of those refer, however, only to the distribution of the returns, where temporal correlations are no longer taken into account.

Here, we present a new method to identify dynamic nonlinearities by analyzing the phase maps of Fourier phases. We find highly significant signatures for nonlinearities in the day-to day returns of the Dow Jones. We repeat the analysis for rank-ordered remapped Dow Jones data, for which by construction the stylized facts referring to fat tails are vanishing. Also in this case we can identify phase correlations. Comparing the data with respective surrogates, we estimate the significance of the detected new signatures of purely dynamic nonlinearities. We further demonstrate that the phase correlations propagate into the calculation of classical nonlinear statistics, e.g. the nonlinear prediction error [1]. We can thus establish qualitatively new signatures in time series of market indices. Realistic market models should be able to reproduce them in addition to the already well-known stylized fact.

[1] C. Raeth, M. Gliozzi, I. E. Papadakis and W. Brinkmann, PRL, 109, 144101 (2012)

SOE 25.17 Thu 17:15 Poster C

Network resilience for interdependent networks — •Marcell Stippinger and Éva Rácz — Department of Theor. Phys., Budapest Univ. of Technology and Economics, 8 Budafoki út, H-1111 Budapest, Hungary

The ongoing economic crisis has drawn special attention to the importance of network stability. Following the work of Buldyrev et al. (Nature 464, 1025*1028, 2010), we examine the behavior of interdependent networks under random failures. Motivated by real-life scenarios, we introduce the possibility of edge re-organization, as a means of enhancing network resilience, to the original model. The interdependence between two networks is known to lead to cascading failures, resulting in a first-order phase transition concerning the size of the mutually connected giant component. In our variant of the model, networks are able to *heal* to a degree that is easily tuned by a model parameter. We investigate the effect of healing on the order of the phase transition as a function of this parameter. We present simulation results for different kinds of network topologies and compare our results with previous findings.

SOE 25.18 Thu 17:15 Poster C

A Big Data approach to the governing rules of "No. 10 Downing Street" — Scott A. Hale, •Taha Yasseri, and Helen Z. Margetts — Oxford Internet Institute, University of Oxford, Oxford, UK

Analysing the collectively generated Big Data in cyberspace has significantly enriched our understanding of social phenomena in recent years. In this work, we focus on mobilization activities within the framework of the UK Government website, "No. 10 Downing Street". We consider a sample of 8,000 petitions and follow their dynamics in a period of two years. We extract the empirical laws governing the growth of the petitions in regard to the number of supporting individuals. We observe the importance of early time evolution of the petitions in determining the overall success of them over long time periods. Moreover, we measure the critical mass needed for a successful percolation of each petition in a giant piece of the society. Our results, not only deepen our knowledge on the mechanisms behind the growth and spread of socio-political ideas and opinions, but also could be considered to develop and enhance infrastructures to facilitate more effective government-society interactions.

SOE 25.19 Thu 17:15 Poster C

University collaboration networks — •Julian Sienkiewicz[1], Krzysztof Soja[1], Janusz Hołyst[1], and Peter Sloot[2,3,4] — [1]Faculty of Physics, Center of Excellence for Complex Systems Research, Warsaw University of Technology, Poland — [2]Computational Science, University of Amsterdam, The Netherlands — [3]National Research University of Information Technologies, Mechanics and Optics, Russia — [4]Nanyang Technological University, Singapore

We perform the analysis of scientific collaboration at the level of universities. The scope of this study tries two answer two fundamental questions: (i) can one indicate a category (i.e., a scientific discipline) that has the greatest impact on the rank of the university and (ii) do the best universities collaborate with the best ones only? Using two university ranking lists (ARWU and QS) as well as data from the Science Citation Index we show how the number of publications in certain categories correlates with the university rank. Moreover, using complex networks analysis, we give hint that the scientific collaboration is highly embedded in the physical space. We also show that the strength of the ties between universities is proportional to product of their total number of publications.