AKSOE 13: Poster Session (posters on display 10:00-19:00)

Time: Wednesday 17:30–19:00 Location: Poster G

AKSOE 13.1 Wed 17:30 Poster G

Phase transitions in operational risk — •Kartik Anand — Department of Mathematics, King's College London, London, UK

In this paper we explore the functional correlation approach to operational risk. We consider networks with heterogeneous a priori conditional and unconditional failure probability. In the limit of sparse connectivity, self-consistent expressions for the dynamical evolution of order parameters are obtained. Under equilibrium conditions, expressions for the stationary states are also obtained. Consequences of the analytical theory developed are analyzed using phase diagrams. We find coexistence of operational and nonoperational phases, much as in liquid-gas systems. Such systems are susceptible to discontinuous phase transitions from the operational to nonoperational phase via catastrophic breakdown. We find this feature to be robust against variation of the microscopic modeling assumptions.

AKSOE 13.2 Wed 17:30 Poster G

Learning, evolution and population dynamics — Juergen Jost and •Wei Li — MPIMIS, Inselstr. 22, 04103 Leipzig

We study a complementarity game as a systematic tool for the investigation of the interplay between individual optimization and population effects and for the comparison of different strategy and learning schemes. The game randomly pairs players from opposite populations (buyers and sellers), with each independently making an offer between 0 and K. When the buyer's offer k(b) is no less than the seller's offer k(s), a deal is done and the buyer wins K-k(b) and the seller k(s); otherwise the interaction fails and both gain nothing. The game is symmetric at the individual level, but has many equilibria that are more or less favorable to the members of the two populations. Which of these equilibria then is attained is decided by the dynamics at the population level. Players play repeatedly, but in each round with a new opponent. They can learn from their previous encounters and translate this into their actions in the present round on the basis of strategic schemes. The schemes can be quite simple, or very elaborate. We can then break the symmetry in the game and give the members of the two populations access to different strategy spaces. Typically, simpler strategy types have an advantage because they tend to go more quickly towards a favorable equilibrium which, once reached, the other population is forced to accept. Also, populations with bolder individuals that may not fare so well at the level of individual performance may obtain an advantage towards ones with more timid players.

AKSOE 13.3 Wed 17:30 Poster G

Complex Correlations in High Frequency Asset Returns — •Tobias Preis, Wolfgang Paul, and Johannes J. Schneider — Institute of Physics, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany

We analyze the conditional probability distribution functions of high frequent financial market data returns in order to test the randomness of financial markets. An observable for pattern conformity is introduced, which is able to measure complex correlations in a time series on short time scales. When we apply this method to high-frequency time series of the German DAX future contract, we find significant correlations on short time scales. We find strong correlations if one takes additionally into account transaction volumes and inter-trade waiting times.

AKSOE 13.4 Wed 17:30 Poster G

Parameter Estimation for a stochastic claim reserving model — •Magda Schiegl — Haydnstr. 6, D - 84088 Neufahrn

Claim reserving is a very important topic in property and casualty (P&C) insurance companies. The reserves represent the value of all liabilities arising from the insured portfolio. Therefore they have a huge influx on accounting and they are essential for the insurance company*s risk management. This is especially important in a time where the EU wide regulatory framework *Solvency II* is built up. A stochastic model for claim reserving has been introduced [1]. It consists of two parts: One model for the number of active claims and one for the claim payments. This model needs to be calibrated to the real world via appropriate data analysis and parameter estimation. We formulate the conditions on the claim data sets that can be used for calibration. Furthermore we apply methods of Bayes data analysis to estimate the model parameters. This allows us to implement our prior knowledge on the run off behaviour of the claims. We discuss the results of applying the calibration methods.

[1] M. Schiegl, A stochastic model for claim reserves in P&C insurance companies, AKSOE, DPG Conference, March 2007, Regensburg

AKSOE 13.5 Wed 17:30 Poster G

Socio-Economic Influences of Population Density — •Yuri Yegorov — Institute for Advanced Studies, Vienna, Austria

While population density represents an important socio-economic parameter, its role is rarely studied in the literature. This paper represents a survey of mostly author*s results on important socio-economic influences of population density. It plays an important role in societies that depend on agriculture and natural resources, but the economic influence is not straight forward. Too high population density decreases the natural endowment per capita, but eases the development of infrastructure, leading to existence of an optimal population density for economic growth. Population density also influences an optimal country size, where the cost balance is now between border protection and communication costs. Ethnic communities based on more cooperative behavior emerge in the case of low cultural and physical distances. Higher probability of large projects (like infrastructure) leads to development of cooperative behavior in the society. Elaboration along these lines leads to the conclusion that population density positively correlates with individualistic (non-cooperative) behavior, through less time spent in cooperative infrastructure projects and higher frequency of meetings between individuals that with some probability lead to non-cooperative games. Population density also influences the demand for a monopolistic product, where too little density can lead to non-survival of a monopoly.

AKSOE 13.6 Wed 17:30 Poster G

Long-term memory effects in volatility first-passage time — •Josep Perelló and Jaume Masoliver — Departament de Física Fonamental, Universitat de Barcelona, Diagonal, 647, E-08028 Barcelona, Spain

Extreme times techniques, generally applied to nonequilibrium statistical mechanical processes, are also useful for a better understanding of financial markets. We present a detailed study on the mean first-passage time for the volatility of return time series [1]. The empirical results extracted from daily data of major indices seem to follow the same law regardless of the kind of index thus suggesting an universal pattern. The empirical mean first-passage time to a certain level L is fairly different from that of the Wiener process showing a dissimilar behavior depending on whether L is higher or lower than the average volatility. All of this indicates a more complex dynamics in which a reverting force drives volatility toward its mean value. We thus present the mean first-passage time expressions of the most common stochastic volatility models whose approach is comparable to the random diffusion description. We discuss asymptotic approximations of these models and confront them to empirical results with a good agreement with the exponential Ornstein-Uhlenbeck model.

[1] J.P and J.M., Phys. Rev. E 75, 046110 (2007)

AKSOE 13.7 Wed 17:30 Poster G

Some remarks on suitable risk measures for Basel II and Solvency II — •Uli Spreitzer[2] and Vladimir Reznik[1] — [1]WatsonWyattHeissmann Deutschland GmbH, Wiesbaden — [2]Beltios GmbH, Munich * 'on leave from institute'

Concerning rsik capital within banks - Basel II - and insurance companies - Solvency II - there has been a broad discussion on how to measure the risk as measured by capital required. Beside the discussions what measure of risk is suitable: quantil, standard deviation etc. here is also some discussions on measures of risk of single or multiple businesses units. Multiple businesses are discussed using correlations matrices. We show, that there are limitations within this concept and suggest applying a measure of risk applied on the complete company after having simulated the whole company.

AKSOE 13.8 Wed 17:30 Poster G

Seeking for criteria to define optimality in economic and social systems — Elena Ramírez Barrios[1] and •Juan G. Díaz

Ochoa[2] — [1]Fachbereich 7, Bremen University, Hochschulring 4, D28359 Bremen — [2]Fachbereich 1, Bremen University, Otto Hahn Allee, D-28359 Bremen

Modeling social phenomena as, for example, voters models or consumers trends formation, is strength elated with collective processes, where the whole population are seeking for an optimum. This social optimum is, for instance, the increase of the total populations welfare within an economic system, or increasing the trust degree inside a given society. However, the criteria to achieve these social optima is difficult to define, because social consensus is underlying these processes and complete coordination is very hard to achieve (Arrow, 1951, 1963). Furthermore, this coordination process has different dynamics between small and large population groups, making more difficult to find appropriate unique criteria.

Using techniques from systems with self organized criticality, we define a system with non-fixed links between individuals, originating continuous fluctuations in the definition of the criteria for an optimum. This model is pillared in system of agents with changing preferences, altering the connectivity with their neighbors. With our simulations we found out that optimization criteria are non static, but exhibit a kind of punctuated equilibrium. This result is analyzed when the system lies in a critical state.

AKSOE 13.9 Wed 17:30 Poster G

Renewal equations for option pricing — •Miquel Montero — Departament de Física Fonamental, Universitat de Barcelona, Diagonal 647, E-08028 Barcelona, Spain.

We will present an original approach, based in the use of renewal equations, for obtaining pricing expressions for financial instruments whose underlying asset can be solely described through a simple continuous-time random walk (CTRW). This setup enhances the potential use of CTRW techniques and results in finance.

We solve the equations for several contract specifications (European binary calls, European vanilla calls, American binary puts, perpetual American vanilla puts), by obtaining explicit expressions for a particular but exemplifying jump probability density function: an asymmetric exponential.

We present plots that depict the properties of the option prices for different values of the free parameters, and show how one can recover the celebrated results for the Wiener process under certain limits.

AKSOE 13.10 Wed 17:30 Poster G

Kauffman Boolean model in undirected scale free networks — Piotr Fronczak, Agata Fronczak, and •Janusz Holyst — Faculty of Physics, Warsaw University of Technology, Koszykowa 75, 00-662 Warsaw, Poland

We investigate analytically and numerically the critical line in undirected random Boolean networks with arbitrary degree distributions, including scale-free topology of connections $P(k) \sim k^{-\gamma}$. We explain that the unattainability of the critical line in numerical simulations of classical random graphs is due to percolation phenomena. We suggest that recent findings of discrepancy between simulations and theory in directed random Boolean networks can have the same reason. We also show that in infinite scale-free networks the transition between frozen and chaotic phase occurs for $3 < \gamma < 3.5$. Since most of critical phenomena in scale-free networks reveal their non-trivial character for $\gamma < 3$, the position of the critical line in Kauffman model seems to be an important exception from the rule.

AKSOE 13.11 Wed 17:30 Poster G

Modeling of financial markets by the Poissonian-like multifractal point processes — •Bronislovas Kaulakys, Vygintas Gontis, Miglius Alaburda, and Julius Ruseckas — Institute of Theoretical Physics and Astronomy of Vilnius University, A. Gostauto 12, LT-01108 Vilnius, Lithuania

Recently we proposed and investigated Poissonian-like point processes with slowly fluctuating mean interevent time, driven by the multiplicative autoregressive stochastic equation [1]. The proposed model relates the power-law spectral density with the power-law distribution of the signal intensity into the consistent theoretical approach. The generated time series of the model are multifractal [2]. Here we present the comparison of the model with the empirical data of the trading activity for stocks traded on NYSE. This enables us to present a model, based on the scaled equation, universal for all stocks. The proposed model reproduces the main statistical properties, including the spectrum of the trading activity with two different scaling exponents and the waiting time distribution.

[1] V. Gontis and B. Kaulakys, Physica A **343**, 505 (2004); **382**, 114 (2007).

[2] B. Kaulakys, M. Alaburda, V. Gontis and T. Meskauskas, In *Complexus Mundi: Emergent Patterns in Nature*, Ed. M. M. Novak, World Scientific, Singapore, p. 277 (2006).

AKSOE 13.12 Wed 17:30 Poster G

Realized Volatility and Realized Covariance in Heavy-Tailed Financial Data — •Oliver Grothe and Christoph Müller — University of Cologne, Research Training Group Risk Management

Realized volatility and realized covariance have recently been used intensively for measuring and forecasting volatility and dependency of intraday financial data. For these estimators, nice convergence properties may be derived under standard assumptions. However, they face two important problems when actually working with high frequency financial data: market microstructure effects and heavy tails in return data. The former introduces a bias to the estimators, the latter may lead to infinite variances of the estimators. While recent research suggested several solutions to overcome the bias, the influence of heavy tails on the estimators remains mainly unexplored.

We analyze this influence and show that the standard estimators tend to get useless if the tail indices of return distributions approach values as commonly observed in financial data. However, we proof that other estimators such as the bipower variation remain accurate.

AKSOE 13.13 Wed 17:30 Poster G

A Chaotic-Dynamic View of Investment Risk in Emerging Economies — •Edgardo Jovero — University of Kent

A Chaotic-Dynamic View of Investment Risk in Emerging Economies by Edgardo Jovero (University of Kent, Canterbury, UK, email: ej34@kent.ac.uk) Dr. Hans Martin Krolzig (Thesis supervisor) An open-economy neo-Keynesian model is developed which highlights market power and price-setting behavior as a source of the indeterminacy and structural instability characterizing the risk environment in emerging markets. This should explain why countries, which constitute the whole of the emerging economies as a group, provide different country investment risks individually.

MSC (2000) : 91B62 (mathematical economics), 37N40 (complex dynamical systems in optimization problems) PACS code: 89.67.Gh (economics, econophysics) JEL classification: F43 (economic growth of open economies) Keywords: risk, foreign capital, emerging markets, neo-Keynesian economics, Hopf bifurcation

AKSOE 13.14 Wed 17:30 Poster G

Optimization of portfolios with longer investment period — •Uli Spreitzer[2] and Vladimir Reznik[1] — [1]WatsonWyattHeissmann Deutschland GmbH, Wiesbaden — [2]Beltios GmbH, Munich; 'on leave from institute'

We investigate the optimization of portfolios with the investment I done periodically (n-times) with a period Δt_1, and the investment is been hold after the last investment for a time Δt_2 much larger than $n\Delta t_1$. We show that, when using the μ - $k\sigma$ optimization for the portfolio one has to consider, that σ is time dependent. Considering different assets (shares) with the same $\sigma(\Delta t_2)$ the investment in the asset is preferable with the highest $\sigma(\Delta t_1)$. That means, that portfolio optimization with the measure of risk as μ - $k\sigma$ and the cost average effect holds best for assets with $\sigma(\Delta t_1)$ large and $s(\Delta t_2)$ small. Also this shows, that one should add a measure of risk for the investment process. With respect to Solvency II, this means, that different measures of risk for different business processes should be applied.

AKSOE 13.15 Wed 17:30 Poster G

On the problem of a suitable distribution of students to universities — •Christian Hirtreiter[1], Johannes Josef Schneider[2], and Ingo Morgenstern[3] — [1]Faculty of Chemistry, University of Regensburg, 93040 Regensburg, Germany — [2]Institute of Physics, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany — [3]Faculty of Physics, University of Regensburg, 93040 Regensburg, Germany

Since many years, the problem of how to distribute students to the various universities in Germany according to the preferences of the students remains unsolved. In a nowadays widely used approach, students apply for a place at various universities. The best students get then several acceptances, whereas some worse students fail everywhere. In the next step, the best students choose a place at their preferred

university, such that places suddenly become free for students, who received a rejection in the first step and who now get an acceptance. This scheme is iterated several times, each time takes some weeks. Then the semester has already started before some students get the acceptance letter. But for some subjects, like medical science, students can lose a whole year by this way. The former way of distributing students was to apply for a place at some preferred universities at a central agency called ZVS (Zentralstelle für die Vergabe von Studienplätzen). However, due to a strange rule set, many students ended up at universities which were not in their preference list. In this talk, we show how the rules for distributing students could be changed easily in order to increase the fraction of satisfied students.

AKSOE 13.16 Wed 17:30 Poster G

Correlation problem in economic capital issues of operatioal risk — •Chitro Majumdar — i-flex Inc.

In Operational Risk we need to estimate loss distributions for 56 Business-Event type combinations (7*8 matrix). Loss Distribution is a combination of frequency dist and severity dist. Each of the 56 cells will have their own frequency and severity dist. Now the problem is to aggregate the Loss Dist across different cells. Currently Basel II recommends simple addition but this is too conservative. So the problem is to determine correlation across Frequency and Severity dist. Currently in the industry there are no standard methods for severity dist aggregation. The practice is to use frequency dist aggregation. Aggregation of frequency is done using copulas. Gaussian/Frank/Gumbel and Clayton are some of the possibilities. But all of these would require estimation of some form of correlation. So the problem is how to find out this frequency correlation? volatility measures the uncertainty of returns, beta measures how much an individual asset is likely to move with the general market and Value at Risk, which is a recent innovation, measures the maximum loss (in the probabilistic sense) that is likely to be occurred in the immediate future. Given the distribution of the risk factors, their Tail Correlations and the Functional Relationship between Loss Metric for the Cluster and underlying factors, we perform a Monte Carlo simulation using Cholesky Factorization, to include correlation effects, to generate the Loss Distribution of the cluster.

AKSOE 13.17 Wed 17:30 Poster G

Mutations in the Three-Species Cyclic Lotka-Volterra Model on a Lattice — •Anton Winkler, Tobias Reichenbach, and Erwin Frey — Arnold Sommerfeld Center for Theoretical Physics and Center for NanoScience, Department of Physics, Ludwig-Maximilians-Universität München, Theresienstraße 37, D-80333 München, Germany

We study the effect of mutations on the dynamics of the three-species cyclic Lotka-Volterra Model, also known as the Rock-Scissors-Paper game, on a regular one-dimensional lattice. It is demonstrated that a simple real-space renormalization group approach is capable of capturing many of the features of the process in the vicinity of the unstable critical point, located at zero mutation rate. Care is taken in discriminating between mutations to the respective “predator” and “prey”, giving rise to two different renormalization group eigenvalues. The approach enables us to work out reliable scaling relations which are robust to a broad range of variations in the model.