AGSOE 3: Financial Markets and Risk Management II

Time: Monday 10:15–12:45 Location: BAR 205

AGSOE 3.1 Mon 10:15 BAR 205

The instability of downside risk measures — Istvan Varga-Haszonits[1,2] and •Imre Kondor[1,3,4] — [1]Eötvös University, Budapest — [2]Analytics Department of Fixed Income Division, Morgan Stanley Hungary Analytics — [3]Collegium Budapest — [4]Parmenides Foundation, Munich

We study the feasibility and noise sensitivity of portfolio optimization under some downside risk measures (Value-at-Risk, Expected Shortfall, and semivariance) when they are estimated by fitting a parametric distribution on a finite sample of asset returns. We find that the existence of the optimum is a probabilistic issue, depending on the particular random sample, in all three cases. At a critical combination of the parameters of these problems we find an algorithmic phase transition, separating the phase where the optimization is feasible from the one where it is not. This transition is similar to the one discovered earlier for Expected Shortfall based on historical time series. We employ the replica method to compute the phase diagram, as well as to obtain the critical exponent of the estimation error that diverges at the critical point. A comparison of the historical and parametric estimators is given. The analytical results are corroborated by Monte Carlo simulations.

AGSOE 3.2 Mon 10:45 BAR 205

GPU Accelerated Fluctuation Analysis and Complex Pattern Formation — •Tobias Preis[1,2], Peter Virnau[1], Wolfgang Paul[1], and Johannes J. Schneider[1] — [1]Department of Physics, Mathematics and Computer Science, Johannes Gutenberg University of Mainz - Staudinger Weg 7, D-55099 Mainz, Germany — [2]Artemis Capital Asset Management GmbH, Gartenstr. 14, D-65558 Holzheim, Germany

The compute unified device architecture is a fundamentally new programming approach for managing computations on a graphics processing unit (GPU) as a data-parallel computing device. With continuously increasing number of cores in combination with a high memory bandwidth, a recent GPU offers incredible resources for computational physics. We apply this revolutionary new technology to methods of fluctuation analysis, which includes determination of the scaling behavior of a stochastic process and the equilibrium autocorrelation function. Additionally, the recently introduced pattern formation conformity [T. Preis et al , Europhys. Lett. 82, 68005 (2008)], which quantifies pattern-based complex short-time correlations of a time series, is calculated on a GPU and analyzed in detail. Results are obtained up to 84 times faster than on a current central processing unit core. When we apply this method to high-frequency time series of the German BUND future, we find significant pattern based correlations on short time scales. Furthermore, an anti-persistent behavior can be found on short time scales. Additionally, we compare the recent GPU generation, which provides a theoretical peak performance of up to roughly 1012 floating point operations per second with the previous one.

AGSOE 3.3 Mon 11:15 BAR 205

Collective firm bankruptcies and phase transition in rating dynamics — •Paweł Sieczka and Janusz Hołyst — Faculty of Physics, Center of Excellence for Complex Systems Research, Warsaw University of Technology, Koszykowa 75, PL-00-662 Warsaw, Poland

We present a simple model of firm rating evolution and resulting bankruptcies, taking into account two sources of defaults: individual dynamics of economic development and ordering interactions between firms. We show that such a defined model leads to phase transition, which results in collective defaults.

Two phases can be observed in the system: the paramagnetic phase of independent bankruptcies and the ferromagnetic phase of collective behavior. The mean interaction between firms decides which of these two scenarios is realized.

AGSOE 3.4 Mon 11:45 BAR 205

Measure of default risk in insurance companies: Do ratings fail? — •Christoph Hamer, Heiko Frings und Ralf Engelshove — Solcency Fabrik, Dürener Straße 295, 50935 Köln

Recent events on the financial markets indicate the need for a better understanding of certain systematic behaviour pattern in networks of risk spread.

Our approach focuses mainly on the relations between insurances and reinsurances, especially on the correlation of defaults on the probability of further default risks. This includes bilateral dependencies as well as external ratings. The aim of our work is to derive a realistic Boolean representation of these interactions. We study cascades of defaults depending on network topologies and seek to support our results by real world data.

AGSOE 3.5 Mon 12:00 BAR 205

Risk properties of structured financial securities offered to the general public — •Martin Treiber — TU Dresden, Germany

In the last years, a multitude of derivative financial products have been offered to the general investor. This includes not only call and put warrants but also more exotic investment vehicles such as reverse convertibles, discount calls and puts, so-called "bonus certificates" or "outperformance certificates", and structured notes that guarantee a certain return at expiration date.

In this contribution, I discuss the risk profile of such products in terms of the return distribution function and, particularly, the value at risk. As a main result, I show that the risk profiles depend strongly on the assumptions for the return profile of the underlying asset. For a lognormal distribution (Black-Scholes ansatz), analytic return profiles are derived even for some of the more exotic products. However, with the inclusion of stochastic volatility, the risk profiles change drastically. This is particularly true for the popular "bonus certificates" as many investors experienced at their own cost, recently.

AGSOE 3.6 Mon 12:15 BAR 205

Nonlinear stochastic modeling of Tsallis statistics with application to financial markets — •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

The financial observables may be related to the superstatistical and Tsallis' statistical approaches. Superstatistical processes generated by driven Poisson processes [1] are long-range with the power-law distributions and may be useful for analysis of traffic, financial and other systems. Here we derive nonlinear stochastic differential equations [2] generating processes with q-exponential and q-Gaussian distributions, with the long-range power-law autocorrelations and $1/f^{\beta}$ power spectral density. We analyze properties of solutions of these equations in relation with the nonextensive statistical mechanics framework and relevance of the generalized and adapted equations for modeling of the financial processes.

[1] V. Gontis, B. Kaulakys, and J. Ruseckas, Physica A **387**, 3891 (2008).

[2] B. Kaulakys and M. Alaburda, J. Stat. Mech., to be published (2009).

AGSOE 3.7 Mon 12:30 BAR 205

Prediction of financial time series with the technology of high-order Markov chains — Vladimir Soloviev[1], Vladimir Saptsin[2], and •Dmitry Chabanenko[1] — [1]Cherkassy National University, Cherkassy, Ukraine — [2]Kremenchuk State Polytechnical University, Kremenchuck, Ukraine

In this research the technology of complex Markov chains, i.e. Markov chains with a memory is applied to forecast the financial time-series. The high-order Markov chains can be simplified to first-order ones by generalizing the states in Markov chains. Considering the *generalized state* as the sequence of states makes a possibility to model high-order Markov chains like first-order ones. The adaptive method of defining the states is proposed, it is concerned with the statistic properties of price returns.

The algorithm of prediction includes the next steps: (1) Generate the hierarchical set of time discretizations; (2) Reducing the discretization of initial data and doing prediction at the every time-level (3) Recurrent conjunction of prediction series of different discretizations in a single time-series. The hierarchy of time discretizations gives a possibility to review long-memory properties of the series without increasing the order of the Markov chains, to make prediction on the different frequencies of the series.

The technology is tested on several time-series, including:

EUR/USD Forex course, the World's indices, including Dow Jones, | S&P 500, RTS, PFTS and other.