AKSOE 3: Financial Markets and Risk Management I

Time: Monday 10:15–12:45 Location: EW 203

AKSOE 3.1 Mon 10:15 EW 203

Modeling and predicting financial data — •Joachim Peinke and Andreas P. Nawroth — Institute of Physics, Carl von Ossietzky University of Oldenburg, D 26111 Oldenburg, Germany

It is shown how based on given financial data stochastic equations can be extracted. Based on these equation a new method is proposed which allows a reconstruction of time series based on higher order multiscale statistics given by the hierarchical process. This method is able to model the time series not only on a specific scale but for a range of scales. It is possible to generate complete new time series, or to model the next steps for a given sequence of data. The method itself is based on the joint probability density which can be extracted directly from given data, thus no estimation of parameters is necessary. The results of this approach are shown for financial data. The unconditional and conditional probability densities of the original and reconstructed time series are compared and the ability to reproduce both is demonstrated. Therefore in the case of Markov properties the method proposed here is able to generate artificial time series with correct n-point statistics.

AKSOE 3.2 Mon 10:45 EW 203

Studies of the limit order book around large price changes — •Bence Toth[1,2], Janos Kertesz[2], and J. Doyne Farmer[3] — [1]Complex Systems Lagrange Lab, ISI Foundation, Torino, Italy — [2]Department of Theoretical Physics, Budapest University of Technology and Economics, Budapest, Hungary — [3]Santa Fe Institute, Santa Fe, USA

Most of the financial markets today are governed by a continuous double auction mechanism, with a limit order book containing the orders placed to buy or sell a stock. We study the dynamics of this limit order book of liquid stocks on the London Stock Exchange (LSE) after experiencing a large intra-day price change. Previous studies of Trade and Quote data[1] revealed interesting results about the volume, volatility and bid-ask spread for these periods. The analysis of the order book at the level of single orders gives insight to the the "microscopic" dynamics of price formation, especially to the role of liquidity thus it enhances our understanding of market risk.

[1] A.G. Zawadowski, G. Andor and J. Kertész, Quantitative Finance 6, 283-295 (2006)

AKSOE 3.3 Mon 11:15 EW 203

The hidden volatility process in financial time series — •Josep Perelló[1], Jaume Masoliver[1], and Zoltán Eisler[2] — [1]Departament de Física Fonamental, Universitat de Barcelona, Diagonal, 647, E-08028 Barcelona, Spain — [2]Department of Theoretical Physics, Budapest University of Technology and Economics, Budafoki út 8., H-1111, Budapest, Hungary

Volatility characterizes the amplitude of log-price fluctuations. Despite its popularity on trading floors, volatility is unobservable and only the price is known. Diffusion theory has many common points with the research on volatility, the key of the analogy being that volatility is a time-dependent diffusion coefficient of a random walk. We present a formal procedure to extract volatility from price data by assuming that it is described by a hidden Markov process which together with the price forms a two-dimensional diffusion process [1]. We derive an alternative maximum-likelihood estimate valid for a wide class of processes. We apply it to the exponential Ornstein-Uhlenbeck stochastic volatility model [2] since studies have shown its good performance in several aspects [3-5] and observe that it is able infer the hidden state of volatility [1]. The formalism is applied to the Dow Jones daily index.

[1] Z. Eisler, J. Perelló, J. Masoliver, Phys. Rev. E 76, 056105 (2007)
[2] J. Masoliver, J. Perelló, Quant. Finance 6, 423 (2006)
[3] J. Perelló, J.Masoliver, Phys. Rev. E 67, 037102 (2003)
[4] J. Perelló, J. Masoliver, Phys. Rev. E 75, 046110 (2007)
[5] T. Qiu, B. Zheng, F. Ren, S. Trimper, Phys. Rev. E 73, 065103 (2006)

AKSOE 3.4 Mon 11:45 EW 203

Characteristic times in limit order executions — •Zoltan Eisler[1,2], Janos Kertesz[1,3], Fabrizio Lillo[4,5], and Rosario N. Mantegna[4] — [1]Science & Finance, Capital Fund Management, Paris, France — [2]Department of Theoretical Physics, Budapest University of Technology and Economics, Budapest, Hungary — [3]Laboratory of Computational Engineering, Helsinki University of Technology, Espoo, Finland — [4]Dipartimento di Fisica e Tecnologie Relative, Universit'a di Palermo, Palermo, Italy — [5]Santa Fe Institute, Santa Fe, NM, USA

We present a study of the order book data of the London Stock Exchange. We study the first passage time of order book prices (i.e., the time needed to observe a prescribed price change), the time to fill (TTF) for executed limit orders and the time to cancel (TTC) for canceled ones. We find that the distribution of the first passage time decays asymptotically in time as a power law with an exponent $\lambda_{\mathrm{FPT}} = 1.5$. The quantities TTF, and TTC are also asymptotically power law distributed with exponents $\lambda_{\mathrm{TTF}} = 1.8 - 2.2$ and $\lambda_{\mathrm{FPT}} = 1.9 - 2.4$, respectively. We outline a simple model, which assumes that prices are characterized by the empirically observed distribution of the first passage time and orders are canceled randomly. The model correctly predicts that $\lambda_{\mathrm{TTF}} \approx \lambda_{\mathrm{TTC}}$, and one can estimate from empirical data that the directly unobservable lifetimes are also power law distributed with an exponent $\lambda_{\mathrm{LT}} \approx 1.6$.

AKSOE 3.5 Mon 12:15 EW 203

Predicting employment and pension levels for the G7 and China — •Hans Danielmeyer and Thomas Martinetz — Institute of Neuro- and Bioinformatics, Universität Bremen, Germany

The fundamental uncertainty of employment and pension policy was so far the lack of long term theories for the demand of the home floor, the productivity of the factory floor, and the return on investment. Our analytically closed solutions for both floors and available data from the life insurance business allow designing sustainable pension systems. For G7 level nations (1.3 bn people) in 2100 the mean life expectancy will be 105 years, and we predict a working time of 24 hours per week (60 years/48 hours before WWII, 45 years/96 hours at the start of the industrial society). A new method distributing paid work for sustainable pension systems must be found immediately. An exclusive (no intergeneration transfer) and collective pension fund controlling directly 33 per cent of the capital market will require an increase of the retirement age to 80 by 2100. The corresponding trade off depends only on the pension level as percentage of average income (40 per cent in the above example). China (1.4 bn people) will be in a comparable position in 2040-50.