SOE 23: Financial Markets and Risk Management III

Time: Friday 10:15–13:00 Location: H44

SOE 23.1 Fri 10:15 H44

Global risks from local behavior in markets — •Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen, Otto-Hahn-Allee, 28359 Bremen

Agent-based models [1] are particularly suited for studying the relationship between local agent behavior in markets and global dynamical consequences from their collective effects. Magnetic spin models [2] are perhaps the simplest such models which can relate to phenomena in real markets, as for example herding dynamics and the origin of stylized facts. I here review the state of the art of spin models in econophysics and discuss their application to modeling risk and crises in financial markets.

[1] E. Samanidou, E. Zschischang, D. Stauffer, and T. Lux, Agent-based models of financial markets, Rep. Prog. Phys. 70, 409 - 450 (2007)

[2] S. Bornholdt, Expectation bubbles in a spin model of markets: Intermittency from frustration across scales, Int. J. Mod. Phys. C, Vol. 12, No. 5 (2001) 667-674.

SOE 23.2 Fri 10:45 H44

Financial crises and the evaporation of trust — •Kartik Anand[1], Prasanna Gai[2], and Matteo Marsili[1] — [1]The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy — [2]The Australian National University, Crawford School of Economics and Government, Canberra, Australia

Trust lies at the crux of most economic transactions, with credit markets being a notable example. Drawing on insights from the literature on coordination games and network growth, we develop a simple model to clarify how trust breaks down in financial systems. We show how the arrival of bad news about a financial agent can lead others to lose confidence in it and how this, in turn, can spread across the entire system. Our results emphasize the role of hysteresis – it takes considerable effort to regain trust once it has been broken. Although simple, the model provides a plausible account of the credit freeze that followed the global financial crisis of 2007/8, both in terms of the sequence of events and the measures taken (and being proposed) by the authorities.

SOE 23.3 Fri 11:15 H44

How to Characterize Trend Switching Processes in Financial Markets — •Tobias Preis[1,2,3], Johannes J. Schneider[2], and H. Eugene Stanley[1] — [1]Center for Polymer Studies, Department of Physics, 590 Commonwealth Avenue, Boston, Massachusetts 02215, USA — [2]Department of Physics, Mathematics, and Computer Science, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55128 Mainz, Germany — [3]Artemis Capital Asset Management GmbH, Gartenstr. 14, 65558 Holzheim, Germany

Financial market fluctuations are characterized by many abrupt switchings on various time scales from increasing trends to decreasing trends—and vice versa. We ask whether these ubiquitous switching processes have quantifiable features analogous to those present in phase transitions, and find striking scale-free behavior of the time intervals between transactions both before and after the switching occurs. We interpret our findings as being consistent with time-dependent collective behavior of financial market participants. We test the possible universality of our result by performing a parallel analysis of transaction volume fluctuations.

15 min. break

SOE 23.4 Fri 12:00 H44

Tracking volatility with higher-order-correlation nonlinear filters — •Oliver Grothe — Department of Economic and Social Statistics, University of Cologne, Germany

A challenging task in financial risk management is the real-time estimation and tracking of hidden parameters of stochastic processes such as price processes. The classical way to estimate latent states is to apply the linear Kalman filter. When interested in sequential estimates of parameters, however, the filtering problem turns out to be nonlinear and thus nonlinear filters have to be applied. Developed for problems in physics and engineering, the basic idea of these filters is to linearize the nonlinear problems, leading to approximations of densities and equations. The computationally most attractive filters for real-time applications are the Gaussian filters.

However, Gaussian filters are not able to sequentially estimate parameters that are not linearly correlated with the measurement. In financial applications, such parameters are stock price volatility or variance, which are of central interest for risk management.

In order to nevertheless estimate such parameters, we extend the standard Gaussian filters with a higher-order-correlation update and the propagation of asymmetric dependence structures. We call this filter type higher-order-correlation filter. We show the validity of our approach in applying it to ultra-high frequency stock price data and to estimate parameters of an Ornstein-Uhlenbeck model.

SOE 23.5 Fri 12:30 H44

Simulation of market behaviour by means of a non-equilibrium molecular dynamics set-up. — •Simon Standaert and Jan Ryckebusch — Department of Physics and Astronomy, Ghent University, Proeftuinstraat 86, B-9000 Gent

To understand the non-Gaussianity of markets on an elementary level, we propose to use a Molecular Dynamics (MD) set-up, as this is a very elementary and well understood technique that can analyse the behaviour of interacting agents on a large scale.

In a normal MD simulation, the displacement of the agents is strictly random and Gaussian. To simulate a non-Gaussian random walk in a liquid-like environment, we propose to use out-of-equilibrium dynamics. This dynamics is achieved by a parameter that changes the size of the particles and thus the density of the system. Immediately after such a change, the system enters a period of non-equilibrium behaviour through the addition of kinetic energy.

We investigate this system because it can produce a deeper understanding of the mechanisms in a market that lead to the non-Gaussianity that is observed in real markets. We can reproduce the statistics of the volatility of the markets in our system and we are able to link our time of the simulation to real market-time via the correlation functions.

In our MD set-up we can attribute different characteristics to every single particle to maximize the heterogeneity of the system or we can simulate the behaviour of an index.