SOE 3: Financial Markets, Risk Management and Stochastic Processes

Time: Monday 11:15–12:00 Location: GÖR 226

SOE 3.1 Mon 11:15 GÖR 226

Grasping asymmetric information in price impacts — •Shanshan Wang[1], Sebastian Neusüss[2], and Thomas Guhr[1] — [1]Fakultät für Physik, Universität Duisburg–Essen, Lotharstraße 1, 47048 Duisburg, Germany — [2]Deutsche Börse AG, Frankfurt, Germany

The price impact for a single trade is estimated by the immediate response on an event time scale, *i.e.*, the immediate change of midpoint prices before and after a trade. We work out the price impacts across a correlated financial market. We then quantify the asymmetries of the distributions and of the market structures of cross-impacts, and find that the impacts across the market are asymmetric and non-random. Using spectral statistics and Shannon entropy, we visualize the asymmetric information in price impacts. Also, we introduce an entropy of impacts to estimate the randomness between stocks. We show that the useful information is encoded in the impacts corresponding to small entropy. The stocks with large number of trades are more likely to impact others, while the less traded stocks have higher probability to be impacted by others.

SOE 3.2 Mon 11:30 GÖR 226

Revealing evolution of the correlation structure in financial markets — •Anton J. Heckens, Sebastian M. Krause, and Thomas Guhr — Universität Duisburg-Essen, Lotharstr. 1, 47048 Duisburg

Complex systems are characterized by a variety of interactions and often produce a strong correlated behavior of their system components. Financial markets are particularly well suited as examples of such complex systems due to their abundance of data for the analysis of correlated phenomena. The correlated price development of various stocks massively increases the financial risk of even broadly diversified financial operators. Financial markets are showing a strong non-stationarity, which must be taken into account in the analysis of correlations. Münnix et al. [1] use correlation matrices over short time horizons, in order to analyze their dynamics with respect to their non-stationarity. Using a cluster procedure, it became apparent that there are longer quasi-stationary periods that are corresponding to so-called market states. Crises break up these structures due to their strong collective behaviour and therefore cause non-stationary periods. Here we present new developments to improve the clustering method concerning the quasi-stationarity of the market states.

[1] M.C. Münnix, T. Shimada, R. Schäfer, F. Leyvraz, T.H. Seligman, T. Guhr and H.E. Stanley, Identifying States of a Financial Market, Scientific Reports 2 (2012) 644.

SOE 3.3 Mon 11:45 GÖR 226

The north pole problem – Explaining asymmetry in repeated random rotations — Malte Schröder and •Marc Timme — Chair for Network Dynamics, Institute for Theoretical Physics and Center for Advancing Electronics Dresden (cfaed), TU Dresden

Imagine rotating a globe uniformly at random by applying an isotropic rotation R, resulting equally likely in any orientation of the globe. By definition, a given point like the north pole is mapped to any other point on the sphere with equal probability. Repeating the same random rotation twice (applying R^2), the north pole ends up on the northern hemisphere with 71% probability. This *north-pole-problem* was originally observed numerically [Marzetta et al., IEEE Trans. Inform. Theory 48 (2002)] and subsequently mathematically analyzed using measure theory [Eaton and Muirhead, Stat. Probab. Lett. 79 (2009)]. Here we provide an intuitive, geometric explanation for this phenomenon [Schröder and Timme, Phys. Rev. Res. 1 (2019)] by decomposing the isotropic rotation into two sequential elementary rotations and explicitly following the action of the rotation. The same geometric argument generalizes to higher dimensions $d > 3$ and also explains why the asymmetry is absent in $d = 2$ dimensions, is strongest in $d = 3$ dimensions and disappears again as $d \to \infty$.