SOE 22: Financial Markets and Risk Management II

Time: Friday 10:00–10:45 Location: ZEU 260

SOE 22.1 Fri 10:00 ZEU 260

Microscopic origin of the persistent order flows: microscopic data analysis — Yuki Sato[1] and •Kiyoshi Kanazawa[2] — [1]University of Tsukuba, Tsukuba, Japan — [2]Kyoto University, Kyoto, Japan

In financial markets, it is a stylised fact that the order flow exhibits persistence (or called the long-range correlation, LRC): if you observe a buy (sell) order, you will likely observe a buy (sell) order even in future. This character can be quantified as the power-law decay of the order-sign autocorrelation function $C(\tau) \propto \tau^{-\gamma}$. In explaining the origin of the LRC, the order-splitting hypothesis was proposed as a promising theory. Further, Lillo, Mike, and Farmer proposed a minimal stochastic model of order-splitting traders in 2005, showing a quantitative prediction connecting the relationship between the microscopic and macroscopic behaviour. However, the LMF quantitative prediction has not yet been verified in the lack of appropriate microscopic datasets. In this talk, we solve this long-standing econophysics problem by analysing a huge microscopic dataset in the Tokyo Stock Exchange market. We apply a strategy clustering to identify the set of splitting traders and then measure the power-law exponent α in the metaorder-length distribution for splitting traders. We finally verify the quantitative prediction of the LMF model ($\gamma = \alpha - 1$) by providing the scatterplot between α and γ.

SOE 22.2 Fri 10:15 ZEU 260

Collective Effects Relative to the Collective Market Motion in Financial Markets — •Anton J. Heckens and Thomas Guhr — Universität Duisburg-Essen, Lotharstr. 1, 47048 Duisburg

Financial markets are usually non-stationary and their dynamics is dominated by strong collective effects. We introduce new measures for collectivity derived from covariance and correlation matrices [1]. The largest eigenvalue of covariance and correlation matrices corresponds to the collective motion of the whole system. By removing the collective motion of the system as a whole, we detect a remaining collectivity which corresponds to the industrial sectors. We use risk-phase diagrams to compare the remaining collectivity with the market collectivity. The time evolution of the remaining collectivity shows a remarkable property as a potential precursor for the Lehman crash in 2008. As of 2015/2016 the collectivity in the US stock markets changed fundamentally. It is connected to trend shifts from smaller mean covariances or correlations to larger ones, especially in recent years. Hence, this new kind of collectivity is connected to systemic instabilities which appear more often in recent years according to our new measures.

[1] A. J. Heckens and T. Guhr, New Collectivity Measures for Financial Covariances and Correlations, Physica A: Statistical Mechanics and its Applications 604, 127704 (2022), arXiv:2202.00297.

SOE 22.3 Fri 10:30 ZEU 260

Quantifying the exposure of banking system to the propagation of supply chain shocks in large scale firm-level production networks — •Zlata Tabachová[1], Christian Diem[1], András Borsos[1,2], and Stefan Thurner[1] — [1]Complexity Science Hub Vienna, Josefstädter Strasse 39, A-1080 Vienna, Austria — [2]Central Bank of Hungary, Szabadság tér 9, 1054 Budapest, Hungary

The credit risk assessment is core to sound banking business and financial stability. Traditional credit risk and macro-prudential stress testing models using solely node-level financial information can not take the risk of supply chain (SC) contagion into account, leading to potential underestimation of risks. Recent crises such as pandemic or natural disasters have drastically revealed that the propagation of shocks along SCs can potentially lead to large financial losses of firms. Based on a unique country wide dataset, we simulate how an initial failure of firms spread along the SC leading to additional firm defaults and losses to banks. We first define a financial systemic risk index (FSRI) of a firm that measures financial losses due to the SC disruptions caused by failure of that firm. We show that a small fraction of firms pose sizeable risks to the financial system, affecting up to 16% of overall bank equity. Second, we calculate expected losses, value at risk and expected shortfall of banks with and without supply network contagion. Our simulations show that these risk measures can be underestimated by a factor of 4. This indicates that it is crucial for regulators financial systemic risk assessment to monitor SC shock propagation.