SOE 9: Economic Models

Time: Wednesday 11:30–12:45 Location: GÖR/0226

SOE 9.1 Wed 11:30 GÖR/0226

Macroscopic Stochastic Model for Economic Cycle Dynamics — •Eckehard Schöll[1,2], Sören Nagel[2,3], and Jobst Heitzig[2] — [1]TU Berlin — [2]Potsdam Institute for Climate Impact Research — [3]Zuse Institute Berlin

We present a stochastic dynamic model which can explain economic cycles [1]. We show that the macroscopic description yields a complex dynamical landscape consisting of multiple stable fixed points, each corresponding to a split of the population into a large low and a small high income group. The stochastic fluctuations induce switching between the resulting metastable states, and excitation oscillations just below a deterministic bifurcation. The shocks are caused by the decisions of a few agents who have a disproportionate influence over the macroscopic state of the economy due to the unequal distribution of wealth among the population. The fluctuations have a long-term effect on the growth of economic output and lead to business cycle oscillations exhibiting coherence resonance, where the correlation time is controlled by the population size which is inversely proportional to the squared noise intensity.

[1] S. Nagel, J. Heitzig, and E. Schöll: Macroscopic stochastic model for economic cycle dynamics. Phys. Rev. Lett. 134, 047402 (2025).

SOE 9.2 Wed 11:45 GÖR/0226

Kinetic theory re-examination of the mean-field theory of Santa Fe financial market model — •Taiki Wakatsuki and Kiyoshi Kanazawa — Department of Physics, Graduate School of Science, Kyoto University, Kyoto 606-8502, Japan

Understanding and accurately modeling the statistical phenomena observed in real financial markets remains a central challenge in econophysics. In particular, the Santa Fe model, where order events occur according to a Poisson process, has been widely used as a verifiable financial market model. Simulation results of the Santa Fe model clearly demonstrate that it can explain the statistical laws of real markets to a certain extent. However, previous theoretical explanations of these statistical laws, which relied on dimensional analysis and mean-field theory, are neither unique nor fully sufficient. Therefore, this study will re-examine the mean-field theory of the Santa Fe model using kinetic theory. This presentation provides a theoretical analysis of the bid-ask spread and reports on its scaling.

SOE 9.3 Wed 12:00 GÖR/0226

Hallmarks of deception in asset-exchange models — •Kristian Blom[1], Dmitrii E. Makarov[2], and Aljaz Godec[3] — [1]Institute of Theoretical Physics, University of Münster — [2]Department of Chemistry, The University of Texas at Austin — [3]Mathematical bioPhysics group, MPI for Multidisciplinary Sciences

Asset-exchange models, such as the Bennati-Dregulescu-Yakovenko money game, have emerged in econophysics as simple models that capture generic features of wealth dynamics. In the BDY game, the wealth of a single player undergoes a one-dimensional random walk. Because the exchange probability of losing and gaining money are equal, one may surmise that this walk is unbiased, but this is not the case: the boundary condition that each player's wealth cannot be negative introduces a loss bias because of the possibility that an exchange partner has zero wealth. This results in an exponential steady-state distribution. Here, we extend the BDY game by introducing probabilistic cheaters that can misrepresent their financial status with a given probability. Cheaters deceive their exchange partners by claiming that they have no money, enabling them to evade potential losses. In a system consisting of honest players and cheaters, we show how cheating alters the transient dynamics as well as steady-state distributions of wealth. We identify a threshold probability for cheating beyond which cheaters accumulate more than half of the total money. Additionally, we show under which conditions cheating becomes beneficial and establish the existence of a critical cheating probability at which the wealth of cheaters undergoes a second-order discontinuity.

SOE 9.4 Wed 12:15 GÖR/0226

Identifying higher order cascading failures in supply chain networks of a national economy — •Jan Fialkowski[1,2], Stefan Thurner[1,2,4], and Shlomo Havlin[3] — [1]Complexity Science Hub, Vienna, Austria — [2]Institute of the Science of Complex Systems, CeDAS, Medical University Vienna, Vienna, Austria — [3]Department of Physics, Bar-Ilan University, Ramat-Gan 52900, Israel — [4]Santa Fe Institute, Santa Fe, USA

Cascading Failure scenarios are a central concern for the design of complex systems. In financial and economic systems these cascading failures give rise to the notion of systemic risk, where the failure of a single entity leads to large disruptions in the entire system. Exhaustively examining the failure of larger sets of elements is difficult due to computational constraints. Here we study the recently introduced notion of economic systemic risk in national supply chain networks of firm-firm interactions. We use an empirical dataset of the ecuadorian economy, consisting of almost 100.000 firms and more than three million buyer-supplier links. Using a modification of the "Random Chemistry" method we can identify small sets of firms, whose simultaneous failure leads to failure cascades that are larger than would be expected from their individual failure cascades.We compare the final cascade size of the small sets of firms with the sum of cascade sizes of the individual firm failures and find pairs that are up to 260 times more destructive than the individual firms themselves. We also provide a classification of the underlying mechanisms leading to this strong increase of the final cascade size.

SOE 9.5 Wed 12:30 GÖR/0226

Overcoming the Prestige Trap: Modelling the Transition to Community-Led Academic Publishing — •Valentin Lecheval[1,2], Clémence Bergerot[1,3], Valerii Chirkov[1,2], Giuseppe Maria Ferro[4], and Daniel Rubenstein[4] — [1]Department of Biology, Humboldt Universität zu Berlin, Berlin, Germany — [2]Science of Intelligence, Research Cluster of Excellence, Berlin, Germany — [3]Charité-Universitätsmedizin Berlin, Einstein Center for Neurosciences Berlin, Berlin, Germany — [4]Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ, USA

The academic publishing industry is dominated by a few for-profit companies, resulting in the corporate capture of a substantial share of public funds that could instead support academia. While alternative publishing models are not lacking–community-led publishers offering diamond open-access, or directing article processing charges towards academic services–they suffer from reduced attractivity compared to their for-profit counterparts, possibly due to first-mover advantages and path-dependent reputational dynamics. Here, we introduce a multi-scale agent-based model depicting the joint dynamics of research groups and journals. The parameters of research groups dictate their preference for journals, weighting various attributes, such as reputation or community services–attributes that can depict for-profit journals, society-based journals, open-access mega-journals or predatory journals. We simulate the model on a wide range of parameters to investigate the conditions leading community-led journals to overcome path-dependent barriers and dominate the publishing landscape.