SOE 1: Tutorial: Dynamics of Economic and Financial Systems (joint session SOE/TUT)

This tutorial is aimed to introduce concepts and illustrate latest developments on the dynamics of economic and financial systems: non-stationary dynamics of correlations in financial markets, interpretable machine learning applied to electricity price dynamics in the context of transitioning to sustainable energy sources, and financial concepts connecting statistical physics and financial markets.

Participants are invited to continue the deep dive into the above topics at the symposium "Statistical Physics of Economic and Financial Systems (SYEF)" on Thursday at 9:30 (Audimax).

Organized by Eckehard Olbrich (Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany), Fakhteh Ghanbarnejad (Potsdam Institute for Climate Impact Research, Potsdam, Germany), and Philipp Hövel (Saarland University, Germany)

Time: Sunday 16:00–18:15 Location: H 1012

Tutorial SOE 1.1 Sun 16:00 H 1012

Non-Stationary Dynamics of Correlations in Financial Markets — •Anton J. Heckens — Universität Duisburg-Essen, Lotharstr. 1, 47048 Duisburg

Financial markets are strongly correlated complex systems. The internal processes in the markets constantly change, and the external effects on the markets do change as well. This implies that there is no form of equilibrium whatsoever, rather, the financial markets are highly non-stationary. This has a large impact also on the correlations of stock prices. Here, I focus on the non-stationarity of the correlation structure that the market as a whole shows. Obviously, systemic risk and its management are severely affected. However, the non-stationarity itself has a structure because quasi-stationary states emerge, disappear, reemerge. They are the different operational modes of the market, reflecting various changes and restructurings. I will give an overview of data-driven research in this field of econophysics for a general audience interested in complex systems, not exclusively for experts.

Tutorial SOE 1.2 Sun 16:45 H 1012

Exploring electricity price dynamics with interpretable machine learning — •Benjamin Schäfer[1] and Dirk Witthaut[2] — [1]Karlsruhe Institute of Technology (KIT) — [2]Research Center Jülich (FZJ)

Mitigation of climate change requires a fundamental transformation of our energy system. Power plants based on fossil fuels must be replaced by renewable power sources, such as wind and solar power. This energy transition (Energiewende) towards a sustainable energy system raises numerous complex challenges, as power generation becomes more uncertain, while simultaneously more operational data becomes available. Hence, data-driven approaches have become feasible and even necessary to fully understand the energy systems of today and tomorrow across all scales.

Machine learning and artificial intelligence can handle these enormous amounts of data but need to do so in a transparent way. Obtaining classifications or forecasts without explanations limits their use severely.

Within this tutorial, we will discuss the uses of machine learning in energy systems and review approaches to make initial 'black box' models transparent. As an application, we will consider electricity markets and price dynamics.

Tutorial SOE 1.3 Sun 17:30 H 1012

Rien ne va plus: Seemingly perfect bets and optimal portfolios, broken ergodicity, washed-out stylized facts and financial death by Black-Scholes option pricing — •Jan Nagler — Centre for Human and Machine Intelligence, Frankfurt

Let's walk the line, together, in this tutorial: From Kelly-optimal bets, blindfolded trading, volatility drag, and ergodicity, to universal power laws in financial markets. On the electronic blackboard, we will develop concepts in statistical physics suited for our guaranteed financial ruin, chasing a fundamental understanding of some concepts and how they are linked together.