

SOE 3: Economic Models

Time: Monday 10:15–11:45

Location: H11

SOE 3.1 Mon 10:15 H11

Generic catastrophic poverty when selfish investors exploit a degradable common resource — ●CLAUDIUS GROS — Institute for Theoretical Physics, Goethe University Frankfurt a.M.

The productivity of a common pool of resources may degrade when overly exploited by a number of selfish investors, a situation known as the tragedy of the commons. We examine the case that degradation is functionally dependent on total investments. The payoffs, which are independently optimized by each agent, are given by the balance between the return from investing in the common resource and the investment costs, which are a function of the agent-specific per-unit costs. The payoffs of most agents are shown rigorously not to scale as $1/N$, the result for cooperating agents, but as $1/(N^*N)$, where N is the number of agents. This scaling in the stationary state is denoted catastrophic poverty. A finite number of oligarchs may be present in addition, with the payoffs of the oligarchs remaining finite even in the large- N limit. The results hold under very general conditions for a wide class of models.

SOE 3.2 Mon 10:45 H11

Games in rigged economies — ●LUIS F SEOANE — Systems Biology Department, Spanish National Center for Biotechnology (CNB-CSIC), C/ Darwin 3, Madrid, Spain.

Modern economies evolved from simpler material exchanges into very convoluted systems. Today, a multitude of aspects can be regulated, tampered with, or left to chance; these are economic degrees of freedom (DOF) which shape the flow of wealth. Economic actors can exploit them, at a cost, and bend that flow in their favor. If intervention becomes widespread, microeconomic strategies can collide or resonate, building into macroeconomic effects. How viable is a *rigged* economy? How do growing economic complexity and wealth affect it? We capture essential elements of rigged economies with a simple model. Nash equilibria in tractable cases show how increased intervention turns economic DOF from minority into majority games through a dynamical phase. This is reproduced by agent-based simulations of our model, which allow us to explore scenarios out of reach for payoff matrices. Increasing economic complexity appears as a mechanism to defuse cartels or consensus situations. But excessive complexity enters abruptly into a regime of large fluctuations (resulting from non-competitive intervention efforts coupled across DOF) that threaten the system's viability. Thus high economic complexity can result in negative spillover from non-competitive actions. Simulations suggest that wealth must grow faster than linearly with complexity to avoid this large fluctuations regime. Our model provides testable conclusions and phenomenological charts to guide policing of rigged economies.

SOE 3.3 Mon 11:00 H11

Risk Preferences in Time Lotteries — YONATAN BERMAN¹ and

●MARK KIRSTEIN² — ¹King's College London — ²Max Planck Institute for Mathematics in the Sciences, Leipzig

An important but understudied question in economics is how people choose when facing uncertainty in the timing of events. Here we study preferences over time lotteries, in which the payment amount is certain but the payment time is uncertain. Expected discounted utility theory (EDUT) predicts decision makers to be risk-seeking over time lotteries. We explore a normative model of growth-optimality, in which decision makers maximise the long-term growth rate of their wealth as suggested by the framework of ergodicity economics. Revisiting experimental evidence on time lotteries, we find that growth-optimality accords better with the evidence than EDUT. We outline future experiments to scrutinise further the plausibility of growth-optimality.

SOE 3.4 Mon 11:15 H11

Macroscopic approximation for an agent based socio-economic model — ●SÖREN NAGEL¹, ECKEHARD SCHÖLL^{1,2}, and JOBST HEITZIG¹ — ¹Potsdam Institute for Climate Impact Research — ²Institut für Theoretische Physik, TU Berlin

We investigate an agent-based model for economic growth that contains an underlying social network in order to incorporate bounded rationality. To further extend the results presented in [1] we combine a moment closure approach for the economy and a stochastic differential equation approximation for the social choice. With this approach we can reproduce some characteristics of the original model like economic inequality, and we are able to link the business cycle oscillations to noise-induced excitation oscillations and coherence resonance.

[1] Yuki M Asano, Jakob J Kolb, Jobst Heitzig, and J Doyne Farmer. Emergent inequality and business cycles in a simple behavioral macroeconomic model. PNAS 118, e2025721118 (2021).

SOE 3.5 Mon 11:30 H11

Socioeconomic modeling of a fossil-fuel and renewable-energy based two-sector economy — ●PHILIPPE LEHMANN¹, ECKEHARD SCHÖLL^{1,2}, and JOBST HEITZIG¹ — ¹Potsdam Institute for Climate Impact Research — ²Institut für Theoretische Physik, TU Berlin

We study a stylized economic model to capture the influence of social dynamics on investment decisions in a fossil-fuel and renewable energy based two-sector production economy. For this purpose the socioeconomic model in [1] is extended to two sectors. Although this model is based on simple assumptions, it shows extensive complex dynamics which we illustrate graphically to reveal the underlying mechanism. This empirical approach allows us to draw several analogies to patterns of our real economy that challenge current econometric models.

[1] Yuki M Asano, Jakob J Kolb, Jobst Heitzig, and J Doyne Farmer. Emergent inequality and business cycles in a simple behavioral macroeconomic model. PNAS 118, e2025721118 (2021).