# SOE 4: Economic Growth and Longevity I

Time: Monday 11:30–13:00 Location: H37

SOE 4.1 Mon 11:30 H37

**Adaptability and growth of socioeconomic systems** — •Flavioaugusto Pinto Piabatto, Anselmo García Cantu Ros, Camila Flórez Bossio, Linda Krummenauer, Katja Voigt, and Jürgen P. Kropp — Potsdam Institute for Climate Impact Research, Potsfach 601203, 14412 Potsdam

The article offers a perspective on socioeconomic systems, worth for analyzing their adaptive dynamics and evolution. We represent socioeconomic systems from two functions -perspectives and productivity functions, to formalize the relations among the main descriptors of adaptability (sensitivity, susceptibility, vulnerability, resilience, coping and adaptive capacity). Adaptation occurs locally, from loops of transformations of insights and potentials into capacity. The creation of capacity to cope with vicissitudes of any type and size-including shocks-is carried out by a structure in charge of the qualification of socioeconomic systems. We show that the transformation of the productive structure of socioeconomic systems over the last two or three centuries has been the construction of the structure of qualification, the structure of adaptive capacity. We explore implications of Ksi for adaptation and growth.

SOE 4.2 Mon 11:45 H37

**Condensation of wealth and control in a network of firms** — •Sebastian M. Krause, Tiago P. Peixoto, and Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen, Hochschulring 18, D-28359 Bremen

A recent analysis of the global network of corporate control found a strongly-connected core of about 1300 large firms controlling up to 80% of the world economy [1]. An interesting question concerning this effect of control concentration is whether it arises due to purposeful strategies, or it is simply a byproduct of simple organization rules.

Here we show that a non-growth rich-get-richer phenomenon in a toy model of wealth flows suffices to forecast a strongly-connected core of rich firms controlling the rest of the system. We find that the distribution of wealth resulting from this dynamics is very broad, even if the substrate graph is random. The wealth distribution, together with the core-periphery structure arises out of a symmetry-breaking process, and is not unique for the same graph. The model has a single parameter controlling the overall relative profit due to dividends which, if increased, results in a broader wealth distribution and smaller controlling core of firms.

[1] S. Vitali, J. B. Glattfelder, and S. Battiston, The Network of Global Corporate Control, PLoS ONE 6 (2011) e25995.

SOE 4.3 Mon 12:00 H37

**Statistical mechanics of organizational growth processes** — •Hernan Mondani[1], Petter Holme[2], and Fredrik Liljeros[1] — [1]Department of Sociology, Stockholm University, 106 91 Stockholm, Sweden — [2]Department of Physics, Umeå University, 901 87 Umeå, Sweden

In this study we address the question of the origin of non-Gaussian, fat-tailed growth-rate distributions in organizational growth processes.

In particular, the remarkable feature that the probability distribution for the growth rate –i.e. how quickly the size changes – follows a non-Gaussian pattern, something unexpected in traditional approaches. In practice, this means that organizational size changes very little most of the time, but dramatically every once in a while.

This pattern shows up in growth processes of various unrelated systems, from bird migration dynamics to investments in mutual funds.

We verify the emergence of this pattern on real data from voluntary organizations in Sweden.

We implement a stochastic model on a contact network with influence-based time evolution. We simulate the model for different network configurations, and are able to reproduce the key features with this model.

We then construct a physical analogy to the model, motivated by the sociological concept of preference falsification. This allows us to find two distinct phases emerging in extreme cases of the control parameter.

**Keywords**: sociophysics, organizational growth process, tent-shaped distribution, complex networks, preference falsification.

SOE 4.4 Mon 12:15 H37

**Growth compulsion in the monetary system** — Christian Kimmich[1,3] and •Oliver Richters[2,3] — [1]Humboldt-Universität zu Berlin — [2]Universität Oldenburg — [3]Wissenschaftliche Arbeitsgruppe nachhaltiges Geld

The need for economic growth is underlined regularly in politics and most branches of economics, though in the 1970ies, fundamental thermodynamic arguments and system dynamics models gave first evidence of "the Limits to Growth". These economic constraints are today confirmed, e.g. by the strong correlation of rising energy consumption and greenhouse gas emissions with Gross domestic product (GDP). To solve this contrast, it is necessary to ask the question if and how our economy is reliant on positive growth rates. In our work, we specifically focus on the monetary order.

We investigate a simplified version of our current monetary system using a stock-flow-consistent system dynamics model of credit money creation, use and redemption. We distinguish between different behaviours of debtors and creditors and examine in each case the trend evolution of debts, deposits and the GDP. Integrating empirical data from economics, we derive the dominant scenarios and conclude that positive growth rates are crucial for the stability of the investigated monetary system. Finally, we motivate why this result can be extrapolated to existing monetary systems and present possible model extensions.

SOE 4.5 Mon 12:30 H37

**Can economic growth last?** — •Oliver Richters — Universität Oldenburg, Institut für Physik — Vereinigung für Ökologische Ökonomie

Many economist have no doubt about ongoing economic growth, as long as we shift to a "green economy" getting his energy supply from renewables. But if we assume – nowadays conservative – a world energy consumption growth rate of 2.3% per year, the power limits of solar radiation to earth are reached within less than 200 years, and even the harvesting of total galaxy throughput would just delay the run-out of energy supply by just one millennium. So let us focus on alternative technologies such as nuclear fission or fusion? Keeping in mind the principles of thermodynamics, every human activity finally ends up as heat. Using Stefan-Boltzmann law calculating earth temperature, the analysis shows why boiling oceans are not even 500 years away under the assumption of exponential growth – even neglecting "peanuts" such as the greenhouse effect. Discontent with this absurdity, more realistic growth schemes has to be taken into account. But all mathematically mandatory show growth rates dropping to zero in the long run, and it can be shown that this is then also valid for growth rates of GDP, that can not be completely decoupled from energy supply. A short insight is given into the significance this trend has for finance, economics, social security and the people on earth.

SOE 4.6 Mon 12:45 H37

**Can economics succeed with an inflationary scale (money) for predicting real progress in human life?** — •Hans Danielmeyer and Thomas Martinetz — Institut für Neuro- und Bioinformatik, Uni Lübeck

During the last 12 years we developed two independent sets of analytically closed solutions: One predicts real medium and long-term economic growth per capita with six relevant variables calibrated with biologically stabilized constants of the human species; the other quantifies short-term business cycles with six different variables calibrated within the inflationary monetary system.

Both sets are used here for separating the investment required for real structural growth from the zero sum game of speculative investment. This is impossible with the mathematical approximations of economic theory, but relatively easy with analytically closed solutions whose time derivatives and some integrals maintain constant parameters. We suggest an alternative to ever increasing but ineffective political controls of the global financial system. It compares the G7 life style with the natural order: the inherited human genome carries gigabytes of information, the destructible technical infrastructure carries kilobytes, money carries nothing.