SOE 12: Statistical Physics of Politics

Time: Wednesday 17:15–18:00 Location: GÖR/0226

SOE 12.1 Wed 17:15 GÖR/0226

Critical Dynamics govern the Evolution of Political Regimes — •Joshua Uhlig[1], Paula Pirker-Díaz[1], Matthew Wilson[2], Ralf Metzler[1], and Karoline Wiesner[1] — [1]University of Potsdam, Potsdam, Germany — [2]University of South Carolina, Columbia, SC, USA

The emergence and decline of democratic systems worldwide raises fundamental questions about the dynamics of political change. Contrary to the idea of a stable end point of liberal democracy, recent backsliding towards less democratic regimes highlights the non-stationary nature of regime evolution [1]. Here, we analyse the historical trajectories of countries within a two-dimensional regime space derived from the principal components of the Varieties of Democracy dataset [2]. We observe weakly non-ergodic dynamics unfolding in an effective landscape characterised by sparse and shifting basins of stability. Step sizes and waiting times follow heavy-tailed distributions near the critical regime, in which mean values appear to diverge, indicating intermittent and heterogeneous regime change. A continuous time random walk model [3] reproduces the dynamics of the three most recent decades with remarkable accuracy. Together, these results suggest that some aspects of political regime evolution follow universal stochastic principles, while remaining punctuated by unique historical pathways.

[1] P Pirker-Díaz et al., R Soc Open Sci. 12, 250457 (2025) [2] K Wiesner et al., R. Soc. Open Sci. 11, 240262 (2024) [3] R Metzler et al., Phys. Chem. Chem. Phys. 16, 24128 (2014)

SOE 12.2 Wed 17:30 GÖR/0226

The Statistical Physics of Political Voting in German Parliament — •Moritz Marpe[1] and Carolin Dylla[2] — [1]Technical University Berlin — [2]Freie Universität Berlin

We propose a singular value decomposition (SVD) of the German parliament voting records from 2021-2024 to answer the question of how polarised was the legislature during the Ampel administration? Arguably, political polarisation is expressed most prominently between elected representatives who can be stylised in a system of their behavioural voting patterns. We built on the work by Sirovich (2003) and Rees & Lee (2025) who analyse the partisan divide and political voting patterns in the US institutions using frameworks borrowed from statistical physics to investigate the degree of polarisation. Likewise we use the median voter theorem to identify *pivotal voters* tipping collective outcomes along mulidimensional political issues. We propose a SVD to identify the most common voting coalitions following Sirovich (2003) for the last full term of the German Bundestag. Our contribution transfers insights from the bipartisan US-system to a multiparty system in general and the German Bundestag in particular filling a vital gap in the quantitative research on political polarisation.

SOE 12.3 Wed 17:45 GÖR/0226

Analyzing political spaces to understand political realignment: The case of Switzerland — •Eckehard Olbrich[1] and Peter Achermann[2] — [1]Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany — [2]University Zürich, Zürich, Switzerland

The rise of right-wing populist parties and the preceding emergence of new left and ecological parties beginning at the end of the 70s in the last century if often as the emergence of a new conflict line ("cleavage") [1] related to the transition from industrial societies to post-industrial societies. A fully developed political cleavage corresponds to an alignment of divisions in three layers: 1) the socio-demographic structure (structural layer), 2) the prevalent attitudes, narratives and ideologies (ideological layer) and 3) the political parties and social movements. We will test the theory of new cleavage for the case of Switzerland by analyzing political spaces derived from geographically resolved data on public votes and elections. We would expect the appearance of a new cleavage to be reflected as a new dimension in the political space, thus roughly speaking increasing the dimensionality of the political space (de-alignment) while a subsequent decline of the dimensionality could represent a re-alignment in the sense that the older cleavage gets replaced. While we observe that re-alignment as a decrease of dimensionality in the data, the picture for the de-alignment appears more complicated.

[1] S. Bornschier et al. Cleavage Formation in the 21st Century: How Social Identities Shape Voting Behavior in Contexts of Electoral Realignment. Cambridge University Press, 2024.