Political Polarization in Legislative Branches

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Introduction

➢ Research objective: How does the social and political polarization evolve over time?
➢ Data-driven analysis:
  ○ We collect congress/parliament voting data of the countries including Sweden (2.4M votes), UK (3M votes) and USA (3.5M votes)
➢ Quantifying the social choices of competition and collaboration by mathematical models.
Partisan Alignment of Members of the U.S. Congress (2015)

Partisan alignment measured by the distance between parties’ centroids:

\[ A_{i,p} = \mathbb{E}_b |\mathbb{E}_i[V_i^{(b)} \delta_{i,p}] - V_i^{(b)}| \]

- Relative measure: if one party deviates, then both should move to the poles, but not exactly symmetrically because of the non-uniform population distribution.

- Members’ loyalty to the party does NOT always lead to polarization. Parties could align with each other on certain bills themselves.

- Mapping \((A_{i,\text{dem}}, A_{i,\text{rep}})\) to the diagonal, which is equivalent to PCA reducing the dimensions from two to one.

*Similar results for other countries are in the making*
Evolution of the Average Partisan Polarization

1900-2018 Monthly

1960 Kennedy defeating Nixon

1962 Cuban missile crisis

1993-2001 Clinton presidency

2001-2009 G. W. Bush presidency

1963 "I Have a Dream"

1980 Reagan defeating Carter

2009-2017 Obama presidency

1929 Great Depression

.941 Pearl Harbor

Political Polarization Workshop, Princeton University, August 9. 2019
Polarization increases as a general trend, but it decreases \textbf{within} each congress in the 70s and 80s.
Evolution within Each Congress (2 years term)

Period I (1969-1989) Polarization decreases

Period III (2001-2017) Polarization increases (seasonal plot)

Candlestick chart of open, close, max, min polarization of each congress

Year
We analyze millions of roll-call votes cast in the U.S. Congress over the past six decades to identify evolution of political polarization patterns.

Using the roll-call vote results, we quantify the level of polarization in the legislative branch of government over the last six decades.
The political polarization levels at ten evenly-distributed sampled time points exhibit an evolution of polarization patterns from one type of behavior to another.
Dynamic Social Competition Model

\[ x \in [0, 1] \] measures the current polarization, so the collaboration is measured by the complementary fraction of \( x \), i.e.
\[ y = 1 - x \]

\[
\frac{dx}{dt} = yP_{yx}(x, u_x) - xP_{xy}(x, u_x)
\]

simple symmetric transition functions:

\[
P_{yx}(x, u_x) = P_{xy}(1 - x, 1 - u_x)
\]

\[ = c \cdot x^a \cdot u_x \]

= **Evolution speed** \( \times \) **Impact of population belief** on the change of polarization \( \times \) **Perceived utility of competition**, 
(the benefit fighting against the other party on certain bills)


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