Simulating Electoral Systems: From open-list to single-member districts in Brazil

What We Do

- We compare observed electoral results in an open-list proportional system with simulated results of a single-member district majoritarian system.
- Main Idea: Open-list electoral systems provide a complete rank ordering of all candidatesparties in a race covering a large area.
- Thus we can observe a complete rank ordering of candidates-parties for any sub-area.

Why is it relevant?

- Comparing electoral systems is at the core of political science and political economy. However, most of the existing empirical evidence is derived from cross-country studies or observations of rare electoral reforms.
- Our approach allows us to hypothesize about potential changes and their impacts without waiting for rare electoral reforms nor relying on cross-country comparisons.
- Unlike the US, whole-scale change in the electoral system are often debated and sometimes implemented in other democracies, such as in Brazil.

From Open-List PR to Single-member districts

- Electoral results available by seção eleitoral (ballot box) allow for ranking reconstruction across any geographic area composed of one or more "sections".
- Key Features of the Brazilian Open-List System:
- Uniform ballot featuring all candidates in the state;
- Uniform rule for candidates' TV and radio time allocation in the state.
- How to deal with selection into candidacy?
- Cost of running for office in Brazil is relatively low; - Multiple candidates with little or no chance of getting elected;
- Assumption: Candidates in open-list would also run in single-member districts.

Discussion of Preliminary Findings

- Convergence of Electoral Systems
- Similarity in outcomes between the open-list proportional system and non-ideological simulated single-member districts
- Emergence of a Two-Party System
- Simulations indicate a natural formation of a two-party system when votes are aggregated by party
- Ideological Shifts and Political Dynamics
- Simulations show a shift towards more right-wing representatives



Figure 1. Brazilian electronic ballot box (Source: TSE)

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Electoral Districting

- We implement the McCartan and Imai (2023)'s Sequential Monte Carlo algorithm, which imposes:
- Similar population per district;
- Compactness;
- Preservation of administrative boundaries.
- Administrative boundaries used:
- Municipal boundaries;
- **Electoral zones** (Zonas Eleitorais), which are areas under the jurisdiction of an electoral notary.
- Outcome:
- 50,000 simulations converged to 1,102 unique districting maps;
- 70 districts in each map;
- Each simulated district has approximately 500,000 voters .



Figure 2. Voting Population within Municipality and Zone boundaries



Figure 3. Example of Simulated boundaries - Population balance ($\leq 5\%$)

Polmeth 2024, Riverside

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Assigning the Winners

- We propose a simple **allocation algorithm** to assign a winning candidate to each district in every map.
- Based on voters' revealed preferences (i.e., votes) aggregated in four different ways.
- Desirable features:
- 1. The winning candidate should reflect the electorate's relative preferences; and
- 2. The winning candidate should be assigned to the district with the highest possible support out of all other districts.

• Current ideia: Serial dictatorship-like

- Assign the candidate with the highest overall voting share among all possible representatives across all districts as the representative for the district where they had this highest share;

Cand/ Dist	C 1	C2	С3	C 4
D1	50%	25%	10%	15%
D2	35%	32%	15%	20%
D3	28%	30%	22%	20%

Iteration 2

Cand/ Dist	C2	C 3	C 4
D2	<u>32%</u>	15%	20%
D3	<u>30%</u>	22%	20%

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	Number c	of elected by pa	rty and idec	logy	
	Actual		S	mulated	
Party	Open-list	Individual rank	Party Agg.	Left-Right Agg.	Three Party Agg.
PL	17	9	52	12	16
РТ	11	9	15	Ο	11
UNIÃO	6	8	0	11	3
MDB	5	6	0	7	4
PSOL	5	4	2	Ο	4
REPUBLICANOS	5	5	1	8	11
PP	4	4	0	5	2
PODE	3	5	0	7	1
PSD	3	5	0	5	7
PSDB	3	7	0	8	1
CIDADANIA	2	1	0	2	1
PSB	2	3	0	Ο	2
NOVO	1	0	0	1	Ο
PSC	1	0	0	1	4
REDE	1	0	0	Ο	0
Solidariedade	1	2	0	Ο	1
PATRIOTA	0	1	0	1	0
РТВ	0	1	0	1	1
AVANTE	0	0	0	1	1
Total Right	50	52	53	70	52
Total Left	20	18	17	Ο	18

Note: Parties are allocated either as 'left' (red) or right' (blue) according to Bolognesi et al. (2022), or 'center-right' (light-blue). In column 2, 3, 4 and 5 we present the 70 candidates elected in the most number of simulated districting plans.

Bolognesi, B., Ribeiro, E., and Codato, A. (2022). Uma nova classificação ideológica dos partidos políticos brasileiros. Dados, 66:e20210164 McCartan, C. and Imai, K. (2023). Sequential Monte Carlo for sampling balanced and compact redistricting plans. The Annals of Applied Statistics, 17(4):3300–3323.



Initial Distribution (Non-ideological rank)

Iteration 1

Cand/ Dist	C 1	C2	C 3	C4
D1	<u>50%</u>	25%	10%	15%
D2	35%	32%	15%	20%
D3	28%	<u>30%</u>	22%	20%

Iteration 3

Cand/ Dist	С3	C 4
D3	<u>22%</u>	20%

Figure 4. Allocation Example

Results

References