On the Prevalence of Condorcet's Paradox

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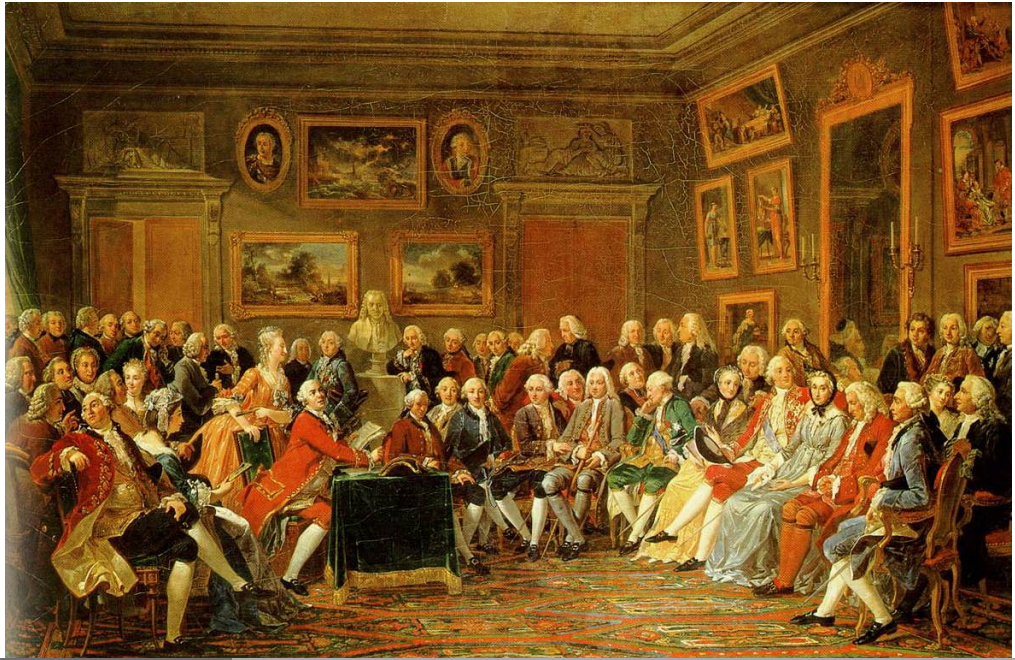
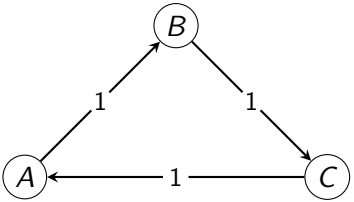


Condorcet Paradox

$P_1 : A \succ_1 B \succ_1 C$

$P_2 : B \succ_2 C \succ_2 A$

$P_3 : C \succ_3 A \succ_3 B$



- Electoral Stability (Black, 1948, 1958)
- Arrow Impossibility Theorem (Arrow, 1950)
- General Equilibrium Theory (Arrow and Hahn, 1971)
- Core Stability (Moulin, 2014)

"discordant", "anarchic", "pathological"
(see Miller (1983, p. 738ff)).

How often do cyclical majorities occur?

- Evidence from simulated data (IAC, IC): they occur quite frequently (Lepelley and Martin, 2001; Gehrlein, 2006; Sauermann, 2022; Pittel, 2025).
- Evidence from spatial models: they also occur frequently (McKelvey, 1976; Plott, 1967).
- Empirical studies of non-political elections (e.g. in academic institutions): they occur only rarely (Tideman, 2009; Popov et al., 2014).
- Single-case or single-country studies: they also report rare occurrences (Kurrild-Klitgaard, 2018; Munkøe, 2014; Darmann and Klamler, 2023; Potthoff and Munger, 2021; Maciel, 2024; McDonald et al., 2012).

Value Restriction, Single-Peakedness

Let the set of alternatives be $\mathscr{B} = \{\ell, c, r\}$. With restriction to anti-symmetric preferences:

$\ell \succ c \succ r$	$r \succ c \succ \ell$
$c \succ \ell \succ r$	$c \succ r \succ \ell$
$r \succ \ell \succ c$	$\ell \succ r \succ c$

Definition (Value restriction)

*In a triple (ℓ, c, r) there is some alternative, say c, such that all the concerned individuals agree that it is not worst, or agree that it is not best, or agree that it is not medium. (Sen, 2017, Def. 10*2)*

Research status and research desideratum

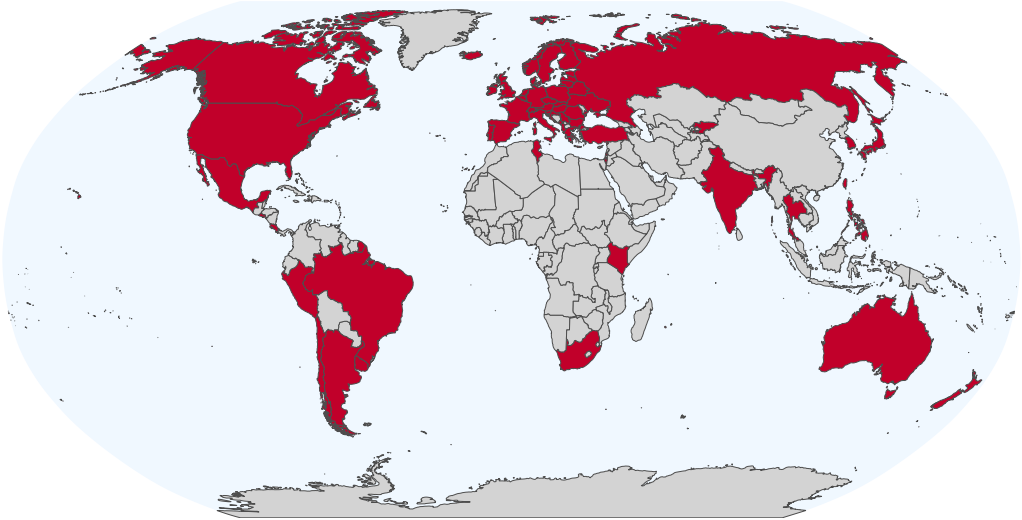
Van Deemen (2014); Sen (2017)

- The most recent survey concluded that its empirical relevance is far from settled (Van Deemen, 2014), largely due to a persistent lack of reliable data.
- Sen (2017, Ch. 10.2) highlighted the necessity of determining the relevance of Condorcet's paradox through a comprehensive empirical analysis as a basis for advancing discussions on electoral reforms. Such a study should ideally cover various points in time and different societies.

Data

- Data from the Comparative Study of Electoral Systems CSES.
- We assess data from 253 elections in 59 countries. In total, we have preference data from ∼450,000 individuals ($\varnothing = 1{,}780$).
- 212 parliamentary elections, 41 presidential elections.

Countries included in the CSES dataset



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Empirical strategy

From thermometer-style data to preference orderings

- The dataset includes party and candidate ratings on a non-ipsative 11-point like-dislike scale (*integer sympathy scales*) for up to nine political parties and candidates.
- 'Strategy-proofed data' (Abramson et al., 2009; Eggers and Nowacki, 2024; Núñez, 2025).
- Following an established procedure that was most recently applied by Lachat and Laslier (2024), we convert the ratings into individual preference orderings.

Example

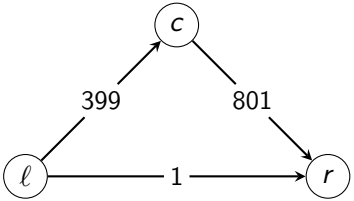
If voter i rates party A with $+2$, party B with $+4$, and party C with $+1$, this information is transformed into binary preference relations $B \succ_i A$, $A \succ_i C$. If a respondent rated two parties equally, we consider this as indifference.

Empirical strategy

Example

Consider the following artificially generated profile $\mathcal{R} = (R_1, R_2, R_3)$ consisting of 1,199 respondents (voters) drawn from a large population. Each respondent holds transitive preferences over three candidates: ℓ, c, and r.

$\lvert R_1\rvert =$ 600	$\lvert R_2\rvert =$ 400	$\lvert R_3\rvert =$ 199
ℓ	c	r
c	r	ℓ
r	ℓ	c



# of bootstrap replications	Condorcet winner
4,754	ℓ
5,246	$\emptyset$

Results

1. We do not find a single instance of a Condorcet paradox among the 212 parliamentary elections.
2. Among the 41 presidential elections, we identify one case of cyclical majorities, namely the 2011 Peruvian presidential election.

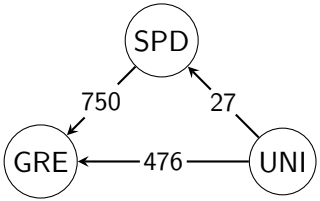


Figure 1: Germany 2013

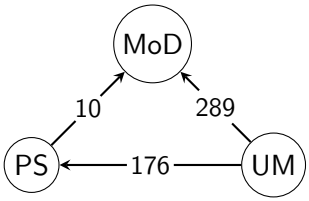


Figure 2: France 2007

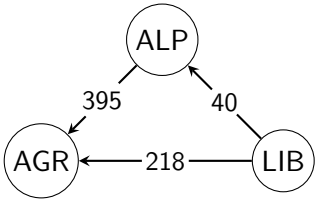


Figure 3: Australia 2019

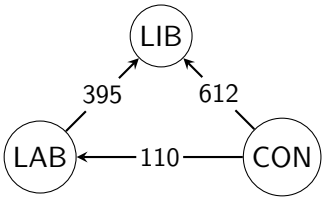


Figure 4: Great Britain 2015

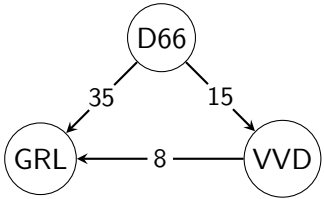


Figure 5: Netherlands 2017

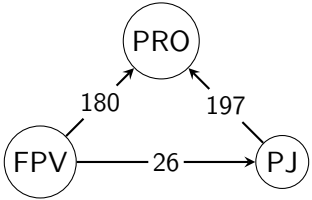
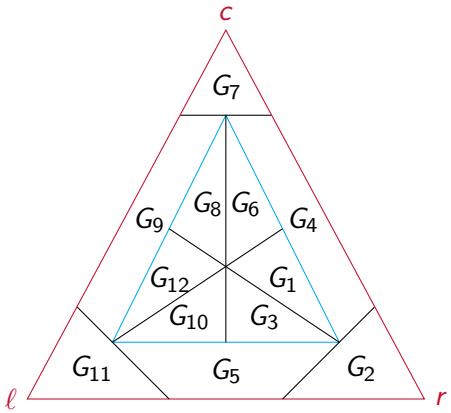


Figure 6: Argentina 2015

Statistical Inference
Approach

1. On each election, we run 10,000 **bootstrap** replications.
2. On each elections, we added a **random-noise** to the thermometer-data.



1. The overall pattern remains remarkably robust across all bootstrap replications.
2. In 198 out of 212 parliamentary elections, none of the 10,000 replications per case exhibits a cyclical majority.
3. In eleven cases, Condorcet cycles occur in fewer than one percent of the replications.
4. Exceptions: Peru 2011 (18%) and Iceland 2003 (11%).
5. A very similar picture emerges for the random-noise replications.

Note: While the party or candidate emerging as the Condorcet winner can vary across replications, what remains robust is the absence of cyclical majorities.

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Explanations

1. What explains the absence of cyclical majorities?
2. Why are the results robust even in cases with narrow margins?

How can we explain the results? Mixed regression model

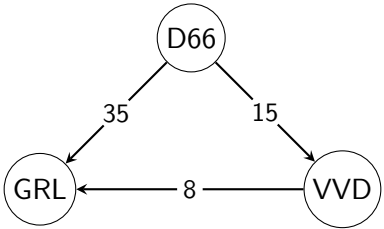
Party ratings on ideological distance between respondent and party

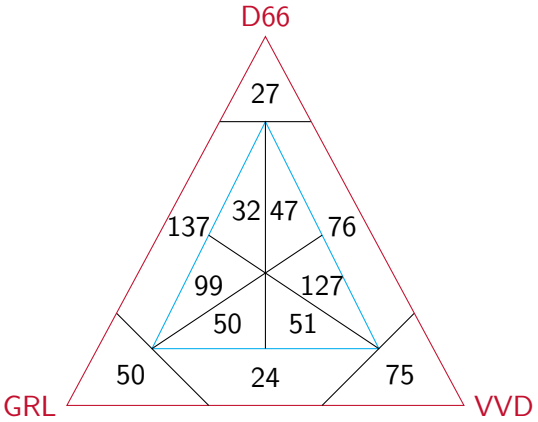
Fixed Effects	*Coeff.*	*Std. Err.*
Intercept	5.44***	0.067
Ideological distance	−2.32***	0.105
Random Effects	*Variance*	*Std. Err. (Var)*
Individual: Intercept	0.990	0.994
Election: Intercept	1.097	1.047
Election: Ideological distance	2.711	1.647
Residual	6.897	2.626
# Individuals		273,535
# Elections		249
# Observations (Individual × party)		1,763,372
Log-likelihood		-4,293,563
AIC		587,140
R^2 (cond.)		0.827
R^2 (marg.)		0.508

Significance: $*** \equiv p < 0.001$

Why are the results so robust?

The 2017 Dutch election as an example





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Condorcet Paradox $\neq$ No Condorcet Winner

Inner cycles instead of top-cycles

- A Condorcet winner in an election does not necessarily imply a transitive order (Sen and Pattanaik, 1969).
- Cyclical majorities can appear 'below' the Condorcet winner.
- In our analysis, we observe such cases four times, including the election in Finland in 2005, which is the only instance where no Condorcet loser is present.
- Overall, our findings indicate that collective preferences are **almost universally transitive**.
- On the contrary, in each election with κ alternatives on the ballot, we have $\binom{\kappa}{3}$ triplets. Summed across all elections, we analyse 8,099 triplets. Among these, we find cyclical majorities in five cases (0.06%).

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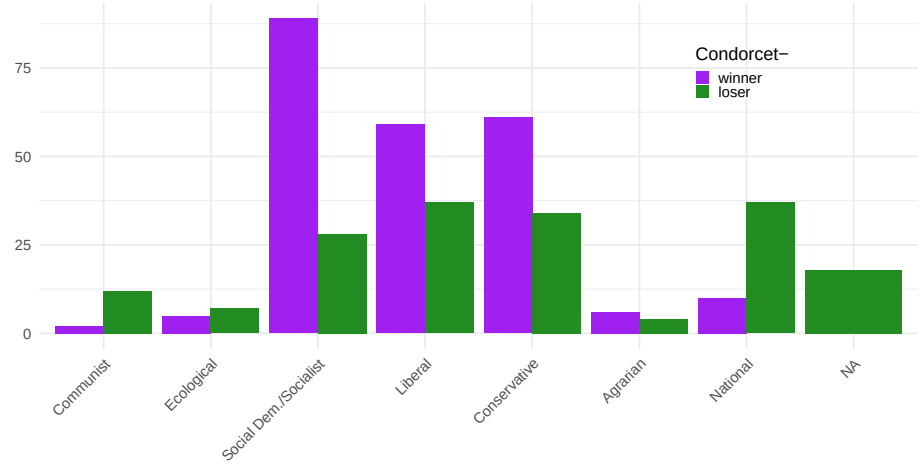
Robustness Checks

1. Political-Behaviour Weights (PBW)
2. Imputation

Results:

1. Considering PBWs: overall robust,
2. Peru 2011: Cyclical majorities vanish after considering PBWs.
3. Imputation: overall robust.

Who are the Condorcet winners? And what about Condorcet losers?



Condorcet Efficiency

Condorcet efficiency by type of election (parliamentary vs. presidential and by electoral systems.

	Parliamentary			**Presidential**
Condorcet Winner	Plurality	Proportional	Mixed	
	$N = 26$	$N = 135$	$N = 51$	$N = 41$
largest elect. party / candidate	68% *[51-81]*	61% *[54-68]*	82% *[72-90]*	79% *[67-88]*
prime minister/ president	88% *[73-96]*	66% *[58-72]*	73% *[61-82]*	78% *[64-87]*
part of government	92% *[78-98]*	89% *[84-93]*	98% *[91-100]*	
Condorcet Loser part of government / president	0%	13% *[11-23]*	6% *[3-19]*	2% *[0-11]*

Summary

1. We find a Condorcet winner in virtually every country and at every point in time.
2. Moreover, we are able to identify who these Condorcet winners are and the party families to which they belong.
3. Our results are encouraging in that Condorcet winners frequently succeed in becoming part of the governing coalitions.
4. However, the degree of Condorcet efficiency varies significantly between electoral systems.

Conclusion

- The Condorcet paradox is an iconic theoretical consideration, for which we do not find empirical relevance regarding the latently-existing preferences of individuals.
- Eminent scientists have recently advocated for electoral reforms in favour of the Condorcet method, even beyond the academic realm (Maskin and Sen, 2016, 2017b,a).
- With regard to candidate elections, our findings may encourage advocates of electoral reform in favour of simple-majority rules based on Condorcet's principle of pairwise comparisons.
- However, we adopt a more cautious stance when it comes to multi-winner elections, such as parliamentary contests.

Replication Files

- Please find our replication files on GitHub.
- Replication files available for R.
- Any comments appreciated!

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