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Alternatives to plurality rule for single-winner elections: When do they make a difference?

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Abstract

Declining levels of turnout and growing distrust in political elites are often seen as symptoms of a crisis of representative democracy. Various proposals of reform have been made to reinvigorate representation and political participation. This paper focuses on one aspect of that debate: finding an alternative to FPTP, which is the electoral rule most frequently used in single-member districts, but which is criticized, among others, for allowing only a limited expression of voters' preferences. Many alternative rules are in use or have been suggested, such as Two-Round majority, Instant Runoff, Approval Voting, Majority Judgement, or Range Voting. The literature on these decision rules has concentrated on their formal properties. Yet, we know surprisingly little about how frequently these rules would lead to different outcomes in normal electoral settings. This paper improves our understanding of these rules by examining their mechanical effects. We start from data on voters' party utilities from "real-world" settings, based on CSES data. This allows simulating and comparing the outcomes of different electoral rules under a variety of distributions of voters' party preferences. We then analyze how frequently they lead to different outcomes and identify the contextual characteristics that explain these differences. For the latter question, we focus on a number of party system or electorate's characteristics, which have been highlighted in debates on challenges to representation (such as ideological polarization, party system fragmentation, or affective polarization).

Keywords

Electoral systems, Condorcet winner, Condorcet efficiency, Polarization, Party system fragmentation

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Introduction

Single-member district elections are very frequent. They are the only option for the direct election of a President or Prime Minister, and they are used in many democracies for legislative elections. Among these, plurality or “First Past the Post” (FPTP) is the most common electoral rule (Farrell 2011). Yet, FPTP and other electoral systems commonly used for single-member districts, such as Two-round elections or Instant Runoff, have been criticized for a number of reasons. They create strong incentives for strategic behaviour, and the outcome may thus not necessarily reflect voters’ sincere preferences. Given the high effective threshold that they imply, many votes are also “wasted,” which can lead to alienation and discontent, lowering one’s sense of political efficacy among supporters of smaller parties or candidates (Banducci and Karp 2009). Also, systems in which voters can cast a single vote only allow for a limited expression of their preferences (Brams and Fishburn 1983, Laslier 2018, Balinski and Laraki 2020).

As majority and plurality elections can lead to electoral outcomes that are sometimes perceived as being unfair (Blais et al. 2021), proposals for electoral reforms have been debated in a number of countries. In the case of parliamentary elections, a radical change toward a system of proportional representation was experienced by many democracies at the turn of the twentieth century (Blais et al. 2004, Boix 1999), and some countries have moved more recently towards a mixed system, such as New Zealand in 1995 (Vowles 1995). But at least for presidential elections, this possibility does not exist. A different type of reform proposal, however, would be to opt for one of the many alternatives to more traditional majority or plurality rules for single-member districts, such as the Instant runoff (also called the Alternative Vote or Ranked Choice voting), Approval Voting, or Borda count, among others. Numerous arguments are advanced in favour of these systems. They offer voters more flexible options by allowing them to express their preferences for more than a single candidate. They are expected

to avoid wasted votes effects. Alternatives to FPTP may also be less susceptible to aggregation paradoxes such as vote splitting, Condorcet cycles, or non-monotonicity (Brams and Fishburn 2002). Some are also expected to lead to an outcome that is more consensual (Alós-Ferrer and Buckenmaier 2011, Baron et al. 2005) and to election tallies that provide a fairer image of the state of the electorate, in particular with respect to small candidates. Another critique raised against FPTP is that it does not account for the intensity of voter preferences (Baharad and Nitzan 2002). This argument builds on the ordinality versus cardinality debate in economic philosophy and social choice (Arrow 1950). It has led several authors to promote evaluative voting procedures (Hillinger 2005, Pivato 2014), that is, score systems with no other constraint than the chosen grading scale (procedures also known as Range Voting, Smith 2000), or systems like the Borda rule, which mimic evaluative voting but impose stronger constraints on the evaluations (Brams and Fishburn 2002, Fraenkel and Grofman 2014).

The goals of avoiding wasted votes and of allowing for a broader expression of citizens' preferences are in line with the general thrust of democratic reforms in recent decades, that favour more inclusive institutions (Bedock 2017). Furthermore, the potential benefits of alternative voting rules may extend to a possible reduction of negative campaigning and an increased turnout (e.g., Brams and Fishburn 1983). Given the important advantages that may result from a change away from the more traditional plurality or majority rules, a change in electoral rule could be a promising way to address a crisis of political representation. The implications of using one electoral system rather than other are thus potentially wide-ranging. We do not claim to address here all of these possible effects, but restrict our attention to one key element: the identity of the selected winner.

Different approaches have been followed in the literature to compare voting rules and their observed or expected outcomes: focusing on their theoretical properties (e.g., Arrow et al. 2010, Peress 2008), working with artificial data obtained from simulations (e.g., Gehrlein and

Lepelley 2011), or relying on experimental approaches, in the lab or as part of a survey, to study whether citizens change their choices under different rules (e.g., Blais et al. 2016, Dolez et al. 2011). For the Instant runoff, which is used in some countries (Australia, Ireland, and Malta) real political data are available and comparative analyses are possible (Bowler and Grofman 2000). But for other rules one must often rely on evidence from less important elections. Some studies have analysed the effects of rules based on real voter preferences, to assess how frequently they lead to different outcomes. But these are usually based on a limited number of elections, such as survey data collected in the context of single parliamentary or presidential elections (e.g., Darmann et al. 2019), or votes expressed in elections of professional associations (e.g., Regenwetter et al. 1998, Regenwetter et al. 2007). Yet, our understanding of how much difference the rules would make in practice is still limited.

In order to get a better sense of how frequently single-winner voting rules lead to different results, and to investigate the conditions under which these rules are likely to cast a different winner, it is necessary to consider a larger set of politically relevant situations. To that end, this paper simulates the outcomes of various electoral rules based on “real” distributions of citizens’ preferences, that is, party preferences as measured in national election studies. These data on voters’ preferences come from the Comparative Study of Electoral Systems (CSES) project. It covers a large number of countries and elections, allowing one to assess the effect of rules under a variety of possible distributions of voter preferences. Another important characteristic of our approach is that we focus on the electoral winners that would result from citizens’ *sincere* preferences. Outcomes resulting from different electoral systems can also differ due to the psychological effects of rules on voters or parties/candidates. But mechanical effects are the starting point, as effects on voters and parties correspond to their reaction to the anticipated mechanical effects (Blais et al. 2011). Discussions on the potential effects of electoral rules change thus require a better understanding of the rules’ mechanical effects.

With that approach, this paper compares the outcome of nine electoral rules (Plurality, Two-round, Alternative Vote, Evaluative voting, Borda count, two variants of Approval voting, and two variants of the best-median choice, Majority Judgement and Typical Judgement), as well as the Condorcet winner (CW), which we take as a reference point in some analyses. We assess how frequently the various electoral rules for single-member districts differ from one another, and which of these rules are more likely to lead to the same outcome. We also examine what context-level characteristics, such as the level of party system fragmentation or affective polarization, lead a rule to select a winner that differs from the CW or from the Plurality winner. Finally, in cases of such divergences, we investigate how alternative winners differ from one another in ideological terms.

Alternatives to Plurality

Plurality is probably the simplest and best-known electoral rule. Each voter can cast a single vote for one candidate, and the one with the most votes wins the race. The ballot structure in a *Two-Round system* is similar, with citizens casting a vote for a single candidate. There are different variants of that system, depending on what majority is required to be elected in the first round, and on the qualification rules for the second round. Here, we use the most common version of a two-round system, in which a candidate is elected directly in the first round if they secure an absolute majority of the votes cast. If no candidate reaches that threshold, the two candidates with the most votes qualify for the runoff, and the one that receives most votes in that second round is declared the winner.

The ballot structure is different with the *Instant Runoff*. Citizens are asked to rank the candidates in order of preference (the ranking does not have to be complete). If a candidate obtains an absolute majority of first preferences, they are elected. Otherwise, the candidate with the smallest number of first preferences is eliminated. The voters who had ranked the eliminated

candidate first have their second preferences added to the vote tally of the corresponding candidate. This process is repeated until a candidate reaches an absolute majority of votes.

Evaluative Voting is a system in which citizens give every candidate a score on a numeric scale. The sum of these scores is then computed for each candidate, and the one with the highest total score wins the election (Felsenthal 1989, Hillinger 2005, Baujard et al. 2014). Using this utilitarian counting is natural as a social choice criterion (Blais et al. 2022). Contrary to a system based on a ranking of candidates, citizens can give the same score to several candidates.

With the *Borda count*, citizens rank candidates in order of preference. For each ballot, this ranking determines how many points a candidate receives: with n candidates, the one ranked first receives $n-1$ points, the second candidate receives $n-2$ points, etc. These points are summed across all ballots and the winner is the candidate with the highest total.

With Approval voting, citizens can cast a vote for (or “approve”) one or several candidates (Brams and Fishburn 1978). The winner of the election is simply the one that was approved by the largest number of voters. Contrary to the other electoral rules that we consider, information on the voters’ preferences over the candidates is not sufficient to determine which ones they would approve. Although we generally assume that voters follow their sincere preferences, that criterion does not here define a precise behaviour because the voter still has to decide where to “put the bar” between approved and non-approved candidates. To fill this gap, we propose two variants of Approval voting, that are not two distinct rules but two distinct hypotheses on voters’ sincere behaviour under the Approval voting rule. The first one, which we label *Average Approval voting* postulates that a voter approves all candidates which she grades above the average grade that she gives to the candidates. The second one, which we label *Leader Approval voting* postulates that voters take as benchmark a candidate who is likely to win (the “leader,” here we take the plurality winner) and reason strategically with respect to the election of the leader (Brams and Fishburn 1983, Laslier 2009). That is, one votes for the leader if and only if

she prefers that candidate to its main challenger (here we take the second-ranked candidate in the plurality count) and she approves all candidates she ranks higher than the leader. The first hypothesis is in line with several attempts in the literature (Merrill 1979, Lehtinen 2010) to set in some ad hoc endogenous manner the threshold of approval within the voter's preferences. It tends to predict a large number of approvals per ballot. The second one is still "sincere" but more in line with a strategic theory of voting under Approval voting and tends to predict a number of approvals per ballot that is relatively low and more in line with observed data (Laslier 2019).

The last set of voting rules which we consider are highest median systems. Similar to evaluative voting, these rules require voters to grade each candidate in competition. But the evaluation is based on an ordinal scale, expressed in verbal rather than numerical terms. The possible evaluations could for instance be Excellent, Very Good, Good, Fair, Poor, To Reject (Balinski and Laraki 2020). The median grade of each candidate is determined. If one candidate has a higher median than all others, he wins the election. But in general, several candidates will share the same highest median, and additional criteria are required to distinguish among them. The simplest way to do that is called by Fabre (2021) the *Typical Judgment*: for each candidate with the best median evaluation, one computes the difference $P^b - P^w$ between the proportion P^b of voters who rated this candidate above the median grade and the proportion P^w of voters who rated this candidate worse than the median grade. The Typical judgment picks the candidate for whom this difference is maximal. The *Majority Judgment* makes a different computation (Balinski and Laraki 2011): one attaches to each candidate either P^b if $P^b > P^w$, or $-P^w$ if $P^b < P^w$; then by maximization, the chosen candidate is either the one with the largest P^b or the one with the lowest P^w .

Comparing the outcomes of electoral rules

In comparing the outcomes of these different electoral rules, we focus on the identity of the winning candidate.¹ So as to limit the number of contrasts between voting rules, we consider the divergences from two points of reference, the CW and the Plurality winner. The CW is probably the most straightforward reference, as it corresponds to a usual normative benchmark to evaluate voting rules (Regenwetter et al. 2006, Young 1988). As will be seen, except in some very rare cases (about 1% of the elections), the CW is well defined, so that we may consider a tenth voting rule that we simply label the *Condorcet rule*. The Plurality winner is also a relevant point of reference to understand in what contexts FPTP and alternative single-winner electoral rules lead to diverging outcomes.

As we explain in more detail below, we simulate the winners under different electoral rules based on voters' evaluations of the parties in competition. The data come from national election studies and are measured with like-dislike questions, expressed on 11-point scales. Using these data as our starting point to determine the potential winners under different electoral rules involves some assumptions and possible limitations.

First, we consider that they represent voters' sincere preferences about the set of parties they are asked to evaluate, and we also assume that sincere preferences are the only considerations that determine how they would vote under a specific rule. That is, when citizens have to select a single choice, they pick the one with the highest rating. And when the rule involves a rating or ranking of several parties, these are determined solely on the basis of the voter's evaluations (see below for how we break tied evaluations when ranking parties). In terms of the classical

¹ Although this is the most straightforward criterion to compare rules, additional analyses are possible, such as comparing the full ranking of candidates (Fabre 2011, Regenwetter et al. 2007).

distinction between mechanical and psychological effects of electoral rules (Duverger 1951), our comparison of the outcomes resulting from different electoral rules focuses on their mechanical effects. These are usually conceived as the effect of rules on the translation of votes into an electoral outcome, that is, the selection of the winner in a single-member district or the distribution of seats in a multi-member district. Psychological effects, in contrast, refer to how voters and parties/candidates adapt their choices and behaviour in anticipation of the mechanical effect (Blais et al. 2011).² Psychological effects on voters mean that individual choices are influenced by expectations about the distribution of preferences or choices in the electorate. This may influence the identity of the winner and thus the likelihood that two rules produce a different outcome. We do not consider such effects in this paper. In order to formulate expectations about how voters should react to anticipated mechanical effects, we first need to better understand what the latter effects could be.³

² Note that the exact definition of these effects would be somewhat different in our case, as we deal with voting rules that require a rating or ranking of all parties, rather than a discrete choice.

³ For the less common electoral rules, it is difficult to know how many citizens would deviate from their sincere preferences based on strategic considerations. We expect such strategic behaviour to be most frequent with Plurality voting, which is easiest for voters to understand, and which is likely to create the most straightforward strategic incentives. Estimates of the rate of strategic voting in FPTP systems vary a lot, ranging from 3% to 17% of strategic voters (Riera 2015). In Appendix C, we discuss how our results could be affected by strategic behaviour in Plurality systems. We simulate the outcomes of Plurality rule with different proportions of strategic voters (who deviate from their sincere preference if that candidate is not among the top-two contenders) and show that this reduces somewhat the frequency with

Second, it is important to qualify the nature of our simulated outcomes. We determine a winner for each election and electoral rule. For instance, we compute a prediction of a winner for the 2018 Italian election under Majority judgment. Yet, we do not view this as a prediction of how Italian citizens in that year would have voted in a nationwide election under Majority judgement. We know there are different limitations to our data and analysis: we have data about evaluations of parties rather than candidates; these evaluations can be missing for some parties; we ignore strategic incentives that could appear with certain decision rules both for parties and voters; etc. However, even if our data about voters' preferences are potentially incomplete and imperfect, we think it is still reasonable to assume that they offer a good image of how voters' preferences are distributed in various electoral contexts. We cover elections under a wide range of institutional and political contexts, which differ in terms of electoral rules, in the level of party system fragmentation, in the number and configuration of party blocks, or in the degree of ideological polarization, among others. This variation can be characterized in terms of several relevant context-level variables, allowing us to assess under which conditions some electoral rules are more or less likely to lead to different outcomes, when simulated on the basis of voters' sincere preferences.

Another potential difficulty is linked with missing data. The proportion of respondents who are unwilling or unable to evaluate a given party varies between both countries and parties. This proportion is usually small for the main parties (a few percentage points), but can be quite high for lesser-known parties. This is problematic as most of the voting rules that we consider require citizens to evaluate all parties in competition. As in previous experiments (Laslier and Van der Straeten 2004) we replace missing evaluations by the value 0, that is, the lowest possible

which Plurality does not select the CW, and the ideological distance between the Plurality winner and CW.

evaluation.⁴ This follows the most standard solution: In most implementations of the Alternative vote, incomplete ballots are allowed and non-ranked candidates are considered to be ranked last. In all proposed implementations of Approval voting a ballot is the list of approved candidates so that no distinction is recorded between not mentioned or not approved candidates.

The last limitation arises from the data being party *ratings*. As explained in more detail below, we start from respondents' party ratings on 0–10 like–dislike scales. For most voting rules, these data need to be transformed in order to form an acceptable ballot. For *Evaluative voting*, no transformation of these data is required, and we simply take the voters' evaluations as measured in the surveys.⁵ In the case of Approval voting (in both the “leader” and “average” variants), the raw evaluations are used to determine which candidates are approved, based on the rules described in the previous section. According to the advocates of the Majority judgment (Balinski and Laraki 2011), evaluations should be based on a limited number of categories, ideally 5 to 7. We group the grades given on the 0-10 scale in six categories: 0 (or missing), 1-2, 3-4, 5-6, 7-8, 9-10. The same recoding is used for the Typical judgement.

All other rules require a ranking of candidate preferences, either a full ranking of all candidates, or at least a possibility to break a potential tie among the preferred candidates. We systematically solve ties by adding a small random noise to the voters' stated evaluations and then creating a ranking of voters' preferences. Once individual preferences are expressed in the form of a ranking of candidates, it is straightforward to determine the winners of the remaining rules (Plurality, Two-round, Instant runoff, and Borda). These rankings also allow identifying

⁴ However, we exclude respondents who do not evaluate any of the parties (this corresponds to about 8% of the overall sample).

⁵ As previously noted, missing evaluations are replaced by the value 0, for all rules.

the CW (when one exists), which is the candidate who beats all other contenders in pairwise majority comparisons. Note that the presence of tied evaluations on the 0-10 scale may reflect the limitation of the measurement instrument, rather than true indifference. It might also follow from inconsistencies in how voters translate their underlying preferences in a series of distinct ratings. By adding a random noise to voters' evaluations in order to break ties, we are considering that voters are never perfectly indifferent between two parties. This approach seems meaningful given that several rules require voters to rank their preferences, at least among the most liked candidates. It also implies that cases of non-existence of a CW can only be due to the occurrence of a Condorcet paradox (cyclical majorities). As it adds a random element, however, we need to make sure that the observed differences are robust, which we do by replicating our analyses with varying random disturbances (see below).⁶

⁶ While breaking tied evaluations is required by some voting rules, another approach can be used when discussing the existence of a CW. If one considers that voters can be truly indifferent between two parties, two notions of a CW must then be distinguished. A strict CW is a candidate who is strictly preferred by a majority of voters to any other candidate. A weak CW, in contrast, is one who, in pairwise contests against each other candidate, is never defeated by a majority of voters. The distinction between strict and weak Condorcet winners becomes relevant when citizens are indifferent between (important) candidates. In a large electorate, a strict CW either does not exist or is unique, but several weak CW can exist simultaneously. The non-existence of a strict CW can be due to two different causes: either many voters being indifferent, or a Condorcet paradox. Given our treatment of tied evaluations, we only have strict CW. For a study making a similar empirical distinction, see Desai and Kalandrakis (2021) and Powell (2022).

Data

Our individual-level data come from the CSES project. We combine the Integrated Module Dataset (modules 1-4), that contains election studies from 1996 to 2016, and the fourth advanced release of the CSES Module 5, which includes elections in the years 2016 to 2020.

Party ratings were asked with the following question: “I'd like to know what you think about each of our political parties. After I read the name of a political party, please rate it on a scale from 0 to 10, where 0 means you strongly dislike that party and 10 means that you strongly like that party. If I come to a party you haven't heard of or you feel you do not know enough about, just say so. The first party is [PARTY A]. Using the same scale, where would you place, [PARTY B]? Etc.”

CSES modules 1 to 5 cover 216 elections in 57 countries. However, some of these cannot be included in our analyses, and we end up with a set of 188 elections (from 52 countries).⁷ In order to measure some of the context-level characteristics that may explain when rules cast different winners, we need additional information on political parties. We code their left-right position, as well as size (based on their electoral result in the corresponding election). Data on party positions are available in the CSES dataset, and correspond to the ideological position on a general left-right scale, as evaluated by the collaborators of the national election study. Parties' election results are usually also included in the CSES dataset. Manual corrections and additions were made wherever necessary.

In order to be more confident about the robustness of our findings, we take into account two sources of uncertainty. The first one is linked to how we transform party ratings into a ranking of party preferences. As mentioned, we do this by adding a random noise to the voters' stated

⁷ The list of countries and election studies can be found in Table A1 in the online appendix, which also explains which cases were excluded and why.

evaluations. This may influence the identity of the winner in a random way, in particular in cases where two (or more) top contenders tend to be equally liked among voters. To address that concern, we repeat this process several times, creating 1000 datasets for each election, based on different random disturbances. While this will not affect the identity of the winner for rules that are based on ratings alone (such as Majority judgement or Evaluative voting), it may influence which party wins under rules based on a party ranking.⁸ Furthermore, changing the random noises used to produce a candidate ranking can affect the identity (or existence) of the CW. As this is our key point of reference when assessing divergences from the CW, all rules are potentially affected.

The second source of uncertainty is linked with the limited size of our samples. Even if there were no tied evaluations in the population, the prediction about the election winner for a given election and rule could change if it were based on a different sample from that population. In other words, any difference between the simulated outcomes of two electoral rules could be due to random sampling variation, rather than to a genuine difference in the outcomes that these rules would produce if based on population-wide preferences. We address that problem by drawing 1000 bootstrapped samples for each election.⁹

⁸ It may also impact the winner under Leader approval: although primarily based on party ratings, it involves a comparison with the rating given to the plurality winner. In 29 of the 188 electoral contexts, the plurality winner varies across the replications. But even in these 29 contexts, this variation concerns only a minority of replications (14% on average).

⁹ When drawing bootstrapped samples, we keep the same random disturbances for all observations. As suggested by a Reviewer at this journal, an additional way to assess how certain we can be that two rules produce the same outcome would be to quantify the number of votes that would need to change in order to select a different winner.

Do all roads lead to the same winner?

The theoretical literature on voting rules has often put forward the possibility of a Condorcet paradox. This corresponds to a situation in which the aggregate candidate preferences are not transitive. In a three-way contest, this would imply that any of the three candidates would be beaten by another candidate in a head-to-head contest. While examples from real electoral contexts have been documented (e.g., Kurrild-Klitgaard 2001), it is not clear how frequent that phenomenon is. It is important for us to assess that first, as we wish to take the CW as a reference point when examining divergences between electoral rules. Based on our data, it turns out that a CW does exist in almost all elections. Out of 188 elections, only Italy in 2006 and Hong-Kong in 2012 do not have a CW, as the respondents' party preferences, as measured in the CSES data, exhibit a Condorcet cycle. The quasi ubiquity of Condorcet Winners becomes even clearer once we account for the fact that we have only limited samples of respondents. As discussed in the previous section, some of our findings could reflect random sample variation rather than genuine population characteristics. The presence (or absence) of a CW based on the sample party preferences is not necessarily a robust characteristic of the underlying population and context. As a matter of fact, when relying on the full set of bootstrapped samples, we notice that there is no single case in which we can confidently reject the presence of a CW. Out of 188 elections, 145 have a CW in all replications. As for the 43 remaining elections, it is only in a minority of bootstraps that a CW does not exist. In 32 of these 43 elections, there are fewer than 5% of bootstraps without a CW. There are only seven contexts in which the absence of a CW characterizes more than 10% of the replications: Iceland 2003 (11%), Romania 2009 (11%), Chile 2009 (13%), Chile 2017 (16%), Hong Kong 2012 (23%), Peru 2011 (27%), and Italy

2006 (30%). The overall proportion of cases in which a CW does not exist is about 1% (2016 out of 188,000, corresponding to the number of elections*bootstraps).¹⁰

These findings relativize the importance often attached to the possibility of a Condorcet paradox when discussing the pros and cons of various electoral rules. They are in line with studies suggesting that a CW often exists. Regenwetter et al. (2002: 178) note for example that “[majority] cycles are simply not as much of a problem in the real world as they might appear from the theoretical social choice literature” (see also Darmann et al. 2019), and Gehrlein and Lepelley (2011: 14) suggest that Condorcet’s Paradox “is probably not a widespread phenomenon.” These results also confirm the practical usefulness of relying on the CW as point of reference to analyze how frequently (and under which conditions) voting rules lead to a diverging outcome.

Next, we consider a basic but central question: how often, overall, does the voting rule make a difference? We consider nine voting rules (plus the CW) in 188 elections (each of them with 1000 bootstraps). For each pairwise set of rules, we compute the proportion of cases in which they cast a different winner. For a given election and dataset (i.e., bootstrap), the outcome of that comparison is dichotomous. Either both rules lead to the same winner, or they do not. We compute the percentage of cases in which two rules differ from one another, across all elections and bootstraps. The corresponding results, presented in Table 1, can be interpreted as a measure of dissimilarity.

[Table 1 about here]

¹⁰ Figure B1 in the online appendix shows the percentage of bootstraps without a CW, by election study.

In Table 1, each line and each column correspond to a voting rule. In the first line, we can for instance read that the Condorcet rule and the Plurality rule select a different winner in 22.6% of the cases, whereas the outcome of a two-round electoral system differs from the CW in 8.8% of the observations. The table is obviously symmetric, and the values of the diagonal (all equal to 0) are not displayed. These results show that the discrepancy is the smallest for the contrast between Two-round majority and Instant runoff, which differ only in 4.2% of cases. The most dissimilar rules are Plurality and the “Average” variant of Approval voting, which differ in more than 30% of cases. A rapid inspection of the table is sufficient to observe that any pair of rules lead to the same outcome in a large majority of cases. In almost two thirds of the cases (64.4%), all rules lead to the same winner. In other words, it is in approximately one third of the cases that the question “How to count votes” is relevant.¹¹

In order to provide a global picture of the family of voting rules we propose a graphical representation of the Table 1 data. We interpret each figure in the table as a distance and we look for a geometrical representation of these distances in a low-dimension Euclidean space. This is exactly what classical Principal Component Analysis does. It turns out that a two-dimension embedding is enough to render 81% of the inertia. Extracting a third dimension renders 88% of the inertia.¹² The location of the electoral rules on the first two dimensions is presented in Figure 1, whereas Figure 2 shows their location on the third and first dimensions.

¹¹ The proportion is about the same if we rely only on the main sample for each election. Without the bootstraps, all electoral rules select the same winner in 122 out of 186 contests (66%).

¹² The third axis essentially corrects an error of perspective about the position of the Mj point, which is not as central as it appears in Figure 1.

[Figures 1 and 2 about here]

The most striking result is that Plurality rule is an outlier, but some additional remarks are in order. One should first note that the axes in a Principal Component Analysis are endogenous. They have no a priori interpretation but they might receive ex post interpretation. In the present case one can see that the main axis distinguishes the rules according to the premium they give to the top-candidates in the voters' preferences. The Condorcet rule appears in a central position. On its right-hand side are rules like Plurality, Two-round, or Instant runoff, that target the candidates that appear on top of individual preferences. On the other side is the Borda rule, that weights in a linear way the ranked candidates. Other rules are intermediate in this respect, with the notable and interesting exception of Average approval (Am), which gives equal weight to some candidates at the top of one's ranking and zero weight to the next ones. But since competition is for the first place, giving no weight at all to the last candidates matters less than giving equal weight to the top ones, so that Average approval is placed even further away than Borda on the first axis.

Evaluative voting (a kind of utilitarian optimum) is closer to Condorcet than the Borda rule is, suggesting that, in their evaluations, respondents tend to distinguish more between the parties they rank high than between the parties they rank low. This is probably especially true for very low grades compared to very high grades: the first ones should be often granted to several parties and the second ones only to one or two. This pattern might further explain why Average approval voting is found at the extreme left of the picture: If the individual distributions of evaluations are right-skewed then approving above the average implies approving a lot and therefore not making distinctions between well-evaluated candidates. But notice that Leader Approval voting is, on the contrary, close to Condorcet, a fact that is easily understood in view of the individual behaviour captured in the definition of this rule. By definition, individual

approvals embody a pairwise comparison with a serious candidate. For this paper we chose the plurality winner as the benchmark candidate. But the result would certainly be the same with any other serious candidate and even if different voters would rely on different benchmarks to determine which candidates are deemed “serious.” This observation is first a reminder that the results of Approval voting really depend on how the voters behave, and second a rejoinder to the claim (Brams and Fishburn 1983, Laslier 2009) that strategic forms of approval voting (i.e., where citizens’ decisions about which candidates to approve are guided by their expected impact on the election outcome) tend to elect Condorcet candidates.

The two variants of median-based evaluation schemes that we propose do not differ with respect to individual behavior but merely to the counting of ballots. In view of their definitions, the distinction between the two variants seems tiny, and is difficult to interpret since it only relies on different ways to “break the tie” between candidates with the same collective evaluation. But the actual difference between these two variants (about 10% of cases, see Table 1) is in fact of the same order of magnitude as the difference between rules based on different principles. We have no intuitive interpretation of this phenomenon but this is at least a reminder that, with respect to counting ballots, apparent minor details can be important.

In what contexts do rules diverge from the Condorcet winner?

In the second part of our analyses, we consider under which conditions some rules are more likely to select different winners. Given the number of rules under consideration, many contrasts could be investigated. Here, we focus most of our attention on divergences from the outcome of the Condorcet rule. In other words, we assess the Condorcet Efficiency of electoral

rules, that is, the proportion of cases in which a rule selects the CW.¹³ This appears to be a good point of reference, given both its normative importance and its centrality on the main dimension structuring differences between voting rules, as identified in the previous section. In addition, we will also consider divergences from the Plurality winner.

The literature on Condorcet Efficiency has investigated differences between rules, as well as the contextual characteristics that increase or decrease a rule's efficiency. Regarding the differences between rules, several studies have shown that the more usual rules for single-member districts, in particular FPTP, tend to have a lower level of Condorcet Efficiency (e.g., Gehrlein and Lepelley 2011, Merrill 1985). As seen in the previous section, however, deviations from the CW concern only a minority of cases, even for the plurality rule. We would thus like to better understand what features of the context may facilitate the selection of the CW. In the literature, a common expectation is that voting rules are more likely to be Condorcet Efficient if the electorate is more homogeneous (Gehrlein and Lepelley 2011, Regenwetter et al. 2002, 2006). Regenwetter et al. (2002), for instance, show that while FPTP is very likely to identify the CW with a homogeneous electorate, failures to do so become more frequent as diversity of preferences among voters become larger. Gehrlein and Lepelley (2011) also show how social heterogeneity, in terms of the fragmentation of the electorate into segments with different preferences, lowers Condorcet Efficiency. Along similar lines, Merrill (1985) investigates the outcomes of different electoral rules, with simulated electoral contexts, that vary in terms of the distribution of voters' preferences and of the number and positions of the candidates. He shows

¹³ An alternative benchmark that has been used to assess the efficiency of voting rules is the winner of Evaluative voting. This is the candidate that receives the highest average evaluation, and thus maximizes the average "social utility," leading to a criterion of Utilitarian Efficiency (e.g., Green-Armytage et al. 2016, Merrill and Tideman 1991).

that the context features that tend to influence Condorcet Efficiency usually have an effect in the same direction for various rules.¹⁴ That is, some contexts make it generally harder, or easier; to identify the CW. However, the magnitude of the effects varies strongly between rules, and he finds that the usual plurality/majority rules (FPTP, Two-round, Instant Runoff) are more strongly influenced by contextual factors. He finds that Condorcet Efficiency improves when there are fewer candidates in competition, when the electorate is less polarized, and when candidates are more polarized. The negative effect of voters' ideological polarization is in line with the expected negative impact of social heterogeneity. In contrast, the other effects are rather due to the centrist CW being "squeezed" by its competitors – which is more likely if the party system is fragmented and if parties are closer to the center (i.e., less polarized). Yet, these results are also a product of the strong spatial assumptions made to simulate the electoral outcomes in the study of Merrill (1985, see also Adams 1997).

Building on that research, we investigate the variation in Condorcet Efficiency between electoral contexts. In general, we expect more frequent divergences from the CW with rules that select a winner on the basis of the voters' top preferences. As the CW is typically a more consensual choice, but not necessarily one that is among the voters' top preferences, it should be less likely to win with rules that ignore relative preferences among lower-ranked candidates. This is the case of the more commonly used single-winner electoral systems, in particular Plurality, but also Instant runoff and Two-round systems.

Next, we take three forms of polarization into account. The first is *party system polarization*. This corresponds to the degree to which the various parties in competition take ideological positions that are more distant from one another. We measure party system polarization as the

¹⁴ He includes five of the rules considered here (Plurality, Two-round, Instant runoff, Borda, Average approval), as well as the Coombs rule.

weighted standard deviation of the parties' left-right positions, weighted by their vote share, and using the left-right party placements provided in the CSES dataset. Second, we include a measure of *ideological polarization among voters*, by computing for each election the standard deviation of the respondents' ideological self-placements on a left-right scale. Next, we also consider *affective polarization*, which receives increasing attention in study of voters' preferences and behaviour. Affective polarization refers to the degree to which citizens' evaluations of the parties are polarized (Iyengar et al. 2012, Wagner 2021). This is conceptually distinct from ideological polarization, as it depends on the distribution of voters' party evaluations, not of their left-right positions. We measure affective polarization at the individual level, by taking the standard deviation of a voter's party evaluations. We then take that variable's average as our measure of election-level affective polarization. Ideological polarization among voters, and affective polarization, can both be seen as direct or indirect indicators of social heterogeneity.

Besides polarization, we also account for party system fragmentation. This is measured as the *effective number of electoral parties* (ENEP, Laakso and Taagepera 1979), which is a count of the number of parties, weighted by their share of votes.¹⁵ We expect the more usual majoritarian systems to be more likely to diverge from the CW with increasing party system fragmentation. In the extreme case of a very strongly concentrated party system, dominated by two parties, the CW (and winner of the plurality rule, for instance) would be one of them. As the effective number of parties increases, possible divergences become more likely.

Last, we should stress that identifying the CW should be easier when citizens' preferences clearly favour one candidate over the others. If a candidate has a very large lead over its

¹⁵ The vote shares used to calculate this index are those in the election for which the CSES election study was conducted.

opponents, it is likely to win whatever the electoral rule is, and to also be the CW. In some additional analyses (see below), we assess that factor by computing the expected *victory margin of the plurality winner*. That is, we take the difference between the predicted vote share of the plurality winner (expressed as a percentage), and the predicted vote share of the plurality runner-up. However, we do not include it in the main series of analyses, as the nature of that variable is somewhat different: the victory margin is part of the results that we would like to explain.

We estimate the effect of the four central context-level characteristics on the *likelihood of divergences from the CW* (that is, the opposite of Condorcet Efficiency) for each of the nine electoral rules. We specify a logistic regression model, estimated with the pooled dataset of all elections and bootstrapped samples.¹⁶ In order to account for the true level of uncertainty around the estimated effects, and to account for the non-independence among the bootstrapped samples, we estimate robust standard errors, clustered by election. The corresponding results are presented in Table 2.¹⁷

[Table 2 about here]

¹⁶ As we focus on divergences from the CW, we ignore cases (i.e., bootstraps) in which there is no CW. The total number of observations is thus a little bit lower than the theoretical maximum of 188,000 (188 elections with 1000 bootstraps each).

¹⁷ The paper's online appendix presents descriptive statistics for the context-level variables (Table B.1), bivariate correlations with the divergences from the CW for the various electoral rules (Table B.2), as well as two replications of the Table 2 models: when adding the victory margin of the plurality winner (Table B.3), and when using multiple samples based on a varying random seed, rather than on a bootstrapping procedure (Table B.4).

First, we find a clear effect of party system fragmentation. It has a positive and significant effect for seven of the nine rules (the exceptions being Evaluative voting and Borda count). A larger number of parties in competition is associated with more frequent divergences from the CW. This is in line with the results of Merrill (1985), but is based here on simulations relying on “real” distribution of voter preferences. Furthermore, we observe that the effect is particularly strong for the most common rules, in particular Two-round and Instant runoff.

We also observe that the commonly used rules (Plurality, Two-round, Instant runoff) are more likely to result in the choice of a non-Condorcet Winner when polarization is stronger. Yet, among the various forms of polarization that we have considered, only party system polarization seems to matter.¹⁸ It leads to more frequent divergences for all three “usual” single-winner rules, as well as in one of the two variants of Approval voting.

The magnitude of these predicted effects of polarization and fragmentation is far from being marginal – at least in the case of the plurality rule, for which deviations from the CW are more frequent. Figure 3 shows some predicted probabilities of selecting a winner different from the CW, as a function of the degree of party system polarization and party system fragmentation, for two rules (Plurality and Instant runoff). These predicted probabilities are computed for a range of values of the independent variables going from the 25th to the 75th percentile. The effects are of a larger magnitude in the case of the plurality rule, as FPTP is the rule that deviates most often from the CW.

¹⁸ The point estimates for the effect of ideological polarization at the level of voters is negative for all rules, but is estimated with a lot of uncertainty. It is only in the case of the average Approval rule that it has a significant effect.

Another way to compare the outcomes of the various electoral rules is to compare the ideological position of the winner that they select with that of the CW. Table 3 shows the average absolute left-right difference, by electoral rule (based on the pooled bootstrapped samples).¹⁹ The first column is based only on those elections in which a rule selects a winner that is not the CW. In such cases, the average (absolute) distance to the CW lies between 2.2 and 3 points on the 0-10 left-right scale. Plurality stands out as an outlier, with the largest average distance to the CW (about three points), which is substantially larger than the follow-up rule. The second column of Table 3 shows again the average absolute distance to the CW, but this time taking all elections into account, even when a rule would choose the CW. This latter series of results thus reflect both the frequency and magnitude of ideological divergences. This makes the gap between plurality and the other rules all the more apparent. On average, the party elected under the Plurality rule stands about 0.64 points away from the CW, whereas this gap is at most half as large with the remaining electoral rules.

[Figure 3 about here]

[Table 3 about here]

Last, we briefly comment on two additional series of analyses. First, as mentioned above, we have replicated the main series of analyses while adding the victory margin of the Plurality winner. These results, presented in Appendix Table B.3, show as expected that a larger lead for the Plurality winner makes divergences from the CW less likely. The second additional set of

¹⁹ Here, we only focus on the absolute left-right distances. However, interested readers can find the average ideological differences (i.e., not the absolute ones) in Appendix Table B.5.

No clear patterns emerge from these additional results.

results focuses on divergences from the *Plurality* winner. For reasons of space, the detailed results are again included in the online appendix. Table B.6 presents results from a series of logistic regression models, estimating which contextual characteristics make divergences from the Plurality winner more likely. The model in the first column, which deals with divergences between the Condorcet and Plurality rules, is identical with the equivalent model of Table 2. It shows again that these two rules are more likely to select different winners in fragmented and polarized party systems. The results in Table B.6 indicate that this applies to virtually all other rules: For each of them, a larger number of parties in competition and a more polarized party system significantly increase the odds of selecting a winner that is not identical with the Plurality winner.²⁰ Given the findings of previous paragraphs, these new results are rather unsurprising. We had seen in the Principal Component Analysis that the Plurality rule represents an outlier, while the Condorcet rule takes a central position among the other single-winner systems (Figure 1). This outlying character of Plurality means that the factors that make it more likely to diverge from the Condorcet rule also make it more likely to diverge from the other rules. Similarly, a comparison of Table 2 and Table B.7 shows that the distances between the Plurality winner and the winners according to other rules are always larger than the corresponding distances from the CW. This again seems quite straightforward, as the CW is expected to often have a more centrist position than the Plurality winner.

²⁰ The only exception to this pattern is the effect of party system polarization on divergences between the Plurality rule and Typical judgement, which just fails to pass the 10% significance threshold.

Conclusion

In academic and political debates, majoritarian electoral systems, in particular the plurality rule, have sometimes been portrayed as a factor that may contribute to a crisis of political representation. Elections based on plurality (or a two-round system) are often characterized by a strong level of vote-seats disproportionality and a large share of “wasted” votes, going to parties or candidates that do not win representation, overall or in a given district.

This paper has investigated when and how electoral rules for single-winner elections differ from one another. The results show that the plurality rule is one of the most distinctive ones among the set of electoral systems that we integrated in our analysis. It is the rule that most often diverges from the other systems. The scaling analysis, based on the patterns of divergences between rules, has clearly shown the distinctive position of FPTP. This analysis does not necessarily indicate why that rule is an outlier. But the main dimension on which the various rules differ, we have suggested, can be interpreted in terms of how much a rule’s outcome depends only on the voters’ top preferences, ignoring distinctions among less preferred parties. This characteristic thus appears as a central element to explain which rules are more or less similar to one another.

The somewhat outlying character of the plurality rule was also clear in the second part of the analyses, in which we investigated when and how rules differ from the CW. The results not only showed that Plurality is the rule that most frequently diverges from that normative benchmark. It is also a rule that selects alternative winners that stand, on average, further away from the benchmark in ideological terms. This lends support to the argument that alternatives to Plurality rule might be better able to select winners enjoying a broader consensus in the electorate, such as the CW. Even if there are differences in the frequency with which rules differ from one another, it is important to remember that these diverging outcomes are not only due to the electoral rules, but rather to the combination of a rule and a set of voters’ preferences.

Some elections – that is, some distributions of voters’ preferences – are more likely than others to lead to diverging outcomes. In fact, we found that in about two-thirds of the elections, all single-winner rules considered in this paper lead to exactly the same winner. This raises questions about which contextual features may be more conducive to a divergence between Condorcet and another rule. We explored several lines of investigation, focusing on the polarization of voters’ preferences and party positions, as well as on the degree of fragmentation of the party system. Divergences from the CW are more likely when the effective number of parties increases, with almost all electoral rules. And in the case of the more usual single-winner rules (Plurality, Two-round, Instant runoff), a greater ideological polarization of the party system also increases the chances that the CW is not selected.

This paper focused on the mechanical effects of electoral rules. In other words, we simulated results while keeping the same voter preferences and assuming that their choice was driven only by sincere preferences. This limits the scope of the analyses, and allows addressing only part of the arguments about the possible effects of electoral rules. For instance, the fact that some rules give voters the opportunity to express a wider set of preferences – not only a single vote in favour of their preferred candidate – could in itself have a positive influence on the perceived legitimacy of the outcome, or on the level of turnout. Alternative voting rules could also incite parties and candidates to campaign differently, giving more citizens the feeling that their preferences and demands are being heard. Yet, we still think that any discussion about effects of electoral rules – and how these rules might create new forms of strategic incentives – first requires a good understanding of the rules themselves, and their practical consequences.

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Table 1. Percentages of cases in which pairs of electoral rules cast a different winner

	Co	Pl	Tr	Ir	Ev	Bo	Am	Al	Mj	Tj
Co		22.6	8.8	8.3	9.1	9.9	14.8	5.3	10.7	9.2
Pl	22.6		18.7	19.3	22.9	27.5	31.9	20.1	25.0	22.9
Tr	8.8	18.7		4.2	13.8	16.4	21.3	6.9	15.2	14.2
Ir	8.3	19.3	4.2		13.7	16.2	20.9	8.4	14.8	13.5
Ev	9.1	22.9	13.8	13.7		9.3	12.3	10.4	10.1	7.1
Bo	9.9	27.5	16.4	16.2	9.3		7.7	12.3	11.3	10.6
Am	14.8	31.9	21.3	20.9	12.3	7.7		17.1	13.6	13.4
Al	5.3	20.1	6.9	8.4	10.4	12.3	17.1		12.2	10.4
Mj	10.7	25.0	15.2	14.8	10.1	11.3	13.6	12.2		10.4
Tj	9.2	22.9	14.2	13.5	7.1	10.6	13.4	10.4	10.4	

Legend. Co: Condorcet rule, Pl: Plurality rule, Tr: two-round system, Ir: Instant runoff, Ev: Evaluative voting, Bo: Borda Count, Am: Average Approval voting, Al: Leader Approval voting, Mj: Majority Judgment, Tj: Typical judgment.

*Note: The figures in the table indicate the percentage of all cases (elections * bootstraps) for which the rules in the corresponding line and column select a different winner. E.g., plurality and the two-round system select a different winner in 18.7% of the cases (second line, third column).*

Table 2. Effects of context variables on the divergence from the Condorcet winner

	Pl	Tr	Ir	Ev	Bo	Am	Al	Mj	Tj
Party system polarization	0.19*	0.35*	0.39*	0.00	0.04	0.01	0.21*	0.01	0.02
	(0.08)	(0.13)	(0.13)	(0.08)	(0.07)	(0.07)	(0.10)	(0.07)	(0.08)
Party system fragmentation (ENEP)	0.38*	0.50*	0.56*	0.10	0.11	0.19 [†]	0.36*	0.25*	0.24*
	(0.12)	(0.14)	(0.15)	(0.13)	(0.11)	(0.10)	(0.12)	(0.12)	(0.12)
Ideological polarization among voters	-0.65	-0.11	-0.05	-0.32	-0.47	-1.00*	-0.40	-0.40	-0.32
	(0.41)	(0.50)	(0.54)	(0.39)	(0.39)	(0.39)	(0.54)	(0.35)	(0.39)
Affective polarization	0.11	0.11	0.10	-0.96*	0.28	0.44	-0.44	-0.53	-0.92 [†]
	(0.54)	(0.74)	(0.83)	(0.49)	(0.44)	(0.43)	(0.66)	(0.50)	(0.47)
Constant	-2.51	-6.47*	-7.24*	0.38	-2.59 [†]	-1.49	-3.62	-1.02	-0.39
	(1.63)	(2.07)	(2.40)	(1.51)	(1.47)	(1.44)	(2.35)	(1.67)	(1.34)
R2	0.07	0.13	0.16	0.03	0.01	0.02	0.06	0.03	0.04

* $p < 0.05$, [†] $p < 0.10$

For each model, $N = 185,984$

Note: Regression coefficients from logistic regressions (robust standard errors in parentheses), estimated on a pooled sample of all elections and bootstraps. Standard errors clustered by election ($N = 188$).

Table 3. Average absolute left-right distance to the Condorcet winner

	Only non-Condorcet winners	All cases
Plurality	3.00	0.64
Two-round	2.38	0.18
Instant runoff	2.18	0.16
Evaluative voting	2.57	0.20
Borda count	2.64	0.23
Average approval	2.44	0.33
Leader approval	2.18	0.09
Majority judgement	2.37	0.23
Typical judgement	2.52	0.21

Note: Average absolute distance on a 0-10 left-right scale between the winners of the rules listed in the first column and the Condorcet winner.

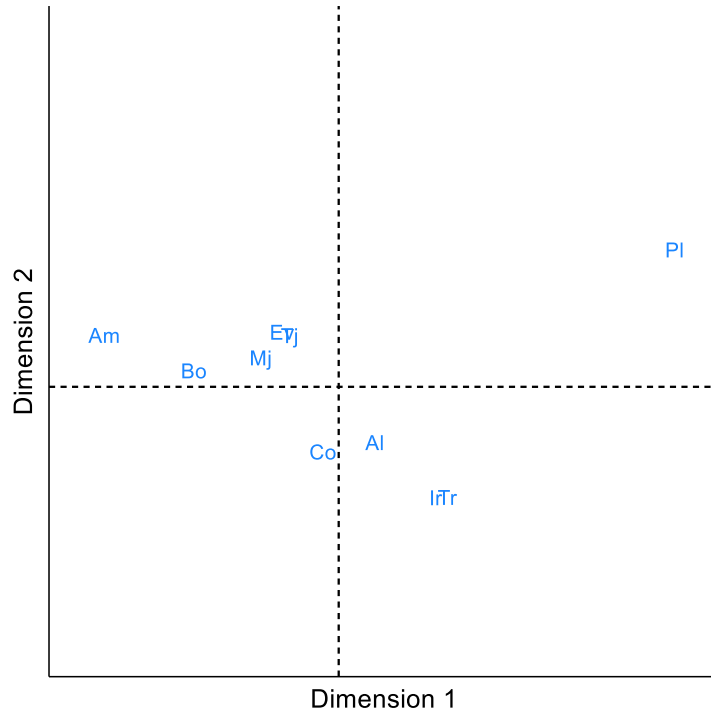


Figure 1. Principal Component Analysis, dimensions 1 and 2

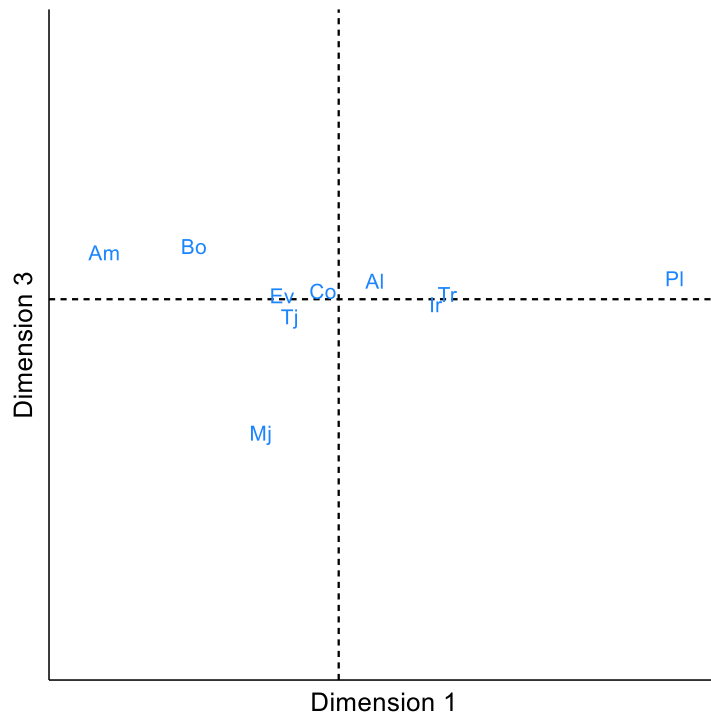
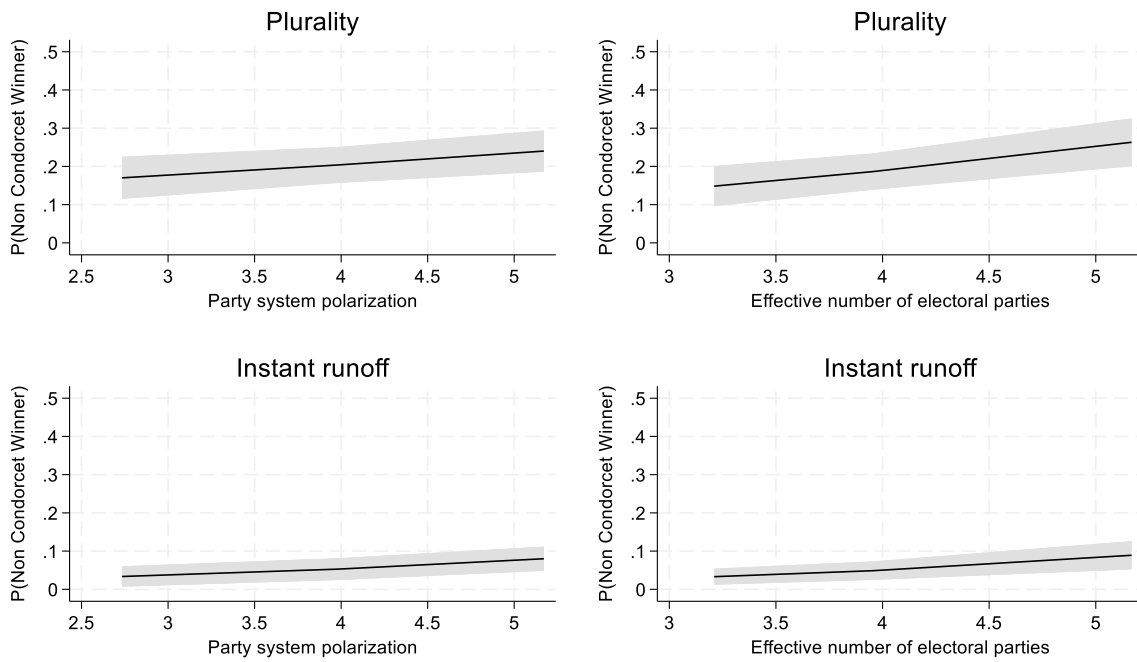


Figure 2. Principal Component Analysis, dimensions 1 and 3

Figure 3. predicted probabilities of divergences from the Condorcet Winner



Note: the figure shows the predicted probability that a given rule (Plurality or Instant runoff) selects a non-Condorcet Winner, as a function of the degree of party system polarization and party system fragmentation (with 95% confidence intervals). The range of values for polarization and fragmentation corresponds to their interquartile range.