CESifo WORKING PAPERS

7418
2018

December 2018

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
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Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl
www.cesifo-group.org/wp

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CESifo *Working Paper No. 7418*
Category 2: Public Choice

Measuring the Competitiveness of Elections

Abstract

The concept of electoral competition plays a central role in many subfields of political science, but no consensus exists on how to measure it. One key challenge is how to conceptualize and measure electoral competitiveness at the district level across alternative electoral systems. Recent efforts to meet this challenge have introduced general measures of competitiveness which rest on explicit calculations about how votes translate into seats, but also implicit assumptions about how effort maps into votes (and how costly effort is). We investigate how assumptions about the effort-to-votes mapping affect the units in which competitiveness is best measured, arguing in favor of vote-share denominated measures and against vote-share-per-seat measures. Whether elections under multimember proportional representation systems are judged more or less competitive than single-member plurality or runoff elections depends directly on the units in which competitiveness is assessed (and hence on assumptions about how effort maps into votes).

JEL-Codes: D720.

Keywords: competitiveness, measurement, electoral systems, mobilization, turnout.

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December 12, 2018
We thank Georgina Evans for research assistance, Olle Folke, Torben Iversen, and Janne Tukiainen for comments, and Peter Selb for kindly sharing his replication data and codes.

The concept of electoral competition plays a central role in many subfields of political science. Political theorists often define democracy as a system in which at least two parties compete in elections for the right to govern (e.g., Schumpeter, 1942; Downs, 1957; Dahl, 1971). In other words: no competition, no democracy. Beyond the simple question of *whether* elections are contested, however, great interest also surrounds the question of *how closely* those elections are contested. Those who investigate the incumbency advantage, for example, often worry that it reduces the competitiveness of elections due to the deterrence of high-quality challengers (e.g., Carson, Engstrom and Roberts, 2007; Hall and Snyder, 2015). Others have argued that uncompetitive elections make for less responsive politicians (e.g., Fiorina, 1973; Griffin, 2006), and numerous others still have focused on the relationship between competitiveness and voter turnout (e.g., Riker and Ordeshook, 1968; Cox, 2015).

Given the ubiquity of references to competition and competitiveness, it is surprising that no consensus exists on how best to measure it. A key challenge is how to conceptualize and measure electoral competitiveness across alternative electoral systems. Studies of single-member district (SMD) elections have repeatedly investigated how "safe" and "swing" districts affect the nature of local politics—in terms of the parties' mobilizational efforts, campaign expenditures, and turnout (e.g., Denver and Hands, 1974; Cox and Munger, 1989; Aldrich, 1993).[1] The "traditional" measure of competitiveness in SMDs used in these studies is based on the simple difference in vote shares between the winner and the runner-up. Much less consensus exists on how to measure competitiveness in multi-member district (MMD) contexts, especially under proportional representation (PR) rules. Elections under PR rules typically involve multiple parties and hence greater complexity in the nature of competition.

[1]One issue, which we do not consider here, is whether ex ante competitiveness can be inferred from ex post measures of actual vote margins (e.g., Cox, 1988). We also do not consider variations in proportional systems, such as options for preference voting or vote transfers, and we assume the D'Hondt allocation method in our theoretical and empirical investigations. Finally, while the theoretical logic that we present assumes that mobilizational effort will increase with competitiveness, it is also possible that decisions by parties or candidates to mobilize voters may also in turn increase competitiveness. We do not attempt to parse the directionality or mutually reinforcing nature of these effects here.

A small number of recent studies have attempted to create general measures of competitiveness that can be applied across SMD and MMD systems. Some focus on the aggregate level, assessing the governing party's probability of losing office (Kayser and Lindstädt, 2015; Abou-Chadi and Orlowski, 2016) or how far a party is from winning a majority in a legislative chamber (Feigenbaum, Fouirnaies and Hall, 2017).[2] A second approach focuses on the closeness of *individual* candidates to being elected (e.g., Kotakorpi, Poutvaara and Terviö, 2017), with the empirical aim of investigating candidate-level outcomes.

A third set of studies has focused on how to measure competitiveness at the district level. Three recent papers in particular—Blais and Lago (2009), Grofman and Selb (2009), and Folke (2014)—have proposed general measures of competitiveness that can be applied to districts of varying magnitude across alternative electoral systems.[3] The authors use their proposed measures to investigate whether PR induces more competitive contests than plurality rule (Blais and Lago, 2009; Grofman and Selb, 2009), to predict turnout across districts in PR systems (Blais and Lago, 2009; Grofman and Selb, 2011), and to explore the policy influence of small parties in PR systems (Folke, 2014).

In what follows, we offer a reconsideration of how to measure the competitiveness of elections at the district level in SMD and MMD contexts. We first review the extant alternative measures and situate them within a typology of possible measures. Next, we argue that any measure of competitiveness should reflect the marginal benefit of effort (MBE) for each party. A party's MBE depends on how its effort maps into votes, how votes map into seats, and how valuable seats are. While all three recently proposed measures rest on explicit calculations about how votes translate into seats, each relies on implicit assumptions about how effort maps into votes (and how costly effort is). Whether PR contests in MMDs are judged more or less competitive than single-member plurality

[2]Even simpler aggregate measures use 100 minus the largest party's vote share to capture "competition," with obvious limitations (e.g., Gerring et al., 2015). Other approaches focus on aggregate volatility in electoral behavior (i.e., party-switching) at the voter level (e.g., Wagner, 2017).

[3]Collectively, these studies—which define the state of the art—have garnered more than 250 citations, according to Google Scholar (as of December, 2018).

(SMP) or majority runoff contests in SMDs depends directly on such assumptions.

Blais and Lago (2009) and Grofman and Selb (2009) show that different measures of competitiveness give different answers to questions about the level and variability of competition in PR systems with MMDs. We reproduce this finding using district-level data from Norway (1909-1927) and Switzerland (1971-2003). The Swiss case has previously been featured by Grofman and Selb (2009), and is useful due to within-country variation in district magnitude, including SMDs as well as MMDs. The Norwegian case we introduce to the body of empirical evidence offers an additionally useful context of within-country variation, as an electoral reform in 1919 shifted all elections from SMD to MMD contests with varying magnitude (see Cox, Fiva and Smith, 2019). We argue that the determination of whether elections in MMD systems are more or less competitive than SMD systems stems primarily from the different units in which distances are expressed by different measures. In particular, it matters a lot whether distances are denominated in vote shares (the traditional measure) or vote shares per seat (revisionist measures). On the basis of our theoretical logic, and survey data from both countries capturing the modes through which parties mobilize voters under alternative electoral rules, we argue that the vote-share-denominated measure of distance makes more sense.

Finally, we investigate the construct validity of the different measures of competitiveness. If a particular measure accurately reflects how close local elites perceive a given electoral contest to be, then it should be useful in predicting their mobilizational efforts and, hence, turnout. Using again the district-level data from Norwegian and Swiss elections covering both SMD and MMD elections, we contrast two families of distance measure—those denominating distances in vote shares (the traditional measure) and those denominating distances in vote shares per seat (those of Blais-Lago or Grofman-Selb). As do Blais-Lago and Grofman-Selb, we show that the relationship between distance and turnout attenuates as district magnitude increases (regardless of the distance metric used). While we agree with Blais-Lago and Grofman-Selb regarding the pattern of evidence, this pattern directly impugns the construct validity of vote-share-per-seat mea-

sures but can easily be accommodated by vote-share measures. Accordingly, we argue in favor of vote-share measures as the most appropriate generalized measure of district-level competitiveness across different electoral systems.

Measuring the competitiveness of district elections

For SMD contests, the traditional measure of competitiveness is the simple difference in observed vote shares between the winner of the seat and the runner-up—expressed as a vote share, rather than in raw votes. This measure makes intuitive sense for SMD contests, but measuring competitiveness in MMD contests requires more consideration. Suppose J parties are competing in a given electoral district in which $M \geq 1$ seats will be awarded, and all M seats will be allocated based on the votes cast in the district (no upper tiers). Moreover, neither joint lists nor *apparentements* are allowed. How should one measure the competitiveness of the contest between the J parties?

Let V_j denote the number of votes received by party j, for $j = 1, ..., J$. Let $V_\bullet \equiv \sum_{j=1}^{J} V_j$ be the total votes cast, and $v_j = V_j/V_\bullet$ be j's share of the votes. For a given vote vector $\boldsymbol{V} = (V_1, ..., V_J)$, the seat vector $\boldsymbol{S}(\boldsymbol{V}) = (S_1(\boldsymbol{V}), ..., S_J(\boldsymbol{V}))$ gives the number of seats awarded to each party. The mapping $\boldsymbol{V} \to \boldsymbol{S}(\boldsymbol{V})$ is determined by the electoral rules in force.

Now consider how many votes would have to change, in order to change the seat allocation.[4] To answer this question, one needs a metric of the "distance" to a seat change.

[4]Freier and Odendahl (2015) take a different approach for measuring electoral closeness. The basic idea of their method is to simulate the voting result of a given election repeatedly, adding noise to the election result. In some of those simulated election results, the seat allocation will be different. If that happens often, they consider the seat allocation as close. Kotakorpi, Poutvaara and Terviö (2017) take a similar simulation-based approach.

Single-party versus multi-party measures

The single-party measure upon which we shall initially focus begins by calculating two numbers. First, $N_j^+(\boldsymbol{V})$ is the minimum number of votes that j must gain in order to win an additional seat, holding the other parties' votes constant.[5] Second, $N_j^-(\boldsymbol{V})$ is the minimum number of votes that j must lose in order to lose a seat, holding the other parties' votes constant.[6]

The smaller of the raw vote counts, $N_j(\boldsymbol{V}) = min\{N_j^+(\boldsymbol{V}), N_j^-(\boldsymbol{V})\}$, is taken as measuring j's incentive to mobilize, given the vote vector $\boldsymbol{V}$. We shall henceforth simplify our notation, writing just N_j^+, N_j^-, and N_j, the dependence on $\boldsymbol{V}$ being understood. We will consider how to normalize or scale N_j later.

Any single-party measure must make assumptions about the other parties when it calculates the minimum votes a given party would need to gain in order to win an additional seat. Grofman and Selb (2009) focus on a worst-case scenario for the focal party: What is the minimum increase in votes that would *guarantee* the party another seat (regardless of vote reallocations among the other parties)?[7] Let N_j^{GS+} denote the answer. Blais and Lago (2009), in contrast, consider the scenario in which all other parties' votes are held constant. In other words, they focus on N_j^+.

Rather than considering hypothetical vote gains (or losses) by a single party, one might instead consider patterns of gains and losses across all the parties. Let $\boldsymbol{R} = (R_1, ..., R_J)$ be a vector of raw vote gains ($R_j > 0$) or losses ($R_j < 0$). Let $R_\bullet^{(j)}$ be the "smallest" change that gives an additional seat to party j. That is, $R_\bullet^{(j)} = \sum_{h=1}^{J} |R_h^{(j)}|$. In other

[5]Formally, $N_j^+(\boldsymbol{V})$ can be defined implicitly by the following equations: $S_j(V_j, \boldsymbol{V_{-j}}) = S_j[(V_j + N_j^+(\boldsymbol{V}) - 1, \boldsymbol{V_{-j}})] = S_j[(V_j + N_j^+(\boldsymbol{V}), \boldsymbol{V_{-j}}] - 1$. We assume that ties are always broken unfavorably for the focal party. The formulas would become somewhat more complex if ties were broken by coin flips.

[6]In other words, $N_j^-(\boldsymbol{V})$ is such that $S_j(V_j, \boldsymbol{V_{-j}}) = S_j[(V_j - N_j^-(\boldsymbol{V}) + 1, \boldsymbol{V_{-j}})] = S_j[(V_j - N_j^-(\boldsymbol{V}), \boldsymbol{V_{-j}})] + 1$.

[7]More specifically, Grofman and Selb (2009) begin by identifying two values representing "worst-case scenarios" for each party, indexed by i: the vote share required to *gain* an additional seat, X_i^G, and the vote share required to *lose* a seat, X_i^L. They then take the larger of the two resulting values when each is subtracted from the threshold of exclusion, T^E (for D'Hondt, $1/(M+1)$), and then also divide this number by the threshold of exclusion. The resultant party-specific measure, c_i, using their notation is thus: $c_i = \frac{max[(T^E - X_i^G), (T^E - X_i^L)]}{T^E}$.

words, $R_{\bullet}^{(j)}$ represents the smallest number of votes that would have to be added or subtracted, without restricting which party was gaining or losing the votes, in order to confer an additional seat on party j. This is the distance metric proposed by Folke (2014), measured in the form of vote shares. Note that the votes that a particular party gains can be generated either by mobilizing supporters who were previously not voting or by persuading other parties' supporters to change their votes.

Issues of aggregation and units

Any measure of the distance in votes to a seat change must answer the following two questions. First, how should the party-specific distances be aggregated into a district-wide measure? One approach would be to focus on the single party with the strongest incentive to mobilize. Blais and Lago (2009, p. 96) take this approach, calculating "the minimal number of additional votes required, under the existing rules, for any party to win one additional seat."[8] Grofman and Selb (2009) instead opt for a weighted average, where the weights are the parties' respective vote shares.[9] In our empirical analysis, we consider aggregations of both types—minima and weighted averages—finding that there is not much difference in the resulting measures.

Second, in what units should the vote distances be expressed? Should distances be stated in raw votes? Should they be stated in shares of the vote (as in the traditional measure for SMDs, and in Folke's measure for MMDs)? Or, should they be expressed as shares of the votes cast per seat (following Blais and Lago, 2009, and Grofman and Selb, 2009)?[10] We discuss this issue further in the next section.

[8]More specifically, the Blais-Lago measure, BL, takes this raw number of votes, divides it by the raw number of total votes cast per seat (i.e., total votes in the district divided by M), and then multiplies this fraction by 100: $BL = 100 * \frac{\text{votes needed to win one additional seat}}{\text{number of ballots per seat}}$.

[9]The authors take the sum of c_i (discussed in footnote 7) for all parties weighted by each party's vote share, v_i, and define this district-level "index of competition" as $C = \sum_{i=1}^{n} v_i * c_i$.

[10]Actually, Grofman and Selb normalize by the threshold of exclusion ($\frac{1}{M+1}$), while Blais and Lago normalize by $\frac{1}{M}$, where M is district magnitude. This difference does not matter for our discussions.

The marginal benefit of effort

If vote distances reflect parties' perceptions of electoral competitiveness, then they should be able to predict how parties exert campaign effort. In this section, we imagine that each party j can exert some kind of mobilizational effort, denoted by e_j. For example, e_j might represent the number of advertisements (urging supporters to vote) that party j purchases. Let $\boldsymbol{e} = (e_1, ..., e_J)$ represent the choices made by all parties.

Let the parties' expected vote shares, given $\boldsymbol{e}$, be denoted $\boldsymbol{v}(\boldsymbol{e}) = (v_1(\boldsymbol{e}), ..., v_J(\boldsymbol{e}))$ and their expected seat shares, given $\boldsymbol{v}$, be denoted $\boldsymbol{s}(\boldsymbol{v}) = (s_1(\boldsymbol{v}), ..., s_J(\boldsymbol{v}))$. We continue to use lower-case variables for vote or seat shares, reserving upper-case variables for raw totals. The mapping $\boldsymbol{v} \rightarrow \boldsymbol{s}(\boldsymbol{v})$ depends on the electoral rules.

We shall assume that party j's payoff equals $s_j(\boldsymbol{v}(\boldsymbol{e}))Mb - c(e_j)$. The first term reflects j's expected share $s_j(\boldsymbol{v}(\boldsymbol{e}))$ of the M seats at stake in the district, each of which is worth b utils.[11] Against this expected benefit must be weighed the cost of effort, denoted by $c(e_j)$.

The marginal benefit of effort for party j (MBE_j) can be written as follows:

$$MBE_j \equiv \frac{\partial s_j(\boldsymbol{v}(\boldsymbol{e}))Mb}{\partial e_j} = \frac{\partial v_j}{\partial e_j}\frac{\partial s_j}{\partial v_j}Mb \tag{1}$$

Equation (1) reveals that party j's MBE depends on three factors: how quickly effort translates into votes ($\frac{\partial v_j}{\partial e_j}$); how quickly votes translate into seats ($\frac{\partial s_j}{\partial v_j}$); and the total value of the seats at stake (Mb). The larger the MBE is, the greater the party's incentive to mobilize its supporters and, thus, the higher turnout is expected to be (Cox, 1999; Herrera, Morelli and Palfrey, 2014).

Extant measures of competitiveness focus exclusively on the votes-to-seats mapping. Their respective authors offer various ways of calculating the minimum votes needed

[11] We do not assume that a seat in one country is of equal value to a seat in another, only that all seats in any given country (at a given time) are equally valuable. This assumption simplifies our theoretical argument, but it is nevertheless plausible that winning the majority-achieving seat, say, might be more valuable than winning any other seat in multiparty systems (Freier and Odendahl, 2015).

to change the seat allocation in j's favor. These minimum vote measures—e.g., N_j^{GS+}, N_j^{+}, $R_{\bullet}^{(j)}$—suggest "how fast" more votes will turn into additional seats. They, or more precisely their normalized inverses, can thus proxy for $\frac{\partial s_j}{\partial v_j}$ in Equation (1).

The importance of the effort-to-votes mapping

If $\frac{\partial v_j}{\partial e_j} = 0$, then it does not matter how large or small the vote distance to a seat change is. Thus, *if they are to be useful in predicting parties' mobilizational efforts, extant measures must rely on some assumptions about how effort translates into votes.*

To further explain this observation, consider a hypothetical area in which two parties, A and B, compete. Each party's supporters are uniformly distributed across the area. The area can be carved into electoral districts in various ways—all single-seat districts, a mix of 1-seat and 2-seat districts, and so forth. We assume perfect apportionment: a single-seat district has n voters, a 2-seat district has $2n$ voters, and so on. We also assume that the seats in each district are allocated by the D'Hondt rule.

Suppose that in each district in the area, in the absence of any mobilization, party A is expected to get *all* the votes and party B none. This scenario—the least competitive possible—makes it easy to compute the minimum votes needed to change the seat allocation. (The reason party B expects to get zero votes, let us say, is that all of its supporters bear positive costs of participation while some of party A's supporters have non-positive costs; thus, there is a Nash equilibrium in which none of party B's supporters vote and some of party A's supporters do.)

Figure 1 plots the distance to a seat gain for party B denominated in vote shares (top-left panel) and raw votes (top-right panel) against district magnitude. While the share of votes party B needs to gain a seat falls with district magnitude, the opposite is true for raw votes (in the example, n=1,000).[12] Instead of focusing on the number or share of *votes* that party B needs to gain its first seat, consider the minimum *effort*

[12]The top-left panel of Figure 1 is essentially plotting the *threshold of exclusion*, defined as the maximum share that a party can possibly win while still failing to win a seat, against district magnitude under the D'Hondt allocation rule.

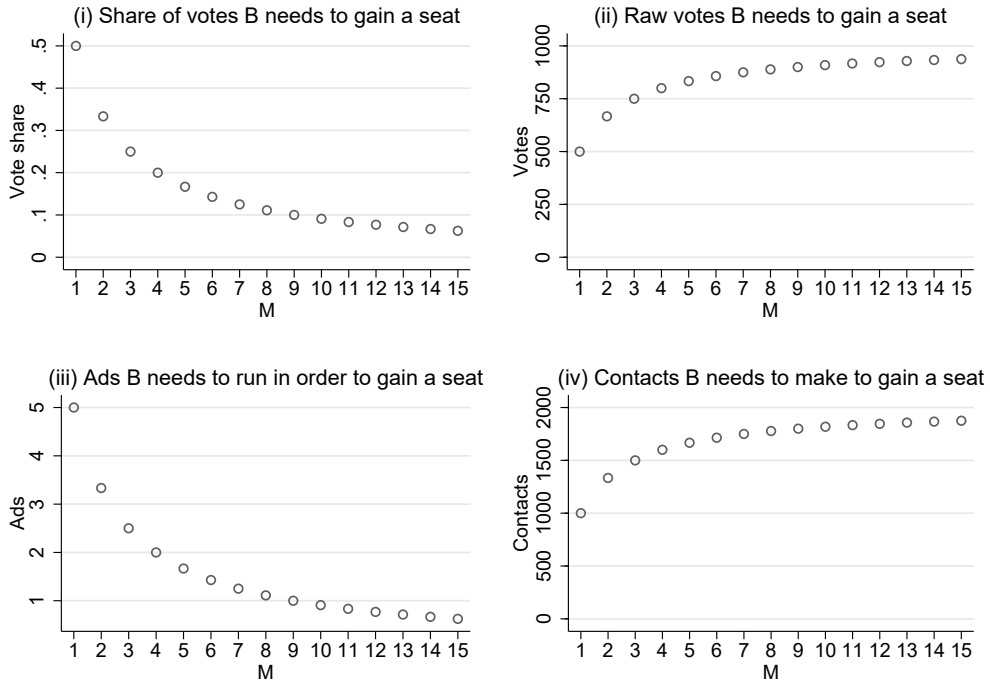

Figure 1: Effort, votes, and seats: which units should be used for measurement?

Note: We consider a situation where two parties, A and B, compete for office in a PR system with districts of varying magnitude (M), where, in the absence of mobilization, party A is expected to get all the votes. This figure illustrates the relationship between district magnitude and (i) the share of votes party B needs to gain a seat (i.e., the threshold of exclusion), (ii) the number of votes B needs to gain a seat, (iii) the number of ads B needs to run, to gain a seat, and (iv) the individual contacts B needs to make, to gain a seat. We assume that seats are allocated by the D'Hondt rule, the number of eligible voters is $1000 \cdot M$ (perfect apportionment), each ad mobilizes 10 percent of voters ($z = 0.1$), and that every other individual contacted is persuaded to vote ($y = 0.5$). Appendix Table A.1 summarizes the distances to a seat gain for party B in table format.

it would have to exert, in order to gain its first seat. Does that effort increase with M, because the technology of mobilization exhibits no economies of scale? Or does it decline, because there are economies of scale in mobilization?

An example of a scalable mobilization technology is advertising in a mass media market that covers the area. Suppose a unit ad mobilizes the same positive proportion of voters, $z > 0$, regardless of where they reside in the market; and that ads translate linearly into vote shares: each additional ad generates the same increase in vote share (at least over some range). Thus, if an ad is purchased and the election in question is held in a 1-seat district, then the ad yields nz votes. If the election in question is held in a 2-seat district, then the ad yields $2nz$ votes. And so on.

The effort distance—the minimum number of ads a party must run to gain an additional seat—is $d_{ads}(z, M) = \frac{1}{(M+1)z}$. Note that the effort distance declines with district magnitude: $\partial d_{ads}(z, M)/\partial M < 0$. We illustrate this result in the bottom-left panel of Figure 1 where we assume $z = 0.1$. If the cost of running ads is a concave increasing function of $e_j(c' > 0, c'' \leq 0)$, then the cost distance—the minimum cost a party must bear to gain an additional seat—is also declining in M.

Now suppose that mobilization consists of contacting individual voters and persuading them to vote—which might entail bribes or non-monetary encouragement delivered through "get out the vote" drives or door-to-door canvassing.[13] In this case, the effort distance—the number of contacts a party needs to make to gain an additional seat—is $d_{con}(y, n, M) = \frac{Mn}{(M+1)y}$, where y is the probability that a contact succeeds in mobilizing the voter (who then votes for the mobilizing party). Thus, the effort distance increases with district magnitude: $\partial d_{con}(y, n, M)/\partial M > 0$. We illustrate this result in the bottom-right panel of Figure 1, where we assume a (constant) success rate of 0.5. Given convex increasing costs of contacting $(c' > 0, c'' \geq 0)$, the cost distance is also increasing in M.[14]

These observations lead to our first general conclusion. Parties' decisions to mobilize

[13]For simplicity, in what follows we assume no spillovers from personal contacts. See Cox (2015) for a consideration of models in which spillovers occur.

[14]Convex increasing costs here might also arise because it becomes increasingly difficult to mobilize those contacted, as the number previously contacted increases.

will depend on the minimum cost they must bear to gain a marginal seat. Thus, measuring distance in votes needed to gain a seat is not enough. If vote distances are to be a defensible proxy for cost distances—which is what we would ideally like to measure—one needs additional assumptions about how effort translates into votes and about the cost of effort.[15]

The units of vote distances

We do not know the effort-to-votes or the cost-of-effort functions. However, different assumptions about these functions have implications for the units in which vote distances should be expressed. If parties use mostly a scalable technology, such as ads, then one should measure competitiveness in vote shares. However, if parties use mostly a non-scalable technology, such as personal contacts, then vote distances should be expressed in raw votes.

Our view is that parties use a mix of mobilizational technologies, but that they have a large incentive to switch to scalable technologies when district magnitude (hence district population) increases. A similar idea from the literature on democratization is that suffrage expansions (which increase the number of voters who must be convinced to give the party their support) make it "too expensive to contest elections on the basis of bribery" (Lizzeri and Persico, 2004, p. 750) and thus induce a transition from such person-to-person exchanges toward wooing voters by the scalable technology of making public promises to enact legislation (Seymour, 1915, pp. 453–454; Cox, 1987; Stokes et al., 2013).

As regards mobilizational technologies specifically, Rainey (2015) makes an argument similar to ours and offers cross-national survey evidence from the Comparative Study of

[15]The technology of voter mobilization—scalable or non-scalable—affects how mobilizational effort translates into votes. If instead we focus on persuasive effort (efforts to change the vote(s) cast by those who are likely to vote), then an important factor affecting the vote-yield of effort is spatial proximity. For example, if the Conservatives trail the Centrists by 100 votes, they might be able to gain a seat by converting 51 Centrist voters. If instead the Conservatives trail the Socialist Greens by 100 votes, it is unlikely they will be able to convert 51 Socialist Greens to conservatism. Instead, they may need to convert 101 Centrists in order to overtake the Greens. In that sense, the effort distance is greater when a party trails a non-proximal party than when it trails a proximal party.

Electoral Systems (CSES) surveys to support the argument. He finds that voters in SMD contests are more likely to report having been directly contacted (i.e., a non-scalable mobilization technology) by a candidate or party as district competitiveness increases, whereas the relationship between competitiveness and direct contact in PR contests in MMDs is much weaker.

Rainey (2015) does not directly test whether direct contact increases with M *within* PR systems. In Figure 2, we present evidence of this extension of the logic using within-country survey data on voters' interactions with political operatives in campaigns in both Norway and Switzerland, for a subset of election years for which such survey evidence is available. The empirical data available for Norway do not cover the historical period when SMDs were in use. We can, however, investigate whether the use of non-scalable technologies of mobilization, viz. direct contact with either a candidate or a party campaign worker during the election campaign, is negatively correlated with district magnitude in general. If one fits a linear model to the data, the relationship is indeed negative in both country cases: higher M, fewer contacts.[16] Thus, the available empirical evidence provides ample justification to denominate vote distances in shares rather than raw votes.

Single-party versus multiparty and minima versus weighted average

Having now argued that vote shares are a more appropriate measure of distance than either raw votes or vote shares per seat, we turn to the question of single-party versus multi-party measures and weighting. Does it matter whether the distance measure is based on a single-party's hypothetical gain or loss needed to change the seat outcome (i.e., the traditional measure), versus patterns of gains and losses across all the parties (Folke, 2014)? And does it matter whether we choose the minimum distance across parties or a weighted average of these distances?

Figure B.2 uses data from Norway to examine the implications of these measurement decisions. In short, it is not important whether we choose a *minima-based* approach

[16]If one considers instead a quadratic model, the relationship is more complex in Norway, but remains similar in Switzerland (see Appendix Figure B.1).

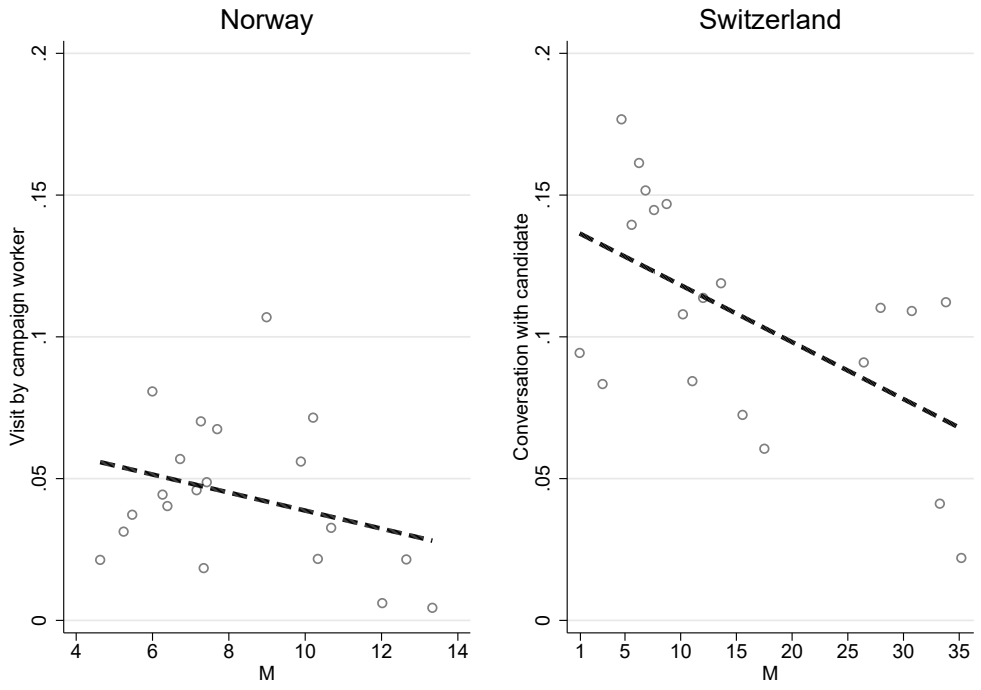

Figure 2: Direct contact and district magnitude: survey evidence of the use of non-scalable mobilization technology

Note: The figure shows the relationship between a non-scalable mobilization technology—direct contact by campaign workers and candidates—and district magnitude. The left-hand panel uses data from the 1965-1969 Norwegian Election Studies surveys (N=3,099) made available by Norwegian Center for Research Data (NSD). Respondents were asked whether any party's campaign worker visited them during the campaign. The right-hand panel uses data from the 1987-1991 Swiss National Election Studies surveys (N=1,895) made available by the Swiss Centre of Expertise in the Social Sciences (FORS). Respondents were asked if they made use of conversations with candidates as information regarding the election campaign. In each panel, we show binned scatterplots residualized by year fixed effects and survey respondent background characteristics (age, gender, education level, and marital status). Appendix Figure B.1 presents the data with a quadratic fit line.

rather than a *weighted-average* approach. The correlation between the two alternative measures is 0.95 in our sample. Nor is it important whether we take a *single-party* rather than a *multi-party* approach. For simplicity, we use the single-party minima measure in the remainder of our investigations.

Are PR elections closer and less variable?

Whether the units of distance are vote shares, raw votes, or vote shares per seat matters in assessing some important claims recently made by Blais and Lago (2009) and Grofman and Selb (2011). Blais and Lago (2009, p. 95) point out that it is conventional wisdom that "elections are more competitive under PR than under SMP." Yet, as Grofman and Selb (2011, p. 99) point out, "this seemingly obvious claim has almost never been properly tested." Moreover, when Blais and Lago (p. 95) and Grofman and Selb (p. 105) perform tests based on their respective measures of competitiveness, both find evidence *against* the conventional wisdom.

Similarly, when Blais and Lago (2009, p. 95) investigate another bit of conventional wisdom—that "local competitiveness is more variable under SMP than under PR" (Cox, Rosenbluth and Thies, 1998; Cox, 1999)—they find that this too "proves to be wrong." Conventional wisdom 0, new measures 2.

Of course, both sets of authors note that the "traditional" measure of distance (denominated in vote shares) supports the conventional wisdom. In particular, using the traditional measure, vote distances decline in mean and variance as district magnitude increases.

To illustrate this point, we use historical data from Norwegian parliamentary (Storting) elections (1909-1927) and more recent data from Swiss National Council elections (1971-2003). As noted, the Norwegian historical data have the advantage of holding country-specific factors constant, while spanning an electoral reform from runoff elections

in SMDs to PR elections in MMDs (Cox, Fiva and Smith, 2016).[17] The Swiss data have the useful feature that district magnitude varies across districts in each election—from single-seat districts to large multimember districts (Grofman and Selb, 2009).

We calculate both a traditional measure of distance, based on the minimum vote share gain that would earn an additional seat for a single party, and the new measures proposed by Blais-Lago and Grofman-Selb. We then use box-and-whisker plots to summarize the distribution of computed distances for each measure, as a function of district magnitude. As can be seen in the left panels of Figure 3, the traditional distances decline in both mean and variance as district magnitude increases. The Blais-Lago measure (middle panels) declines in both country cases when moving from $M = 1$ to $M > 1$, but then exhibits no clear pattern. Similarly, as the right panels illustrate, neither the mean nor the variance of the Grofman-Selb index of competition changes consistently with district magnitude, apart from a decrease in variance when moving from $M = 1$ to $M > 1$.

All told, the conclusion is clear. The conventional wisdom is vindicated when one measures vote distances in shares of the vote. The revisionist position is vindicated when one measures vote distances in vote-shares-per-seat. So, the next question is: how can one tell which unit of distance is the correct one to use?

A central point of our analysis is that one must explicitly justify measures in terms of the assumptions about the effort-to-votes mapping they entail. Our preferred measure of competitiveness, denominated in vote shares, is justified if effort translates linearly into vote shares. We have argued that this is true for "scalable" technologies, such as TV or newspaper ads. Indeed, we simply follow the standard assumption in marketing and public opinion studies, which is that ads have a linear per-viewer effect. As long as districts are nested within relevant media markets (cf. Snyder and Strömberg, 2010), this assumption justifies denominating distances in vote shares.

To justify denominating distances in vote shares per seat, one must assume that

[17] A two-round SMD system was used from 1909-1918. A closed-list PR system in MMDs (using D'Hondt) was used from 1921-1927. In the SMD period we construct the distance measures using the electoral results from the first round.

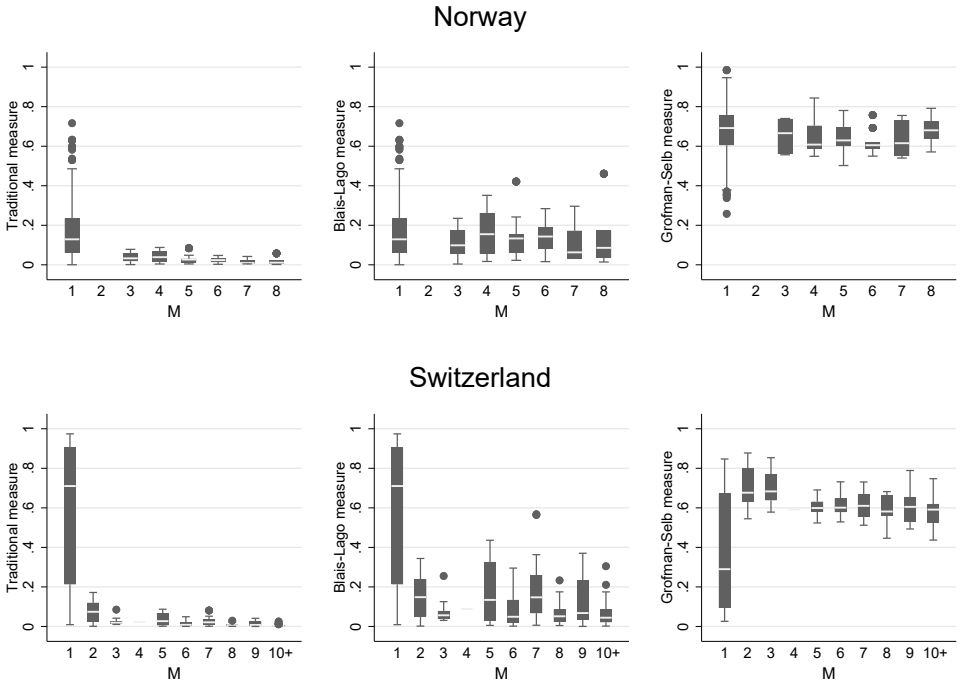

Figure 3: Alternative measures of competitiveness and the relationship of each with district magnitude

Note: The left-hand panels relate the minimum vote share gain that would earn an additional seat for a single party to district magnitude. The middle panels relate Blais and Lago's (2009) measure to district magnitude. The right-hand panels relate Grofman-Selb's (2009) index of competition to district magnitude. In the top panel, we use the balanced panel data set of Cox, Fiva and Smith (2016) covering Norway, 1909-1927. Two-round elections were used from 1909-1918, proportional representation from 1921-1927. In the pre-reform period we construct the distance measures using the electoral results from the first round. In the bottom panel, we use data from Switzerland, 1971-2003 (Grofman and Selb, 2011). We exclude one district where voting is compulsory (Schaffhausen).

effort translates linearly into vote shares per seat. Thus far, no one has defended such an assumption; nor do we see an obvious line of argument that could do so. Thus, purely in terms of grounding each measure in an explicit assumption about the effort-to-votes mapping, we prefer denominating distances in vote shares, rather than vote shares per seat. In the next section, we provide an additional reason to prefer vote share-denominated measures, based on their construct validity.

Construct validity: Does competitiveness predict turnout?

Construct validity is the degree to which inferences can legitimately be made from the operationalization of a measure to the theoretical construct on which it is based (Trochim and Donnelly, 2008, p. 56–57). A common method of assessing the construct validity of a proposed measure is to examine whether it correlates with other variables with which it should, in theory, correlate. To put it another way, evaluating construct validity involves examining whether the proposed measure correlates with variables that are known to be related to the construct.

In our case, the construct of interest is the perceived closeness of an electoral contest. When elite actors, such as candidates and parties, perceive that a particular district is more competitive, they should exert more effort to mobilize their supporters, thereby boosting turnout. These straightforward predictions about mobilization and turnout have been extensively explored and validated in previous works focusing on SMDs operating under majoritarian rules (e.g., Denver and Hands, 1974; Cox and Munger, 1989).

What about MMDs operating under PR rules? The Blais-Lago and Grofman-Selb measures of competitiveness vary considerably across both MMDs in PR systems and across SMDs in majoritarian systems. Since the operational measure varies widely across districts in both MMD and SMD systems, elite perceptions should also vary widely—if the measure has construct validity. Thus, the correlation between district-level competitiveness and turnout should be just as strong in PR systems as in majoritarian systems.

This is not what the evidence shows, however. Grofman and Selb (2011, p. 101), examining Swiss and Spanish elections, report that competition boosts turnout in the Swiss SMDs but "there is essentially no relationship between [district-level] turnout and [district-level] competition" in either country's MMDs. Blais and Lago (2009, table 6), pooling data from Britain, Canada, Portugal and Spain, reach a similar conclusion. Variations in district-level competition significantly affect turnout in the low-magnitude districts in their data but this effect shrinks (and eventually disappears) as magnitude increases.[18]

We would highlight three parts of the findings just reviewed. First, the competition-on-turnout effect is significant in low-magnitude districts. Second, the effect declines with district magnitude. Third, the effect eventually loses statistical significance. We illustrate these findings in Figure 4, which again uses data from Norway (top panel) and Switzerland (bottom panel) to relate turnout to competitiveness with the traditional measure (left-hand panels), the Blais-Lago measure (middle panels), and the Grofman-Selb measure (right-hand panels).[19]

We view these patterns as challenging the construct validity of the Blais-Lago and Grofman-Selb measures: If their measures are valid, and they vary just as much in MMDs as in SMDs, then they should produce effects that are just as large in MMDs as in SMDs. While neither set of authors explicitly raise and rebut this challenge, Blais and Lago (2009, p. 99) do offer an explanation for the declining effect of competition on turnout: "All else equal, the larger the district magnitude the harder it is to know how many votes can make a difference. As a consequence voters in large districts should be less inclined to pay attention to the competitiveness of the race."[20]

While this may be true as regards voters, what about the candidates, parties and their

[18]In Appendix Figures B.2 and B.3, we replicate Figure 3 and Figure 4 using Grofman and Selb's (2011) data from Spain. However, the Spanish case features only two SMDs, so is less suited to our purposes than the Norwegian and Swiss cases.

[19]Each sub-panel includes a fitted regression line. We relegate the full regression output to Appendix Tables B.1 and B.2.

[20]Grofman and Selb (2011) do not offer an explanation for the lack of relationship between turnout and closeness in their data.

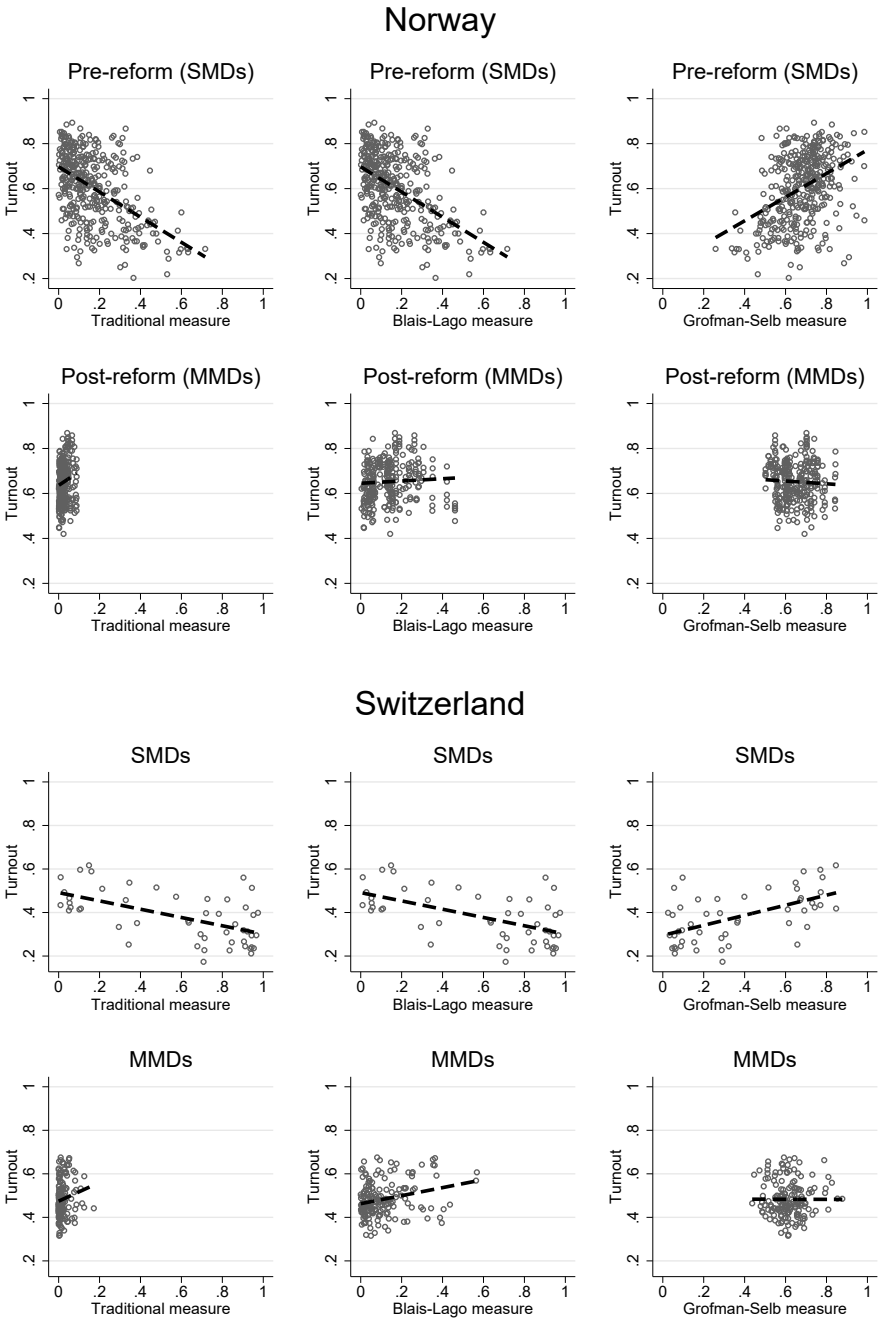

Figure 4: Alternative measures of competition and their relationship with voter turnout

Note: The figure relates voter turnout to three alternative measures of competition. In the left-hand panels the x-axes display the minimum vote share gain that would earn an additional seat for a single party. In the middle panels the x-axes display Blais and Lago's (2009) measure. In the right-hand panels the x-axes display Grofman-Selb's (2009) index of competition. In the top-panel, we use the balanced panel data set of Cox, Fiva and Smith (2016) covering Norway, 1909-1927. Two-round elections were used from 1909-1918 (pre-reform), proportional representation from 1921-1927 (post-reform). In the pre-reform period we construct the distance measures using the electoral results from the first round. Voter turnout is measured in the final round, as in Cox, Fiva and Smith (2016). In the bottom panel, we use data from Switzerland, 1971-2003 (Grofman and Selb, 2011). We exclude one district where voting is compulsory (Schaffhausen).

in-house pollsters? Suppose we have observations on many SMDs, some of which are "very competitive" and some of which are "uncompetitive." We can use these observations to calibrate what "very competitive" and "uncompetitive" means, in terms of the Blais-Lago (or Grofman-Selb) distance metric.

Now suppose that a particular 10-seat district varies substantially over time in competitiveness, as measured by Blais-Lago (or Grofman-Selb). The local elites should notice, even if the local voters do not, that their district is "very competitive" in one year and "uncompetitive" in another. They should more intensively mobilize their supporters in the first year than in the second. Turnout should be higher in the first year than the second. Thus, one cannot explain the disappearance of the competition-on-turnout effect simply by referring to the voters' lack of information about how close the contest is in higher-magnitude districts—because local elites should have good information and the resources to act on that information.

We offer a different explanation for the disappearance of the competition-on-turnout effect. As noted in the previous section, the distribution of vote-share distances changes dramatically as district magnitude increases: both the mean and variance shrink toward zero. Thus, there are two reasons to expect that the competition-on-turnout effect should disappear. The first is substantive: in high-magnitude districts, competitiveness will have a high mean and low variance, so elites' mobilizational effort will also have a high mean and low variance. The second reason is statistical: attenuation bias. If the range over which an independent variable is observed shrinks toward zero, the estimated impact of that variable on any dependent variable will also shrink toward zero (as long as there is some measurement error in the independent variable, which is certainly plausible in the present context).

All told, if one uses the traditional measure of distance denominated in vote shares, one has a consistent story to tell. First, in low-magnitude districts, large variations in vote share distances can occur. Local elites respond by adjusting their mobilizational efforts accordingly—getting out the vote more when the race is close, less when it is

foregone. Second, vote-share distances shrink on average and become less variable as district magnitude increases. Thus, the competition-on-turnout effect shrinks with district magnitude—either because local elites react less to variations in competition around a higher mean or because of attenuation bias. Third, in high-magnitude districts, local elites exert such consistently high mobilizational effort that there is little detectable variation in turnout over time within a given district.

Conclusion

Despite its ubiquity across studies of elections and democracy, the concept of competitiveness in elections has been inconsistently measured, particularly in cross-national studies that include data from multiple electoral systems. Several studies have recently proposed general ways to measure the closeness of district-level elections across systems with varying magnitude and allocation formulas (Blais and Lago, 2009; Grofman and Selb, 2009; Folke, 2014). The goal of this research pursuit is to provide a measure that can accurately compare the level of competition in districts of different magnitude (often operating under different electoral rules). Based on their new measures, the Blais-Lago and Grofman-Selb teams have challenged conventional wisdom in electoral studies—in particular, the claim that competitiveness will be higher on average and less variable in MMDs operating under PR than in SMDs operating under majoritarian rules.

In this study, we have first pointed out that all extant measures of district-level competitiveness, both traditional and new, implicitly rely on assumptions about how parties' mobilizational effort translates into votes. We have then argued that the most plausible assumption about the effort-to-votes translation supports a measure of competitiveness denominated in vote shares (such as the traditional measure or Folke's measure) rather than one denominated in vote shares per seat (such as those of Blais-Lago and Grofman-Selb).

We have validated our theoretically preferred measure, while impugning those based

on vote shares per seat, by considering a construct validity test. In particular, if a particular measure of competitiveness reflects how elite actors view the electoral lay of the land, then that measure should be able to predict elite responses. Elites should concentrate their mobilizational effort in more competitive districts, with the result that such districts exhibit higher turnout. Our empirical results from Norway and Switzerland, two separate country cases with complementary advantages in the within-country variation in electoral institutions, show that the Blais-Lago and Grofman-Selb measures fail this sort of validity test, while the family of measures we advocate passes them.

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A. Supplementary Material

Definitions of distance metrics

We can define the distance metrics discussed in the text more formally as follows.

$$R_{\bullet}^{(j)}(\boldsymbol{V}) = \underset{(R_1,...,R_J)}{\arg\min} \sum_h |R_h| \; s.t. \; S_j(\boldsymbol{V}+\boldsymbol{R}) = S_j(\boldsymbol{V}) + 1. \tag{2}$$

$$N_j^{+}(\boldsymbol{V}) = \underset{R_j}{\arg\min} \; R_j \; s.t. \; S_j(\boldsymbol{V}+\boldsymbol{R}) = S_j(\boldsymbol{V}) + 1 \; if \; \boldsymbol{R_{-j}} = (0,...,0). \tag{3}$$

$$N_j^{GS+}(\boldsymbol{V}) = \underset{R_j}{\arg\min} \; R_j \; s.t. \; S_j(\boldsymbol{V}+\boldsymbol{R}) = S_j(\boldsymbol{V}) + 1 \; \forall \; \boldsymbol{R_{-j}} \in \{\boldsymbol{R_{-j}} : \sum_{h \neq j} R_h \leq 0\}. \tag{4}$$

Effort, votes, and seats

In the second section of the main text, we discuss a hypothetical area which could be carved into different numbers of electoral districts. Table A.1 displays the distance to a seat gain for party B, denominated in different units: vote shares, raw votes, ads, and individual contacts.

Table A.1: Effort, votes, and seats

Number of seats in district	Number of voters in district	Share of vote B needs to gain a seat	Raw votes B needs to gain a seat	Ads B needs to run to gain a seat	Contacts B needs to make to gain a seat
1	N	$\frac{1}{2}$	$\frac{n}{2}$	$\frac{1}{2z}$	$\frac{n}{2y}$
2	2n	$\frac{1}{3}$	$\frac{2n}{3}$	$\frac{1}{3z}$	$\frac{2n}{3y}$
...	...	...	...	...	...
M	Mn	$\frac{1}{M+1}$	$\frac{Mn}{M+1}$	$\frac{1}{(M+1)z}$	$\frac{Mn}{(M+1)y}$

Vote shares, raw votes, or vote shares per seat?

The main text also discusses the units in which vote distances should be expressed—vote shares, raw votes, or vote shares per seat—if they are to reflect cost distances. To elaborate on that discussion, suppose that the technology of mobilization is scalable. In this case, we can approximate Equation (1) as follows:

$$MBE = \left(\frac{increment\ in\ vote\ share}{ad}\right)\left(\frac{increment\ in\ seat\ share}{increment\ in\ vote\ share}\right)Mb \qquad (5)$$

By assumption, the first term is z. Let $n_j^+ = \frac{N_j^+}{V_\bullet}$ be the minimum vote share gain that j needs to win another seat.[21] Then the second term can be approximated as $\frac{(1/M)}{n_j^+}$, since the party gains a seat share of $1/M$ when it gains a vote share of n_j^+. Substituting and simplifying, we find that $MBE = zb/n_j^+$. In other words, the MBE is proportional to the reciprocal of the distance n_j^+, which is denominated in vote shares.

Now suppose that mobilization consists of contacting individual voters. In this case, the first term in Equation (5) should be replaced by $\left(\frac{increment\ in\ vote\ share}{contact}\right)$.

By assumption, the increment in vote share per contact would be y votes out of $V_\bullet$, or $y/V_\bullet$. Substituting and simplifying, we find that $MBE = b/N_j^+$. Thus, in this case, the MBE is proportional to the reciprocal of the distance N_j^+, which is denominated in raw votes.

[21] One could alternatively use $R_\bullet^{(j)}$ or N_j^{GS+}, rather than N_j^+, in these calculations.

B. Supplementary Analyses

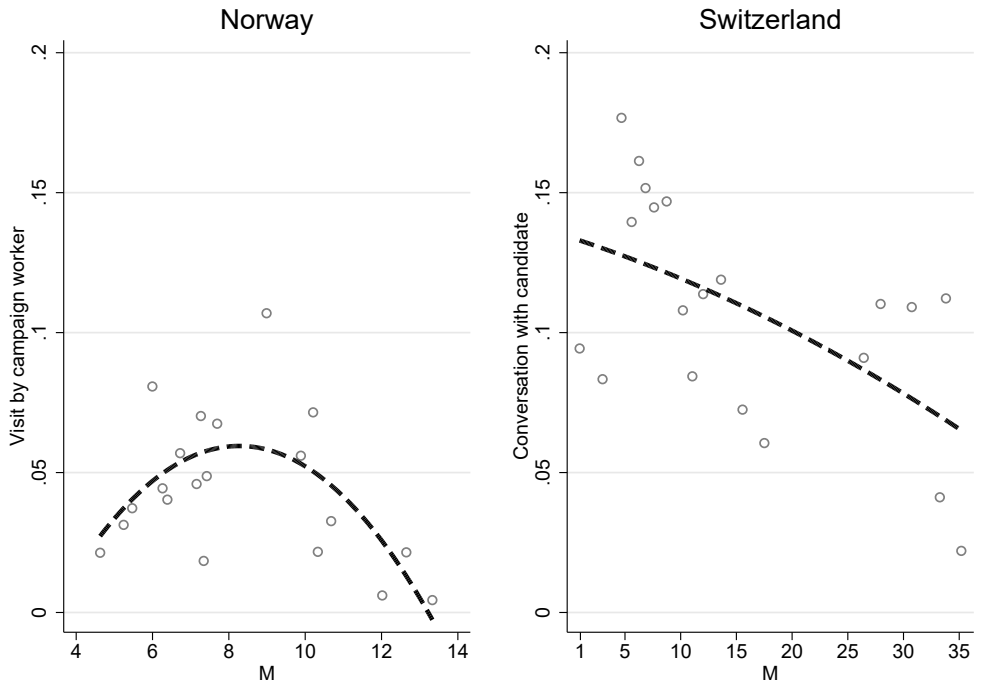

Figure B.1: Direct contact and district magnitude: survey evidence of the use of non-scalable mobilization technology

Note: The figure shows the relationship between a non-scalable mobilization technology—direct contact by campaign workers and candidates—and district magnitude, with a non-linear model fitted to the data. This figure complements the linear fit model presented in the main text as Figure 2. The left-hand panel uses data from the 1965-1969 Norwegian Election Studies surveys (N=3,099) made available by Norwegian Center for Research Data (NSD). Respondents were asked whether any party's campaign worker visited them during the campaign. The right-hand panel uses data from the 1987-1991 Swiss National Election Studies surveys (N=1,895) made available by the Swiss Centre of Expertise in the Social Sciences (FORS). Respondents were asked if they made use of conversations with candidates as information regarding the election campaign. In each panel, we show binned scatterplots residualized by year fixed effects and survey respondent background characteristics (age, gender, education level, and marital status).

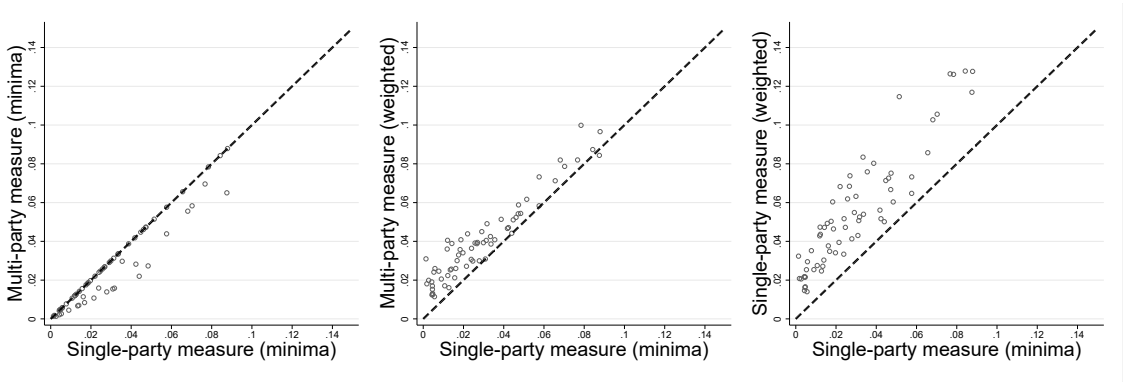

Figure B.2: Comparing across measurement decisions

Note: The left-hand panel relates the minimum vote share gain that would earn an additional seat for a single party to the minimum vote share gain that would earn an additional seat for any party. The middle panel relates the single-party minima measure to a weighted multi-party measure. The right-hand panel relates the single-party minima measure to a weighted single-party measure. We use the balanced panel data set of Cox, Fiva and Smith (2016) covering Norway, 1909-1927. Two-round elections were used from 1909-1918, proportional representation from 1921-1927. In the pre-reform period we construct the distance measures using the electoral results from the first round.

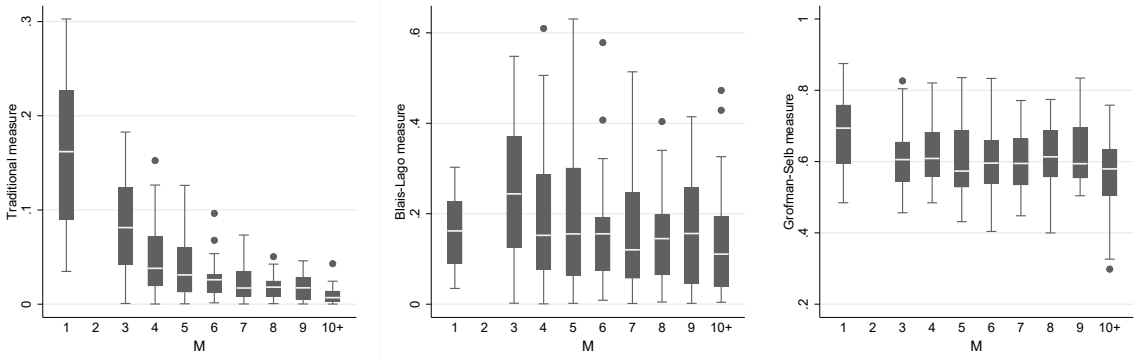

Figure B.3: Alternative measures of competition and their relationship with district magnitude: Spain, 1977-2004

Note: The left-hand panel relates the minimum vote share gain that would earn an additional seat for a single party to district magnitude. The middle panel relates Blais and Lago's (2009) measure to district magnitude. The right-hand panel relates Grofman-Selb's (2009) index of competition to district magnitude.

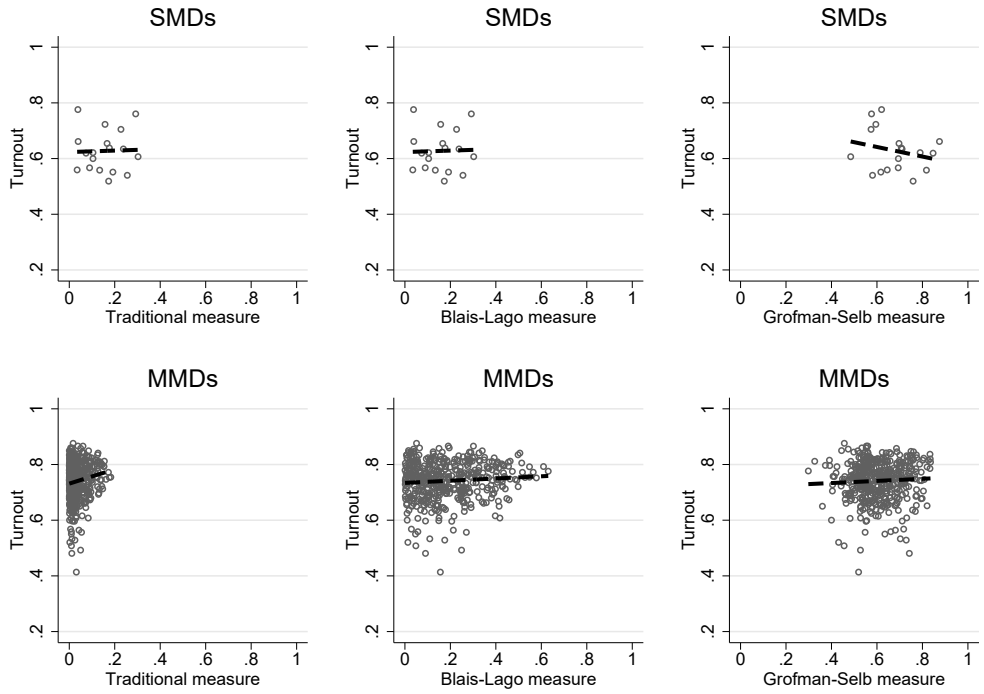

Figure B.4: Alternative measures of competition and their relationship with voter turnout in SMDs and MMDs: Spain, 1977-2004

Note: The figure relates voter turnout to three alternative measures of competition. In the top panel the x-axes display the minimum vote share gain that would earn an additional seat for a single party. In the middle panel the x-axes display Blais and Lago's (2009) measure. In the bottom panel the x-axes display Grofman-Selb's (2009) index of competition.

	(1) SMD	(2) SMD	(3) SMD	(4) MMD	(5) MMD	(6) MMD
Traditional measure	-0.560			0.601		
	(0.047)			(0.562)		
Blais-Lago measure		-0.560			0.051	
		(0.047)			(0.114)	
Grofman-Selb measure			0.526			-0.061
			(0.075)			(0.102)
Constant	0.697	0.697	0.246	0.636	0.645	0.692
	(0.015)	(0.015)	(0.052)	(0.019)	(0.018)	(0.066)
N	368	368	368	276	276	276
R^2	0.256	0.256	0.161	0.022	0.004	0.003

Table B.1: Alternative measures of competition and their relationship with voter turnout: Norway, 1909-1927

Note: Simple linear regression of (final round) voter turnout against three alternative measures of competition. We use the balanced panel data set of Cox et al. (2016) covering Norway, 1909-1927. In columns (1), (2), and (3), we use data from 1909-1918 (two-round elections). In columns (4), (5), and (6), we use data from 1921-1927 (proportional representation). Clustered standard errors (in parentheses) at the SMD (n=92) or MMD (n=22) level. In the pre-reform period we construct the distance measures using the electoral results from the first round. Voter turnout is measured in the final round, as in Cox et al. (2016).

	(1) SMD	(2) SMD	(3) SMD	(4) MMD	(5) MMD	(6) MMD
Traditional measure	-0.190			0.430		
	(0.036)			(0.337)		
Blais-Lago measure		-0.190			0.184	
		(0.036)			(0.090)	
Grofman-Selb measure			0.231			-0.002
			(0.048)			(0.075)
Constant	0.491	0.491	0.295	0.474	0.463	0.484
	(0.023)	(0.023)	(0.023)	(0.014)	(0.013)	(0.051)
N	50	50	50	169	169	169
R^2	0.325	0.325	0.319	0.023	0.067	0.000

Table B.2: Alternative measures of competition and their relationship with voter turnout: Switzerland, 1971-2003

Note: Simple linear regression of voter turnout against three alternative measures of competition. In columns (1), (2), and (3), we use data from SMDs and in columns (4), (5), and (6), we use data from MMDs. We report regular heteroscedasticity-robust standard errors in parentheses for column (1), (2), and (3) because we have only 7 SMDs. In columns (4), (5) and (6) we report cluster-robust standard errors (n=20) in parentheses. Regular heteroscedasticity-robust standard errors in parentheses. Data from Switzerland, 1971-2003. We exclude one district where voting is compulsory (Schaffhausen).