The Effects of District Magnitude on Voting Behavior

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Abstract. Is there more sincere voting in multi-member districts than in single-member districts? Existing research on this question is inconclusive, at least in part because it is difficult with observational data to isolate the effect of district magnitude on voting behavior independently from voters' preferences or number of parties. Hence, we investigate this issue in a laboratory experiment, where we vary district magnitude while keeping the distribution of voters' preferences and the number of parties constant. We find that voting for the preferred party (sincere voting) increases with district magnitude. This is consistent with existing findings from observational data. We also discover a surprising result: a high incidence of 'frontrunner' voting, which cannot be easily explained by existing research.

Keywords. District Magnitude, Sincere, Strategic, Experiment

(a) Supplementary material available in online Appendix
(b) Replication files available in the JOP Data Archive in Dataverse, http://thedata.harvard.edu/dvn/dv/jop
(c) Research conducted in line with *1964 Declaration of Helsinki* and its later amendments

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Introduction

The design of electoral systems is a salient policy concern for new democracies as well as many advanced democracies. One key issue is the ideal *district magnitude* (*DM* henceforth): the number of candidates to be elected in each district. Between 2012 and 2016, for example, Romania considered switching from large multi-member districts to single-member districts, Israel considered switching from a single national multi-member district to smaller multi-member districts, Tunisia introduced small multi-member districts for its first democratic elections, while Chile decided to replace two-member districts with medium-sized multi-member districts. What are the consequences of DM in terms of voter behaviour?

Cox (1997) suggests that as DM increases, the proportion to voters who behave *strategically* decreases, while the proportion who votes *sincerely* for their most preferred party increases. This argument is similar to a claim made by Sartori (1968, p. 279) much earlier: "The general rule is that the progression from maximal manipulative impact [via strategic voting] to sheer ineffectiveness follows, more than anything else, the size of the constituency". However, there is some observational research which suggests we should observe similar proportions of strategic voting under proportional representation and single-member districts (Abramson, Aldrich, Blais, Diamond, Diskin, Indridason, Lee, and Levine (2010)). We investigate the effect of DM on voting behavior via a laboratory experiment designed to isolate the motivations behind voter choices. In most observational studies, the effect of district magnitude on voting behavior is difficult to isolate because the number of parties and the distribution of voters' preferences varies with district magnitude (both within and across countries), and voters often consider post-election coalition bargaining when voting. So, in our experimental set up, we keep constant the distribution of voters' preferences and the number of parties and exclude post-election bargaining. We build our analysis on two stylized types of behavior: (1) *sincere behavior*, where a person votes for the party that yields the highest utility regardless of information about the electoral chances of the party; and (2) *strategic behavior*, where a person also takes into account the viability of parties when deciding whom to vote for. We define voters as being strategic when they act "in accordance with both their preferences for the candidates and their perceptions of the relative chances of various pairs of candidates being in contention for victory" (Myerson and Weber, 1993, p. 135). In contrast with some of the previous literature, we do not define being strategic as being non-sincere: a strategic subject is one that votes for the party that maximises her expected utility, which may or may not also be the sincere choice. In order to compute expected utilities, subjects need to consider the viability of candidates; just as pre-election polls serve to inform the electorate about the relative chances of the candidates (Fey, 1997), in our multi-election setting, past voting behavior helps voters form expectations on their chances of influencing the outcome. Consistent with observational studies and some existing lab experiments, we find that sincere voting increases with DM.

However, whereas *DM=1* and *DM=2* have similar levels of sincere voting, this behavior nearly doubles as DM increases to 3. Instead, strategic behavior decreases as soon as DM is 'more than 1'.

Even though the main focus of our analysis is to understand sincere *vis-à-vis* strategic voting, consistently across treatments we find a third pattern of behavior: voting for the winner of the previous round. Since we cannot impute sincere or strategic behavior to votes that are simply a vote for the frontrunner, we incorporate this type of voting in our analysis to not introduce biases in our results.

The experiment

Our experiment consists of four treatments, each corresponding to a different DM: a single-member district (DM=1); a two-member district (DM=2); a three-member district (DM=3); and pure proportional representation (PR). Subjects belong to a group of 25 subjects[1] and participate in 60 elections by casting a single vote for one of five parties.[2] In the DM=1 treatment, a candidate from the party that receives the most votes is elected, and each subject receives a payoff from the election equivalent to his or her utility for that party. In the DM=2 and DM=3 treatments, we apply a form of closed-list proportional representation, where seats are allocated to the parties in proportion to their vote-shares (using the Sainte-Laguë divisor method), and each subject receives a payoff from the election equivalent to his or her utility for the party of each candidate that is elected. Finally, in the PR treatment, we assume parties win seats in direct proportion to votes and each subject receives a payoff proportional to the share of votes each party receives. This specification of payoffs allows us to identify the strategic incentives of voters as we modify DM while leaving aside coalition formation considerations. This last aspect is indeed important and has received a great deal of interest (see for instance Kedar (2012) and Duch, May, and Armstrong II (2010)) yet is out of the scope of this paper.

Each of our 212 subjects participated in a single treatment (always voted in an electoral system with the same DM) during 60 elections –there are 12,720 observations. In all treatments, the utility that subjects derived from each of the parties was privately announced. Every five periods, subjects' preferences were redrawn. We discuss the specific details of the overall distribution of preferences in Appendix C. For our purposes what really matters is that subjects never observe other voters' preferences. After each election aggregate results are publicly announced but individual payoffs are private information: voters can only work out the distribution of preferences by observing past voting behavior. Implicit in this feature of our experiment is that we want subjects to condition their voting decisions solely on their own preferences and aggregate past voting behavior.

[1]Due to some participants not showing up on time some groups had slightly less participants (see Table 1 in Appendix B). Instructions were modified accordingly.

[2]Casting a vote for a single party is the most common ballot-structure in single-member as well as multi-member districts in national parliamentary elections in democracies (Reynolds and Steenbergen, 2006).

The same procedure was used in all sessions.[3] Instructions (see Appendix A) were read aloud and questions answered in private. Students were asked to answer a questionnaire to check that they fully understood the experimental design, the seat-allocation method, and the payoff structure for their particular treatment group. If any of their answers were wrong, we referred the participant to the section of the instructions where the correct answer was provided. Students were isolated and could not communicate with each other.

In the first election each participant was shown a screen with their utility from each of the five parties and was asked to cast a single vote for one of the parties. Abstention was not allowed. The participants were then informed of the outcome of the first election: the number of votes each party received; which candidate(s) was (were) elected; and the payoff they received from the election. The participants were then asked to vote again for one of the parties. This procedure - in which we counted the votes for each party, we assigned seats, and we informed participants about the outcome of the election and their payoff - was repeated for five elections. Then, after five elections, the participants' preferences were redrawn and the participants interacted for a further five elections, after which the preferences were redrawn again. In other words the experiment was organized as 12 sets of five rounds (60 elections in total) and after each set of elections, participants' preferences and party labels were redrawn.

At the end of the last election, the computer randomly selected four elections and subjects were paid the profits they obtained in those four elections and a show-up fee of 3 GBP. At the end of each session, participants were asked to fill in a questionnaire on the computer and were given their final payment in private. Session length, including waiting time and payment, was around 90 minutes. The average payment was 15.71 GBP (approximately 26 USD).

Aggregate Results

As an illustration of our results, Table 2 shows the outcomes of elections 11 to 15 for one of the groups in each treatment (we report the votes received by each of the five parties and the candidates assigned to each party). The results with DM=1 shows voters *coordinating* around the first two parties A and B, with support for the other three parties declining over time. This suggests a high proportion of strategic behavior, with voters whose preferred party was C, D or E realizing that their most preferred party had no chance of winning. When DM=2, voters appear to settle around three parties (A, B and C) as Cox (1997) would have predicted. In contrast, when DM=3 party C ran away with the election after a few rounds and there seems to be a fight for the last seat. Finally, in the fully proportional treatment group, there were considerable shifts in voting

[3]No subject participated in more than one session. Students were recruited through the online recruitment system ORSEE (Greiner, 2004) and the experiment took place on networked personal computers in Centre for Experimental Social Sciences at Nuffield College, Oxford in November 2011. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007).

patterns, despite the fact that the optimal behavior for each participant in this treatment is always to vote sincerely: recall that there are no post-election coalitional concerns in our experimental design and voters' payoff solely depends on the distribution of votes in the PR treatment.

election	**DM=1**	**DM=2**	**DM=3**	**PR**
11	(6,7*,4,4,3)	(7*,6,6*,3,3)	(5*,5*,6*,4,4)	(5,6,3,6,4)
12	(7,12*,4,1,0)	(8*,7,8*,1,1)	(4*,7*,10*,1,2)	(6,7,3,5,3)
13	(8,12*,3,1,0)	(7,8*,7*,1,2)	(4*,3,16**,0,1)	(9,7,2,4,2)
14	(8,14*,2,0,0)	(7,8*,8*,0,2)	(6*,3,13**,1,1)	(11,6,1,5,1)
15	(9,14*,1,0,0)	(7,8*,8*,1,1)	(3,4*,14**,2,1)	(13,5,2,3,1)

TABLE 1. Sample of election results for each treatment.
In each cell we indicate the votes received by parties A, B, C, D, and E (resp.) and we identify with one or two stars (* or **) the parties that obtained 1 or 2 candidates, respectively.

In what follows we classify a vote as *sincere* when the subject votes for his/her most preferred party, the one that yields maximum payment if elected. A *strategic* vote is instead a vote in which the subject not only considers his/her preferences for all parties but also the likelihood that his or her vote will be pivotal – we compute expected utilities and assume that a strategic subject votes for the party that maximises expected utility. In Appendix D we offer a detailed explanation of the computation of expected utilities when voting for each party. For this purpose we build on Myerson and Weber (1993), and consider that our subjects best respond to previous period play by assuming that the probability that any other player votes for each of the parties coincides with the previous period frequency of votes.[4] As stated above, our definitions allow a voter to be *simultaneously* strategic and sincere: the optimal action may consist of voting towards the subjects' preferred party.[5] The frequency of sincere and/or strategic voting behavior in our four treatments is shown in Table 3. The long-standing hypothesis in the electoral studies literature that sincere voting should increase with DM seems to find little support in our aggregated data when comparing our three non-fully proportional treatments.

Most surprisingly, we see a decrease in strategic voting as we increase DM from 1 to 3. We expected the opposite because when DM increases it is more likely that that a strategic vote coincides with a sincere one. This increased coincidence in both types of voting is captured in the last row of the table, where the 'predicted' values are the percentage of observations where voting sincerely for the most preferred party in an election can also be classified as a strategic vote for the party that maximizes the expected payoff.

[4]Forsythe, Myerson, Rietz, and Weber (1993) is the only experimental work we are aware of that uses past election information as the cue from which voters form expectations about their probability of being pivotal.

[5]The literature disagrees on what should be referred to as *strategic voting*. Similar to us, Kawai and Watanabe (2013) and Cho (2014) consider a voter to be strategic when his/her action maximizes expected utility (regardless of this action being sincere or not); instead, the empirical political behavior literature only classifies a voter to be strategic when his/her vote maximises expected utility and is *not* sincere. In Appendix E we show that all our results are robust to considering either definition.

	DM=1	DM=2	DM=3	PR
% sincere	*70.5*	*72.4*	*72.7*	*89.8*
% strategic	*84.2*	*74.1*	*70.5*	*89.8*
% observed both	*64.5*	*67.0*	*66.6*	*89.8*
% predicted both	*72.5*	*85.5*	*91.2*	*100*

TABLE 2. Frequency of Types of Behavior by Treatment."Observed Both": a vote is *both* sincere and strategic. "Predicted Both": the sincere vote and the strategic vote coincide

Something that seems puzzling in Table 3 is the huge difference between the percentage of observations that are both sincere and strategic and the situations that are predicted to be so. In situations in which both sincere and strategic actions coincide, the voter should have no conflict about supporting his preferred party. However, we observe that around a 20 percent of subjects fail to choose this action when it is optimal to do so. For whom are they voting? To our surprise we see that 50 percent of the subjects who did not vote for their most preferred party (when sincere and strategic actions coincide) voted instead for the party that obtained the most votes in the previous election round –the *frontrunner*. When adding this third type of behavior to being sincere or strategic, we can classify more than 90 percent of all vote choices in our data.

Voting for the frontrunner in our setup is only defined for election rounds 2,3,4 and 5 given that in the first election (round 1) preferences have been redrawn and there is no previous period of play with the same preferences. Voting for the frontrunner is usually rationalised in terms of herding (Nageeb and Kartik, 2012), information aggregation (Feddersen and Pesendorfer, 1997), or favoring a stable governing party (Riambau, 2016). However, there is no room for such rationalizations in our private values setup. Further evidence towards frontrunner behavior is found in our control treatment, with a fully proportional electoral system, where voting sincerely is the dominant strategy (i.e. sincere and strategic votes always coincide).

An important issue when analysing our data (as with actual voting data) is that many observations can be simultaneously classified as more than one type. Consider for instance a subject whose preferred party is also the one that obtained most votes in the previous period when DM is 1. In this situation, when the subject votes expressively, s/he is also voting for the frontrunner and most likely her/his vote also coincides with her/his strategic action. Table 3 shows the subsample of observations in which the three types of actions do not coincide.[6]

The last row in the table shows yet another manifestation of a mechanical effect of DM: as DM increases it is more likely that the sincere and strategic actions coincide, thus our sample becomes thinner. We are now only considering less than 7 percent of our observations yet we see that sincere voting is greater when DM is 3 rather than 1, and strategic voting decreases. Possibly due to the increased complexity of the voting rule we see frontrunner voting and "other" types of behavior increasing when DM is larger than 1.

[6]Duch, May, and Armstrong II (2010) restrict their analysis to such disjoint sample.

	DM=1	DM=2	DM=3
% sincere	*14.4*	*12.4*	*22.5*
% strategic	*70.5*	*53.7*	*42.8*
% frontrunner	*7.4*	*24.8*	*22.5*
% other	*7.7*	*9.2*	*12.3*
observations	*312*	*218*	*138*

TABLE 3. Frequency of Types of Behavior by Treatment when Sincere, Strategic and Frontrunner do not coincide.

Tables 3 and 4 both indicate the heterogeneous effects of DM in our population. If all subjects were sincere we should observe 100 percent of observations as sincere, while strategic voting should increase with DM (due to the increased coincidence between sincere and strategic voting), and frontrunner voting should remain unchanged. Instead, if all subjects were strategic, sincere voting should increase with DM, strategic voting should always be at 100 percent, and frontrunner voting should decrease with DM, because more parties become viable so less voters end up favoring the frontrunner candidate. In the next section we analyse in detail individual voting decisions, to understand whether and how DM has a systematic effect on the individual behavior of subjects.

Strategic Versus Sincere Types

We follow a similar strategy to Duch, May, and Armstrong II (2010) to estimate the proportion of each type of voter. We assume a strategic type's utility (alternatively, sincere or frontrunner)[7] follows a standard conditional logit function. In this way, we can estimate how responsive subjects are to payoff differences when casting their vote. Our goal is to estimate the probability that the vote of individual i in election t is of type strategic, sincere or frontrunner. We estimate these probabilities using the Expectation-Maximization (EM) algorithm. We report the average of all such probabilities across types and rounds, and, as standard in the mixture models literature, interpret it as the proportion of votes of each type in the population. To compute these probabilities, we start by making an educated guess for the average responsiveness to payoff differences across individuals, as well as the unconditional probability an individual is of a particular type. We then construct a standard likelihood function which allows us to compute the conditional probability that each single vote in our experiment is of each type. We then plug these values back into the likelihood function and get updated estimates for our parameters of interest. This once again feeds back into new updated individual conditional probabilities, which allows us to update the likelihood function, etc... We iterate this process until convergence. For a detailed account of our estimation see Appendix G.

[7]Our analysis focuses on the comparison between sincere and strategic types yet, as discussed earlier, we would be biasing our results if we did not consider the possibility of subjects voting for the frontrunner.

Table 4 reports the results. For each DM we report the percentage of individuals classified as being of each type and the percentage of correct vote predictions (reported 95% confidence intervals are computed using bootstrapping, with 1,000 replications). The estimated proportion of sincere types sharply increases between DM=2 and DM=3. Instead, the estimated proportion of strategic types goes down with DM: being aware of the viability of the different parties becomes too difficult and psychological effects kick in. Hence, subjects become less strategic.[8]

	DM=1	**DM=2**	**DM=3**	**PR**
% sincere	*19.99* *(17.5, 21.9)*	*20.41* *(17.2, 25)*	*35.86* *(30.6,41.2)*	*86.06* *(84.9,88.4)*
% strategic	*71.04* *(69.3, 73.85)*	*63.73* *(60.2, 68.4)*	*53.89* *(48.1,58.5)*	
% frontrunner	*8.97* *(7.6, 10.1)*	*15.86* *(7.4, 18.3)*	*10.25* *(8.8,12.6)*	*13.94* *(11.6,15.1)*
% correctly predicted votes	*91.32*	*79.58*	*78.24*	*92.38*
observations	*2,304*	*2,400*	*3,360*	*2,112*

TABLE 4. Proportion of subjects of each type. Sincere and strategic actions coincide in PR. 95% confidence intervals in parenthesis.

A possible explanation of the above results is that for a small increase from *DM=1* to *DM=2* voters might still want to engage in strategic thinking, but make mistakes that result in them casting a vote we cannot rationalize. As DM becomes even larger, some voters seem to entirely give up on strategic thinking and vote sincerely. Some of our subjects did not vote for their preferred party in the first round of elections when there was no information about (previous) aggregate turnout. Dropping these subjects reinforces our findings –Appendix F contains various robustness checks.

As noted above, one of the main issues with our experimental design is that many actions are observationally equivalent. As a robustness check, we estimate the proportion of types in the subsample where the three types of action do not coincide and find support for our previous findings. Our results are also robust to considering the alternative definition of strategic voting as a strategic and non-sincere vote –see Appendix E. There is yet another way to classify strategic behaviour by focussing on the last seat assigned: vote towards *last winner* vs. *first loser*, see Cox (1994). This different way to rationalize strategic behavior is not that different from the one we have considered in the text: both criteria coincide in their classification in 76% of our observations. Thus, it does not come as a surprise that results presented in the paper are robust to this different specification. Finally, in Appendix I we regress our estimated probability of being strategic on the usual socio-demographic characteristics (age, gender, experience in experiments, studies, nationality) yet find no significant relationship.

[8]In the fully proportional treatment both sincere and strategic behaviors coincide. In other treatments we dropped the first rounds when sincere and strategic votes coincide.

Finally, we compare the fit of our three types model with models hitherto used in the literature by looking at the predictive power (percentage of correctly predicted observations) of different approaches. We consider the conditional logit model, the mixed logit model, and a two types model. Our approach consistently improves predictions by at least 30% –see Appendix J.

Conclusion

A widely-held assumption in political science is that non-sincere voting should be lower in higher-magnitude districts. We designed a lab experiment to isolate this effect and found that sincere voting increases with DM. There is a mechanical component to this effect: as DM increases, the proportion of voters who find that their most preferred party yields the highest expected utility increases. However, not all of this increase in sincere voting is due to a mechanical effect, as strategic voting decreases with DM. So, part of the increase in sincere voting is due to voters changing their strategy. The source of these effects remains a fruitful area for future research.

We also discover a surprising regularity: in more than 10% of our observations subjects vote for the frontrunner irrespective of DM. As Hinich (1981) points out: "voting for the winner is no less plausible than the assumption that voters believe they can be pivotal". To understand which subjects vote for the frontrunner, we replicate the analysis in the previous section and regress the probability of being a frontrunner on personal characteristics yet find no significant effects. In short, we do not fully understand the psychological motivations behind such behavior yet we contend that this form of voting behavior should be taken more seriously in future theoretical and empirical research.

In terms of external validity, there are, of course, many other factors that come into play in 'real' elections, such as parties changing positions if the electoral system changes, and voters thinking about government formation expectations when casting their vote. Nonetheless, we believe that we can draw some general inferences from our results. In particular, our results are consistent with previous research that suggests that a change from a single-member district electoral system to a low-magnitude form of PR would significantly increase the proportion of voters who would choose to vote for their most preferred party rather than to vote for their second- or third-best option.

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