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Abstract: We examine through an experimental design how rational and non-rational considerations affect the decision to vote or to abstain in First Past the Post and PR elections. We show that in both types of elections, but particularly so under PR, a majority of subjects do not make the "right" decision, that is, they do not choose the option that is the most beneficial to them, given. We also demonstrate that a social norm such as sense of civic duty plays a bigger role, even in the lab, and particularly so in PR elections. We suggest that civic duty has a greater impact under PR because this electoral system has a more complicated formula, making it more difficult for voters to realize that their vote is unlikely to substantially affect the outcome of the election.

Keywords: Experiments, Voting, First Past the Post, Proportional Representation, Civic Duty

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To Vote Or To Abstain? An Experimental Study

of First Past the Post and PR Elections

Why so many people decide to vote in an election when their chance of casting a pivotal vote is so small is one of the great paradoxes that rational choice theorists have been struggling with for a long time (Blais 2000; Grofman 1993; Levine and Palfrey 2007; Mueller 2003). Since voting is costly one would expect instrumental voters to abstain unless they are in the extremely exceptional situation of having a chance to affect the final result of the election. Stemming from this 'paradox of voting' a vast literature has looked at the motivations, both rational and non rational, that induce people to vote or not to vote. A good part of that literature has examined the contextual determinants of variations in turnout across space and over time (for a review see Blais 2006), while another stream of research has looked at the perceptions and attitudes that influence the decision to vote or to abstain (for a review see Blais 2008). Some recent research has examined how contextual and individual level factors interact in the process (Kittilson and Anderson 2011). This article follows the last tradition.

We examine how rational and non-rational considerations affect the decision to vote or to abstain under two different electoral systems. Many scholars have tried to ascertain the effect of the electoral system on turnout, most of the time on basis of cross-sectional evidence. Most studies find that turnout is higher under PR (Blais & Carty 1990; Bowler et al. 2001; Ladner & Milner 1999). It is not clear, however, why it is so. A first argument is that because PR produces more parties voters are more likely to find a party in line with their views (Seidle & Miller 1976). It has also been suggested that PR increases turnout because of the lower probability of a wasted vote (Franklin 2004). Under plurality or majority rule many voters are in districts strongly held by one party while under PR any vote may have an influence on the balance of power between parties.

Yet other scholars have argued that we should expect turnout to be lower under PR. First Past the Post, in particular, is easier to understand (Geys 2006). Second, PR typically produces coalition governments that obscure the link between the act of voting and its effect on the formation of government (Jackman 1987). Finally the probability for one single voter to change the outcome of the election is equally infinitesimal under PR and non PR rule.

In short, we are left with an empirical regularity, that is, turnout is higher under PR, for which we have no compelling micro foundation (Blais 2006). In order to shed new light on this issue this paper exploits the results of an

experimental study of the decision to vote or to abstain in First Past the Post (FPTP) and Proportional Representation (PR) elections. We determine how rational and non-rational factors play in the two types of elections.

The Study

The experiment is as follows.[1] A group of 21 people is invited to participate in two series of ten elections. In each of these elections, there are two parties (named A and B) located respectively at 5 and 15 on a 0 to 20 scale (see Figure 1). Each participant is randomly allocated a different position on the 0 to 20 scale. One participant is thus located at each of the 21 positions. Participants are informed about the overall distribution of positions but they do not know the positions of specific individuals. They are not allowed to communicate with each other, and their position changes randomly at each election.

At each election, participants vote for party A, for party B, or they abstain. At each election a participant's gain equals 16 points minus the distance between the winning position and the participants' position. They are informed about the outcome of the election and their personal gain after each vote. How votes translate into winning positions depends on the voting rule, as explained below. There is a one point cost in voting. Ten points equal one dollar (Montreal) or one euro (Brussels).

There are two series of ten elections, one series under first past the post (FPTP) and one under proportional representation (PR). Under FPTP, the winning position is that of the party with the most votes (there is a random draw in case of a tie). Under PR, the winning position depends on the relative support given to the two parties. The winning position is a weighted average of the candidates' positions (5 and 15), where the weight given to a candidate's position is the vote share obtained by that candidate. More formally, it equals 15 minus the proportion of votes for party A times 10. For example, if all votes go to party A, the winning position is party A's position, 5. If all votes go to party B, the winning position is 15. If each party gets the same number of votes, the winning position is right in the middle, at 10. If 70% of the votes go to A, the winning position is 8 whereas if 70% of the votes go to B, the winning position is 12.[2] This way of modeling Proportional Representation intends to grasp a key feature of PR systems: that the policy is driven by more than one party, with forces proportional to their vote shares. It is used by Ortuno-Ortin (1997), Laslier and Ozturck (2006), De Sinopoli and Iannantuoni (2007), and De Sinopoli et al. (2011).

Four groups performed the experiment in Montreal and four groups in Brussels. In each location, two groups started with FPTP elections and two groups started with PR. In each location, two groups were asked to indicate, at the

time of voting, their expectations about the outcome of the election and two groups were not asked to reveal their perceptions. At the end of each session, subjects were asked to fill in a questionnaire with questions about socio-demographic variables, as well as questions about political attitudes, including questions designed to tap their sense of civic duty.

Our experimental design differs from previous research on a number of dimensions. First, and most important, participants in our experiment are explicitly told that they are involved in an election with parties and that they have to decide whether to vote or not (and, if the former, for which party to vote for). In previous turnout experiments (see Duffy and Tavits 2008; Levine and Palfrey 2007; Schram and Sonnemans 1996), there is no reference at all to voting or elections. Participants are assigned to one of two groups, and they are given the choice of purchasing a token or not (at a certain cost). The winning group is the group with a plurality of tokens (under the equivalent of FPTP). Purchasing a token is equivalent to voting with a cost in our experiment, and not purchasing a token is equivalent to abstaining. The researchers explain that they avoid referring to elections and voting because « they did not want to cue subjects' beliefs with regards to social norms or sanction surrounding voting decisions. » (Duffy and Tavits 2008, 606). Since we wish to understand both the rational and the non-rational considerations that drive people's decision to vote or to abstain in elections, the experiment is framed explicitly as an election, and the decision as one between voting and abstaining.

Second, our experiment includes FPTP and PR elections. As far as we can tell, only one experimental study (Schram and Sonnemans 1996) has compared FPTP and PR. That study, however, like all others, is not framed as an election. Furthermore, the payoffs and the cost of voting are not identical in the two systems.

Third, our study includes measures of participants' perceptions of the likely outcome of the election, thus making it possible to determine whether the participants made the "right" choice given these perceptions. Very few studies tap subjects' perceptions, an important exception being that of Duffy and Tavits (2008), who asked people to indicate the probability that their vote would be pivotal. We are concerned that some people may have great difficulty comprehending what a pivotal (or decisive) vote really means (see Esponda and Vespa 2010) and that many find it difficult to rate probabilities, especially those that are quite small (Kahneman et al. 1982). For those reasons, we simply ask participants to indicate how many of the 20 other subjects they expect to vote for party A and party B, and how many they think will abstain. We thus refrain from talking about probabilities. We rather ask about the most likely outcome and we can determine how close this is to a situation where the individual's vote would be pivotal.

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Fourth, in our experiment there are 21 different positions, and the participants are assigned a new (randomly chosen) position in each election while most experiments involve only two or three positions (or groups) and the subjects stay in the same position throughout all rounds. Our approach allows for a more precise analysis of how one's position affects the decision to vote or abstain. Because positions are shifting from one election to the next, however, it is more difficult to take into account learning effects.

Theoretical Expectations

Many scholars have attempted to measure the effect of PR on turnout (compared to FPTP). The results seem to converge (Blais & Aarts 2006). The difference is typically around 5 percentage points. In their comparison of 20 industrialized democracies over a century Blais and Carty (1990) find an impact of PR of 7 percentage points. Rose's study of EU countries talks of a PR boost of 9 percentage points (Rose 2004). Comparing Swiss cantons, Ladner and Milner (1999) report again a PR boost varying between 3 and 7 points.

The problem, as explained in the introduction, is that the mechanisms behind this difference remain unclear. One interpretation is that PR fosters turnout because it increases the number of parties running in the election. But the empirical evidence suggests that having more parties in fact decreases turnout (Blais & Dobrzynska 1998). The positive effect of party mobilization on turnout is also hard to link with the PR boost. Turnout is higher when candidates and parties campaign actively (Denver & Hands 1974) though the effect is not always linear (Caldeira, Patterson & Markko, 1985). But PR has no straightforward positive effect on campaign mobilization (Karp, Banducci & Bowler 2007). It has also been suggested that PR increases turnout because of the lower probability of a wasted vote (Franklin 2004), but this has not been supported by empirical evidence. At the same time theoretical arguments of why PR should deter electoral participation are not better confirmed empirically. The expected negative influence of coalition government on turnout, for example, has been disconfirmed (Brockington 2004).

The experimental design should allow us to shed some new light on this question. We do not focus on the intervening variables that may contribute to producing a higher turnout in PR than in FPTP elections. In particular, we leave aside the impact of the number of parties (we have only two parties in the experiment), as well as the influence of party mobilization. Our goal is to better comprehend the individual "calculus of voting" under the two different rules. We choose to focus on this specific aspect not because we think that other factors are not important, but because we cannot

capture and test for all of them in one single experiment. We first examine the rational incentives to vote or abstain under the two systems; we then turn our attention to non-rational factors (sense of civic duty).

We start by using a game-theoretical framework to study those rational factors under FPTP and PR. We study the 21-player games defined by the experimental protocol under the assumption that voters are expected payoff maximizers. In both cases (FPTP and PR) the optimal decision of a voter depends upon what the other voters are going to do. Yet the incentives are different under the two rules. Details are provided in the Supporting Information (SI).

Under FPTP, the rational voter may be willing to pay the cost and vote in only two types of situation. Either the other voters' votes result in an exact tie, in which case voting makes the decision for sure while abstention leads to a draw (random outcome). Or the other voters' votes result in a situation where the voter's preferred party is exactly one vote behind the other party, in which case abstention leads to a sure defeat and voting results in a draw. The expected benefit of voting, to be compared with the cost of voting, is thus equal to half of the difference in payoff between the two possible outcomes, weighted by the probability of these situations in which the voter is "pivotal". The expected benefit of voting is only half the difference in payoff because no single voter can completely turn the tide of an election. A single voter can either create or break a tie; thus, a single pivotal voter is only responsible for half the difference in expected payoff based on the possible outcomes of the election. Note that the difference in payoffs depends on the voters' position: it is equal to 0 for the voter in position 10 and equal to 5 for all voters in positions from 0 to 5 or from 15 to 20.

Under PR, on the contrary, voting always makes a difference, because it always tilts the outcome in one direction or the other. But the size of this effect depends on how many other voters participate. If participation is small, the effect of one more vote is relatively important: at one extreme if 20 individuals abstain, the last one can decide if the winning position will be 5 or 15. If participation is large one more voter has only a tiny impact: indeed, at the other extreme if 20 voters vote, the last voter can tilt the outcome by only .24 points, for instance from 10 to 9.76. ($(11\times5+10\times15)/21=9.76$). This individual power decreases rapidly with participation. When 10 other voters vote (5 for each candidate), the shift is 0.45, that is, much less than the cost of voting. Compared to FPTP, the payoff resulting from voting rather than abstaining does not vary as much across positions, as soon as group participation is not too low.

Thanks to the questions we asked about subjects' anticipations of other voters' behaviour, we are able to determine whether subjects' decisions in the experiment were rational or not, at the individual level. So far, we have

described optimal individual decision to vote or to abstain, given other voters' behaviour. We now turn to equilibrium analysis, by describing the expected outcome of the game if all individuals are pure payoff maximizers.

Supporting Information provides the full equilibrium analysis. We compute Nash equilibria of the two games (FPTP and PR). Under First past the post, all pure strategy equilibria are characterized by very high participation: at least 18 voters vote out of 21. Allowing for mixed strategies we prove that all symmetric equilibria exhibit high expected participation rates, at least 18 votes. As to asymmetric mixed-strategy equilibria, no such prediction can be made. An example is provided of an equilibrium in which participation is low: average turnout is 2.26 out of 21 (and one party is elected with probability close to 0.99). For proportional representation, even if there again exist many different equilibria (pure and mixed), we prove that participation cannot be high: in any equilibrium, mixed or pure, the expected participation is less than 6.3 out of 21.

The theoretical prediction is thus that rational considerations should lead to a low turnout in PR elections (whatever the kind of equilibria we consider), and to a high turnout in FPTP elections, if we restrict attention to pure or symmetric mixed strategy equilibria. Since it may be considered quite unlikely that subjects manage to coordinate on asymmetric mixed equilibria under FPTP (the only cases where low participation can occur), our conclusion is therefore that rational considerations alone should lead to a higher turnout in FPTP than in PR elections.

What about non-rational factors? Our prediction is that they will play a larger role in PR than in FPTP elections. The PR system is more complicated. In the case of FPTP, there are only two possible outcomes: either A or B wins. Things are more complicated under PR, where the winning policy can take many different values, depending on the distribution of the votes between candidates A and B. Furthermore it is easier under FPTP to see that one's vote will not matter, that is, it will have no effect on the outcome of the election. In PR elections, as we have noted, one's vote always has some effect, even if that effect is often tiny. In such a context calculating expected benefits is more costly than under FPTP, and so people may be inclined to vote or to abstain on basis of other non-rational elements. In this study, we examine one such consideration, sense of civic duty, which has been shown to be an important motivation for voting (Blais 2000).

Aggregate Results

We first present aggregate results. On average, turnout is slightly higher in FPTP (72%) than in PR (69%) elections. The difference is statistically significant but it is substantially small. These results are not in line with the

predictions of the game theoretic model outlined above. They are particularly surprising in the case of PR elections where the theoretical prediction is that participation should be quite low. The (relatively) high turnout observed in PR elections constitutes a puzzle that we examine below.

One explanation could be that it takes voters some time to understand the consequences of their own decision on electoral outcomes. In particular, because learning and coordination may take some time, theoretical predictions might only become accurate descriptions of what actually happens after some trial and error period. Figure 2 depicts turnout by order of elections, for the two voting rules (remember that we hold series of 10 elections under each voting rule). Under FPTP, turnout starts at 76% in and progressively declines to 71%, whereas it goes from 77% to 64% under PR. We indeed observe that turnout decreases from the first to the tenth election.[3] This suggests the presence of a learning effect; people come to understand after a few elections that it may be more rational to abstain. As we can see from those numbers, however, learning is quite modest. The turnout gap between the two systems remains small, even after ten elections.

Before turning to the individual level analysis, we should make some observations about other factors which could have influenced the patterns but did not. Turnout was slightly lower in Brussels (68%) than in Montreal (73%). The existence of compulsory voting in Belgium does not seem to produce a greater willingness to participate in elections in which voting is not mandatory. None of the patterns that are examined later are affected by the inclusion of the place of experiment as a control variable.

More importantly for our purposes, we observe no significant difference between the groups depending on whether they were invited or not to reveal their predictions about the other participants' behavior. The concern is that asking such a question would induce people to think more strategically and to come to the conclusion that the rational decision, in most cases, is to abstain . Interestingly, we do not find such an effect. In fact, turnout is slightly higher in those groups who were asked their perceptions (72%) than in those who were not asked (69%). Our nil result is similar to that reported by Duffy and Tavits (2008). Finally, turnout is the same in the first (71%) and second (70%) series of elections.

The Impact of Rational Considerations

We now turn to individual-level analysis. In a first step, we examine the impact of individuals' positions on turnout. We then proceed to analyze how expectations about other participants' behavior affect people's behavior. Lastly, we test whether voters make a "rational" decision by comparing expected gains from voting and abstaining.

The theoretical prediction of the rational choice model is that turnout should be highest for those at positions 0 to 5 and then decline progressively for those at positions 6 to 10.[4] Let us start with FPTP and consider those at position 5. Their differential benefit related to the outcome of the election is 10 more points if party A wins rather than party B. That differential benefit, that is, the absolute difference in the gain associated with a party A (16-(5-5)=16) versus a party B(16-(15-5)=6) victory, is the same (10 points) for all positions between 0 and 5. This differential benefit is the same for voters at positions 0 to 5; it decreases from 8 points for those at position 6 to 0 for those at 10. The turnout rate should thus be the same for all positions between 0 and 5 and then it should progressively decline from positions 6 to 10. The relationship should be similar in the opposite direction, that is, turnout should increase from 10 to 15 and then stabilize from 15 to 20. The shape of the relationship should be the same in PR elections. A vote for party A will tilt the winning position a little closer to 5, thus yielding a similar differential benefit for all positions between 0 and 5. As in the case of FPTP, this differential benefit decreases as one's position approaches 10. In PR elections, however, the stakes are much smaller as one vote can only slightly modify the winning position. As a consequence, turnout should vary only weakly across positions.

Figure 3 shows the mean turnout associated with each position under the two systems.[5]The pattern is basically the same under the two systems though it is somewhat more pronounced under FPTP. Turnout decreases substantially as one's position moves from 5 to 10. These results confirm that people react to the differential benefit associated with their position.

Unexpectedly, however, turnout is substantially lower at the extreme positions than at position 5, even though the party differential is the same. Why is someone at position 0 more prone to abstain than someone at position 5? The most plausible answer is that people do not consider only their *differential* benefit when they decide to vote or not, they are also less inclined to vote for a party that is not very close to their own position, irrespective of their distance from the other party.

This interpretation can be tested. We can relate the propensity to vote to two variables that reflect respondents' location: the differential benefit associated with the victory of the two parties, and the distance between an individual's location and the location of the closest party (the two variables are correlated, but not too strongly, at -0.37). Table 1 shows that this is indeed the case. People do respond to the differential gain associated with one party winning rather than the other, as they should according to rational choice theory, but they also react on the basis of how far they are from any

party, irrespective of the other competitor's position. This is so in both systems, though the pattern is stronger under FPTP.

These results are broadly consistent with the predictions of the rational choice model. Those whose positions are between 0 and 5 have more to gain or lose and they are more likely to vote. Because the stakes are more dependent on positions in FPTP, turnout varies more strongly across positions under that system. Support for the theory is only partial, however. People at the extreme are less prone to vote than those at positions 5 or 15, even though their differential benefit is the same. Besides, under FPTP, voters in position 10, being indifferent between candidates A and B, should never incur the cost of voting, no matter what other voters do. Still, participation rate for those voters is over 25%.

These initial results provide only limited support for the rational choice model. The rational choice model predicts that individual behavior should depend on their position, but also on their anticipations about how other voters are going to behave. We now test those predictions.

More specifically, under FPTP, the individual should vote only if she thinks that her vote will be pivotal, that is, her vote will decide the outcome of the election. As a consequence, the larger the vote gap between parties A and B is, the greater the propensity to vote. We test this hypothesis in two different ways, first using the actual vote gap in the election and then using the participants' perceptions, at the time of the election, of how many people would vote for A and B (and how many would abstain).

Strategic behavior takes a different form in a PR election. Here one vote always makes a difference, but the magnitude of the difference depends on the total number of people who vote. This leads to a different prediction: the lower the number of people who vote in the group, the higher the propensity to vote. The rational citizen should go against the trend: she should vote only if most people abstain.

Table 2 tests these two predictions. We can see that neither prediction is supported by the data. We do find a correlation between closeness of the race and the propensity to vote in FPTP elections but the relationship is weak. Furthermore there is no link with perceived closeness, which provides a more direct test of the rational choice model. In the case of PR elections, individuals are in fact more likely to vote when they believe that many others will participate. This is exactly the opposite of what we should observe according to rational choice, that is, people should be more inclined to vote if they think that many others will abstain. This suggests that the participants did not engage in strategic

thinking. They were inclined to "follow the crowd", perhaps inferring that the majority must be doing the right thing (Bartels 1988).

While the first set of findings, about the impact of positions, were relatively supportive of the rational choice model, the second set of results, about the non influence of closeness and the negative effect of group abstention, are clearly not supportive. What should we conclude?

We perform a final "global" test. We wish to determine whether the participants were making the "right" decision, that is, whether they chose the option that was the most beneficial to them, given their position and the choices made by the other participants. And we wish to ascertain whether the patterns are different under FPTP and PR.

We start with FPTP elections. We have to determine how many points each individual would gain if she voted and if she abstained, given her position and the distribution of votes and abstentions among the other participants. This variable will be called Diffvote, and it corresponds to how many more (or fewer) points the individual would gain if she voted than if she abstained. To do this we need to determine for which party each person would vote if she decides to participate. Under FPTP, conditional on voting, she should vote for the party whose position is closest to hers, since this party's victory would entail a higher payoff.

In many cases, the person's vote is not decisive. This occurs if the person's preferred party is already a winner among the other 20 participants or if it trails the other party by more than one vote. In those instances the outcome will be the same whether the person votes or abstains. The only difference is that if she votes she incurs a cost of one point. In these cases Diffvote equals -1, indicating that the participant will get one less point if she votes than if she abstains. The "right" choice is then obviously to abstain.

Then there are cases where one's vote could be decisive, that is, there is a tie between A and B and one's vote will make A or B win, or one's closest party is trailing by only one vote and one's vote will create a tie. What is the value of Diffvote under such circumstances? It depends on one's location. Let us take those who are from 0 to 5 (or 15 to 20). Whether A or B wins makes a difference of 10 points. One's vote is never completely decisive; it either breaks or creates a tie. When there is a tie, the probability of one's preferred party winning is .5. As a consequence, breaking a tie increases the probability from .5 to 1, while creating a tie moves the probability from 0 to .5. In both cases, this is an increase in probability of .5. By voting for the preferred party the expected additional gain is 5 points (.5 X 10 points), from which one point, the cost of voting, must be substracted. For all those whose vote could be decisive and who are located under 6

or above 14 Diffvote equals +4. Following the same logic, it can be inferred that Diffvote equals +3 for those at positions 6 and 14, +2 for those at 7 and 13, +1 for those at 8 and 12, and 0 for those at 9 and 11.

The distribution of Diffvote is shown in Table 3. The value is -1 for 1373 of the 1680 cases, that is, 82%. The second most frequent value is +4, which corresponds to 184 instances (11%). Most of the time for most people, the "rational" choice was to abstain.

We can see how many of the participants made the "right" choice, that is, they voted when the value of Diffvote was positive and they abstained when it was negative. This is shown in Table 4. Among the 275 individuals with a positive payoff, 81% voted, that is, they made the right decision. Among the many more (1,373) with a negative payoff, however, a clear majority (71%) also voted, thus making the "wrong" decision". It is true that the turnout rate is 10 percentage points higher when the payoff is positive than when it is negative. There is thus some limited support for the rational choice model, but the bottom line is that the largest group is made of those who voted in spite of the fact that their differential payoff was negative. In short, in most cases people were not in a situation to cast a pivotal vote, and thus the rational choice was to abstain. Yet, more than 70% voted.

The above analysis assumes that people were able to perfectly predict the other participants' behavior. Perhaps their decision was consistent with their perceptions. We can determine how much each participant would gain if she votes and if she abstains, given her expectation about how many of the other participants would vote for A and for B. We call this variable Diffvotep, which is identical to Diffvote, except that we use the respondent's perception rather than the actual outcome. The distribution of the variable is shown in Table 5. We observe that the distribution of Diffvotep is somewhat different from that of Diffvote. 36% of the participants expected to be pivotal, which is twice as much as the percentage of those who were objectively in a situation to cast a pivotal vote (18%; see Table 8). People are overestimating the competiveness of these elections, a finding consistent with previous results (Blais 2002).

Table 6 shows how the decision to vote or abstain is related to the differential payoff that the participants believed to be associated with voting rather than abstaining. Three quarters of those who were bound, according to their own perceptions, to gain one less point if they voted than if they abstained did nevertheless vote. Even when we consider the participants' perceptions of the race, the rational choice model does not perform well, as the majority do not make the choice that would maximize their gains.

The above analysis is based on responses to a question asking each person how many of the other participants they thought would vote for party A and party B and how many would abstain. These responses provide the participants' best estimates of the likely outcome. We may assume, however, that many people were uncertain about their "predictions". It is thus possible that quite a few people thought that while they were unlikely to be pivotal, there was some chance that their vote would make a difference.

We capture such uncertainty through the following procedure. Consider a person at position 5 who indicates that she expects party A to get 8 votes and party B to get 6 votes, with six abstentions (excluding herself). In the above analyses, this person cannot be pivotal, and her expected differential payoff if she votes (compared to abstaining) is -1. To take uncertainty into account, we will now assume that this person expects party A to get 7 votes with a probability of ε, 9 votes with the same probability of ε, and 8 votes with a probability of $1 - 2X\varepsilon$. The same logic applies to her estimate of party B votes. There is thus in her view the possibility of both parties getting 7 votes, in which case she would be pivotal. We have performed simulations with values of ε set at .1, .2, or .33. We present and discuss the results associated with the highest uncertainty, under which a probability of .33 is given to the score given by the respondent, as well as to the scores just above and below (see Appendix A for a full description).

We can compute for each individual a new "uncertainty weighted" differential payoff, which corresponds to the weighted mean payoff associated with the set of 9 possibilities that emerge if we allow for an uncertainty of one vote. Does this procedure produce more people with positive payoff? Yes, the percentage with an expected positive payoff increases from 31% to 44% .The main pattern, however, holds, that is, the majority of participants have a negative payoff, and the majority do not behave as the rational model would predict.[8]

We thus conclude that rational considerations are not very helpful in explaining the decision to vote or not to vote in our FPTP elections. Rational factors do play a role, in the sense that people take into account their position and that of the parties: they are more inclined to vote when it makes a bigger difference whether party A or B wins, and they are more likely to abstain when it does not matter much. But that is all. The participants do not seem to pay attention to whether their vote may be pivotal or not.

Let us now consider the situation under PR. We proceed to the same analyses as those performed for the FPTP elections, that is, we construct Diffvote, which indicates how many more (or fewer) points each participant would gain if she voted rather than abstaining, given the distribution of votes and abstentions among the other participants. We also

compute Diffvotep, which is similar to Diffvote except that we use the participants' perceptions rather than the actual results.

The mean, the median, and the mode of both Diffvote and Diffvotep under PR are -0.7. There is not a single individual with a positive value for either Diffvote or Diffvotep! The implication is that the rational choice for each and individual person in each and every election, given their perception of how the other participants would behave or given the actual choices made by the other participants, was to abstain. Yet, mean turnout in PR elections was 69%.

Again, we performed analyses allowing for uncertainty around the predictions made by the participants, giving a probability of .1, .2, or .33 to the scores just above (+1) or below (-1) those provided. Even allowing for such uncertainty, every participant except one has a negative value on Diffvotep in each and every election.

The implication is that in the two types of elections the rational decision, given people's perception of what the other participants would do, was to abstain. Yet the majority did vote. There is also a contrast between PR and FPTP elections. While rational considerations play weakly in both types of elections they appear to be somewhat more relevant under FPTP, where there were at least a significant minority of participants with a positive perceived differential payoff associated with voting. Why is it so?

Our interpretation is that it is easier for people to understand that it is in their interest to abstain under FPTP than under PR. Most people (but see Esponda and Vespa 2010) can see that if the gap between the two parties is two votes or more their own vote cannot make a difference, and thus that they are going to win one fewer point if they vote. Things are more complicated under PR. In our setting, one's vote always has an effect, though a very small one. The potential gain turns out to be always inferior to the voting cost, but this may not be clear to many people. This, we suspect, mimics what is going on in the mind of voters in real elections. In FPTP elections, at least some people feel that their vote "does not count". The same feeling may exist in PR elections but it is probably weaker and less prevalent.

Sense of Civic Duty in FPTP and PR elections

Clearly the decision to vote or to abstain is also shaped by non-rational considerations. One reason why so many people vote in "real" elections is that they feel that voting is a civic duty that the "good" citizen must fulfil (Blais 2011; Knack 1992). Could that motivation play a role in these lab elections? Could it play a larger role in PR than in FPTP elections? The post-experiment questionnaire included a set of three questions about sense of civic duty.[9] We use the responses to these three questions to construct a civic duty scale that goes from 0 to 1. A first simple way of determining

whether sense of duty may have been a factor is to look at the bivariate correlation between duty and the total number of elections in which the participants voted. This is shown in Figure 4. We can see that the general pattern is for those with the highest score on duty to vote in 15 elections, compared with 11.5 for those with no sense of duty. This is a relative difference of 30%. While sense of civic duty is not as powerful in our lab experiments as it is in real elections (Blais and Achen 2011), it remains quite influential.

Table 7 relates the propensity to vote in a given election to one's position, and to the order of the election (from the first to the tenth), plus the duty variable, in FPTP and PR elections. The results confirm that those with a strong sense of duty are more likely to vote, even taking into account their location and order effects. More importantly, however, sense of duty has a more powerful impact in PR than in FPTP elections. The likelihood of voting increases by 13 and 30 points respectively (from mimimal to maximal values of duty) under FPTP and PR.

We suggest that civic duty has a greater impact under PR because it has a more complicated formula. The winning position depends on how many votes party A and party B obtain but how exactly this works may not be entirely clear to many participants. In such a context norms like civic duty come to play a more powerful role than under FPTP, which is more prone to facilitate strategic thinking.

Conclusion

Our purpose in this paper has been to contribute to a better understanding of some of the factors that foster turnout in FPTP and PR elections. We have proposed an experimental design to explore this question. Our design is different from previous experiments, the most crucial difference being that we explicitly involve our subjects in elections and that they have to decide, like in real elections, to vote or to abstain. Prior studies have used contexts that are formally equivalent to the electoral context but they have refrained from talking about elections and voting in order to immunize the participants from the influence of social norms (Duffy & Tavits 2008). Our approach has been to take these norms into account and to examine how they interact with strategic incentives. Note that we are probably underestimating the effects of these norms since norms are expected to be weaker in the lab than in real political elections.

Our study suggests one reason why turnout appears to be higher under PR than under FPTP. Normative considerations play a larger role in more complicated systems, which make it more difficult for voters to realize that their vote is unlikely to substantially affect the outcome of the election. More research is needed to validate such a conclusion.

It would be important to determine whether the same pattern emerges in survey-based cross-sectional analyses. Unfortunately, as far as we can tell, comparative cross-sectional data sets such as CSES do not include questions on sense of civic duty. It would also be important to check the robustness of the findings when some aspects of the experimental design are modified. We have used here the simplest situation possible, with only two parties, a situation that makes sense in a FPTP election but that is unlikely in a PR system. We need to design experiments with more parties.

We hope to have shown, however, that experiments like this one, in which subjects are explicitly invited to participate in elections and in which their perceptions and attitudes are tapped either at the time when they decide to vote or to abstain or at the very end, can shed light on enigmas that standard cross-sectional research has been unable to solve.

Notes

[1] The experiment was programmed and conducted using software z-Tree (Fischbacher 2007). The recruitment of participants (almost all of them students) was undertaken by CIRANO in Montreal and Cevipol in Brussels.

[2] The logic is that the outcome of the election will be a coalition between the two parties, with the relative weight of the two parties in the coalition depending on the proportion of votes they receive.

[3] The relationship is logarithmic, most of the decline taking place in the first five elections.

[4] We are focusing on those at positions 0 to 10. The same logic applies to those at positions 11 to 20.

[5] Positions on the two sides, that is, 0 and 20, 1 and 19, and so on, are collapsed.

[6] We looked at those who found themselves at the same position in two successive elections. They were slightly more likely to abstain in FPTP elections (35% against 28%) but slightly more prone to vote under PR (72% against 67%).

[7] We assume that a person would vote for the closest party, if she decided to vote. Under PR, it might in theory be the case that a voter could be better off voting for the most distant party. This counterintuitive situation may occur if support for this more distant party is much lower than that received by the closest party. For example, consider a voter in position 9 when only one of the 20 other voters votes and votes for A. If she votes for A the winning position is 5 whereas if she votes for B it is 10. Although this voter is closer to party A she would be better off voting for B.

[8] We performed the same analyses with Diffvote rather than Diffvotep. The percentage of participants with a positive payoff increases from 16% to 32%.

[9] Two questions are agree/disagree items about statements that it is the duty of every citizen to vote in an election and that it is essential that the great majority of citizens vote in elections in order to maintain democracy. The third question asks how guilty (very, somewhat, a little, not at all) the respondent would feel if she did not vote in an election.

[10] As a reminder: a respondent whose position is at the extreme wins 10 more points if her candidate wins the election rather than if the other candidate wins. However, in our experimental design, no respondent can be

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"fully" decisive; one can either prevent a loss and create a tie, or break a tie and create a win. Since ties are broken randomly, we divide the differential gain by 2 to correspond to the fact that participants can be decisive with a probability of 50%.

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Appendix A: Prediction Uncertainty

In the course of our study, we use the real results of elections as proxies for participants' expectations of the results. We also asked half of our sample about their predictions regarding the outcome of the election. However, the participants did not rate how likely they perceived this outcome to be. As a consequence our measure does not take into account uncertainty, and presumes that respondents were certain that their predictions would materialize. To remedy this situation, we have to add uncertainty to those expected results. To illustrate this, let us consider the procedure under FPTP.

We first conducted our analyses with measures allowing no uncertainty, with variables named Diffvote and Diffvotep, the first one being based on the actual results and the second one on respondents' perceptions of what the results would be. Then, we added uncertainty. To do this, we considered that party A and party B could each get one more or fewer vote than predicted, with a probability of 10%, 20%, or 33%. This probability that the results will deviate by one is expressed as epsilon, or ε. This leads to the following matrix of probabilities:

A\B	B-1 : ε	B: (1-2ε)	B+1 : ε
A-1 : ε	ε^2	ε (1-2ε)	ε^2
A : (1-2ε)	ε (1-2ε)	(1-2ε)^2	ε (1-2ε)
A+1 : ε	ε^2	ε (1-2ε)	ε^2

For example, if a respondent predicted that A would receive 7 votes and B 7 votes, we would obtain the following matrix of probabilities with an ε of 0.33:

A\B	6 : ε	7: (1-2ε)	8 : ε
6 : ε	0.33*0.33=0.11	0.33(1-0.66)=0.11	0.33*0.33=0.11
7 : (1-2ε)	0.33(1-0.66)=0.11	0.33*0.33=0.11	0.33(1-0.66)=0.11
8+1 : ε	0.33*0.33=0.11	0.33(1-0.66)=0.11	0.33*0.33=0.11

While the probabilities are the same in each cell when we use an epsilon of 0.33, this is not always the case. Epsilons of 0.10 or 0.20 produce cells with varying probabilities.

In this matrix, there are 5 instances out of 9 in which the respondent may cast a pivotal vote. If the respondent is at a position that is inferior to 10, those are the three cases with an equality (6/6, 7/7, 8/8) and the two cases in which A trails B by one vote (6/7, 7/8). This means that the respondent with a position between 0 and 5 can hope to gain 4 more points if she votes rather than abstains in 5 cases out of 9, and to gain one fewer point in 4 cases out of 9, as indicated in the following table.

A\B	B-1=6	B=7	B+1=8
A-1=6	4	4	-1
A=7	-1	4	4
A+1=8	-1	-1	4

This is the case because this respondent is pivotal in 5 cases out of 9. If she is not a pivotal voter, then the respondent gains one fewer point if she votes, which leads to a differential "gain" of -1. On the other hand, in the 5 cases in which the respondent is a pivotal voter, she can expect to win 5 more points, minus the voting cost, if she votes.[1] Consequently, this respondent has 5 chances out of 9 of winning 4 more points if she votes, and 4 chances out of 9 of gaining one fewer point.

Then, a weighted average of the differential gains based on the probability of each cell is calculated, which provides an overall expected differential benefit, taking into account uncertainty at various levels.

The same procedure was used for PR. The only difference is that in PR there is no such thing as a pivotal vote, which explains why the results did not vary as much as they did in FPTP once the uncertainty parameters were added.

Table 1

Table 1: Turnout, Differential Benefit, and Distance

	FPTP		PR	
	Coef.	**Std. Err**	**Coef.**	**Std. Err**
Differential Benefit	0.17*	0.02	0.09*	0.02
Distance	-0.30*	0.43	-0.26*	0.39
Constant	0.60*	0.21	0.88*	0.20

N = 1680   N =   1680
Log pseudolikelihood = -879.47   Log pseudolikelihood = -988.76
Pseudo R2   =   0.11   Pseudo R2   =   0.05

Significance Levels
0.05 *

Table 2

Table 2 : Turnout and Strategic Considerations

	FPTP				PR			
	Coef.	**Std. Err**	**Coef.**	**Std. Err**	**Coef.**	**Std. Err**	**Coef.**	**Std. Err**
Position	0.63*	0.07	0.70*	0.10	0.57*	0.07	0.47*	0.09
Position Squared	-0.08*	0.01	-0.09*	0.01	-0.07*	0.01	-0.05*	0.01
Order (log)	-0.04*	0.09	-0.19	0.12	-0.01	0.09	-0.13	0.12
Closeness	-0.19*	0.04						
Perceived Closeness			0.03	0.03				
Group Turnout					0.24*	0.03		
Perceived Group Turnout							0.18*	0.04
Constant	1.14*	0.22	0.79*	0.28	-3.10*	0.50	-2.18*	0.62

N =   1680   840   1680   840

Log pseudolikelihood = -878.12   -427.68   -947.32   -477.67
Pseudo R2   =   0.11   0.12   0.09   0.07

<u>Significance Level</u>
0.05 *

Table 3

Table 3 : Differential Payoff (Turnout vs Abstention) in FPTP Elections

Differential Payoff	Frequency	Percent	Cumulative Percent
-1	1,373	81.73	81.73
0	32	1.9	83.63
1	28	1.67	85.3
2	33	1.96	87.26
3	30	1.79	89.05
4	184	10.95	100

Table 4

Table 4 : Differential Payoff and Turnout in FPTP Elections

Turnout	Differential Payoff						Total
	-1	**0**	**1**	**2**	**3**	**4**	**Total**
Abstain	28.91	46.88	42.86	15.15	16.67	16.3	27.62
Vote	71.09	53.13	57.14	84.85	83.33	83.7	72.38
Total (%)	100	100	100.00	100.00	100	100	100
Total (n)	1,373	32	28	33	30	184	1,680

Table 5

Table 5 : Perceived Differential Payoff in FPTP Elections

Differential Payoff	Frequency	Percent	Cumulative Percent
-1	537	63.93	63.93
0	41	4.88	68.81
1	35	4.17	72.98
2	33	3.93	76.9
3	31	3.69	80.6
4	163	19.4	100

Table 6

Table 6 : Perceived Differential Payoff and Turnout in FPTP Elections

Turnout	Perceived Differential Payoff						
	-1	**0**	**1**	**2**	**3**	**4**	**Total**
Abstain	24.21	60.98	45.71	24.24	12.9	23.31	26.31
Vote	75.79	39.02	54.29	75.76	87.1	76.69	73.69
Total (%)	100	100	100	100	100	100	100
Total (n)	537	41	35	33	31	163	840

Table 7

Table 7: The Impact of Duty on Turnout under FPTP and PR

	FPTP		PR	
	Coef.	Std. Err	Coef.	Std. Err
Position	0.64*	0.07	0.57*	0.07
Position squared	-0.08*	0.01	-0.07*	0.01
Order (log)	-0.16	0.02	-0.30*	0.02
Duty	0.71*	0.28	1.46*	0.26
Constant	0.36	0.27	-0.37	0.26

N = 1680
Log pseudolikelihood = -877.35
Pseudo R2   =   0.11

N =   1680
Log pseudolikelihood = -966.86
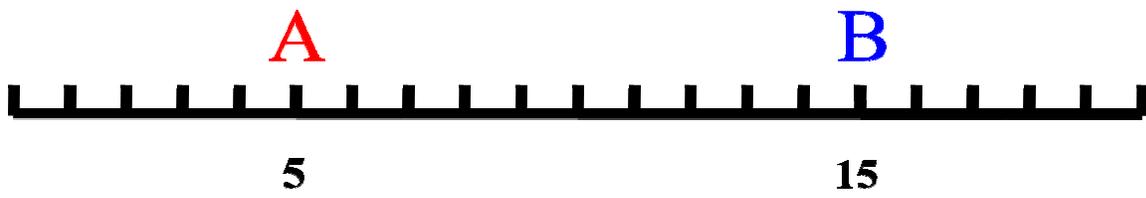Pseudo R2   =   0.078

Significance Level
0.05 *

Figure 1

FIGURE 1 : Party Positions

Figure 2

FIGURE 2 : Probability of Voting According to Order

Probability of Voting According to Order
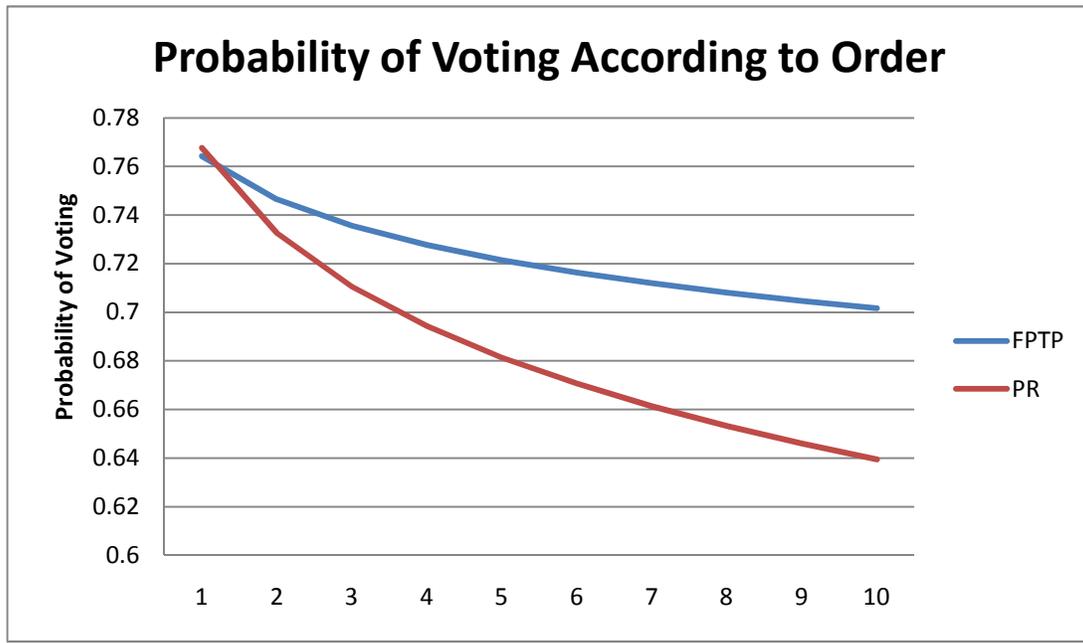
Figure 3

FIGURE 3 : Probability of Voting According to Position

Probability of Voting per Position
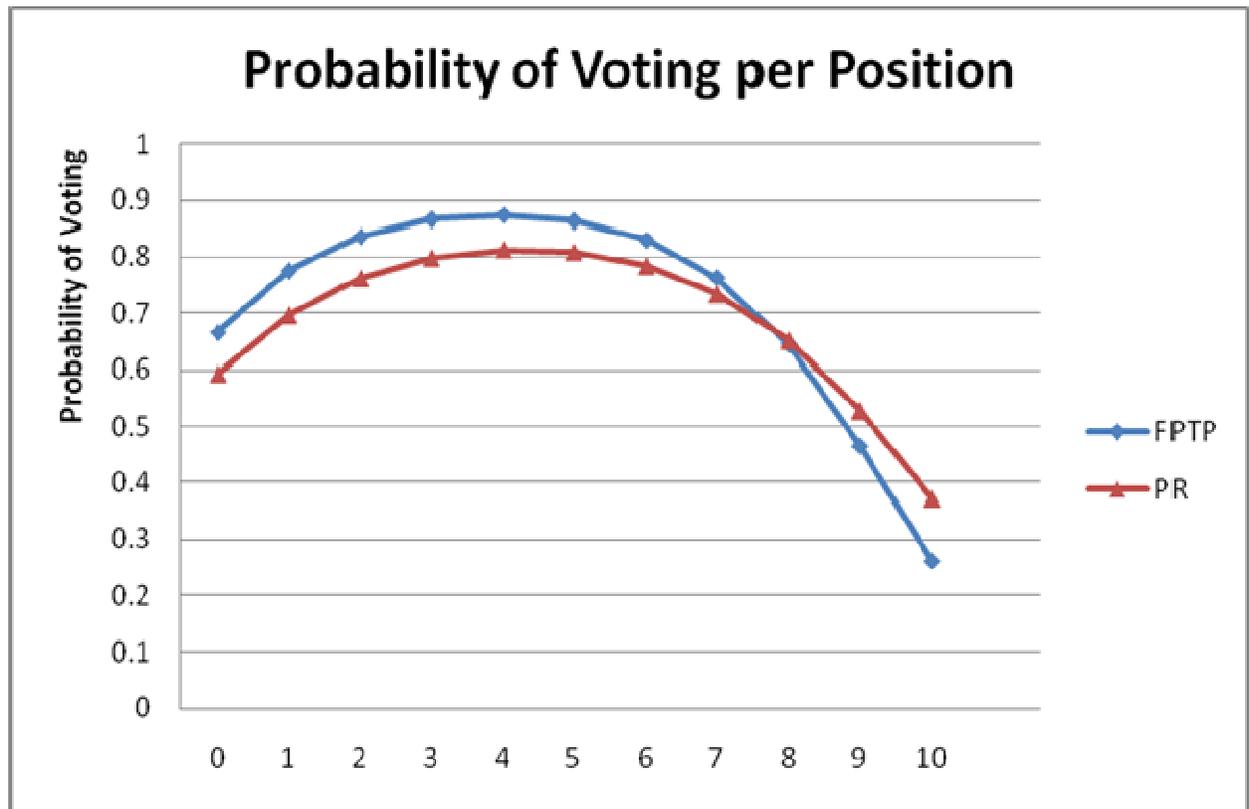
Figure 4

FIGURE 4 : Duty and the Frequency of Voting