



To vote or to abstain? An experimental test of rational calculus in first past the post and PR elections



André Blais ^{a, *}, Jean-Benoit Pilet ^b, Karine Van der Straeten ^c,
Jean-François Laslier ^d, Maxime Héroux-Legault ^e

^a Université de Montréal, Département de Science Politique, C.P. 6128, Succursale Centre-ville, H3C 3J7 Montréal, QC, Canada

^b Université Libre de Bruxelles, Belgium

^c Toulouse School of Economics & CNRS, France

^d Paris School of Economics & CNRS, France

^e University of Toronto, Canada

ARTICLE INFO

Article history:

Received 31 July 2013

Received in revised form 23 May 2014

Accepted 9 July 2014

Available online 18 July 2014

Keywords:

Turnout

Vote

Abstention

Election

Laboratory experiment

ABSTRACT

We test the rational choice model of turnout in the lab. We performed laboratory experiments in which participants had to decide whether to vote or not in a number of first past the post and proportional representation elections. We test the predictions of rational choice theory from three different angles:

(i) First, we compare aggregate turnout with the Nash equilibrium predictions.

(ii) Second, we compare individual decisions with those derived from a rational calculus and count the number of decisions which are consistent with the rational recommendation, and.

(iii) Third, we determine, still at the individual level, whether, at the margin, people are more likely to vote as the expected payoff increases.

The overwhelming thrust of the evidence is inconsistent with the rational calculus paradigm.

© 2014 Elsevier Ltd. All rights reserved.

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 (Grofman, 1993; 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 (Riker and Ordeshook, 1968). Stemming from this ‘paradox of voting’ a vast literature has looked at the motivations that induce people to vote or not to vote.

A lingering question in the literature is whether rational choice theory (RCT) is useful in accounting for the decision to vote or not to vote in large electorate elections. In their

provocative indictment of rational choice theory, Green and Shapiro (1994, 68) conclude that “readers ... will derive little insight from the empirical work in the rational choice tradition.” Blais (2000, 137–143) comes to a similar, though somewhat more nuanced, verdict. Blais contends that rational choice does make a contribution to the turnout literature but that the contribution is quite limited. In his judgment, the model has no explanatory power among those (estimated to be about half the electorate) with a strong sense of duty to vote, those whose act of voting is motivated by their commitment to the democratic system rather than interest-based or party-oriented goals. Furthermore, the impact of rational considerations remains weak among those with little or no sense of duty.

The evidence reviewed by Green and Shapiro or Blais is almost exclusively based on observational data, either

* Corresponding author.

E-mail address: andre.blais@umontreal.ca (A. Blais).

individual level survey data or aggregate level data. Such data offer useful insight. However, inferring causal relationships from such data is problematic. Since variations in the variables of interest are not controlled by the researcher, and since elements foreign to these variables may influence how voters act, one cannot be sure that variations in turnout are actually due to the variables of interest. Experiments are therefore a very useful complement to observational studies. Their main advantage lies in how they allow researchers to isolate the effect of the variable of interest while controlling as much as possible for the potential intervening effects of other variables. As to the turnout question addressed in this paper, experiments allow to pin down the specific impact of rational considerations, of the costs-benefits calculus, while keeping the effect of the many other intervening factors constant. Factors like party identification, the nature of the electoral contest, the efforts deployed by parties to mobilize voters, voters' perception of prior elections' outcome, play a role in the turnout decision but cannot be controlled for easily by researchers in observational studies. In lab experiments like the ones on which this paper is based, it is possible to control for them. Such experiments not only corroborate the evidence provided by observational studies, but also allow for a more rigorous test of causal relationships (Kittel and Morton, 2012; Druckman et al., 2011).

Many field experiments have assessed the impact of get out the vote efforts (for a review, see Green and Gerber, 2008) but that research has focused on the role of factors such as social pressure or information transmission. It is worth mentioning an intriguing classroom experiment conducted by Blais and Young (1999) at the time of the 1993 Canadian election. The authors presented a short lecture on the paradox of voting in five classes and report that turnout among the students who were exposed to the lecture was lower than in a control group of five other classes. It is not clear, however, whether the effect could be imputed to rational considerations.

There have been a few laboratory experiment-based studies of the impact of rational considerations on turnout. In previous laboratory studies (see Schram and Sonnemans, 1996a, 1996b; Duffy and Tavits, 2008; Levine and Palfrey, 2007; Herrera et al., 2013; Kartal, 2012), there is no reference at all to voting or elections. Participants are assigned to one of two groups, and offered to purchase a token or not (at a certain cost). The winning group is the group with a plurality of tokens. Purchasing a token is considered equivalent to voting, and not purchasing a token is equivalent to abstaining. Here, in contrast to these experiments, we present the results of a lab experiment that is similar in its goal – studying the impact of rational considerations on turnout – but with a design that is explicitly an election. For example, unlike previous experiments, we use the words “vote”, “election”, and “parties”. The decision to use these words, and therefore to frame the lab experiment as an election, has been made in order to limit the risk of artificially boosting the impact of rational considerations in the absence of social norms associated with elections. As underlined in earlier works on turnout (Blais and Achen, 2009), the effect of values and social norms such as apprehending the vote as a

civic duty is a major element in the decision to vote in real elections. These components may override the effect of rational considerations.

As just explained, the goal is to test a strict rational choice model according to which people vote only if the expected benefits outweigh the expected costs. Here, benefits are defined in terms of the outcome of the election, thus excluding ‘consumption’ benefits, such as sense of civic duty (Riker and Ordeshook, 1968). Sticking to a narrow definition of rationality allows us to avoid the risk of being tautological (Downs, 1957, 6; Barry, 1978, 16) and, even if we use, in the protocol, the vocabulary of politics, the monetary benefits are defined by the outcome of the election.

We test the rational choice model in two types of settings: first-past the post (FPTP) and proportional representation (PR) elections. These are the two most frequent types of electoral systems (Carter and Farrell, 2010), and much of the debate over electoral systems has centered on the merits and limits of these two systems (Blais, 1991). The literature on the rationality of voting has focused mostly on FPTP elections, where the voter has to ascertain the probability that her vote will be decisive, that is, whether she votes or not determines whether her preferred candidate or party wins or loses the election. In other words, the crucial element is the pivotality of one's vote.

The situation is both similar and different in a PR election. On the one hand, like under FPTP, to determine if her vote is decisive, the voter should determine the odds that her preferred party will get one more seat if she votes rather than if she abstains. But a PR system is also construed to be a power-sharing institution (Lijphart, 1999) and in such a context the notion of pivotality may not apply. Indeed, the type of PR election that we design, as will be shown below, is one in which each vote makes a difference, though usually a tiny one.

Testing a theory means checking some predictions of the theory and that is what we do in this article. We test the predictions of the theory from three different angles. We first compare aggregate turnout with the Nash equilibrium predictions. We show that the observed turnout figures are not compatible with equilibrium predictions.

But there are many reasons why rational actors may not be observed in equilibrium: the group may not have had the time to coordinate on a particular equilibrium, the equilibria may be unstable, or the participants may use hardly observable mixed strategies, etc. We thus use simpler and more direct predictions of rational theory in terms of individual decision. Our results here are very striking. In most cases, the participants decide to vote when they should not according to the rational choice model.

Third we consider an even weaker prediction of the theory. Since the key variable for the decision to vote is the difference between expected benefits and costs (this variable will be denoted *Diffvote*), one should observe a global positive correlation between *Diffvote* and the turnout rate. The results of the econometric analysis are again striking and invalidate rational behavior predictions.

Most of the paper is devoted to the second angle, which is a very simple and direct test of the rational model: for each individual decision, we determine whether or not it is

consistent with the rational recommendation. Most other studies, such as [Levine and Palfrey \(2007\)](#), focus on comparative statics on equilibrium predictions, and conclude that the rational theory explain quite well those comparative statics. In the objective of assessing the rational choice model, it seems natural to focus on the performance of the theory in explaining individual decisions rather than comparative statics predictions of turnout since rational choice theory is in the end a theory of individual decision-making.

We describe below the experiments that we performed with two types of elections (FPTP and PR) to test the rational choice model. We run three different experiments, varying the learning and coordination opportunities given to subjects. We specify the rational choice model's predictions, and we compare with what we observe. We show that the theory is not very good at predicting the participants' behavior. Moreover, the performance of the rational choice theory is not improved by giving subjects more time to learn.

The paper is organized as follows. Section 1 presents the baseline experiment (Experiment 1) together with the main predictions of the rational choice theory. Section 2 tests the aggregate equilibrium predictions of the theory and evaluates the proportion of individual decisions which are consistent with the theory, using the data collected in experiment 1. Section 3 presents experiments 2 and 3, which are very similar to the baseline experiment, except that subjects are given more time to learn and coordinate, and we perform the same two tests on those data. Section 4 runs the econometric analysis testing whether the propensity to vote increases with the expected payoff.

1. Experiment 1 and the rational calculus of participation in FPTP and PR elections

1.1. Description of the protocol

Experiment 1 took place in Brussels (four sessions in January 2011) and Montreal (four sessions in February 2011).¹ A group of 21 people is invited to participate in two series of ten elections.

For each election, there are two parties (named A and B) located respectively at 5 and 15 on a 0 to 20 scale. Each participant is randomly allocated a different position on the 0 to 20 scale (random draw with no replacement). 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.

¹ The experiment was programmed and conducted using software z-Tree ([Fischbacher 2007](#)). The complete instructions are available upon request. The recruitment of participants was undertaken by CIRANO in Montreal and CEVIPOL in Brussels. In Brussels, the participants were students aged between 18 and 30 years old. In Montreal, the sample was more evenly divided between students and non-students; age varied between 19 and 53 years old (the average age was 25).

At each election, participants vote for party A, for party B, or abstain. A participant's gain equals 16 points minus the distance between the winning position and the participant's 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. 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

The contrast between FPTP and PR rules mimics the contrast that is usually made between majoritarian and proportional systems ([Powell, 2000](#)). In FPTP elections the winning position is that of the majority. This corresponds to the majoritarian 'vision' with 'concentrated policy-making power in which 'it is the citizen majority that should, normatively, prevail over a minority' ([Powell, 2000, 5](#)). In PR elections the winning position represents a 'compromise' that reflects the overall distribution of votes. This corresponds to a proportional 'vision' which includes 'all the factions in the society into the policy-making arena' and 'the majority will take into account minority preferences' ([Powell, 2000, 6](#)). This type of power sharing proportional system is widely utilized in the formal model literature (see [Ortuno-Ortin, 1997](#); [Lizzeri and Persico, 2001](#); [Laslier and Ozturk, 2006](#); [De Sinopoli and Iannantuoni, 2007](#); [De Sinopoli et al., 2011](#)). From the participant's point of view the two settings contrast situations where one individual vote can induce (i) a big change but only in very specific cases (FPTP) or (ii) a small change but in every single election (PR).

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.

It should be noted that our experiment design exhibits one important deviation from voting in real elections. The probability that one's vote will be pivotal in determining

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.

the result of the election is higher in our experiment than in real elections. In real elections with very large electorates, the probability that one elector will decide the issue of the vote is infinitesimal. On the contrary, in our research design, which contains only 21 participants, this probability, while not high, is certainly not infinitesimal. Given that the classic problem of rational choice theory in explaining turnout is why people vote when they are not pivotal, this can potentially bias our analysis. This means that our experimental design makes it easier to confirm expectations from rational choice theory than observations from actual elections, since more people will be in a position to act rationally by being the pivotal voter. We come back to this particularity of our experimental design in the discussion of the results.

1.2. *The rational calculus of participation in FPTP and PR elections*

We test a simple model of rational participation. Following Downs (1957), and Riker and Ordeshook (1968), citizens decide to vote only if the expected benefits of voting rather than abstaining are higher than the costs. People attempt to anticipate what the outcome of the election will be if they vote and if they don't. If they think that the outcome will be the same whatever they decide to do, they abstain (when there is a cost in voting, as is the case in our experiment). If they think that their vote will affect the outcome, they vote if the expected benefit is higher than the cost of voting.

As mentioned above, we test the predictions of rational choice theory from three different angles. In a first step, we examine aggregate turnout. We can compute, using a game-theoretical framework, aggregate outcomes *if all individuals behave in such a rational way and anticipate that the others do so*. Formally, we study the 21-player games defined by the experimental protocol under the assumption that voters are expected payoff maximizers (one game for FPTP and one game for PR). We compute Nash equilibria for the two games. Appendix A (<http://dx.doi.org/10.7910/DVN/26139>) provides the full equilibrium analysis and the main results are as follows.

Under first past the post, all pure strategy equilibria are characterized by very high participation: at least 18 voters vote out of 21 (that is, a participation rate above 85%). 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 30%.

The equilibrium 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 higher turnout in FPTP elections if we restrict attention to pure or symmetric mixed strategy equilibria. Since it may be considered 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 the rational equilibrium paradigm predicts a much higher turnout in FPTP than in PR elections. Hypothesis 1 is thus that turnout is substantially higher under FPTP than under PR.

In a second step, we look at each individual decision and we determine whether it is consistent or not with what rational choice theory would recommend. Hypothesis 2 is that those whose expected payoff of voting (rather than abstaining) is positive vote most of the time while those with a negative expected payoff abstain most of the time. We explain later on in detail how this expected payoff of voting is computed for each voter at each election. This is, in our view, the most direct test of the theory.

Aggregate equilibrium expectations may differ from individual level rational decisions. For an individual, equilibrium behavior is optimum if the other individuals are at equilibrium, whereas individual decision is rational if it is optimum given the individual's expectations about others. If the individuals are not in equilibrium, the two concepts differ. This is what happens in our data. Rejecting rationality at the individual level is a stronger rejection of RCT than simply rejecting equilibrium prediction because the best response, for a given individual, in the situation where exactly everyone else is rational may be very different from the best response of the same individual in a situation where not everyone is rational. In that case the equilibrium-RCT prediction can be rejected even if most voters are indeed acting in a rational manner. Equilibrium requires rationality plus common knowledge of rationality; when rejecting equilibrium it is not clear whether we reject rationality itself or common knowledge of it.

We finally see, still at the individual level, whether rational choice predicts the participants' behavior at the margin, that is, whether there is a positive relationship, overall, between expected payoffs and the propensity to vote. Hypothesis 3 is that the propensity to vote increases as the expected payoff of voting increases.

The expected payoff of voting depends on the voting rule. Under FPTP the rational voter will be more willing to pay the cost and vote if she is pivotal (Hypothesis 4). Indeed, the only situations where the voter's vote can affect the outcome are situations where 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 where the other voters' votes result is such that 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. In both cases, the probability of being pivotal is 0.5 since the probability of the preferred party winning the election increases from 0.5 (0) to 1 (0.5). In these two types of situation, the expected benefit of voting, to be compared with the cost of voting, is equal to half the difference in payoff between the two possible outcomes. Note that under FPTP the difference in payoffs between the two possible outcomes (A wins or B wins) depends on the voters' position: for voters whose position is between 0 and 5 (inclusive) or 15 and 20 (inclusive), it is 10 points, that is, they gain 10 more points if A wins than if B wins (or the reverse). At the other extreme,

the individual at position 10 gets exactly the same number of points (16 minus 5) whether A or B wins. Here the difference in payoff is nil. Under the same logic, the differential benefit of those at positions 1 (19), 2 (18), 3 (17), and 4 (16) is respectively 2, 4, 6, and 8 points. Thus our Hypothesis 5: The propensity to vote in FPTP elections increases when voters' extremism increases, that is, with the stake of the election for the individual voter.

Under PR, rational incentives to vote are different. 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 the 20 other individuals abstain, the last one can decide by voting whether the winning position will be 5 or 15, whereas if she abstains, the implemented policy will be 10. If participation is large one more voter has only a tiny impact: indeed, at the other extreme if the other 20 voters vote (assuming 10 vote for each candidate), the last voter can tilt the outcome by only 0.24 point, for instance from 10 to 9.76 ($((11 \times 5 + 10 \times 15) / 21 = 9.76)$). Individual power decreases rapidly with participation. When 10 other voters vote (assume that 5 vote for each candidate), the shift is 0.45, that is, much less than the cost of voting. Thus our Hypothesis 6: The propensity to vote in PR elections decreases as turnout in the group increases.

Compared to FPTP, the payoff resulting from voting rather than abstaining under PR does not vary much across positions, if group participation is not too low. Finally, one's vote has a little more leverage when one's party is relatively weak, as one more vote for a weak party tilts the winning position slightly more than one more vote for a strong party.^{3,4} As a consequence, the propensity to vote in PR elections should be higher among supporters of the party receiving fewer votes (Hypothesis 7).

2. Testing hypotheses 1 and 2 (experiment 1)

2.1. Aggregate level results (hypothesis 1)

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 substantially small. These results are not in line with the predictions of the game theoretic model outlined above and do not support hypothesis 1. They are particularly surprising in the case of PR elections where the theoretical prediction is that participation should be quite low (below 30%). The (relatively) high turnout observed in PR elections constitutes a puzzle from a rational equilibrium perspective.

³ Let us assume for instance that party A has 10 votes and party B has 5 votes (among the other voters). If I abstain, the winning position is $(10 \times 5 + 5 \times 15) / 15 = 8.33$. If I vote for A, the winning position is tilted from 8.3 to 8.1, a difference of 0.2. If I vote for party B, the winning position is tilted from 8.3 to 8.7, a difference of 0.4. A vote for the weaker party makes a (slightly) larger difference than a vote for the stronger party.

⁴ See the Appendix (<http://dx.doi.org/10.7910/DVN/26139>) for more detailed computations of the benefit of voting under the two voting rules.

One explanation could be that we are not observing an equilibrium situation because it takes voters some time to understand the consequences of their own decision on electoral outcomes. In particular, because learning and co-ordination may take some time, equilibrium predictions might become accurate descriptions of what actually happens only after some trial and error period. If this is the case, one expects to see turnout increasing with time in FPTP elections (equilibrium turnout predictions being over 85%) and decreasing in PR elections (equilibrium turnout predictions being below 30%).

We observe that turnout tends to decrease with time, for both voting rules (see Fig. 1). Under PR, turnout is 74% on average in the first three elections and 65% in the last three elections. We do observe some decrease of the participation rate, but even in the last three elections turnout remain much higher than predicted by rational equilibrium. Under FPTP elections, contrary to what would be expected were some learning effect at play, we also observe decreasing participation rates. Under FPTP, turnout is 75% on average in the first three elections in and 71% on average in the last three elections. Note that 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. First, location might have influenced the outcomes. Indeed, the participants in Montreal are more familiar with FPTP, which is used for all elections in the country, while participants in Brussels are more accustomed to PR, which is used for national, EU, regional and local elections. Yet, interestingly, the differences between the two locations do not produce any significant effects on the findings. We observed that turnout is slightly lower in Brussels (69%) than in Montreal (76%), but none of the patterns that are examined in this paper are affected by the inclusion of the place of experiment as a control variable. Second, we

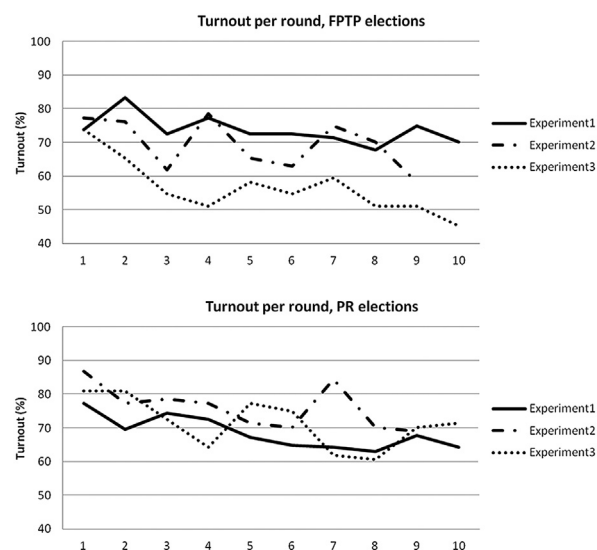


Fig. 1. Participation Rates According to Order, in FPTP and PR elections.

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 could 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.⁵

2.2. Individual level results (hypothesis 2)

We now turn to the individual level analysis. Indeed, testing *equilibrium* predictions is a very strong test of the theory, since it makes the assumption that *all subjects* behave according to the rational model. It might be the case that a significant majority does, whereas only a minority does not. To explore this question, we now determine to what extent each participant in each election behaves as the rational choice model predicts, that is, whether he/she chooses the option that is the most beneficial to him/her, given the choices made by the other participants. We test hypothesis 2 according to which individuals with a positive net expected benefit of voting vote most of the time and those with a negative benefit abstain most of the time.

We start with FPTP elections. We have to determine how many points each individual would gain if she votes and if she abstains, 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 will gain if she votes than if she abstains. To do this we need to determine for which party each person should 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. As noted in Section 1.2, 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, and the "right" choice is to abstain. Then, as explained above, 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. For all those whose vote could be decisive and who are located under 6 or above 14 Diffvote equals $+4$, it 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 prediction to be tested is that most individuals with a positive Diffvote score vote and that most with a negative score abstain.

It turns out that Diffvote has a negative value for 81% of the 1680 cases; it is positive for 17% of the cases (and nil for 2%). We can see how many of the participants make the "right" choice, that is, they vote when the value of Diffvote

is positive and they abstain when it is negative. Among the 291 cases in which an individual has a positive payoff, 82% vote, that is, they make the right decision (Table 1, lines "Diffvote"). Among the many more cases (1357) with a negative payoff, however, a clear majority (71%) also vote, thus making the "wrong" decision". In short, in most cases people are not in a situation to cast a pivotal vote, and thus the rational choice is to abstain. Yet, more than 70% vote. And, all in all, 62% of the participants make the wrong choice, that is, they vote even if their expected payoff is negative or they abstain when the payoff is positive. Hypothesis 2 is disconfirmed.

The above analysis assumes that people are able to perfectly predict the other participants' behavior. The poor performance of the rational model at the individual level may be due to the fact that subjects are not very good at predicting other voters' behavior, but their decision may be consistent with their perceptions. In half of the groups, subjects were asked to determine how many of the other participants they think will vote for party A and party B and how many will abstain. We can compute how much each participant would gain if she votes and if she abstains, given her expectation about how many of the other participants will vote for A and for B. We call this variable Subjective Diffvote, which is identical to Diffvote except that we use the respondent's perception rather than the actual outcome. The distribution of Subjective Diffvote is somewhat different from that of Diffvote. The participants have a positive expected benefit of voting 31% of the time (262 out of 840), twice as much as the percentage obtained with the objective measure (17%, 291 out of 1680). People are overestimating the competitiveness of these elections, a finding consistent with previous results (Blais and Massicotte, 2002). In a sense, this observation might provide a key to save the rational model. An individual may appear irrational either because she does not make correct inferences or because she makes correct inferences from wrong premises. It might be the case that participants reason correctly but have inaccurate subjective perceptions.

Table 1

Turnout among participants with positive and negative differential payoff in FPTP elections.

	Experiment 1	Experiment 2	Experiment 3
Among subjects with <i>positive</i> Diffvote (out of 291)	82%	82% (out of 87)	60% (out of 204)
Among subjects with <i>negative</i> Diffvote (out of 1357)	71%	68% (out of 659)	56% (out of 614)
Among subjects with <i>positive Subjective</i> Diffvote (out of 262)	72%	79% (out of 208)	51% (out of 305)
Among subjects with <i>negative Subjective</i> Diffvote (out of 537)	76%	67% (out of 517)	60% (out of 501)
Among subjects with <i>positive uncertainty weighted Subjective</i> Diffvote (out of 366)	73%	78% (out of 296)	53% (out of 417)
Among subjects with <i>negative uncertainty weighted Subjective</i> Diffvote (out of 474)	70%	64% (out of 460)	60% (out of 423)

⁵ Our nil result is similar to that reported by Duffy and Tavits (2008).

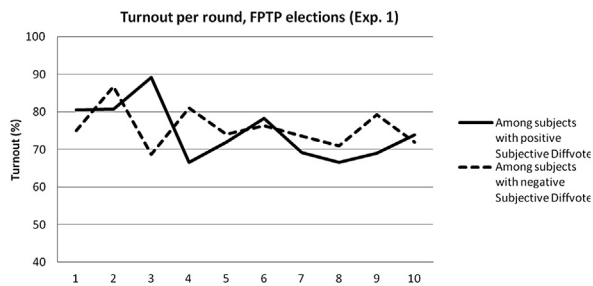


Fig. 2. Participation rates According to order for subjects with positive and negative subjective Diffvote (experiment 1).

Table 1 shows how the decision to vote or abstain is related to these subjective differential payoffs. 76% of those who are bound, according to their own perceptions, to gain one fewer point if they vote than if they abstain do nevertheless vote. This participation rate is even slightly lower (72%) among those who should vote, according to the rational model. Once again hypothesis 2 is not supported, as the rational recommendation is followed only 40% of the time, overall.

Let us see how those figures evolve through time. Fig. 2 presents the participation rate according to order, for subjects with positive and negative perceived benefit. The two graphs show no difference: participation declines with time for *both* groups, whereas if learning were taking place we should observe increasing participation rates for subjects with positive perceived benefit and the opposite for subjects with negative perceived benefit.

As a last robustness test, we allow for some uncertainty in subjects' predictions. The above analysis is based on responses to a question asking each person how many of the other participants they think will vote for party A and party B and how many will abstain. These responses provide the participants' best estimates of the most likely outcome. Many people, however, may be uncertain about their predictions.

We capture such uncertainty through the following procedure.⁶ Consider a person at position 5 who indicates that she expects party A to get 8 votes and party B to get 7 votes, with 5 abstentions (excluding herself). In the above analysis, this person is not 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, while still considering the situation where A gets 8 votes and B 7 votes as the most likely outcome, also assigns a positive probability to "similar" or "close" outcomes. More specifically, we make the following assumptions. Such a voter 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 $1-2\epsilon$. The same logic applies to her estimates of party B's votes. There is in her view a positive probability of both parties each getting 7 votes (with probability $\epsilon(1-2\epsilon)$) or of both parties each getting 8

votes (also with probability $\epsilon(1-2\epsilon)$), in which case she would be pivotal. We have performed simulations with values of ϵ set at 0.1, 0.2, or 0.33. See Appendix B (<http://dx.doi.org/10.7910/DVN/26139>) for more detail about the way we model uncertainty, and further details on this example. We present and discuss the results associated with the highest uncertainty, under which a probability of 0.33 is given to the score given by the respondent, as well as to the scores just above and below.

We can compute for each individual a new "uncertainty weighted" subjective differential payoff. Does this procedure produce more cases with positive payoff? Yes, the percentage of cases with an expected positive payoff increases from 31% to 44% (366 out of 840). Table 1 shows that the participation rate is slightly higher among subjects with positive differential payoff (73%) than among subjects with negative differential payoff (70%), but the latter figure remains very high. The data fail to support hypothesis 2,⁷ even when we allow for uncertainty in participants' perceptions. Furthermore, when one looks at the time evolution (results not shown), we note that the participation rate among subjects with negative differential payoff is pretty much constant from the first election to the last, but that turnout among subjects with positive differential payoff is globally decreasing (from 77% on average in the first three elections down to 72% in the last three elections).

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 will gain if she votes rather than abstaining, given the distribution of votes and abstentions among the other participants. We also compute Subjective Diffvote, 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 Subjective Diffvote under PR are -0.7 . There is not a single individual with a positive value for either Diffvote or Subjective Diffvote. The implication is that the rational choice for every single individual person in each single election, given their perception of how the other participants would behave or given the actual choices made by the other participants, is to abstain. Yet, overall turnout is 69%, which is in direct contradiction with hypothesis 2.

We also performed analyses allowing for uncertainty around the predictions made by the participants, giving a probability of 0.1, 0.2, or 0.33 to the scores just above or below those provided. Even allowing for such uncertainty, every participant except one has a negative value on Diffvote in each and every election. Yet, most people vote, again in contradiction with hypothesis 2.

In the two types of elections the rational decision for a majority of participants, given the actual decisions made by the other participants and also given their perceptions of what the other participants would do, is to abstain. Yet the majority of participants vote. Most of the time, the participants' decisions are not in line with the predictions of the

⁶ The idea is derived from the notion of trembles in game theory (see Myerson, 1991), and is used within an empirical test of rationality by Vander Straeten et al. (2010).

⁷ All in all, the rational recommendation is followed 51% of the time, that is, the 'wrong' decision is made as often as the 'right' one.

rational choice model. This is true despite the fact that our experimental design favors the rational choice model by putting some voters in the position of being pivotal, which gives them the opportunity (in some instances) to vote and still be rational actors.

3. Making position reallocation less frequent: experiments 2 and 3

One reason which may explain the poor performance of the rational choice model is that, even if elections are repeated (subjects voting several times with the same voting rule and the same distribution of positions), individual positions are shifting from one election to the next. In the baseline protocol, subjects are randomly assigned to a new position at every single period. This may make the learning process difficult.

To facilitate learning, we perform two variants of the baseline protocol. In Experiment 2 (moderate persistence), we perform two series of nine elections, one under FPTP and one under PR. Each series consists of three blocks of three elections each, the participants' positions remaining constant within each block, and positions shifting only from one block to the next. In Experiment 3 (strong persistence), we perform two series of ten elections, one under FPTP and one under PR; within each series, each voter's position remains constant throughout the ten elections.

Four groups performed Experiment 2 in Montreal in April 2012, and four groups performed Experiment 3 in Paris in November 2012. All these groups were invited to reveal their expectations about how the other members of the group would behave.⁸

Under FPTP elections, mean participation rates are respectively 72%, 70% and 57% in experiments 1, 2, 3. Under PR the rates are respectively 69%, 76% and 72% in experiments 1, 2, 3. Hypothesis 1 is again disconfirmed, as turnout is not systematically higher under FPTP. In FPTP elections, making position reallocation more frequent unambiguously decreases the average level of participation. Therefore, allowing for greater position persistence does not bring experimental outcomes closer to equilibrium predictions (remember that rational equilibrium participation rate is above 85%). In PR elections, there is no apparent relationship between position persistence and average participation rate.

Let us now consider the time trend in each experiment (see Fig. 1). As in experiment 1, there is a tendency for turnout to decline from the first to the last round, under both voting rules. In PR elections, the patterns are quite similar in the three experiments, and the decrease is modest. In FPTP elections, the patterns are different across experiments. The decrease through time is more important in experiment 3 (65% on average in the first three elections

and 49% in the last three elections, compared to an average of 75% in the first three elections in experiment 1 and 71% in the last three elections). Note also that in experiment 2 the pattern is not as gradual as in experiment 1. In experiment 1, we hold 10 successive elections under a given rule with individual positions shifting at every election. In experiment 2, there are three blocks of three rounds, with individual positions remaining constant within a given block of three elections. In experiment 2, turnout decreases rather sharply, by about 15 points, from the first to the third round within a block, and then goes back up at the first round of the next block. It seems that when a situation is repeated exactly in the same way people become more inclined to abstain but that this effect does not last; turnout increases as soon as individual positions are reallocated.

Let us now turn to individual level analyses. Is the rational choice model better able to predict individual behavior in experiments 2 and 3?

Table 1 compares the performance of the rational model in the three experiments in FPTP elections. Consider first the subjects with a negative Diffvote. These are participants who were not in a position to cast a decisive vote (given the other participants' actual decisions) and so were bound to gain one fewer point if they voted than if they abstained. The fraction of such voters who nevertheless vote is 71% in experiment 1, 68% in experiment 2 and 56% in experiment 3. When restricting attention to these voters, it therefore seems that making position reallocation less frequent does improve the prediction of the rational calculus model. Yet, one gets a quite different picture when considering voters with a positive Diffvote, that is, participants who were in a position to cast a decisive vote and so were bound to gain at least one more point if they voted than if they abstained. One observes that the fraction of such voters who indeed vote is 81% in experiment 1, 82% in experiment 2 and 60% in experiment 3 (Table 1). When restricting attention to these voters, it seems that making position reallocation less frequent actually deteriorates the quality of the predictions of the rational calculus model. Making position reallocation less frequent decreases participation among voters who should not vote, but also among those who should vote. All in all, the 'wrong' decision is made 62% of the time in experiment 2 and 52% in experiment 3.

When we take into account the participants' subjective perceptions of what their fellow participants will do, the patterns are very similar. Note that in experiment 3, for both the Subjective Diffvote variable and the uncertainty based Diffvote variable, the participation rate among voters who should not vote is surprisingly higher (60% in both cases) than among voters who *should* vote (53% with uncertainty weighted perceptions and 51% with no uncertainty weighted perceptions). The bottom line is that in all these sessions, most participants had a negative expected payoff and that most of them did vote, in contradiction with hypothesis 2.⁹

⁸ One additional change was made to the protocol in Experiment 2. We introduced an incentive for the participants to come up with their best estimation of what the other members of the group would do. The participants were told that the person with the most accurate prediction of the vote distribution in a randomly selected election would gain an additional 50 points. It turns out that providing an incentive to report accurate anticipations does not improve the accuracy of stated beliefs. Detailed results are available upon request.

⁹ All in all, the rational recommendation is followed 46% of the time in experiment 2 and 40% of the time in experiment 3 in the case of Subjective Diffvote. The equivalent percentages with respect to uncertainty weighted Subjective Diffvote are 53% and 46%.

Last, let us now consider the PR elections. In experiment 2 as in experiment 1, no single individual had a positive expected differential payoff associated with voting, whether this payoff was computed on the basis of the other participants' actual behavior, on the basis of participants' perceptions, and whether we allow for uncertainty around predictions or not. Yet turnout was even higher than in experiment 1 (76%). In experiment 3, the participation rate was low enough (especially so in the last rounds) in some sessions, that a few individuals had a positive expected payoff associated with voting. When this payoff was computed on the basis of participants' perceptions of the other participants' behavior, 15 individuals were in such a situation (out of whom only 1 voted), and when we allow for some uncertainty around predictions, 23 individuals were in this case (out of whom only 2 voted). The main message, again, is that in PR elections, almost everyone had a negative expected payoff, yet, contrary to hypothesis 2, most people decided to vote.

In short, the evidence is inconsistent with the rational choice model in experiments 2 and 3 as well. Turnout is higher under PR than under FPTP while it should be the opposite. The majority of participants vote even if the expected payoff of voting is negative. In FPTP elections, it seems that the main effect of making position reallocation less frequent is to decrease participation, but it does so both for those who should indeed abstain and for those who should vote. We conclude that there is no evidence of learning effects. The fact that we observe no learning effects is consistent with the remark that the performance of the RCT does not depend on the location (Canada, France or Belgium), although these countries use different electoral rules. These results suggest that there is no learning taking place, neither from repetition with persistence in the lab, nor from external familiarity with the institutions in different countries.

4. Econometric analysis

The individual level analyses in Sections 2 And 3 are based on a dichotomous distinction between subjects with a positive and subjects with a negative expected payoff, and simply look at participation rates in those two groups of subjects. We also perform a weaker test of the theory, and ascertain whether there is a positive correlation between Diffvote and turnout, that is, whether the propensity to vote increases as Diffvote increases (hypothesis 3).

All regressions in this paper use clusters based on individuals, since the same individuals participate in many voting decisions over the course of the experiment. Table 2 presents the results. The findings are clear and striking in the case of PR elections. The coefficient associated with Diffvote is almost always negative and statistically significant. The more negative the expected payoff of voting the higher the propensity to vote, in direct contradiction with hypothesis 3.

Why is it so? As noted in Section 1.2, the expected benefit of voting in a PR election is higher when turnout in the group is low (hypothesis 6) and when one's party is weak (hypothesis 7). In Table 3, we regress the decision to vote or abstain on turnout (T) in the group (the number of

Table 2

The decision to vote and differential payoff: Logistic estimations.

Experiment	Diffvote	FPTP		PR	
		Coef.	S.E.	Coef.	S.E.
Exp1	Objective	0.16**	0.04	0.28	0.42
	Subjective	0.02	0.05	-1.80	0.78
	Subjective with uncertainty	0.20	0.11	-2.57**	0.81
Exp2	Objective	0.15*	0.07	-2.32*	0.92
	Subjective	0.12*	0.05	-2.40	1.30
	Subjective with uncertainty	0.31**	0.10	-3.95**	0.96
Exp3	Objective	0.06	0.04	-1.84**	0.70
	Subjective	-0.05	0.05	-2.75**	0.98
	Subjective with uncertainty	-0.08	0.10	-3.19**	0.86

Sig levels: 0.05: *, 0.01: **.

The numbers are the logit coefficients obtained when regressing the decision to vote or abstain successively on the three measures of Diffvote.

people, excluding that participant, who vote in that election) and the strength (S) of one's preferred party (the proportion of voters, excluding the participant, who vote for the preferred party). To construct variables T and S, we use both their objective values, and the subjective values based on the subjects' reported anticipations (with and without uncertainty). The rational choice model predicts a negative relationship between voting and these two variables. But we observe exactly the opposite pattern, that is, positive coefficients, especially with respect to subjective measures of Diffvote. Contrary to hypotheses 6 and 7, the participants are more inclined to vote when they expect a high turnout and when they perceive their party to be strong. This is consistent with the finding of a field experiment which shows that people are more inclined to vote when they are told that most people are voting, an indication of the strength of descriptive social norms (Gerber et al., 2010).

Things are more nuanced in FPTP elections (Table 2). Even though most people make the 'wrong' decision, that is, they vote while the expected payoff of voting is negative, there is a positive relationship between Diffvote and turnout in seven cases out of nine, and the relationship reaches statistical significance in four instances. Even though the majority does not make the 'rational' choice, the participants appear to be slightly more inclined to vote when the expected benefit is higher, at least in experiments 1 and 2. There is here some limited support for hypothesis 3.

Why? To address this question we look more deeply at the factors that affect the expected payoff of voting. Diffvote is the result of two factors: first, the differential benefit (B) that will accrue to the individual depending on whether party A or party B wins, and second the probability (P) that one's vote will be decisive. As pointed out above, B depends on one's position and ranges from 0 point when the position is 10 to 10 points when it is lower than 6 or higher than 14. As to P, it equals 0.5 when one can create or break a tie and 0 otherwise (in the case where no uncertainty is introduced in the predictions; when allowing for uncertainty, P ranges between 0 and 0.5). One expects the propensity to vote to increase with the probability to be decisive (hypothesis 4) and with the stakes (hypothesis 5).

Table 3

The decision to vote, group turnout (T), and strength (S) of preferred party in PR elections.

Experiment		Objective		Subjective		Subjective with uncertainty	
		Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Exp1	T	−0.01	0.03	0.16**	0.04	0.16**	0.04
	S	−0.17	0.57	2.14**	0.57	2.23**	0.58
Exp2	T	0.13**	0.04	0.25**	0.05	0.25**	0.05
	S	0.70	0.90	1.68*	0.85	1.80*	0.86
Exp3	T	0.13*	0.05	0.18**	0.05	0.18**	0.05
	S	2.34**	0.87	2.27*	1.01	2.55*	1.01

Sig levels: 0.05: * 0.01: **.

The numbers are the logit coefficients obtained when regressing the decision to vote or abstain successively on the three measures of group turnout and strength of preferred party.

Table 4

The Decision to Vote, the Stakes (B), and the Probability of Being Decisive (P) in FPTP elections.

Experiment		Objective		Subjective		Subjective with uncertainty	
		Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Exp1	B	0.21**	0.02	0.20**	0.03	0.21**	0.03
	P	0.74*	0.31	−0.81	0.44	−1.03	0.98
Exp2	B	0.09**	0.03	0.09**	0.03	0.09**	0.03
	P	1.13*	0.55	0.54	0.41	1.72*	0.86
Exp3	B	0.11*	0.04	0.11*	0.04	0.11*	0.05
	P	0.22	0.42	−0.74	0.51	−2.05*	1.17

Sig levels: 0.05: * 0.01: **.

The numbers are the logit coefficients obtained when regressing the decision to vote or abstain successively on the stakes (B) and the three measures of the probability of being decisive (P).

The findings are shown in Table 4. Again, to construct variable P, we use both its objective value and the subjective values based the subjects' reported anticipations (with and without uncertainty). It can be seen that B is significant and has the predicted positive sign in all cases. This confirms that, in conformity with the rational choice model, the participants are more inclined to vote when the stakes are higher, that is, when it makes a bigger difference (given the individual's position) whether party A or party B wins (hypothesis 5). The results are more ambiguous with respect to P. Whether one's vote is likely to be decisive appears to have an effect only when we use the objective measure of P. With the subjective measures, P is not significant (and often has the wrong sign). Hypothesis 4, according to which people are more inclined to vote if they believe that their vote could be pivotal, is not confirmed.

These results suggest that the reason why we get inconsistent results for Diffvote under FPTP is that the rational choice model is only partially supported. The participants do take into account the importance of the election when they decide whether to vote or to abstain, that is, they are more willing to vote when the stakes are higher. But they pay little attention to whether their single vote is likely or not to make the difference.

5. Conclusion

Our purpose in this study was to test the rational choice model of turnout in the lab. To that effect we performed experiments in Brussels, Montreal, and Paris, in which participants had to decide whether to vote or not in a number of first past the post and proportional

representation elections. We tested the predictions of rational choice theory from three different angles: first comparing aggregate turnout with the equilibrium predictions derived from game theory, second comparing the actual decisions made by the participants with those that the theory indicates they should have made in order to maximize their payoff given the choices by the other participants or their expectations about these choices, and third by determining whether, at the margin, people are more likely to vote as the expected payoff increases. We have performed a great variety of simple and straightforward tests.

We have found the following. Contrary to hypothesis 1, turnout is not higher under FPTP than under PR. Contrary to hypothesis 2, most participants, most of the time, do not make the choice (voting or abstaining) that would maximize their payoff, given the choices made by the other participants or their expectations about these choices. Hypothesis 3, according to which, at the margin, the propensity to vote increases when the expected payoff of voting is higher, is partially confirmed in FPTP elections and disconfirmed under PR. Under FPTP, the results are mixed. On the one hand, the participants are indeed more likely to vote when the stakes are higher, which is in line with the predictions of rational choice (hypothesis 5). On the other hand, contrary to the theory (hypothesis 4), the participants are not more prone to vote if their decision is pivotal. The theory performs very poorly in PR elections because the participants are more inclined to vote when turnout in their group is high and when the party they support is strong, which is exactly the opposite of what the theory would recommend (hypotheses 6 and 7).

The overwhelming thrust of the evidence is inconsistent with the rational calculus model, both in FPTP and PR elections, both at the aggregate and individual levels, in both static and dynamic terms. We pay particular attention to the more direct test (hypothesis 2), in which we compare individual decisions with the recommendations derived from a rational calculus. We find that the rational recommendation is not followed most of the time.

We conclude that the rational choice model is not very useful in making sense of the decision to vote or abstain during elections. As noted at the outset, this conclusion has been reached by many analysts in the past. But previous research is based almost entirely on survey data. The evidence presented here indicates that the verdict is the same when we move to the lab.

The fact that the rational choice model is not supported in the lab is quite telling. Most of the participants are university students. The elections that they participate in involve party A and party B and thus are emotion free. They are told after each election how many points they won and they have every incentive to think about how best to maximize their points and ultimate monetary payments. Furthermore, because of the small number of voters in the lab the probability of being pivotal is not infinitely small, thus biasing the tests in favor of the rational model. Yet, people's behavior systematically diverges from the predictions of rational choice.

Interestingly, these results confirm findings from observational data but not what had been observed in the few earlier attempts to test the validity of rational choice theory of turnout in the lab. These earlier studies were more supportive of the rational choice model but, as explained above, did not refer explicitly to elections and parties in their protocol. In our study, it has been decided to present explicitly the decision to be made by participants as a decision to vote in an election. The gap between our findings and those of previous lab experiments may come partly from the different framings. Referring to elections may give more influence to social and normative considerations that are often associated with elections, like sense of civic duty (Blais, 2000) or social pressures (Gerber et al., 2008). Such considerations go beyond the scope of this article but would certainly deserve to be examined further in future research.

We find it quite interesting that experimental and observational results converge in this case, that is, they fail to support the 'Rational Choice Theory'. This confirms that lab experimentation can be a useful complement to observational studies.

We would not want to go too far in our verdict against RCT, however. Clearly, in FPTP elections people are less likely to vote when, because of their position on the scale, they have little to win. The importance of the election does matter. Furthermore, other aspects of the voting decision in the lab, such as the decision to vote sincerely or strategically, are better explained by the theory (see Van der Straeten et al., 2010).

It would seem, however, that, as Barry (1978) claimed a long time ago, when it comes to making sense of the turnout decision as such we may have to learn more from sociologists than from economists. Recent work on the social

determinants of turnout, such as duty (Blais and Achen, 2009), altruism (Fowler, 2008), and social pressure (Gerber et al., 2008) reinforces this conclusion. The observed departure from RCT is that voters vote more often than predicted; this deviation is consistent with any additional causal factor which may drive participation, such as those which have been identified by the empirical literature: especially social pressure and sense of civic duty. Introducing in the rational choice model such behavioral elements of conformity to social norms inspired by traditional sociology might therefore increase its predictive power.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.electstud.2014.07.001>.

References

- Barry, B., 1978. *Sociologists, Economists, and Democracy*. University of Chicago Press, Chicago.
- Blais, A., 1991. The debate over electoral systems. *Int. Polit. Sci. Rev.* 12, 239–260.
- Blais, A., 2000. *To Vote or Not to Vote? The Merits and Limits Rational Choice Theory*. University of Pittsburgh Press, Pittsburgh.
- Blais, A., Achen, C., 2009. Duty, preference, and turnout. In: Paper Presented at the ECPR Conference, Postdam.
- Blais, A., Massicotte, L., 2002. Electoral systems. In: LeDuc, L., Niemi, R.G., Norris, P. (Eds.), *Comparing Democracies 2*. Sage, London.
- Blais, A., Young, R., 1999. Why do people vote? An experiment in rationality. *Public Choice* 99, 39–55.
- Carter, E., Farrell, D.M., 2010. Electoral systems and election management. In: LeDuc, L., Niemi, R.G., Norris, P. (Eds.), *Comparing Democracies 3*. Sage, London.
- De Sinopoli, F., Ferraris, L., Iannantuoni, G., 2011. The effect of ideology on policy outcomes in proportional representation systems. *Math. Soc. Sci.* 62 (2), 87–90.
- De Sinopoli, F., Iannantuoni, G., 2007. A spatial voting model where proportional rule leads to two-party equilibria. *Int. J. Game Theory* 35, 267–286.
- Downs, 1957. *An Economic Theory of Democracy*. Harper and Row, New York, p. 310.
- Druckman, J.N., Green, D.P., Kuklinski, J.H., Lupia, A., 2011. *Cambridge Handbook of Experimental Political Science*. Cambridge University Press, New York.
- Duffy, J., Tavits, M., 2008. Beliefs and voting decisions: a test of the pivotal voter model. *Am. J. Polit. Sci.* 52, 603–618.
- Fowler, J.H., 2008. Altruism and turnout. *J. Polit.* 68, 674–683.
- Gerber, A., Green, D., Larimer, C., 2008. Social pressure and voter turnout: evidence from a large scale field experiment. *Am. Polit. Sci. Rev.* 102, 33–48.
- Gerber, A., Green, D., Larimer, C., 2010. An experiment testing the relative effectiveness of encouraging voter participation by inducing feelings of pride and shame. *Polit. Behav.* 32, 409–422.
- Green, D.P., Gerber, A.S., 2008. *Get Out the Vote: How to Increase Voter Turnout*. Brookings, Washington.
- Green, D.P., Shapiro, I., 1994. *Pathologies of Rational Choice Theory: a Critique of Applications in Political Science*. Yale University Press, New Haven.
- Grofman, B., 1993. Is turnout the paradox that ate rational choice theory? In: Grofman, B. (Ed.), *Information, Participation, and Choice: an Economic Theory of Democracy in Perspective*. University of Michigan Press, Ann Arbor, pp. 93–103.
- Herrera, H., Morelli, M., Palfrey, T., 2013. *Turnout and Power Sharing*. Mimeo Columbia University.
- Kartal, M., 2012. *Laboratory Elections: Proportional Representation Versus Majoritarian Rule*. Mimeo New York University.
- Kittel, B., Morton, R.B., 2012. Introduction: experimental political science in perspective. In: Kittel, B., Luhan, W.J., Morton, R.B. (Eds.), *Experimental Political Science: Principles and Practices*. Palgrave, London.
- Laslier, J.-F., Ozturk, B., 2006. *Opportunist Politicians and the Evolution of Electoral Competition*. Working Paper. École Polytechnique.
- Levine, D.K., Palfrey, T.R., 2007. The paradox of voter participation? A laboratory study. *Am. Polit. Sci. Rev.* 101, 143–158.

- Lijphart, A., 1999. *Patterns of Democracy: Government Forms and Performance in Thirty-six Countries*. Yale University Press, New Haven.
- Lizzeri, A., Persico, N., 2001. The provision of public goods under alternative electoral systems. *Am. Econ. Rev.* 91, 225–239.
- Mueller, D.C., 2003. *Public Choice III*. Cambridge University Press, Cambridge.
- Myerson, R., 1991. *Game Theory: Analysis of Conflict*. Harvard University Press.
- Ortuno-Ortin, I., 1997. A spatial model of political competition and proportional representation. *Soc. Choice Welf.* 14, 427–438.
- Powell, G.B., 2000. *Elections as Instruments of Democracy: Majoritarian and Proportional Visions*. Yale University Press, New Haven.
- Riker, W.H., Ordeshook, P., 1968. A theory of the calculus of voting. *Am. Polit. Sci. Rev.* 62, 25–43.
- Schram, A., Sonnemans, J., 1996a. Voter turnout as a participation game: an experimental investigation. *Int. J. Game Theory* 25 (3), 385–406.
- Schram, A., Sonnemans, J., 1996b. Why people vote: experimental evidence. *J. Econ. Psychol.* 17 (4), 417–442.
- Van der Straeten, K., Laslier, J.-F., Sauger, N., Blais, A., 2010. Sincere, strategic, and heuristic voting under four election rules. *Soc. Choice Welf.* 35 (3), 435–472.