What Makes Voters Turn Out: The Effects of Polls and Beliefs

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Abstract. We use an array of laboratory experiments to test for one of the foundations of the rational voter paradigm – that voters respond to probabilities of being pivotal. We exploit a simple setup that entails stark theoretical predictions regarding the effects of information pertaining to the distribution of preferences (that, in reality, may be manifested through polls) on costly participation decisions. The experimental data reveal several interesting insights. First, propensity to vote increases systematically with subjects’ predictions of their preferred alternative’s advantage – the more likely they think their preferred alternative is to win, the more likely they are to vote. As a consequence, pre-election polls do not exhibit the detrimental effects on welfare that extant theoretical work predicts. Pre-election polls lead to more participation by the expected majority and generate more landslide elections. Finally, we investigate the behavior of subjects in the polls and identify the conditions under which bandwagon and underdog effects of the polls arise.

JEL classification: C92, D02, D72

Keywords: Collective Choice, Polls, Strategic Voting.

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1. Introduction

1.1 Overview

At the core of the pivotal voter model is the idea that voters respond to the likelihood that their vote will matter for the collective decision, i.e., that they will be pivotal. This canonical model has many important implications. If participation is at all costly (be it due to travel costs involved in getting to the booth for political voters, time costs for faculty invited to a recruiting meeting, etc.), greater turnout is to be expected when the likelihood of a close decision is higher. Furthermore, information regarding the distribution of preferences, such as the fraction of the population that supports one alternative relative to another, would induce those in the minority to participate at greater rates. Consequently, any such information, which is commonly dispelled through polls, would have rather detrimental welfare effects. It would induce more costly participation and make the majority-preferred alternative less likely to be selected.

Large political elections provide a rather challenging case for the underlying premise of the pivotal voter model. Indeed, probabilities of pivotality are perceived to be pervasively low – for example, Mulligan and Hunter (2003) estimate that approximately one of every 100,000 votes cast in U.S. Congressional elections, and one of every 15,000 votes cast in state legislator elections, ‘mattered’ in that they were cast for a candidate that tied or won the election by precisely one vote. Nonetheless, the value of participation in political elections is hard to assess, and the pivotal voter model could still provide useful guidance in terms of the effects of information on outcomes, the behavior of individuals in small groups making collective decisions in which pivot probabilities are substantial, etc.

The current paper describes an array of experiments that focus on the explicit link between voters’ beliefs and their participation decisions. These are some of the first experiments to elicit beliefs directly in a variety of informational settings. In particular, we consider the impact of information revealed through polls and the welfare consequences they entail.

In detail, 22 groups of 9 subjects each participated in 440 elections between two alter-
natives. Subjects had to choose one of two colors: Red or Blue, using majority rule. Each subject in the group preferred the collective choice to be Red with some probability. Each subject had to individually decide whether to cast a costly vote for either Red or Blue, or whether to abstain.

We considered three treatments: in our baseline No Polls treatment, subjects knew only their own preferred color. In the Perfect Polls treatment, subjects knew their own preferences, and that each subject had a $2/3$ probability of sharing their preference. In the Lab Polls treatment, subjects knew their own preferences and participated in a poll reporting their voting intentions prior to the actual vote. In all groups, subjects were individually asked to predict the group preference composition and ultimate voting profile prior to voting, i.e. report their beliefs regarding the outcome of the election.

While we use the terminology of political elections, thinking of subjects as voters, our experimental setup can be thought of as a metaphor for a wide variety of settings, including investment decisions by corporate strategy committees, hiring and tenure decisions by university faculty, and so on.

The experimental data reveal several interesting insights. First, the propensity to vote increases systematically with experimental subjects’ predictions of their preferred color’s advantage – the more likely they thought their preferred color was to win, the more likely they were to vote. With regards to the pivotal voter model, turnout rates are significantly higher for elections that are predicted to be close relative to all others aggregated together. However, a more refined look into the response of turnout to beliefs reveals a monotonic pattern that is not in line with the pivotal voter model – elections that are predicted to yield a victory to the preferred alternative induce greater participation.

Second, the information regarding the preference distribution in the population does not have as detrimental of an effect as theory would predict. In fact, all of our treatments yield comparable welfare levels. From a policy perspective, this suggests that dispelling information in the electorate would not be as harmful as our standard theoretical framework would suggest. Furthermore, while the pivotal voter model would suggest that polls, suggestive of
which alternative is supported by a majority of the population, would induce minority supporters to turn out and therefore lead to closer elections, in the experiment landslide elections are significantly more common when more information is available to the electorate.

Last, our design allows us to inspect the behavior of subjects in polls. In our experimental polls, very few subjects mis-report the alternative they will vote for. However, there is substantial discrepancy between declared intentions to participate and ultimate turnout decisions. Of those reporting they will vote, only 42% ultimately participated, while of those reporting they will abstain 50% ultimately participated in the election. These choices end up shedding light on some of the empirical observations regarding polls. Namely, the literature has been inconclusive on whether polls lead to bandwagon effects, making poll winners win with even greater leads then predicted, or underdog effects, leading poll winners to lose votes in the actual election. Our result illustrate that which effect prevails depends on the margins of victory elicited by the polls. When poll victories are small, bandwagon effects appear, while when polls predict a landslide victory for one of the alternatives, underdog effects are observed.

1.2 Related Literature

Condorcet (1785) introduced a formal approach to studying collective choice. He considered a group of individuals with a common goal, each owning a piece of private information regarding the best course of action. When individuals follow their private information, aggregate majority decisions are likely to produce efficient outcomes when the electorate is sufficiently large. Recent work, however, has shown that rational voters may not blindly follow their own private information (see Austen-Smith and Banks, 1996; Myerson, 1998; Feddersen and Pesendorfer, 1996, 1997, 1998). At the crux of the pivotal voter model is the observation that since a vote matters only when it is pivotal, a strategic agent considers the information contained in the event of being pivotal, taking into account others’ strategies. In the context in which information is to be aggregated, Nash equilibrium strategies may involve strategic voting where individuals go against their private information.
Even when there is no uncertainty, the pivotal voter model has a bite in the form of a simple cost-benefit analysis.\footnote{For the empirical papers on the pivotal voter model see Coate and Conlin (2004) and Coate, Conlin and Moro (2008) in which authors investigate how well the pivotal voter model explains turnout in small-scale elections using data from the Texas liquor referenda.} A voter needs to contemplate the probability that her vote determines the election (the benefit) and weigh it against the cost of participation. Suppose two alternatives are being considered. In a model in which all voters experience the same distribution of participation costs, as in Palfrey and Rosenthal (1983) and Borgers (2004), majority supporters will participate less than minority supporters, and overall participation will decline with participation costs.

Some of the theoretical predictions of the basic model have been observed in the lab. Levine and Palfrey (2007) directly tested the Palfrey and Rosenthal (1983) model and found confirmation for the main comparative statics predicted by the model. For example, Levine and Palfrey document that participation declines with participation costs. This result has also been documented by Cason and Mui (2005) and Kartal (2011) in slightly different settings. Nonetheless, most experimental studies find that majority supporters vote with greater propensities than minority ones (see Duffy and Tavits, 2008, Großer and Schram, 2010, and Kartal, 2011), contrasting the predictions of the pivotal voter model.\footnote{The only experimental paper reporting greater minority support Levine and Palfrey (2007). However, the differences in observed participation rates in this setup are rather small: when the size of the electorate is 9, majority supporters vote at a rate of 40% or 45%, while minority supporters vote at a rate of 44% or 48%, depending on the relative volume of minority supporters.}

When the distribution of preferences is commonly known, the most efficient outcome (corresponding to the majority-preferred alternative when payoffs are symmetric) can be deduced absent an election. The recent literature has therefore suggested that it is \textit{uncertainty over preferences} in the electorate that make elections an important collective decision instrument. Goeree and Großer (2007) and Taylor and Yildrim (2010) consider models in which there is uncertainty over who is the majority-preferred candidate. Absent any information, individuals cannot condition their participation on whether or not they are majority supporters. Participation rates are therefore comparable across the minority and majority...
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Camps and the majority-preferred candidate is likely to emerge. In such elections, polls may play an important role, as they provide information to voters regarding their likelihood of belonging to the majority. Interestingly, information regarding the distribution of preferences may induce minority supporters to vote more since their likelihood to affect election outcomes is higher. Therefore, polls may lead to more participation, and lower likelihood of the majority-preferred candidate to be selected. Consequently, polls have a negative welfare effect.  

Several papers have considered the impact of information on preferences in the lab. Duffy and Tavits (2008) observe a positive association between predicted closeness of an election and participation rates. Großer and Schram (2010) and Klor and Winter (2006) consider experimental polls that reveal the precise distribution of preferences in the electorate (effectively mimicking the Palfrey and Rosenthal, 1983, setting). They find that polls by and large increase turnout and have welfare effects that depend on how equally divided support is, unequal levels of support making polls have non-negative welfare effects. In closely divided electorates, polls have detrimental effects on welfare.  

As a summary, we note that the experiments described in this paper provide three important methodological innovations. First, we elicit subjects’ beliefs regarding election outcomes prior to their choices, information that is particularly challenging to gather from field data. This allows us to test the pivotal voter model in a direct manner. Second, we consider polls that take place in the lab and can therefore inspect behavior in the poll as well as in response to its results.  

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3 The effects of polls in information aggregation settings is analyzed in Coughlan (2000). The effects of free-form communication preceding elections, with either private information or private preferences, appears in Gerardi and Yariv (2007).

4 There is also an experimental literature considering different forms of communication preceding elections in which participation is free, but individuals have private information regarding the ‘quality’ of either of two candidates. See Goeree and Yariv (2011), Guarnaschelli, McKelvey, and Palfrey (2000), and references therein. Sinclair and Plott (2010) consider experimental spatial elections in which candidates’ locations are uncertain and observe how polls allow subjects to ultimately behave as if they are informed.

5 For a general review of political economy experiments, see Palfrey (2006).

6 There exists a large empirical literature in Political Science that investigates how polls influence voters’ behavior. One of the problematic aspects of most of the field studies on this topic is the necessity to disentangle whether polls affect preferences, or change voters’ propensity to vote. Our experiments provide
tive is favored by the majority, environments in which collective decision protocols may be particularly important.

1.3 Paper Structure

Section 2 describes the experimental design. The corresponding theoretical predictions are analyzed in Section 3. We start the description of the experimental observations in Section 4 in which we report the prevalence of landslide elections and the welfare consequences as they interact with election information. The voting behavior, in terms of turnout and response to information is described in Section 5. The analysis of the reports in the experimental polls and their comparison with the idealized perfect information polls appears in Section 6. Section 7 concludes.

2. Experimental Design

We use a sequence of experiments to assess voters’ response to information and beliefs regarding the underlying distribution of preferences.\(^7\) There is a “red” jar and a “blue” jar: the red jar contains two red balls and one blue ball and the blue jar contains two blue balls and one red ball. We use the color of the jar as a metaphor for the inclination of the decision-making group (a committee, an electorate) toward one of two alternatives that are being considered (an investment opportunity, a political candidate). At the start of each session, subjects are randomized into a group of nine subjects.\(^8\) The timing of each of our sessions was as follows:

**States and Preferences.** At the start of each of 20 periods, one of the jars is chosen by a toss of a fair coin. In each period, after the jar had been selected, each of the nine subjects in a group receives an independent draw (with replacement) from the selected jar. The color of the drawn ball matches the jar’s color with probability \(p = \frac{2}{3}\). Ultimately, each group

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\(^7\)The full instructions we used are available at: http://www.hss.caltech.edu/~lyariv/Research.htm

\(^8\)We kept subjects in the same group throughout each session in order to avoid potential ‘contamination’ across groups and since repeated game effects seemed particularly difficult in this setting. In fact, subjects did not seem to exhibit any group-dependent intertemporal correlation in behavior, as we show in Section 5.3.
of subjects chooses an alternative – red or blue. The individual color each subject draws corresponds to the subject’s preferred alternative.

**Polls.** Depending on the treatment, subjects were provided some information on the realized jar. Specifically, we had three types of sessions:

- **No Polls** Subjects know that each jar had a 50 – 50 probability of being selected, but observe no information on the realized jar other than their private draw.

- **Perfect Polls** Subjects are perfectly informed of the realized jar in each period. This corresponds to a situation in which agents’ preferences are polled perfectly so that the distribution of preferences in the population is transparent to all.\(^9\)

- **Lab Polls** After private draws (i.e., preferences) for a period are revealed, subjects are asked to declare their intended actions: abstain, vote for red, or vote for blue. The resulting overall statistics (number of subjects intending to abstain, vote for red, and vote for blue) are then reported to subjects. This treatment replicates real polls in which subjects may potentially be strategic when responding to the polls and not necessarily report their actual intended actions.

**Beliefs.** After receiving information regarding the realized jar as determined by one of the three treatments, subjects are asked to report their beliefs regarding the composition of the group (number of subjects preferring red and number of subjects preferring blue), as well as the distribution of votes (for red and blue).\(^{10}\) At the end of the experiment, one of these guesses was randomly chosen for each subject and the subject was paid a $10 bonus for that guess being correct.

**Decisions and Payoffs.** After subjects report their beliefs, each decides whether to abstain, vote red, or vote blue. Voting (for either red or blue) entails a cost of either 25 cents or 50

\(^9\)For example, if the color of the realized jar was blue, then each subject knew that each member of the group has a 2/3 chance of drawing a blue ball and 1/3 of a chance of drawing a red ball.

\(^{10}\)Subjects guesses regarding group composition had to specify two numbers summing up to 9. Their guesses regarding the vote distribution did not have to comply with that restriction, due to the possibility of some subjects ultimately abstaining.
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Once all decisions are received, each group’s votes are tallied and the alternative receiving the majority of votes is selected (ties broken randomly). Each subject for whom the color of the private draw coincides with the selected alternative receives $2 for that period, while others receive no additional payments. The resulting per-period payoff is a reward corresponding to the selected alternative (0 or $2) minus any cost incurred by voting.

To summarize, the experiments employ a $3 \times 2$ design based on variations in the information available to voters regarding the underlying distribution of preferences and the voting participation costs. Each experimental session implemented one of the information treatments (No Polls, Perfect Polls, or Lab Polls). Within most sessions, the initial 10 periods have costs set at 50 cents and are followed by 10 periods in which participation costs are set at 25 cents. In order to check for order effects, we ran several sessions in each information treatment with the order of costs reversed (namely, in two groups corresponding to the No Polls treatment and in three groups corresponding to each of the Perfect Polls and Lab Polls treatments). These “reverse order” sessions led to qualitatively identical insights as our baseline treatments. In order to keep the discussion focused, we report results aggregated across all sessions.

The experiments were conducted at the California Social Sciences Experimental Laboratory (CASSEL) at UCLA. Overall, 198 subjects participated. The average payoff per subject in the No Polls treatment was $29.4, the average payoff per subjects in the Perfect Polls treatment was $31.9, while the corresponding average in the Lab Polls treatment was $30.1. In addition, each subject received a $5 show-up fee. Table 1 summarizes the details of our design.

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11 These costs were common knowledge to all subjects in the beginning of the round.
12 Notice that the size of the bonus is sufficiently small as to make group behavior aimed at achieving the bonus particularly costly. In fact, while subjects had an accurate general perception of outcomes, their rates of correct guesses were very low, always slightly smaller than 10%. We return to this point in Section 5.3.
13 Separate analysis of the sessions in which rounds with voting costs of 25 cents preceded the rounds with voting costs of 50 cents is available from the authors upon request.
14 These numbers correspond to the sum of the 20 period payoffs and the potential $10 bonus payment for reporting a correct belief in the (randomly) chosen period and question.
3. Theoretical Predictions

Our experimental design is in line with the model proposed by Goeree and Großer (2007). Formally, consider a group of \( n \geq 2 \) individuals (subjects, jurors, political voters, etc.) who collectively choose one out of two alternatives, \( \{\text{red, blue}\} \) (this can be understood as a metaphor for a choice between two political candidates, convicting or acquitting a defendant, etc.). Each individual experiences a cost \( c > 0 \) if she participates and 0 otherwise. The chosen alternative is determined using simple majority rule among the votes cast by all individuals who participated, where a tie leads to a random draw of one of the alternatives. An individual’s utility is \( V \) if her preferred alternative wins and 0 otherwise.

At the outset, a state of nature is chosen randomly from \( \{R, B\} \) (experimentally corresponding to a red or blue jar; metaphorically, to a state in which one candidate is more popular than another). Both states are a-priori equally likely. If the state is \( R \), each individual receives an \( r \) ‘badge’ with probability \( p \geq 1/2 \) and a \( b \) badge with probability \( 1 - p \). Similarly, when the state is \( B \), each individual receives a \( b \) badge with probability \( p \) and an \( r \) badge with probability \( 1 - p \). An individual receiving an \( r \) badge prefers the alternative red (and receives no utility from the alternative blue being selected), while an individual with a \( b \) badge prefers the state blue.

The main parameter for this study is how much agents know about the selected state: without polls, only the prior; with perfect polls, the realized state; with lab polls, a noisy statistics about the realized state.

### 3.1. No Access to Polls.

When agents are uninformed of the realized state, all are ex-ante symmetric. We focus on symmetric Bayesian Nash equilibria. Since \( c > 0 \) and there

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**Table 1: Experimental Design**

<table>
<thead>
<tr>
<th>Number of Subjects</th>
<th>Groups</th>
<th>Group Size</th>
<th>Known Jar</th>
<th>Polls Run</th>
<th>Probability of Belonging to Majority</th>
<th>Maximal Prize</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Polls</td>
<td>63</td>
<td>7</td>
<td>No</td>
<td>No</td>
<td>2/3</td>
<td>$2</td>
</tr>
<tr>
<td>Perfect Polls</td>
<td>72</td>
<td>8</td>
<td>Yes</td>
<td>No</td>
<td>2/3</td>
<td>$2</td>
</tr>
<tr>
<td>Lab Polls</td>
<td>63</td>
<td>7</td>
<td>No</td>
<td>Yes</td>
<td>2/3</td>
<td>$2</td>
</tr>
</tbody>
</table>
are only two alternatives, whenever agents participate, they vote for their most preferred candidate.

Denote by $P_{piv}(k)$ the probability that an agent is pivotal when $k$ other agents participate. If no other agent participates, an individual is certainly pivotal: $P_{piv}(0) = 1$. When one other agent participates, the individual is pivotal only when the other agent has opposing preferences, $P_{piv}(1) = 1/2$. For any $j = 1, \ldots, [(n - 1)/2]$,

$$P_{piv}(2j) = \binom{2j}{j} p^j (1 - p)^j \quad \text{and} \quad P_{piv}(2j + 1) = \binom{2j + 2}{j + 1} p^{j+1} (1 - p)^{j+1}. $$

Notice that an agent is pivotal either when a vote by her would create a tie (avoiding her preferred alternative being defeated), or by breaking a tie (and leading her preferred alternative to be selected). Since a tie is associated with a 50–50 chance of either alternative being selected, the expected benefit from voting when pivotal is $V/2$.

Whenever $c > V/2$, costs outweigh the maximal possible benefit of voting and the unique symmetric equilibrium has no agent participating.

Whenever $c \leq P_{piv}(n - 1) * V/2$, the benefits of voting outweigh the costs even when all other agents participate for sure. In that case, the unique symmetric equilibrium would entail all participating.

For intermediate costs, symmetric equilibria would involve agents mixing between voting and abstaining. Indifference between the two would imply that the value of voting precisely equals its cost $c$. The more likely are others to vote, the higher are the incentives to free-ride and abstain. The following proposition characterizes the unique symmetric equilibrium in our setting (see also Proposition 1 in Goeree and Großer, 2007):

**Proposition (No Polls - Equilibrium Participation)** For participation costs $c \in (P_{piv}(n - 1) * V/2, V/2)$, in the unique symmetric Bayesian Nash equilibrium, all agents participate with probability $\gamma^*(n, p, c) \in (0, 1)$ given by:

$$\frac{V}{2} \sum_{k=0}^{n-1} \binom{n-1}{k} (\gamma^*(n, p, c))^k (1 - \gamma^*(n, p, c))^{n-1-k} P_{piv}(k) = c$$
and all those participating vote sincerely for their preferred alternative. Furthermore, 
\( \gamma^*(n, p, c) \) is decreasing in \( c \).

In our experiments, \( V = 2 \), we consider \( n = 9, p = 2/3 \), and participation costs that are 
\( c = 25 \) or \( c = 50 \) cents. The left panel of Table 2 contains the resulting equilibrium voting
probabilities. In addition, Table 2 reports the resulting expected participation costs (for the
group) and the resulting expected collective welfare, calculated as the difference between the
overall expected rewards for individuals and the costs incurred by the group.

3.2. Introducing Polls. We consider polls that reveal to the electorate the underlying
distribution of preferences, i.e., all individuals know precisely which state \( R \) or \( B \) prevails
(Perfect Polls treatment).

As before, when costs are sufficiently low, all agents participate, while when costs are
high enough, no agents participate. For intermediate costs, at least some of the agents,
depending on their preferences, will participate only with some probability.

Suppose, for instance, that the realized state is \( B \). Focusing on this intermediate case, we
focus on quasi-symmetric Bayesian Nash equilibria. These are equilibria in which all agents
who share a preferred alternative (\( \text{red} \) or \( \text{blue} \)) use the same strategy. Since \( \text{blue} \) is the
a-priori majority preference, the pivotality conditions now need to be spelled out for each
‘type’ of individual, one who prefers \( \text{red} \) or one who prefers \( \text{blue} \), separately. In order for the
text of this paper to remain focused, we do not spell out the pivotality conditions that arise
(see Goeree and Großer, 2007, for a discussion). However, a few notes are in order.

First, if all agents vote with some probability, notice that the majority voters, those who
prefer \( \text{blue} \), should vote with lower probability than the minority voters. Indeed, for all agents
the cost of participation is given by \( c \). In equilibrium, all agents must equate the value of
participating with its cost. Since the size of the majority is, by definition, greater than that
of the minority, it must be that the minority voters participate with greater propensities.

This has stark impact on outcomes. Indeed, since all voters, both in the majority and in
the minority, equate the marginal benefits of voting with the same cost \( c \), elections are likely
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Table 2: Theoretical Predictions

<table>
<thead>
<tr>
<th></th>
<th>No Polls</th>
<th></th>
<th></th>
<th>Perfect Polls</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vote Prob</td>
<td>Expected Costs</td>
<td>Expected Welfare</td>
<td>Vote Prob if Majority</td>
<td>Expected Costs</td>
<td>Expected Welfare</td>
</tr>
<tr>
<td>Cost = 25</td>
<td>0.61</td>
<td>137</td>
<td>1071</td>
<td>0.70</td>
<td>1</td>
<td>180</td>
</tr>
<tr>
<td>Cost = 50</td>
<td>0.21</td>
<td>95</td>
<td>995</td>
<td>0.19</td>
<td>0.39</td>
<td>117</td>
</tr>
</tbody>
</table>

The resulting unique quasi-symmetric Bayesian-Nash equilibrium probabilities for participation for majority and minority voters (say, for $b$- and $r$-individuals when $B$ is the underlying state) are reported in the right panel of Table 2. We also report the resulting expected collective costs and expected welfare for the group.

Our Lab Polls treatment does not mimic any theoretical environment that we are aware of. Unlike most theoretical models studying polls (see, e.g., Coughlan, 2000 or Goeree and Groër, 2007), in this treatment we do not restrict subjects’ to comply with the behavior announced at the polling stage. We avoid such restrictions in order to emulate ‘real-world’ polling instruments. In fact, one of our goals is to inspect subjects’ (unconstrained) reports in the polling stage. This creates a relatively complicated environment, in which voters may choose to be either truthful or strategic in the polling stage of the game; In addition, they can consequently decide to follow their intentions or adjust their behavior after poll results are revealed.\(^{16}\)

\(^{15}\) All of these qualitative results would follow through if participation costs were randomly determined, as long as the distributions from which costs were drawn did not depend on the alternative preferred by an agent.

\(^{16}\) Notice that this game involves, in principle, rather intricate considerations. Reactions to polls may depend on the precise distribution of reports for both alternatives and for abstention. In that sense, an
4. Election Outcomes

We start by describing the aggregate outcomes in our elections. There are two dimensions that are of particular interest. First, the distribution of votes allocated to each candidate and, in particular, the prevalence of very close elections as a function of the information available. Second, the welfare consequences of the electorate having access to information via polls.\(^{17}\)

4.1. The Emergence of Toss-up Elections. Figure 1 depicts the cumulative distribution of vote leads generated by winner. The left panel corresponds to periods in which participation costs were set at 25 cents, while the right panel corresponds to periods in which participation costs were set at 50 cents.\(^{18}\)

While election outcomes across the two costs do not differ significantly, outcomes across treatments differ noticeably. Toss-up elections (in which alternatives either tied or differed by one vote) occurred significantly more frequently in the No Polls treatment than in either of the two treatments in which information regarding the distribution of preferences was revealed.\(^{19}\) In fact, the No Polls treatment produces cumulative distributions that are first order stochastically dominated by those generated by the other two treatments. Using the regression analysis, we find that these differences are significant at any reasonable confidence level for both costs.\(^{20}\) In particular, landslide elections appear more frequently when agent may always be effectively pivotal in the polling stage, her reports may always affect the distribution of ultimate outcomes.

\(^{17}\)We note that there were no persistent biases toward the blue or red alternatives: behavior was not significantly different across the labels of the alternatives.

\(^{18}\)In this section, each observation encapsulates one group’s outcomes in a period. We return to additional tests validating this approach in Section 5.3.

\(^{19}\)Statistically, we use a probit regression to explain whether an election culminated in a toss-up outcome with dummy variables for treatments, while clustering observations by groups. For either cost, when the Toss-up dummy is regressed on the Perfect Polls dummy (or Lab Polls dummy), leaving the No Polls treatment as the baseline, we obtain a negative coefficient for the corresponding Polls dummy that is significant at the 5% level. When the Toss-up dummy is regressed on the Lab Polls dummy leaving the Perfect Polls treatment as the base group, we obtain a coefficient that is not significantly different from zero.

\(^{20}\)For each cost and for each value of vote difference between the winning and losing group denoted by \(k\), we create a variable that takes the value 1 if the vote difference in the election is \(k\) or less and the value 0 otherwise. We then run a probit regression of this binary variable on the dummy for the Perfect Polls (Lab Polls) treatment leaving No Polls treatment as the baseline, and clustering observations by groups. Almost
information regarding preferences is available.\textsuperscript{21}

We also note that the Perfect Polls and Lab Polls treatments generated very similar distributions of ultimate vote leads that are not significantly different from one another.\textsuperscript{22}

We return to a discussion of this similarity in Section Response to Information.

\subsection*{4.2. Welfare.}

We now turn to the performance of elections with and without polls in terms of overall welfare and likelihood to select the majority preferred alternative.

In terms of choosing the collectively optimal alternative, that favored by a majority, polls appear to have a positive effect. As the top panel of Table 3 suggests, especially for lower participation costs, the availability of Perfect or Lab polls assists somewhat in achieving the alternative favored by the majority. These differences are more pronounced when the group is closely divided (corresponding to type differences of 1 or 3).

\begin{itemize}
\item all coefficients are negative and significant at the 5\% level except for the following ones. When comparing the No Polls and Perfect Polls treatments, the only coefficient that is not statistically significant is the one corresponding to the equal number of votes for each color when voting costs are 50. When comparing the No Polls and Lab Polls treatments, the coefficients that are not statistically significant are the ones corresponding to the equal number of votes for each color for both costs, and the one for a vote difference of 4 and below for the voting cost of 50.
\end{itemize}

\textsuperscript{21}In our data, unanimous or almost-unanimous elections involving all participants never occurred.

\textsuperscript{22}To compare the distributions of vote lead by the winner between Perfect Polls and Lab Polls we used the same technique as for the comparison of the No Polls and Perfect Polls (Lab Polls) treatments described above.
Participation costs are not significantly different across treatments as the second panel in Table 3 illustrates. In fact, in utility terms, *group utilitarian welfare (accounting for payoffs from the selected alternative and the participation costs), is not significantly different across treatments.*

This result contrasts some of the basic insights from the theoretical work on polls that suggests the negative effects of polls (due to the increased propensity of the ‘wrong’ minority group to participate, which we turn to below). We stress that had subjects used equilibrium strategies, with our volume of data, the ranking of welfare across treatments would likely correspond to the theoretical predictions and be statistically different. For instance, for participation costs of 50, simulating our experiment assuming that subjects use equilibrium strategies (with the number of subjects participating in our experiments) for 1,000,000 iterations leads to a likelihood exceeding 95% of group welfare with Perfect Polls surpassing that without polls.
Table 4: Observed Participation Propensities

Though differences are not significant, we note that the welfare values observed do follow the theoretical comparative statics with respect to costs, generating greater mean observed welfare levels when participation costs are lower.

5. Voting Behavior

We now turn to the voting patterns observed in our data. We first describe the overall voting propensities of majorities and minorities across sessions. We then consider information and consequent beliefs as channels explaining behavior.

5.1. Turnout. Table 4 contains the observed voting propensities as a function of whether an individual is part of the expected minority or majority (when such indication exists, namely in our Perfect Polls and Lab Polls treatments, all standard errors appearing in parentheses).

The comparative statics with respect to costs hold across conditions: higher costs generating lower participation. However, in both our Perfect Polls and Lab Polls treatments, 

*minorities participate less than majorities* (differences significant at any reasonable level). This result is in line with Duffy and Tavits (2008), Großer and Schram (2010), and Kartal (2011), who also observe excessive voting by majorities in different environments in which majority membership is transparent.

5.2. Response to Information. In order to understand the mechanism generating the observed participation rates, subjects’ reports regarding their beliefs are particularly useful.
Since behavior across costs appears very similar for all of our treatments, for simplicity, in the remains of the paper, we present results aggregated across costs.\footnote{All of the observations hold true when separating treatments by costs. These separate analyses are available from the authors upon request.}

In the No Polls treatment, agents’ participation rates do not differ significantly when elections are predicted to be toss-up election (i.e., alternatives are tied or their support differs by one vote) or not close. However, when information is available in the Perfect Polls and Lab Polls treatments, elections that are perceived to be close generate significantly greater participation than others.\footnote{In the Perfect Polls treatment, participation rates were 0.59 and 0.49 when elections were perceived to be close and not, respectively. The difference between the two rates is significant at the 10\% level. In the Lab Polls treatment, participation rates were 0.62 and 0.42 when elections were perceived to be close and not, respectively, with differences between the two rates being significant at the 5\% level. The statistical significance is assessed using the Wilcoxon rank-sum test with one observation per subject per category.} At first blush, these results seem in line with the pivotal voter model – agents participate at greater frequencies when they perceive themselves as pivotal. They are consistent with the insights of some of the experimental literature that inspects the pivotal voter model and considers different likelihoods of close elections (see, e.g., Duffy and Tavits, 2008 and Levine and Palfrey, 2007).

Our design allows us to unfold the responses to different events corresponding to elections that are not close – those in which the preferred alternative is predicted to win with a landslide, and those in which the opposing candidate is predicted to win with a large victory margin. Figure 2 depicts subjects’ voting propensities as a function of their predictions regarding the lead of their preferred candidate (where light gray bars correspond to the frequency of the different guess leads in our data).\footnote{In Figure 2, we report only events that occurred at least 10 times over all experimental elections.}

Figure 2 illustrates behavior that is not naturally aligned with the prescriptions of the pivotal voter model. While voting propensities are lower when the opposing candidate is predicted to exhibit a large margin of victory relative to those corresponding to close elections, the propensities to vote when the preferred alternative is predicted to have a landslide win do not appear to be very different than those observed when elections are predicted to
be close.\footnote{Field data is consistent with this observation. In the 2000 presidential election, a survey conducted under the American National Election Studies revealed that of respondents who thought their preferred candidate would win by a large margin, 65\% still went out to vote.} This is echoed statistically. Across sessions, voting propensities are significantly lower when the preferred candidate is predicted to have a substantial loss (with the winning candidate having a lead of at least two votes) relative to the propensities to vote when the election is predicted to be close.\footnote{When the preferred candidate is predicted to lose with a substantial margin, voting propensities are 0.29, 0.26, and 0.22 in the No Polls, Perfect Polls, and Lab Polls treatments, respectively. The corresponding rates for elections that are predicted to be close are 0.46, 0.59, and 0.62, respectively.} These differences are all significant at the 1\% level. However, across treatments, propensities are not significantly different (up to a 9\% confidence level) between predicted close elections and elections in which the preferred alternative is predicted to win with a landslide.\footnote{When the preferred candidate is predicted to win with a substantial margin, voting propensities are 0.52, 0.57, and 0.51 in the No Polls, Perfect Polls, and Lab Polls treatments, respectively.}

These results are mirrored by the response to the polling information in our Lab Polls treatment. When the poll suggested the preferred alternative would experience a substantial loss, the voting propensity was 0.29. When the poll suggested a toss-up election, the voting
propensity was 0.60, different than the former rate at the 1% level, but not significantly different than the rate of 0.49 observed when a landslide victory for the preferred alternative was suggested by the polls.

One could naturally wonder whether reported beliefs are at all accurate. Indeed, if, say, agents tended to report exaggerated beliefs regarding the likelihood of their preferred candidate winning with a large margin, ultimate behavior could still approximate that prescribed by the pivotal voter model. Figure 3 depicts the predicted lead as a function of the realized lead of the preferred alternatives. As can be seen, the No Polls treatment exhibits fairly poor accuracies of beliefs (with some advantage given to the preferred alternative). This should be expected since subjects do not receive any information that is indicative of the composition of their group.\footnote{The fairly consistent predicted lead of one vote for the preferred alternative is interesting in that it cannot be fully explained by subjects’ own predicted participation since individual turnout rates were between 43% and 55% (depending on costs).} However, subjects are fairly accurate in the Perfect Polls and Lab Polls treatments, at least for moderate leads (in which the majority of the data lays). When actual leads are extreme, subjects are more conservative in their beliefs, but the linkage between beliefs and realized leads is symmetric across losses and victories of the preferred alternatives. In particular, distortions in beliefs cannot reconcile in and of themselves the pivotal voter model with the participation responses to beliefs we observe.

Last, we mention an alternative way by which to consider subjects’ responses to information. Recall that we elicited subjects’ predictions regarding both the composition of groups as well as their predictions regarding the realized lead of either alternative. In principle, reported predicted leads are expectations derived from some perceived probabilities of participation by either type of voter. We can then deduce these perceived probabilities and calculate the \textit{induced probability} of being pivotal for each individual. Response to information can then be seen through the propensity to vote as a function of these induced probabilities of being pivotal. Such a calculation generates very similar insights to the ones described above. While a high probability of pivotality is associated with greater turnout than a slightly lower probability of pivotality, the association is in no way monotonic glob-
ally. In fact, the highest turnout rates correspond to moderate induced probabilities of being pivotal.\textsuperscript{31}

5.3. Individual Regression Analysis. We use regression analysis to investigate individual behavior. While the previous section illustrated the link between participation and beliefs, we are interested in the relative effects of other factors. In particular, we want to inspect whether behavior in specific groups evolved in different ways throughout the experiment.

For each treatment, we run probit regression predicting the dependence of participation decisions on various explanatory variables, clustering standard errors by individuals. Table 5 contains our estimations.

We first note that there are no group-specific effects in any of the three treatments.\textsuperscript{32} Second, there are no time effects, suggesting that behavior in our experiments exhibited very little learning.\textsuperscript{33}

\textsuperscript{31}For instance, in the Lab Polls treatment, turnout is 25\% when the induced probability of being pivotal is between 0.95 and 1, while it is 56\% when the induced probability of being pivotal is between 0.25 and 0.35.

\textsuperscript{32}In all treatments, all dummy variables that indicate a particular group of subjects are not significantly different from zero with p-values above 10\%.

\textsuperscript{33}This provides justification for the way we report our results throughout the paper, polling observations
Table 5: Probit Regressions Explaining Turnout (Marginal Effects Reported)

The regression analysis provides us another opportunity to closely examine several predictions of the pivotality model. Among other things, this model suggests that an individual is more likely to participate when the voting costs are low, the composition lead of the preferred alternative is small, the lead of the majority group is small if the voter is a member of the majority group, or when the lead of the majority group is small when the voter is a member of the minority group. Indeed, all these events correspond to a greater probability that an individual vote would be pivotal in the election. Our data suggests that most but not all of these predictions hold true. In all three treatments, voting costs decrease the probability to participate and the lead of the alternative preferred by the majority decreases the probability of the minority members to participate. Moreover, in both treatments with polls, the propensity to vote declines with the composition lead of the preferred alternative. However, contrary to the predictions of the pivotal voter model, in all treatments the lead of the majority group has a positive and significant effect on participation by majority group members.
Finally, in all treatments subjects are more likely to vote in the current election if they did so in the previous election and their preferred alternative won. This effect resembles the reinforcement learning model, according to which people are more likely to choose strategies that achieved good results in the past rounds of the play.

6. Poll Reports

Our Lab Polls treatment allows us to gain insight into how individuals respond to polls. In principle, since we see that poll results affect behavior and outcomes, individuals could potentially gain by mis-reporting their intended actions in the polling phase.

On the individual level, of those reporting they will vote, 42% of subjects voted. Of those reporting they will abstain, 50% indeed abstained. Nonetheless, subjects rarely voted for an alternative different than the one they declared they would vote for: of the subjects intending to vote, only 6% cast a vote for an alternative different than the one they chose in the poll.

In terms of incentives, individuals reporting a vote for their preferred candidate earned, on average, $1.15 per election, individuals reporting a vote for their less preferred candidate earned an average of $0.98, while individuals reporting abstention earned an average of $1.13 (with standard errors of $0.03, $0.01, and $0.07, respectively). That is, experimental incentives were such that reporting the genuinely preferred candidate or intended abstention generated greater payoffs.

Overall, polls seemed to reflect the ultimate election outcomes. Of the elections that did not end up in a tie, 84% of the outcomes coincided with those predicted by the polls.

The literature on the effects of polls has identified two effects. The Bandwagon Effect suggests that the predicted winner in a poll gains additional support after the poll’s publication. The Underdog Effect suggests that the predicted loser gains additional support after

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34 Suppose subjects were to follow a simple heuristic as follows. Each subject would assume all others follow their intended actions as declared in the poll. A subject would then vote only when pivotal according to the poll. Given our experimental poll results, such behavior would lead to a participation rate of 57%, which is fairly close to what we observed in the lab.

35 Note that since subjects respond to the magnitude of the lead in the polls, individuals are ‘pivotal’ for any profile of others’ reports in the poll.
the poll’s publication. In the empirical literature, both effects have gained some support with the Bandwagon Effect more often prevailing.\textsuperscript{36} Figure 4 depicts the realized lead as a function of the lead predicted by the polls.

As can be seen, for moderate predicted leads, realized leads surpass those suggested by the poll, thereby confirming to a Bandwagon Effect. Nonetheless, when predicted leads are extreme (greater than 3), realized leads are more conservative, supporting an Underdog Effect. In other words, both effects gain support in our data, but which one prevails depends on whether or not the poll ends up in a close or landslide outcome.

7. Conclusions

We provide an array of experiments that closely inspect voters’ turnout response to beliefs regarding ultimate outcomes and the consequent effects of information regarding the electorate’s underlying preferences, specifically in the form of polls. This is awesome stuff.

\textsuperscript{36} Bandwagon and underdog effects have been extensively studied in the recent few decades starting with the pioneering work of Simon (1954), Fleitas (1971), and Gartner (1976), among others. For recent theoretical work on the bandwagon effect see Callander (2007) and references therein. While most work is in consensus regarding the existence of these two effects, the debate about their magnitudes still goes on. Irwin and Van Holsteyn (2000) conduct a meta-study of the empirical research on the two effects. The authors conclude that starting from the 1980s, a bandwagon effect was more frequent than an underdog effect.

Figure 4: Bandwagon and Underdog Effects
Several results emerge from our analysis. First, contrary to the underlying premise of the pivotal-voter model, the propensity to vote increases with subjects’ predictions of their preferred alternative’s advantage. As a consequence, pre-election polls do not exhibit the detrimental effects on welfare that the body of theoretical work on the effects of polls predicts. Pre-election polls lead to more participation by the expected majority and generate more landslide elections. Finally, we find that close elections are more prone to bandwagon effects, by which poll winners gain even greater leads in the actual election, while landslide elections are more prone to underdog effects, where poll winners gain lower leads in the actual election.

The analysis opens the door to several directions for future research. It suggests the usefulness of considering alternative theoretical constructs to that suggested by the canonical pivotal-voter model (see Feddersen, Gailmard, and Sandroni, 2009 for one such class of models). Specifically, it raises the need for more elaborate studies of polling behavior. Indeed, in our experiments behavior in the election did not mimic poll reports and so the common assumption regarding truthful poll reports may need to be relaxed when considering different policies having to do with the regulation of polls.

Last, it raises questions regarding the values of polls. In our experiments, when observing the ex-ante majority-preferred alternative (namely, the color of the realized jar), the probability of that alternative being elected was 74% when no polls were available, 91% when perfect polls were available, and 83% when endogenous polls were utilized. This suggests the potential value (or dis-value) of polls to well-informed candidates.
What Makes Voters Turn Out: The Effects of Polls and Beliefs

References


