Journal of Experimental Political Science (2019), **6**, 141–158
doi:10.1017/XPS.2018.29

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Public Voting and Prosocial Behavior

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Abstract

One argument against secret ballots is that such procedures lead to more selfish voting behavior and that public voting can increase prosocial voting and the likelihood of prosocial outcomes when voters are not subject to intimidation and coercion from outside interests. We investigate this supposition as well as voter preferences over observability in voting in this context. We find that voters are significantly more likely to choose unselfishly when voting is public. These differences in behavior advantage prosocial choices in elections (by 27%) when voting is public. Moreover, voters appear to recognize these differences and a substantial minority of voters whose selfish preference is not the prosocial choice willingly choose public voting even though the likely outcome will be costly to themselves.

Keywords: Laboratory experiment, prosocial voting, observability

The argument that the secret ballot facilitates selfish behavior at the expense of the public good goes back to at least John Stuart Mill (1862). Much recent experimental research finds that observability alone may influence individuals' choices, in particular, their willingness to engage in prosocial behavior.[1] This evidence suggests that Mill's criticism of secret ballots may be correct: that the extent that voting is public may affect individuals' willingness to forgo private selfish concerns for "the greater good."

Support for this research from New York University is gratefully acknowledged. We appreciate the comments of Bernd Beber, Eric Dickson, Jon Eguia, Ignacio Esponda, Timothy Feddersen, Guillaume Fréchette, Jens Großer, Sera Linardi, Reuben Kline, Dorothea Kübler, Salvatore Nunnari, and especially Ernesto Reuben whose suggestions greatly improved the paper. Earlier versions of this paper were presented at the WZB Berlin Social Sciences Center, the Center for Experimental Social Sciences, Columbia University, New York University, University of Rochester, University of Warwick, Shanghai Jiao Tong University, and the University of Pittsburgh Behavioral Models Conference. We thank the participants for their comments and suggestions. We also thank Han Il Chang, Dominik Duell, Jorge Gallego, Tianyang Xi, and Biling Zhang for their assistance in conducting the experiments. All errors remain the responsibility of the authors. The data, code, and any additional materials required to replicate all analyses in this article are available at the *Journal of Experimental Political Science* Dataverse within the Harvard Dataverse Network, at: https://doi.org/10.7910/DVN/NCH88M (Morton and Ou 2018). The experiment was approved by the New York University Institutional Review Board. There are no conflicts of interest.

[1]See Camerer (2011), Forsythe et al. (1994), Funk (2010), Kahneman, Knetsch, and Thaler (1986), Koch and Normann (2008).

Of course, one of the main arguments in favor of secret ballots is the fear that when voting is public individuals will be subject to intimidation and coercion, forced to bend to the will of others with greater political power which may not lead at all to a prosocial outcome. But when such concerns are absent or there are safeguards to prevent strong armed tactics by private interests, public voting may have the desirable property of reducing selfish behavior and promoting more prosocial choices.

In this paper, we investigate voters' preferences over secrecy in balloting in which some voters' selfish choices are contrary to the prosocial choice and intimidation and coercion by selfishly motivated outsiders is not an issue. We conduct experiments in which voters participate in elections using both secret ballots and public voting and then choose which method of voting to use in subsequent elections. In our experiments, we are able to control and manipulate underlying voter preferences and the choices before voters while varying privacy in voting independently, so that we can measure voter preferences over voting mechanisms as well as the causal effect of observability directly.

In the next section, we briefly review related literature. We then turn to the voting games used in the experiment and equilibrium predictions, our experimental design and results, followed by concluding remarks.

Related Literature

The extent that individuals have privacy in voting is not uniform. Recent studies of e-voting systems which are being adopted or considered in many jurisdictions find that they cannot guarantee the anonymity of a secret ballot (see Jefferson et al. 2004; Loeber and Council 2008). Mail-in and absentee ballots used in many states and localities are also potentially not secret as individuals' choices may be made in homes and other localities where privacy may not be ensured. Legislatures vary in their use of secret ballots; although public voting is used for most votes in the U.S. Congress, secret ballots are often used in making committee assignments (see Frisch and Kelly 2006) as well as in some leadership and other internal decisions. Similarly, while most European countries adopted public voting early in the 20th century, the Italian parliament used secret ballots extensively until 1988 and the President in Italy (not Premier) is still elected by secret ballots of legislators and regional delegates. The European Union parliament allows for the use of secret ballots if requested by 20% or more of its members. Likewise, Robbins (2007) finds that although most law schools in the United States use secret ballots for personnel decisions, nine of the top eleven law schools (according to rankings in U.S. News & World Report) do not use them.

Despite the variance in the extent that voting is public, the theoretical argument that observability makes voters more socially responsible, and the suggestion from other research that observability affects individuals' prosocial behavior, there is no empirical evidence on the question of the effects of secret ballot on the content of voters' choices either in the field or the laboratory nor of how voters would choose between voting mechanisms in the context of a prosocial choice. Most of the empirical research on the secret ballot (both with observational and experimental data)

https://doi.org/10.1017/XPS.2018.29 Published online by Cambridge University Press

focuses on its effects on turnout in large elections.[2] The observational research suggests that the advent of the secret ballot in U.S. elections led to a large decline in turnout, which most presume resulted from a reduction in vote-buying, although some argue that the decline is due to the literacy requirements implicit in a secret ballot.[3]

A recent field experiment conducted during a naturally occurring election suggests a complicated relationship between the secret ballot and turnout in modern-day elections. Specifically, Gerber et al. (2013) found that alleviating privacy concerns of voters who do not have a history of participation can increase their turnout, while having little effect on voters who tend to vote regularly. Furthermore, another field experiment on privacy in a naturally occurring election found that voters whose preferences are in the minority are most likely to be concerned about the privacy of their decisions (see Karpowitz et al. 2011), suggestive of a relationship between observability and social conformity.[4] Related to these studies is the work of DellaVigna et al. (2016) and Rogers, Ternovski, and Yoeli (2016) who find that participation increases when voters are asked about their voting after the fact. These field studies on turnout, however, are unable to investigate directly whether the secret ballot actually changes individual voters' choices, makes them choose more selfishly and less for socially desirable options. That is, although there may be effects of the secret ballot on vote shares (as found by Vicente 2014), these effects could be simply due to the effects of observability on turnout, not in voters making different choices. Moreover, in naturally occurring elections it is difficult to measure individuals' private preferences and determine when a voter's selfish preference may be in conflict with an arguably prosocial choice. The closest such study is Funk (2016), who finds differences in stated preferences in a (face-to-face) survey and "revealed preferences" at the (secret) ballot box. Finally, we are unaware of any study of voter preferences over observability in voting in which individuals choose which mechanism to use.[5]

Research Design

Voting Games

We investigate a simple voting game in which there are 10 voters, divided into two groups, labeled A and B voters. There are x type A and $(10 - x)$ type B voters, where $x = 6$ in our principal treatments.[6] The size of the electorate and of each type of

[2]See for example, Heckelman (1995), Gerber et al. (2013), Karpowitz et al. (2011), Rusk (1970).

[3]For example, Heckelman (1995) contends that the decline is due to the reduction in vote buying while Kousser (1974) contends that the secret ballot increased the literacy requirement for voting which penalized black and poor voters disproportionately. Vicente (2014) found that a campaign against vote buying in West Africa significantly reduced turnout and increased the vote share of the incumbent.

[4]Grönlund, Setälä, and Herne (2010) conducted a deliberation experiment in the field in which they compared secret ballots with nonsecret deliberation. They found little differences in opinion changes between treatments, but a greater increase in knowledge of participants without secret ballots.

[5]A number of previous experiments compare simultaneous private voting with sequential public voting such as Battaglini, Morton, and Palfrey (2007), Fischbacher and Schudy (2013), and Morton and Williams (1999, 2000). In situations of sequential voting, earlier voters may have an incentive to attempt to influence later voters as later voters update based on observed choices. In this paper we wish to isolate the effects of observability of one's vote from the effects of choosing sequentially versus simultaneously.

[6]As explained in Supplemental Online Appendix B, we vary x in our robustness tests.

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Table 1
Voter payoffs in U.S. Dollars

	Election C		Election E1		Election E2	
Voter Type	*A* wins	*B* wins	*A* wins	*B* wins	*A* wins	*B* wins
A	20	5	25	20	25	18
B	5	20	5	20	5	23

voters is common knowledge. All voters receive monetary payoffs that depend on which party is elected. Table 1 presents the payoffs in the principal voting games.[7] Subjects were asked to vote for party *A*, party *B*, or abstain. Hereafter, for expositional purposes, we label the votes for own party "selfish preference" and the votes for other party "other party voting." Voting for a party is costly, while abstaining is free. The cost of voting was always $2. Although subjects played 24 voting games in a session (eight games of each type of election), only one voting game of the total was paid. This game was randomly selected by one of the subjects at the end of each session.

We used a random dictator rule to determine the winner in each election. Specifically, in each election all ballots (including abstentions) were placed in a box and a subject was chosen to draw one of the ballots to determine the winner. Subjects were chosen to draw the winners sequentially such that all subjects chose the winner in at least two elections. If the ballot drawn was an abstention then another ballot was drawn until a ballot marked with either *A* or *B* was chosen.[8] We used the random dictator rule for four reasons. First, introducing a random effect on the outcome of the election allowed us to identify unique symmetric equilibria to the voting games in our principal treatments, as described in the Supplemental Online Appendix A.[9] Second, the random dictator rule introduced some uncertainty over the outcome of the election such that even if all voters voted sincerely, there was a probability that *B* could win the election. This uncertainty captures the "realism" of naturally occurring voting situations in which individual preferences may be subject to random shocks or variations. Third, the randomness helps to relax the artificial condition that voters know the exact distribution of voter types. Even in the era of scientific polling, estimates of the distribution of voters are imprecise; so while the information about the distribution is precise in the experimental setting, the final outcome is similarly imprecise because of the random dictator rule. Fourth, in order to manipulate the degree of privacy subjects experienced in the voting games (as discussed below), we conducted the experiment "by hand," not via computer

[7]In the Supplemental Online Appendix A, we discuss the modeling and equilibrium predictions.

[8]Feddersen, Gailmard, and Sandroni (2009) use a similar mechanism. However, in their formulation if the dictator drew an abstention, then the computer randomly chose which choice was the winner.

[9]An alternative method of introducing random effects in voting games is to make the cost of voting random as in Levine and Palfrey (2007). Given that we conducted this experiment without the aid of a computer network in order to manipulate privacy, the added complication of having a random cost of voting would have made the experiment longer than is typically acceptable for subjects. As discussed in the Supplemental Online Appendix A, there are asymmetric equilibria in voting games C and E2, but we find little support for these equilibria in the data.

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networks as is typical for such voting experiments. Hence, it was more time efficient to use the random dictator rule than the traditional counting of the ballots (although we did also publicly count ballots in some treatments as we describe below).

As noted in Table 1, we conducted three types of elections: a *Control Election* (Election C) and two *Prosocial Elections* (Elections E1–E2). Following Feddersen, Gailmard, and Sandroni (2009), our payoffs in the prosocial elections meet the following three conditions:

(a) Party *B* minimizes the inequality in payoffs
(b) Party *B* maximizes the minimum payoff
(c) Party *B* maximizes aggregate payoffs

In our Control Election, the inequality in payoffs and the minimum payoff for party *A* is the same as for party *B* and neither condition holds for either party. However, voting for party *A* maximizes the sum of payoffs when $x = 6$ in our Control Election because *A* voters will be in greater numbers. Thus, in our Control Election voting for party *A* is weakly prosocial (Condition (c) is satisfied for party *A*, but not conditions (a) or (b)). Hereafter, vote choices when an *A* subject chooses party *B* in E1 and E2 (or when a *B* subject chooses party *A* in C) are labeled "prosocial other party voting" and vote choices when a *B* subject chooses party *A* in E1 and E2 (or an *A* subject chooses *B* in C) are leaded "non-prosocial other party voting."

The prosocial elections vary in whether inequity exists when party *B* wins. That is, in Election E1, both types of voters benefit equally if party *B* wins, but in Election E2, voting prosocially for *A* voters means that they give *B* voters more of a payoff than they receive themselves. Hence, Election E1 is a prosocial election without inequity and Election E2 results in inequity. When such inequity exists, *A* voters may place a lower value on voting prosocially for party *B* as when such inequity does not exist. Feddersen, Gailmard, and Sandroni (2009), for example, set up their prosocial choice so that such inequity does not occur because they anticipate voters will be less willing to sacrifice to benefit others.[10] Thus, if *A* voters care about the fairness of outcomes in relation to themselves, we expect to observe more prosocial voting in Election E1 than in Election E2. Note also that the aggregate payoffs are the same in E1 and E2, so the only difference is in the degree of fairness.

We assume that with probability θ a voter is a "prosocial" voter and will always vote for the prosocial choice and with probability $1 - \theta$ a voter is selfish and will make a voting choice in order to maximize his or her expected selfish payoffs. Implicitly we assume that prosocial voters are expressive rather than instrumental since their vote choice is assumed independent of the instrumental benefits of voting. Furthermore, we assume that θ is a function of observability, such that an increase in observability of votes increases θ (see Friedrichsen and Engelmann 2017 for a similar study).

We choose to model prosocial behavior in this fashion rather than assuming that a voter receives some utility from voting for the prosocial choice since we are agnostic as to the motivations behind voting prosocially. That is, as Batson and Powell (2003) discuss, prosocial behavior does not imply or require altruistic preferences.

[10] Shayo and Harel (2012) similarly set up their prosocial choice to involve an equal distribution of payoffs.

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Indeed, if observability of voting leads to more prosocial behavior, then arguably one reason is that these voters are engaging in the behavior not because they are more altruistic in such a situation, but because they care about how they are perceived, their social image (note that we minimize possible reciprocity and reputation reasons in our experimental design). Yet, we also do not want to assume that all prosocial voting is due to social images concerns; we wish to allow that some voters are genuinely altruistic and engage in prosocial voting even when ballots are secret and social image concerns are not relevant. Voters may also vote prosocially when voting is secret because of self-image concerns as well. Our experimental design, by varying privacy, allows us to manipulate social image concerns to determine if they affect prosocial voting. We derive the symmetric mixed strategy equilibrium for different levels of θ and calculate the expected payoffs for different types of voters. The results are reported in Table 2.

Experiments I and II

In our study, we are interested in voters' preferences over observability in voting in the context of a prosocial choice. However, our theory concerning voter preferences is based on the assumption that observability causes voters to be more prosocial, which has not been previously established. Hence, we conduct our study in two Experiments I and II. In Experiment I, we first establish whether there are effects of observability on subjects' prosocial voting behavior and in Experiment II we consider voter preferences between public voting and secret ballots.

The experiments were conducted at New York University. Subjects were recruited via a subject pool in which there are more than 4500 registered students from different majors. Subjects were not allowed to participate in more than one session of the experiments. Subjects were identified by their ID numbers; no names were revealed before or after the experiment. Subjects received a show-up fee of $8. On average, the payoff for each subject was about $24.

Experiment I

In Experiment I, we conducted three principal treatments: Secret Ballot (hereafter, S), Secret Ballot with Information (hereafter, SI), and Public Voting (hereafter, P). We wished to provide subjects with anonymity from even the experimenter as well as other subjects in order to ensure that S and SI were equivalent to a true secret ballot (we explain the difference between S and SI below). And in P, we wished to ensure that individuals faced each other and could observe each others' voting choices. As such, we chose to conduct our experiment using pen and paper rather than the standard computerized environment used in such experiments.

To maintain anonymity in S and SI we recruited an additional subject as "monitor." The monitor sat in a room where he or she could not see the subjects but could see the experimenters and hear the experimental instructions. The monitor calculated payoffs for subjects by ID number, but did not know which subject was assigned to which number. In P our special concern was that subjects made decisions simultaneously, but then revealed them sequentially without the ability to change decisions in response to others'

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Table 2

Predictions with prosocial voters

			Expected percent votes						Pr.	Expected payoffs			
			From All *A*'s			From All *B*'s			*A*	Seflish		Prosocial	
θ	$p^\star$	$q^\star$	*A*	*B*	Abs.	*A*	*B*	Abs.	wins	A	B	A	B
Election C													
0.02	0.325	0.526	34%	0	66%	2%	52%	46%	50%	11.84	11.44	10.5	10.5
0.06	0.255	0.542	30%	0	70%	6%	51%	43%	50%	11.98	11.42	10.5	10.5
0.10	0.184	0.558	27%	0	73%	10%	50%	40%	50%	12.14	11.38	10.5	10.5
0.14	0.113	0.575	24%	0	76%	14%	49%	37%	50%	12.28	11.34	10.5	10.5
Election E1													
0.02	0.008	0.325	0.8%	2%	97.2%	0	34%	66%	4%	22.48	11.76	18.2	17.4
0.06	0.010	0.235	1%	6%	93%	0	28%	72%	4%	22.48	11.92	18.2	17.4
0.10	0.014	0.135	1%	10%	89%	0	22%	78%	4%	22.47	12.22	18.2	17.4
0.14	0.021	0.015	2%	14%	84%	0	15%	85%	4%	22.46	12.46	18.2	17.4
Election E2													
0.02	0.083	0.442	8%	2%	90%	0	45%	55%	20%	21.33	16.62	17.4	17.4
0.06	0.089	0.362	8%	6%	86%	0	40%	60%	20%	21.32	16.78	17.4	17.4
0.10	0.095	0.270	9%	10%	81%	0	34%	66%	20%	21.31	17.06	17.4	17.4
0.14	0.103	0.164	9%	14%	77%	0	28%	72%	20%	21.29	17.18	17.4	17.4

choices. We implemented special procedures as a result. We describe our procedures in full detail in Supplemental Online Appendix B.

One possible confounding factor in P is a possible experimenter effect. That is, in P as compared to S and SI, not only can other voters observe voters' choices but also the experimenters. To make sure that the effect we observe is the effect of observability of other voters rather than the experimenter, we also conducted a version of S, SE, in which voters' choices were observed by experimenters but not by other voters, which is reported on in the Supplemental Online Appendix B. We find the same effects when we compare P to SE as we do when we compare P to S and SI.

In Experiment I, we conducted six sessions which varied by privacy treatment with two sessions each of S, SI, and P. Because of the complicated procedures, we used a between-subjects comparison of privacy treatments, but varied elections within each session, using between- and within-subjects comparisons of election types.

We used a fixed order of elections in Experiment I in which $x = 6$ (there were 6 A and 4 B voters) and subjects participated in Elections C, E1, and E2 sequentially, with 8 periods for each for a total of 24 elections. That is, for periods 1–8 subjects played Election C with $x = 6$, for periods 9–16 subjects played Election E1 with $x = 6$, and for periods 17–24 subjects played Election E2 with $x = 6$. Subjects also stayed in the same roles throughout a session. The design was chosen in order to facilitate learning and convergence to equilibria as well as within-subjects' comparisons of behavior across election types. In the Supplemental Online Appendix B, we report on robustness tests with other sequences of elections and for other values of x. We find that our results are robust across such comparisons.

In P voters necessarily receive information on the distribution of voter choices after an election given that there is no privacy. However, in S, subjects are only given the information of who won each election, not the complete distribution of voter choices after each election. Revealing voter distribution information also allows voters, in some cases, to infer what choices others are making and thus to some extent provides less privacy. For instance, if all voters choose their selfish preference, revealing votes of 6 for party A and 4 for party B, then it may seem a safe inference to voters that everyone is voting selfishly.

Hence, in S we did not reveal vote distribution information. We controlled for the effects of such information as distinct from the variation in privacy by conducting SI, in which the information on the distribution of voter choices was revealed even though the choices were private. SI was conducted exactly as S, except that after each election, the envelopes containing voter's choices were opened and the distribution was tabulated and written on the board for subjects to see. The identities of the voters by choices, were, however, kept anonymous to both the experimenter and the other subjects as described above.

Results: Experiment I

Main Results

Given that all voter decisions are made simultaneously (even when there is limited privacy as in P), the selfish and prosocial voting predictions should continue to hold regardless of privacy condition. Moreover, our design limits the ability of subjects to

https://doi.org/10.1017/XPS.2018.29 Published online by Cambridge University Press

engage in coercion or otherwise intimidate or bribe fellow voters since the subjects did not know each other in advance, did not know the details of the experiment in advance, and communication between subjects was not allowed during the experiment. Therefore, we do not expect that reductions in privacy should affect voters via those mechanisms. Our focus is on the effects of observability on the willingness of voters to both participate and choose prosocially rather than selfishly without coercion, intimidation, bribes, or communication.

We find minor effects of vote distribution information on voting behavior when comparing SI to S. The results reported in this section are based on the results observed in treatments of Secret Ballots (S and SI) and Public Voting (P). The detailed analysis of selfish voting behavior, the comparison of SI and P and the comparisons of S and P and SI to S, learning, and the design and results from robustness checks are in the Supplemental Online Appendix B. Our main results are qualitatively robust to additional investigations and robustness checks.

Hypothesis 1 (Experiment I: Direct Effect). We expect that voters whose selfish preference is not the prosocial choice should vote more prosocially under public voting. That is, observability increases the probability that B voters are prosocial and they vote more for A in Election C under public voting than secret ballots and that A voters are more prosocial and they vote more for B in Elections E1 and E2 under public voting compared to secret ballots.

Result 1 (Prosocial Voting is Greater When Public). *Voters are generally more likely to choose prosocially when voting is public.*

Support. We first consider the effects of observability on other party voting, our principal interest. Figure 1 presents other party voting by privacy treatment and voter type in each period in an election type. Prosocial other party voting does appear to be affected by whether voting is public or not, although the effect is not always significant. Specifically, in Election C we expect B voters to vote prosocially for party A. B voters choose party A 11% of the time when voting is public as compared to less than 1% of the time when it is private ($z = 3.32$, $p = 0.001$), whereas A voters in Election C vote for party B less than 1% of the time with both secret ballots and public voting ($z = 0.71$, $p = 0.48$).[11] In Elections E1 and E2, we expect prosocial other party voting by A voters. We find significant effects in Election E2: A voters choose party B 38% of the time when voting is public as compared to about 12% of the time when it is private, whereas B voters in Election E2 never vote for party A.[12] In Election E1, we do not find a statistically distinguishable difference on other party voting between public voting (6%) and secret ballots (6%) ($z = 0.17$, $p = 0.87$). We find slightly more other party voting by B voters under public voting (3% as compared to 1%, $z = 1.23$, $p = 0.22$), but an examination of Figure 1 shows that the effect appears a delayed reaction to the change in the voting payoff matrix by some voters. We thus find some support for our prediction concerning the Direct Effect of Observability.

[11]We are not able to cluster our observations by subject since our privacy procedures prevent us from identifying individual subjects' choices.

[12]The z statistic comparing Type A voters' choices $= 5.06$, $p < 0.001$.

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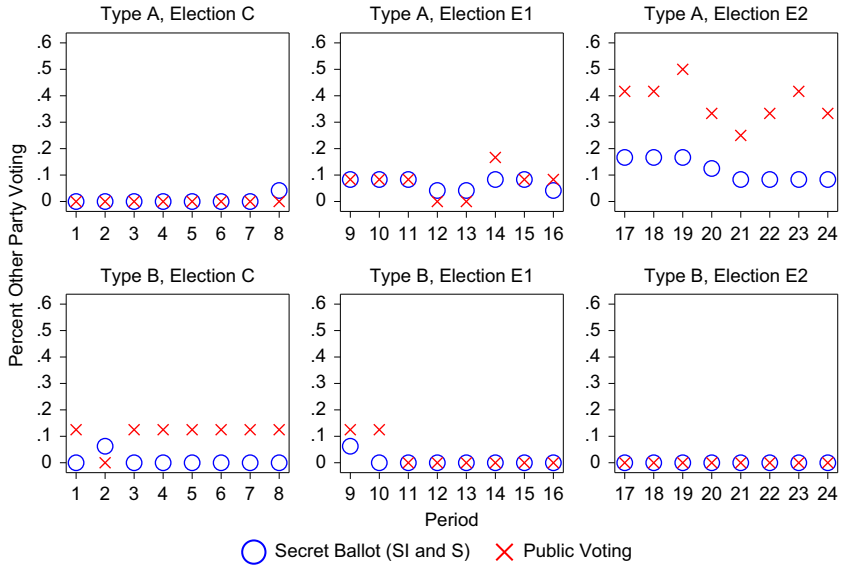

Figure 1
Other party voting by privacy treatment.

However, as discussed in the Supplemental Online Appendix A, increasing θ leads to compensating behavior of non-prosocial voters such that prosocial choices are not actually advantaged. That is, selfish voters who prefer the prosocial choice should participate less and selfish voters whose selfish preference is not the prosocial choice should participate more.

Hypothesis 2 (Experiment I: Indirect Effect). We expect that under public voting selfish voters whose selfish preference is not the prosocial choice will participate more, voting selfishly and those selfish voters whose selfish preference is the prosocial choice will participate less, abstaining more. That is, observability also leads to greater voting for B by B voters in Election C and greater voting for A by A voters in Elections E1 and E2. Observability also leads to more abstention of A voters in Election C and B voters in Elections E1 and E2.

Result 2 (Turnout is Higher Under Public Voting). *Overall, observability of voting behavior results in higher participation of voters. The effects of observability of voting behavior on turnout of voters depend on whether voters' first preference is the prosocial choice.*

Support. Figure 2 presents percent abstention by privacy treatment, election type, and voter type in each period. We find that overall abstention is significantly lower under public voting than under secret ballots treatments. A voters abstain about 33% of the time overall under secret ballots but only 20% in P ($z = 3.82$, $p < 0.001$), while B voters abstain 41% under secret ballots as compared to 15% in P ($z = 6.43$, $p < 0.001$). When we break the effects down by election type, the effects

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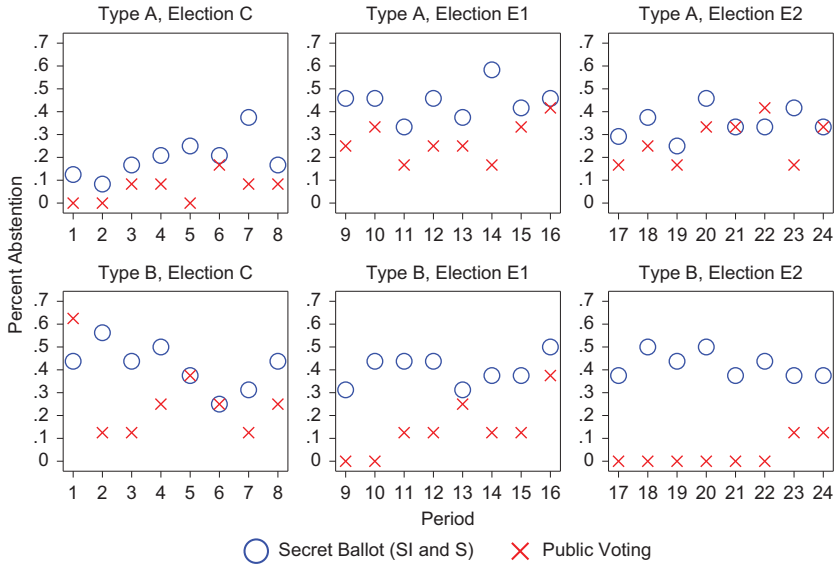

Figure 2
Abstention by privacy treatment.

become more nuanced. In Election C, which takes place in the first 8 periods of each session, the greater participation of both A voters (abstention is 20% under secret ballots as compared to 7% in P) and B voters (abstention is 41% under secret ballots as compared to 27% in P), is significant.[13] In E1 we find that the effects of observability on turnout are significant. A voters abstain 44% of the time under secret ballots but only 27% in P ($z = 2.83$, $p = 0.005$), while B voters abstain 40% of the time under secret ballots as compared to 14% in P ($z = 3.63$, $p < 0.001$). However, we find that in Election E2, there is only a significantly higher participation rate of B voters, whose selfish preference is the prosocial choice (A's abstain 35% of the time under secret ballots as compared to 27% in P and B's abstain 42% of the time under secret ballots as compared to only 3% of the time in P).[14] The Indirect Effect Prediction of Observability suggests that B's should abstain more in P than in S and SI and A's should abstain less. Taken together, while the greater participation of B voters is predicted by the Indirect Effects of Observability, A voters are predicted to abstain more in P than in S and SI, contrary to what we observe.

One explanation for such behavior may be social image concerns. For example, the field evidence of Karpowitz et al. (2011) suggests that voters whose preferences are in the minority are likely to be more concerned about their privacy in expressing their vote choices. Hence, under public voting we might expect that turnout of those voters who think their vote choices may be contrary to the majority opinion might be lower

[13]The z statistic for the comparison with A voters is 2.75, $p = 0.006$ and for B voters 2.01, $p = 0.04$.
[14]For the comparison for E2, Type A, the z statistic = 1.34, $p = 0.18$ and for Type B = 5.61, $p < 0.001$.

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as compared to S and SI. Instead of engaging in compensating behavior by participating more, selfish voters whose selfish preference is not the prosocial choice may be choosing to participate less because they are unwilling to reveal their preference types. By abstaining, these voters are not "outed" as being selfish and having preferences contrary to the social norm (e.g., Bénabou and Tirole 2006).

Hypothesis 3 (Experiment I: Joint Effects on Election Outcomes). The combination of Direct and Indirect Effects implies that observability should have no effect on the probability that the prosocial choice wins unless the effects of observability on prosocial voting is exceptionally large.

Result 3 (Prosocial Choice Wins Somewhat Higher Under Public Voting). *Prosocial parties are more likely to win in Election E2 when voting is public.*

Support. Given that we find support for the Direct Effects, but no support for the Indirect Effects, then it is not surprising that we find that observability increases the likelihood that prosocial parties win. Nevertheless, the greater turnout and prosocial other party voting actually leads to a higher probability of A winning in Election C under public voting (71%) than secret ballots (68%), although the difference is not significant ($t = 1.17$, $p = 0.25$). Similarly, overall in Election E1, the estimate of A winning is slightly higher under public voting (53%) and secret ballots (52%), but the difference is not significant either ($t = 0.27$, $p = 0.79$). In Election E2, as expected, the higher prosocial other party voting and the differential effect of observability on turnout under P leads to a significantly lower probability A wins than under secret ballots (26% vs. 53%, $t = 6.94$ $p < 0.001$). Thus, we find strong evidence that public voting in Election E2 increases the probability that the prosocial choice wins, by approximately 27% points.

Measuring Subject Types

To further explore the implications of our theory, we estimated a mixture model allowing for two different types of voters: the prosocial voters ($\mathcal{P}$) will always vote for the prosocial choice and the selfish ($\mathcal{S}$) voters will sometimes vote for the selfish choice but other times abstain ($\emptyset$).[15] Our method is similar to Cappelen et al. (2007) in that our model takes into account the presence of different types of players within a population. Let y_{it} be the observed voting choice by subject i at time t, and p ($0 < p < 1$) denote the probability that an individual is a prosocial voter. Then, the likelihood choice for subject i is as follows:

$$L_i = p\prod_{t=1}^{T} Pr(y_{it} = \emptyset|\mathcal{P})^{I_{y_{it}=\emptyset}} Pr(y_{it} = A|\mathcal{P})^{I_{y_{it}=A}}|Pr(y_{it} = B|\mathcal{P})^{I_{y_{it}=B}}$$

$$+ (1-p)\prod_{t=1}^{T} Pr(y_{it} = \emptyset|\mathcal{S})^{I_{y_{it}=\emptyset}} Pr(y_{it} = A|\mathcal{S})^{I_{y_{it}=A}} Pr(y_{it} = Vote\ B|\mathcal{S})^{I_{y_{it}=B}}$$

[15]More details of the estimation are reported in Appendix B of Supplementary material.

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Table 3
Distribution of voter types based on modal behavior

Player	Secret ballot	Public voting	Combined	χ^2 statistic	*p*-value
A's	0.094	0.219	0.135	16.2	0.00
	(360.689)	(204.834)	(573.603)		
B's	0.008	0.109	0.042	10.6	0.00
	(93.878)	(61.603)	(160.794)		

Note: Log-likelihood estimation is reported in parentheses.

where $I_{(.)}$ is the indicator function that takes the value 1 if the subscripted expression is true and 0 otherwise. The objective function of the maximum-likelihood estimation is therefore given by

$$LogL = \sum_{i=1}^{n} \log L_i$$

Again, we use the results observed in treatments of Secret Ballot (S and SI) and Public Voting (P) to estimate subjects' types. Since our principal interest is on the effects of observability on voters' prosocial behavior, we combine A's voting in E1 and E2; similarly, we focus on B's voting in EC. We report the results of the estimation in Table 3.

The results of the mixture model estimation suggest that the public recognition of good behavior has a significant effect on prosocial voting behavior. Specifically, both A and B voters are more likely to be a prosocial voter in P than under secret ballots. The results of the mixture model analysis are consistent with our main results reported earlier.

Experiment II: Choosing Between Public Voting and Secret Ballot

The Setup of Experiment II

We find strong evidence that voter behavior is affected by observability, even controlling for the possibility of signaling through sequential choices, coercion, or intimidation. Voters whose first preference is the prosocial choice participate at a greater rate and those whose first preference is not the prosocial choice engage in prosocial other party voting and to some extent greater abstention. Prosocial choices are as a consequence significantly more likely to win when voting is public. Although the effects on participation are contrary to our theoretical predictions, the effects of observability on the outcomes of the elections, advantaging the prosocial choice, are not inconsistent with a large effect of observability on prosocial behavior as we predicted. An important question is whether voters would actually prefer public voting to secret ballots in order to advantage prosocial outcomes. Institutions are endogenous. Hence, in Experiment II, we investigate how voters choose between voting mechanisms.

In Experiment II, we conducted six sessions with 10 subjects each in which subjects experienced both types of voting systems and then were given the opportunity

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Table 4
Summary of sessions in experiment II

Stage	Periods before choice	First	Repeat	Non-monitor subjects
Short first stage	5 each method	Secret	Yes	10
Short first stage	5 each method	Public	Yes	10
Long first stage	10 each method	Secret	No	20
Long first stage	10 each method	Public	No	20

Note: All periods used Election E1 and there were 6 A voters.

to vote over which system they preferred for succeeding periods. Subjects played Election E1 only in these sessions and $x = 6$. In two of these sessions, subjects participated in 5 periods of public voting and secret ballots each using Election E1 and then voted over which method to use for the next 5 periods. They then voted again over which method to use for the final 5 periods (Short First Stage). In the other four sessions, subjects participated in 10 periods of each type of voting and then voted over which method to use for the final 5 periods (Long First Stage). We used the Long First Stage to increase the experience subjects had with the two mechanisms prior to voting. We varied the order in which subjects experienced the two voting mechanisms, that is, in half of the sessions in each subjects used public voting first and in the other half they used secret ballots first. We used secret balloting for the choice of voting mechanism. Subjects were allowed to abstain if they wished. Table 4 summarizes the order of these six sessions.

Restricting the comparison to the periods before choosing a voting mechanism, these sessions provide within-subjects comparisons of voting behavior under the two mechanisms, which we examine first. In three sessions public voting was the chosen voting mechanism. To ensure comparability and control for possible selection effects, we restrict our comparisons to the periods in which both mechanisms were used in equal numbers of periods before choosing.

Results of Experiment II

In Experiment II, we first compare subjects behavior under the two mechanisms using our within subject design. We find support for our results in Experiment I in the behavior of subjects. Specifically, we find that *A* voters are more likely to abstain in P (66% vs. 57%), but *B* voters are more likely to abstain in S (43% vs. 35%).[16] We also find that *A* voters vote for party *B* 8% of the time when voting is public and 4% of the time with secret ballots, a difference that is statistically significant, while there is only one *B* voter engaging in other party voting out of 560 observations.[17] The greater abstention and other party voting of *A*'s in public voting provide strong evidence that is supportive of the results in the between-subjects' sessions in Experiment I.

[16]The z statistic for Type A subjects $= 2.46$, $p = 0.014$ and for Type B subjects $= 1.76$, $p = 0.079$.
[17]The z statistic for the comparison of A subject behavior $= 1.99$, $p = 0.047$.

https://doi.org/10.1017/XPS.2018.29 Published online by Cambridge University Press

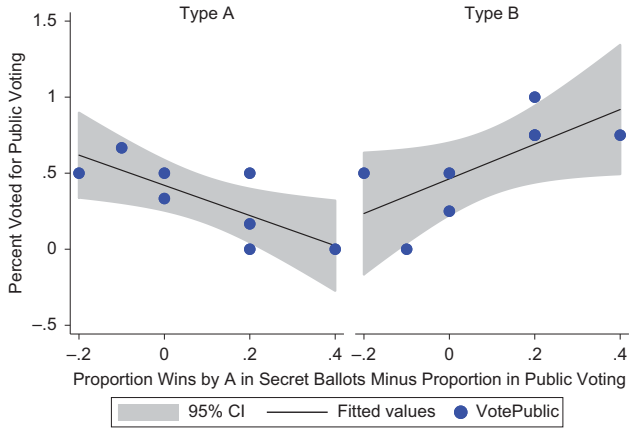

Figure 3
Percent voting for public voting versus relative success of A.

As explained above, if observability increases θ it affects selfish voters' expected utility. The expected utility of selfish voters whose selfish preference is the prosocial choice increases because they participate less and the expected utility of selfish voters whose selfish preference is not the prosocial choice decreases because they participate more. If θ is large with P, then the effects on expected utility are in the same direction but larger because the probability of winning of the prosocial choice increases. Thus, our theory predicts that we should observe the following voting behavior when choosing between mechanisms:

Hypothesis 4 (Experiment II: Voting Privacy Preferences). We expect that when given the chance to choose between voting mechanisms, voters whose selfish preference is the prosocial choice will prefer Public Voting and voters whose selfish preference is not the prosocial choice will prefer Secret Ballots.

Result 4 (Privacy Preferences). *Although most A voters choose Secret Ballots and most B voters choose Public Voting, we find that a substantial minority of both types of voters sometimes choose contrary to our predictions (A's choosing Public Voting and B's choosing Secret Ballots), which is somewhat explained by previous wins.*

Support. When we examine the choices subjects made over voting mechanisms, we find that a substantial minority of *A* voters chose public voting. Specifically, 33% of *A* voters and 56% of *B* voters voted for public voting. Three more *A* voters chose to abstain (6% of A's). The greater tendency of *B* voters to choose public voting is not surprising given that *B* is more likely to win under public voting. These results suggest that indeed a consequential minority of *A* voters, nearly a third, appear to prefer a mechanism that made it easier for the prosocial choice to win.

One explanation for *A* voters choosing public voting may be that due to the random nature of dictator rule, *A* may have happened to win more under public voting

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than secret ballots. So naive voters may have simply voted for the mechanism in which his or her selfish preference won more elections in the periods prior to voting. We find evidence that voters are responding to the success of their preferred candidate in choosing whether to vote for public voting or secret ballots. In Figure 3, we graph the percentage choosing public voting versus the difference in percentage wins by *A*. As shown in the figures, there is a clear significant relationship between the two variables. However, even when the percentage of wins for *A* is 20 points higher under secret ballots than in public voting, we observe more than 22% of *A*'s choosing public voting over secret ballots and when the difference in wins is 0, we find approximately 42% of *A*'s choosing public voting. Hence, we find evidence that a substantial minority of *A* voters chose public voting even when their previous experience suggested public voting reduced the chances *A* would win.[18]

Concluding Remarks

Secret ballots are used in most large elections and many other smaller voting groups ranging from legislative bodies to academic personnel committees. Secret ballots have evolved to be the norm in large elections to prevent vote-buying or more violent coercion and intimidation. Individuals advocate the use of the secret ballot in small group decision-making likewise to encourage candor and truthful revelation of preferences. Secret ballots have been justified for legislators as a way of avoiding coercion from party leaders and other political bosses and to allow them to "vote their conscience" in line with the "trustee" view of representation. In academic circles the concern is that when voting is public individuals will be reluctant to make choices contrary to the preferences of deans and administrators or tenured-faculty if the voter is untenured. These arguments for the use of the secret ballot in academic personnel decisions have been recently articulated by Robbins (2007).

In contrast, as noted in the Introduction, some have contended that the secret ballot leads to more selfish choices by voters than when voting choices are observed. We find support for these concerns with the secret ballot. We find that when voting is public, individuals are significantly more likely to make prosocial rather than selfish choices than when voting is private. We also discover that participation in elections is in general higher when voting is public, but the effect is primarily among those voters whose selfish preferences are the prosocial choice. The participation of voters whose selfish preferences are not prosocial is either largely the same or significantly less when voting is public as compared to secret ballots.

These induced differences in voting behavior caused by observability (higher turnout by voters whose selfish preference is prosocial and prosocial other party voting by some voters) have real consequences on the outcomes of elections. In particular, the differences in behavior advantage prosocial choices in elections such that the probability that the prosocial choice wins is on average 27% points higher under

[18]Appendix B10 of Supplementary material reports the results of probit regressions by subject type in which the dependent variable is the probability of voting for S and the independent variable is the proportion wins by *A* before choosing the mechanism in S minus the proportion wins by *A* before choosing in P. We find not surprisingly a relationship which is positive and highly significant for Type *A* voters and negative and significant at the 6% level for Type *B*'s.

https://doi.org/10.1017/XPS.2018.29 Published online by Cambridge University Press

public voting as compared to secret ballots. Moreover, we find that a large minority of voters whose selfish preference is not the prosocial choice prefer public voting (33%) and that many appear to know the consequences of that preference. Hence we find evidence that some voters care about making prosocial choices in themselves, not just to improve their social image, and are willing to use public voting to increase such behavior.

Importantly, our experimental design isolates the effects of observability on voters' choices from possible confounds in public voting (coercion, intimidation, communication, and sequential voting). Observability alone makes voters choose more prosocially which advantages prosocial choices.

In summary, our results demonstrate that there is a trade-off between positive and negative benefits from ballot secrecy. Secret ballots may help shield voters from strong arm practices and corruption in some cases, but they also lead voters to make more selfish and less prosocial choices. When coercion and intimidation are unlikely under public voting, these negative effects of the secret ballot on the likelihood of prosocial choices may outweigh the benefits of privacy. And even some voters who benefit from secret balloting advantaging their selfish choices may prefer public voting.

Supplementary Material. To view supplementary material for this article, please visit https://doi.org/10.1017/XPS.2018.29.

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Cite this article: Morton RB and Ou K (2019). Public Voting and Prosocial Behavior. *Journal of Experimental Political Science* **6**, 141–158. https://doi.org/10.1017/XPS.2018.29