Turned Off or Turned Out? Campaign Advertising, Information, and Voting

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Abstract

We present results from laboratory experimental elections in which voter information is endogenously provided by candidates and voting is voluntary. We also compare advertisements that are costless to voters with those that reduce voter payoffs. We find that informative advertisements increase voter participation and thus informative campaign advertising "turns out" voters. However, the effect of information is less than that found in previous experimental studies where information is exogenously provided by the experimenter. Furthermore, we find that when advertising by winning candidates reduces voter payoffs, informed voters are less likely to participate, are "turned off" rather than "turned out." Finally, we discover that candidates tend to overadvertise, and contrary to theoretical predictions, advertise significantly more when voting is voluntary than when it is compulsory.

Turned Off or Turned Out? Campaign Advertising, Information, and Voting

Two aspects of the American electoral process typically receive considerable attention from public commentators – the turnout rate of American voters and the quantity of campaign advertisement expenditures by candidates. When discussing turnout, a number of pundits conclude that turnout is lower than it "should be" compared to other countries.[1] Similarly, many argue that through financing campaigns and campaign advertising, special interest groups exert a disproportionate influence on elected officials.[2] Furthermore, often a link is suggested between these two issues; that is, some observers contend that turnout is low partly as a consequence of the influence of special interest groups who provide campaign contributions.[3] Testing such an argument in an empirical study of aggregate turnout in US elections from 1960-1998, Cebula (2007) finds a negative relationship between PAC congressional election campaign contributions and voter participation, controlling for other

[1] For examples of statements made by lay commentators as well as academics arguing that US turnout is too low, see Bill Bradley, "We Can Get Out of These Ruts," Washington Post, April 1, 2007, page B03 and Jerry Schwartz, "How We Choose: The Myth and Reality of Declining Voter Turnout," the Associated Press State and Local Wire, April 11, 2004. Although recent research by McDonald and Popkin (2000) demonstrates that much of the argued decline in turnout in the latter half of the 20th century in the US was a consequence of an overestimation of the eligible voting population by the census (which inaccurately included noncitizens and disenfranchised felons), nevertheless turnout in the US is on average lower than in many other democracies and did decline in the 1960s; see Morton (2006) for details.

[2] See for example, Lou Dobbs, War on the Middle Class: How the Government, Big Business and Special Interest Groups Are Waging War on the American Dream and How to Fight Back, Viking Press, 2007 and newspaper articles on efforts to reduce the influence of special interests through campaign finance regulations as in Joe Grundle, "Lobbying and Legislators: Money Talks, Panelists Say," Milwaukee Wisconsin Daily Reporter, April 7, 2006.

[3] Numerous newspaper editorials often suggest such conclusions: Eric Frydenlund, "A Clean Campaign? It Will Be – Next Time," Madison, Wisconsin State Journal, June 25, 2006 and Norm Steenstra, "The Clean Elections idea would help Public financing hurts fat cats, gives voters more choice," Charleston, West Virginia Daily Mail, November 6, 2002. Note that this is a different issue from the debate over whether negative advertising does or does not mobilize voters. The argued link we are referring to is that the size of extensive campaign contributions reduces the desire for voters to participate in the electoral process regardless of whether the monies are used for positive or negative campaign advertising because the size of expenditures suggests to voters that candidates are making choices that benefit special interest groups (and not voters). In the experiments described in this paper, all advertising is positive.

influences on turnout during the period. Voters are believed to be "turned off" rather than "turned out" by campaign finance.

In contrast, recent formal theoretical analysis of the effect of information on turnout suggests the opposite relationship might exist if we assume that campaign advertising provides information to voters, which helps clarify their choices. Specifically, both decision theoretic models of turnout [Matsusaka (1995)] and game theoretic ones [Feddersen and Pesendorfer (1999)] predict that as a voter becomes more informed he or she is more likely to participate in elections. In the decision-theoretic model, information directly increases the expected utility from voting, and thus increases the likelihood of participation. In the game theoretic approach, which has been labeled the "Swing Voter's Curse," uninformed voters are less likely to participate because of the possibility that their uninformed vote might cancel out an informed voter with similar preferences. In both approaches, as overall information levels increase, overall turnout also increases. Thus, if campaign advertising increases the number of informed voters, then turnout should also increase with advertising.

The theoretically predicted relationship between turnout and information has received empirical support in both observational and experimental data. Palfrey and Poole (1987), Wattenberg, et al. (2000), and Coupe and Noury (2004) show that turnout is positively correlated with voter information levels. However, since becoming informed about politics may be a consequence rather than a cause of political participation, these studies cannot establish a causal link. In a number of recent studies, researchers have exploited situations where political information can be viewed as exogenous in order to determine the

impact on turnout of changes in political information. For example, McDermott (2005) and Klein and Baum (2001) show that survey respondents during elections are more likely to state preferences when information is provided to them. Gentzkow [2005] finds that with the advent to television in U.S. counties (and an associated decrease in information about Congressional candidates as voters read fewer newspapers which contained more of this information) is correlated with decreasing voter turnout in Congressional elections. Lassen (2005) examined turnout in a Copenhagen election where residents of four of the city's fifteen districts were provided with detailed information about the choices in an upcoming referendum. He discovers that voters provided with the additional information were more likely to participate.

The relationship between turnout and information has also been subject to experimental study. Battaglini, Morton, and Palfrey (2006, 2008), hereafter BMP, present the first laboratory experimental analysis of Feddersen and Pesendorfer's Swing Voter's Curse Theory. In their experiments, a jar is randomly selected which either has three red balls and nine white balls (called the red jar) or three yellow balls and nine white balls (called the yellow jar). An odd number of subjects randomly select a ball within the jar, revealing its color. If a white ball is revealed, subjects are uninformed about the true jar, but if a red or yellow ball is revealed, subjects learn which jar is correct. Subjects then have a choice whether to abstain or guess which jar is correct. If a majority of the guesses are correct, then the subjects each receive an 80 cent payoff, if incorrect then the subjects each receive a 5 cent payoff. In some of the treatments there are also "artificial actors" or "computer voters"

who always vote for the red jar, whose votes are also counted to determine the winning jar. These computer voters are equivalent to partisans who prefer the red jar independent of which jar is randomly selected.

The swing voter's curse theory predicts in the experiments that when there are zero computer voters, uninformed voters will abstain and informed voters will participate. However, when there are computer voters, then uninformed voters are theoretically predicted to have a positive probability of voting for the yellow jar, even if the yellow jar is less likely than the red jar. BMP find support for these predictions. That is, when there are zero computer voters, uninformed voters abstain in large numbers while informed voters participate. As the number of computer voters increases, uninformed voters vote for the yellow jar even when that jar is known to be less likely than the red jar.

In summary, much evidence suggests that the information voters receive influences their participation decisions, which would suggest that campaign advertising that increases voter information also increases participation in the electoral process as a consequence. Yet, as noted above, a number of commentators contend that campaign advertising funded by special interest groups can cause voters to be apathetic and less likely to participate in the electoral process. Which view is correct? In this paper we address this question using a laboratory experiment. Our experiment advances the literature in two directions. First, we endogenize voter information. In the experiment there are two candidates, one is called the Striped candidate and the other is called the Solid candidate. The Striped candidate provides all the voters with a higher payoff. The candidates can engage in advertising,

providing truthful information about their identity (whether they are Striped or not).

Second, we use two variants of campaign advertisement finance schemes – one where advertising by the winning candidate does not reduce voters' payoffs and one where voters' payoffs are reduced when campaign advertising occurs which captures the situation where campaign advertising is financed by providing interest groups with special favors. The first variant of campaign financing can be seen as a baseline treatment where we measure only the effect of endogenously provided campaign information on voter choices. It measures the possible "turned out" effect of campaign advertising. The second variant then adds in a cost to voters when winners advertise. So comparing behavior of voters between the first and second variants allows us to measure the "turned off" effect of campaign advertising that is seen as costly to voters.

Although as in BMP, the subjects are all swing voters and all prefer the Striped candidate, their payoffs depend also on their assignment to a party (which is either called Circle or Triangle) and whether the winning candidate is in their same party. Thus, although voters all prefer the Striped candidate, the voters in the Striped candidate's party benefit more from his or her candidate's selection by the group. We find that indeed endogenously provided informative campaign advertising increases voter participation, although the effect is much smaller than the information effect found by BMP. We find that many uninformed voters participate anyway, suggesting that the voters are influenced by their party assignment and the endogenous nature of the advertising. Furthermore, we find that when the advertising implies that candidates have given away favors to special interest groups, the effect of voter

information on turnout is reduced, suggesting that voters are "turned off" by campaign advertising financed by special interest groups.

Our results also have implications for the efficiency of elections where participation is voluntary. A number of commentators contend that compulsory voting would enhance democracy while others contend that forcing uninformed and uninterested voters in participating can lead to less efficient outcomes.[4] In order to address this debate, we compare our results to identical experiments where participation was mandatory. We find that when subjects are allowed the option to abstain (which they are more likely to do when uninformed), the outcome of the election does not result in more efficient outcomes and in fact, when advertising is costless to voters, candidates avertise excessively and there is no significant difference in the informational or economic efficiency.

In the next two sections we discuss our theoretical model and experimental design. In Section IV we present our empirical analysis and Section V concludes.

A Model of Endogenous Campaign Advertising with Abstention

Voting Model and Information

We consider a game with a set of n voters who choose by plurality rule. We assume that n is even. Two of the voters are candidates A, B. All voters (including the candidates) may abstain, vote for candidate A, or vote for candidate B. There is no cost to voting. The candidate who receives the most votes cast is the winner and ties are determined by random

[4] For the argument that compulsory voting would be beneficial to democracy see Lijphart (1997) and for a recent theoretical study that discusses potential problems see Jakee (2006).

draws.

There are also two states of the world. We assume that both states of the world are equally likely. For reasons that will be come clearer below, without loss of generality, we label A the first state and B the second. Candidates know the true state of the world but voters can only learn about the true state of the world through campaign advertisements. Candidates can purchase campaign advertisements equal to m_j, $j = A, B$, which reveal the true state of the world to a randomly selected voter with replacement (who may also be the candidate herself or her opponent). Let m be the total number of ads aired by both candidates. There is no constraint on the number of campaign advertisement a candidate can purchase.

Preferences

Candidate Preferences

Candidates' utlities depend only on whether they win an upcoming election and how many campaign advertisements they purchase as given by the following function (where C and c are constants such that $C > c > 0$):

$$U_C = \begin{cases} C - cm_j & \text{If candidate } j \text{ wins} \\ -cm_j & \text{If candidate } j \text{ loses} \end{cases}$$

Thus, candidates are purely motivated by winning the election.

Voter Preferences

Free Information Regime Half of the noncandidate voters, $\frac{n-2}{2}$, are labeled A type and the other half are B type. We consider two campaign financing regimes. In the *Free*

Information Regime, noncandidate voters' utilities are independent of how many campaign advertisements are purchased. The noncandidate voters in this regime have preferences represented by a utility function $u(t, w, \theta)$ that is a function of their type $t \in \{A, B\}$, the state of the world $\theta \in \{A, B\}$, and the winner $w \in \{A, B\}$ (where $0.5 > \lambda > 0$):

$$u(A, A, A) = u(B, B, B) = 1$$

$$u(B, A, A) = u(A, B, B) = 1 - \lambda$$

$$u(A, A, B) = u(B, B, A) = \lambda$$

$$u(B, A, B) = u(A, B, A) = 0$$

Notice that in this game all noncandidate voters' utilities are highest if the candidate selected, either A or B, matches the state of the world, either A or B, regardless of their type. For example, if the true state of the world is A, then type A noncandidate voters receive a payoff of 1 if A wins and λ if B wins, so they prefer A. And if the true state of the world is B, then type B noncandidate voters receive a payoff of $1 - \lambda$ if A wins and 0 if B wins, so they also prefer A. Although the noncandidate voters' utilities depend on their type, under this regime, they are in a common value voting game.

There are two possible interpretations of these preferences. One interpetation is that noncandidate voters' types represent their policy preferences between the candidates but that the state of the world represents a valence or nonpolicy dimension that noncandidate voters also care about such as honesty, capabilities in times of crises, integrity, etc. In state of the world A, candidate A has an advantage in terms of the valence dimension and in state of the world B, candidate B is has an advantage in terms of the valence dimension. The

noncandidate voters are all "swing" voters who care more about the valence dimension than the policy differences.

A second interpretation is that candidates are either moderates or extremists and that noncandidate voters prefer moderates (even in a different party) to extremists (even in their own party). This is another common interpretation of the term "swing voter." In state of the world A, candidate A is a moderate and candidate B is an extremist and in state of the world B, candidate B is a moderate and candidate A is an extremist. Noncandidate voters care about policy in this interpretation, but are more willing to vote for a moderate candidate in a different party than have an extremist in their own party.

Costly Information Regime In the *Costly Information Regime* voters' utilities are reduced by the purchase of campaign advertisements by the winning candidate. The costly information regime corresponds then to the situation where the winning candidate makes promises of post election favors to contributors who finance his or her campaign advertisements. The voters in this regime have preferences represented by a utility function $u(t, w, \theta)$ that is a function of their type $t \in \{A, B\}$, the state of the world $\theta \in \{A, B\}$, and the winner $w \in \{A, B\}$ (where $0.5 > \lambda > 0$):

$$u(A,A,A) = u(B,B,B) = 1 - \lambda m_w$$

$$u(B,A,A) = u(A,B,B) = 1 - \lambda - \lambda m_w = 1 - \lambda(1 + m_w)$$

$$u(A,A,B) = u(B,B,A) = \lambda$$

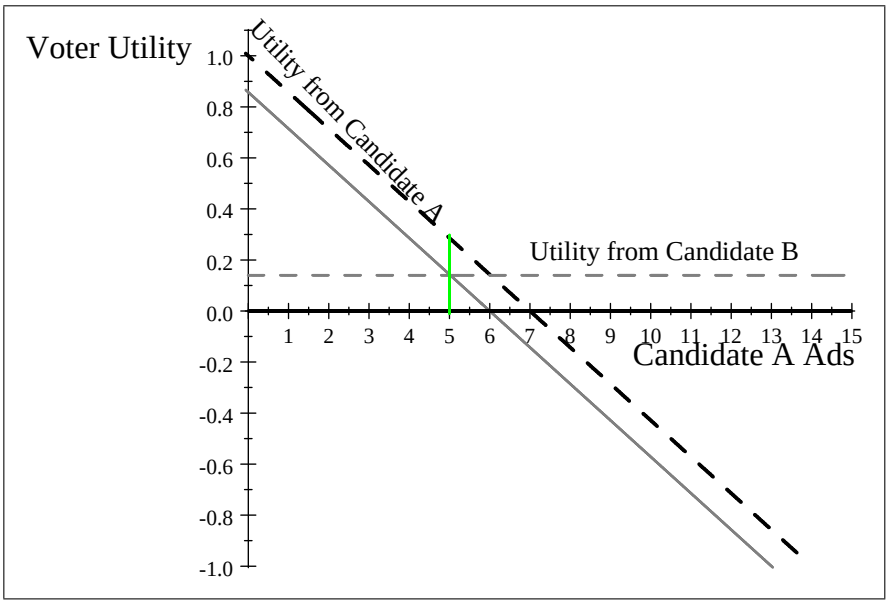
$$u(B,A,B) = u(A,B,A) = 0$$

Notice that in the costly information regime for some numbers of campaign ads, voters are no longer in a common value game and do not always prefer a candidate whose identity (A or B) matches the state of the world. Suppose that only candidate A advertises in state of the world A and only candidate B advertises in state of the world B [Later we will show that this is their optimal choice] and the true state of the world is A. Then an A type voter prefers candidate A if $m_A < \frac{1}{\lambda}$; is indifferent between the candidates when $m_A = \frac{1}{\lambda}$; and prefers candidate B when $m_A > \frac{1}{\lambda}$. And a B type voter prefers A if $m_A < \frac{1}{\lambda} - 2$; is indifferent between the candidates when $m_A = \frac{1}{\lambda} - 2$; and prefers B when $m_A > \frac{1}{\lambda} + 2$. Assume that when indifferent, all voters prefer the candidate whose identity matches their type. Then for $m_A < \frac{1}{\lambda} - 2$ all voters prefer A, for values of $\frac{1}{\lambda} - 2 \leq m_A \leq \frac{1}{\lambda}$, type A voters prefer A and type B voters prefer B, and for values of $m_A > \frac{1}{\lambda}$, all voters prefer B.

In Figure 1 we demonstrate an example of these payoffs where A is the true state of the world, $m_B = 0$, and $\lambda = \frac{1}{7}$ (in our experiments we construct payoffs such that $\lambda = \frac{1}{7}$). In the figure the dark lines represent the utilities to A type voters as a function of the number of ads purchased by candidate A and the light lines represent the utility to B type voters. The dashed lines represent the utilities to voters if candidate A wins and solid lines represent the

utilities to voters if candidate B wins. Notice that the cutpoint for B type voters is when $m_A = 5$ and for A type voters it is when $m_A = 7$. Thus, if $m_A < 4$, all voters prefer A, if $5 \leq m_A \leq 7$,type A voters prefer A and type B voters prefer B, and if $m_A > 7$, all voters prefer B.

Figure 1: Voter Payoffs in Costly Information Regime



Equilibrium Behavior

Free Information Regime

Voter Choices

Candidate Voters and Fully-Informed Noncandidate Voters As is standard in formal models of voting behavior we solve for Bayesian-Nash symmetric equilibria. We begin with an analysis of equilibrium voter choices in the free information regime. In the voting game we have three sorts of voters – candidate voters, noncandidate voters who

have observed a campaign advertisement and thus are fully informed about the state of the world, and noncandidate voters who have not observed a campaign advertisement and thus are uninformed about the state of the world. Henceforth when we refer to informed voters we mean noncandidate informed voters and, since by definition uninformed voters are also noncandidates, we refer to them simply as uninformed voters. We assume all voters condition their vote on the likelihood that their vote is pivotal; that is, the case where their vote might lead to a change in the electoral outcome which is possible if the election is a tie or one vote short of a tie.

Given this, we can easily see that since candidates only receive payoffs from winning, they have a weakly dominant strategy of voting for themselves. Second, fully informed voters in this regime have a weakly dominant strategy to vote for the candidate whose identity matches the true state of the world since they prefer this candidate and, if their vote is pivotal, then their expected utility is highest if they vote for this candidate.

Should Uninformed Voters Abstain? In contrast, the equilibrium behavior of uninformed voters is more complicated. As in the swing voter's curse models uninformed voters have a possible incentive to abstain rather than voting for either candidate. This is because in the free information regime all voters prefer the candidate whose identity matches the state of the world. So uninformed voters have the same preferences as informed voters. Thus, if an uninformed voter votes for either candidate A or B, and his or her vote is pivotal, there is the possibility that his or her vote will cancel out the vote of an informed voter and lead to a less desirable outcome.

To see how abstaining can be an optimal strategy, consider the case of an uninformed voter of type A where the true state of the world is B and there is exactly one informed voter who is voting for B and all other noncandidate voters (who are uninformed) are abstaining. If our uninformed voter of type A votes his or her identity, then the election is a tie, and our uninformed voters' expected utility is 0.5. But if our uninformed voter of type A abstains, then B wins for sure and our uninformed voters' expected utility is $1 - \lambda > 0.5$. Note that if A is the true state of the world our uninformed voters' choice whether to vote for A or abstain does not change the outcome but our uninformed voter could change the outcome by voting for B, but with a similar loss in expected utility. Thus, given that all other uninformed voters are abstaining and there is at least one informed voter who is voting for the candidate who matches the state of the world, abstention is an optimal response.

Should Uninformed Voters Participate? However, uninformed voters may have other optimal responses because of the asymmetry in voter payoffs. That is, for large values of λ, a small number of voters, and a small number of advertisements purchased, abstaining is not always an optimal response by uninformed voters. This is because when the number of voters is small and there are a small number of advertisements, there is a higher probability that advertisements are seen by candidates rather than noncandidate voters and thus no noncandidate voter is informed. In this case, uninformed voters receive higher expected utility from voting for the candidate whose identity matches their type rather than abstaining.

To see how this can be true, consider the case of an uninformed voter of type A where all

advertisements are seen by candidates and thus all other noncandidate voters are uninformed. Assume that all the other uninformed voters are voting their identity. If the A type voter abstains, then B wins for sure and his or her expected utility is $0.5(1-\lambda)$. But if the A type voter votes his or her identity, then his or her expected utility is $0.5 > 0.5(1-\lambda)$. Hence, in this situation, where there are no informed voters and all other uninformed voters are voting their identity, our uninformed voter of type A is better off voting his or her identity as well. As the number of noncandidate voters increases and/or the number of campaign advertisements purchased increases, the probability that noncandidate voters are informed increases and the benefit from abstaining increases and the benefit from voting for the candidate whose identity matches the uninformed voter's type decreases.

Voting Behavior Summary In summary, for given values of λ, n, and $m > 0$, a voting equilibrium is possible where all uninformed voters abstain. However, it is also possible that an equilibrium exists where all uninformed voters vote for the candidate whose identity matches their type. Again, the possibility of this equilibrium depends on the values of λ, n, and m. Intuitively, when λ is high and m and n are low, then it is less likely there is an informed voter whose vote will be canceled out by an uninformed voter who votes. That is, when all uninformed voters are voting their type, then only half of the noncandidate voters will be affected by campaign ads (those voters who by seeing an ad would choose to vote for the candidate whose identity does not match their type), and thus there is a smaller probability of canceling out informed voters' choices when uninformed voters participate. These results are stated formally in the following lemmas which are proved in the appendix:

Lemma 1 *In the Free Information Regime, if at least one ad is purchased by candidates and noncandidate voters who see ads vote for the candidate whose identity matches the state of the world, there is a critical value of* λ, $\overline{\lambda} \leq 0.5$, *for a given number of voters* $n \geq 4$ *and ads,* m, *such that if* $0 < \lambda < \overline{\lambda}$, *an optimal strategy for all uninformed voters is to abstain. Furthermore, the greater the number of voters and/or the number of ads, the larger* $\overline{\lambda}$.

Lemma 2 *In the Free Information Regime, there is a critical value of* λ, $\underline{\lambda} \leq 0.5$, *for a given number of voters* $n \geq 4$ *and ads,* m, *such that if* $0 < \underline{\lambda} < \lambda$, *an optimal strategy for all uninformed voters is to vote their identity. Furthermore, the smaller the number of voters and/or the greater the number of ads, the larger* $\underline{\lambda}$.

In our experiments we use $\lambda = \frac{1}{7}$. In the appendix we show that given the number of subjects in the experiment $n = 22$ and $n = 24$, for all values of m, $\lambda < \overline{\lambda}$. Moreover, for $n = 22$ if $m \geq 3$, $\underline{\lambda} > \lambda$ and for $n = 24$ if $m \geq 4$, $\underline{\lambda} > \lambda$. Thus, if the number of ads are less than 3 (when $n = 22$) or 4 (when $n = 24$), both symmetric pure strategy voting equilibria are possible – the equilibrium where all uninformed voters vote their identity and the equilibrium where all uninformed voters abstain. But if the number of ads is equal to 3 or more (when $n = 22$) or 4 or more (when $n = 24$), the only symmetric voting equilibrium in pure strategies which is possible is where all uninformed voters abstain.

Candidate Advertising Choices Obviously candidates' whose identities do not match the state of the world have a dominant strategy of never advertising as, given voter strategies, advertising increases the probability that voters are informed and the likelihood of losing the election. In contrast, candidates' whose identities match the state of the world have an incentive to advertise. However, this strategy depends on how voters are likely to respond.

When Uninformed Voters Abstain First we consider the case where all uninformed voters abstain as in the swing voter's curse theory. For ease of exposition, assume that the

true state of the world is A and candidate B does not advertise. In this situation, if candidate A could be sure that only noncandidate voters see campaign ads, then in equilibrium we would expect him or her to air one and only one ad since it would take only one informed voter for him or her to win for sure given the voter strategies above. However, candidate A cannot be sure that a noncandidate voter will see a given ad, but does know that the probability increases with the number of ads. The probability that a noncandidate voter will observe an ad when candidate A purchases only one ad is given by $1/n$, while the probability that a noncandidate voter will observe an ad when the candidate purchases two ads is given by $\left(\frac{1}{n}\right)^2$ and so on. Thus, financial gains for advertising is increasing at a sharply decreasing rate.

Assuming all uninformed voters abstain, informed voters vote the state of the world, and candidate B does not advertise, then candidate A's expected payoff under voluntary voting, $E(A)$ is given by the following function:

$$E(A) = \left(\left(\tfrac{1}{2}\right)\left(\tfrac{2}{n}\right)^{m_A} + \left(1 - \left(\tfrac{2}{n}\right)^{m_A}\right)\right) C - cm_A$$

In our experiments we set $C = 15$ and $c = 0.1$. It is straightforward to show that for these parameter values $E(A)$ is maximized when $m_A = 2$ for both $n = 22$ and $n = 24$.

When Uninformed Voters Vote Their Party As discussed above, one possible pure strategy voting equilibrium is for all uninformed voters to vote their party identities. When all uninformed voters are voting for their party, this means that ads only change voting behavior and electoral outcomes when voters are both uninformed and not members of the party whose candidate matches the state of the world. As a result candidate optimal

advertising choices are different.

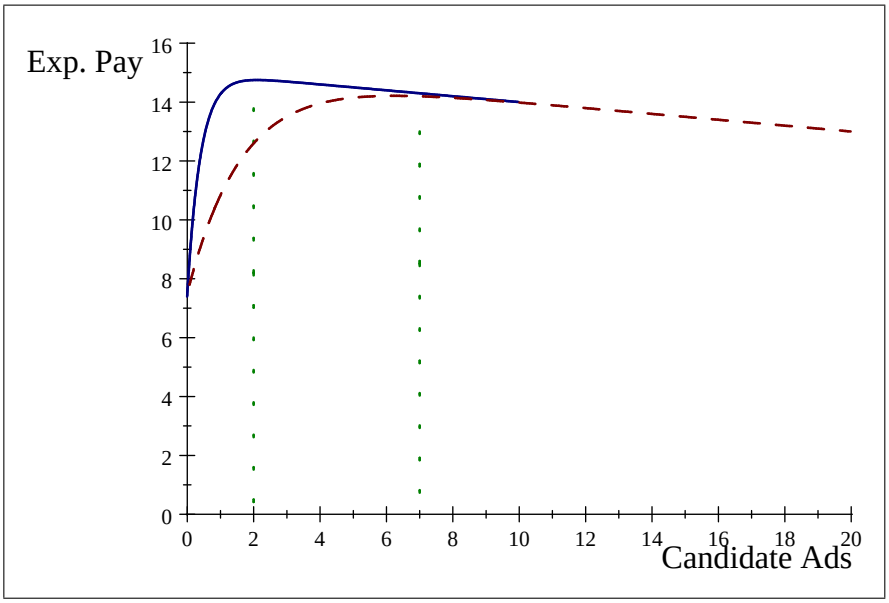
Assuming once again that the true state of the world is A and that candidate B does not advertise, candidate A's expected financial payoff, $E(A)$, is given by the following formula:

$$E(A) = \left[\left(\frac{2+0.5(n-2)}{n}\right)^{m_A} 0.5 + \left(1 - \left(\frac{2+0.5(n-2)}{n}\right)^{m_A}\right)\right] C - cm_A$$

For the parameter values in the experiments and the number of subjects, candidate A should optimally purchase 7 advertisements to maximize his or her expected payoffs, which is significantly greater than the predicted 2 advertisements in this case when all uninformed voters are abstaining.

Figure 2 below graphs the two expected payoff curves for the cases of when all uninformed voters abstain (the blue line) and when all uninformed voters vote their party identity (the red line) when $n = 24$.

Figure 2: Expected Candidate Payoffs to Advertising



When $n = 24$

However, as noted above, if ads are greater than 3 or 4 (depending on n), it is no longer optimal for uninformed voters to vote their party identity. So if candidate A purchases 7 ads, uninformed voters will optimally abstain and candidate A is no longer optimizing. So when voting is voluntary, an equilibrium where all uninformed voters vote their party and candidates advertise optimally given that behavior does not exist. Hence, under voluntary voting, theoretically we expect that all uninformed voters to abstain.

Costly Information Regime

As discussed above, when campaign advertisements are costly to voters, noncandidate voters' payoffs are affected and the noncandidate voters are no longer in a common value game. We can still ignore voters who are also candidates as they will continue to trivially vote for themselves, canceling out. But informed and uninformed noncandidate voters appear to face a complicated choice. Both informed and uninformed noncandidate voters' choices now depend on their beliefs over the total number of ads purchased by the winning candidate.

However, recall that if noncandidate voters follow the strategy of uninformed voters abstaining and informed noncandidate voters voting for the candidate whose identity matches the state of the world, then the optimal campaign advertisement strategy is 2 ads in our experiment. Candidates' whose identities match the state of the world have no incentive to advertise more than this optimal number even though uninformed subjects do not know the total number of ads purchased. If the candidte whose identity matches the state of the world is following this strategy, then all noncandidate voters receive a greater payoff from he or she as in the case when advertising is free and voters are optimizing.

Summary of Equilibrium Predictions

Somewhat counterintuitively, our theoretical analysis suggests that we do not expect any difference in behavior of voters or candidates between the two regimes – free information and costly information. In both regimes, we expect candidates whose identity matches the state of the world to purchase 2 ads, for informed voters to vote for the candidate whose identity matches the state of the world, and for uninformed voters to abstain. Theoretically we expect campaign advertising to have a "turn out" effect, but no "turned off" effect when advertising is costly to voters since candidates' advertisements are not expected to be large enough.

Experimental Design

Basic Procedures

The experiment was implemented entirely on computers using software created specifically for election experiments with campaign advertising. Subjects were recruited using an automated recruitment mechanism at George Mason University. Subjects were seated at individual computer terminals and could not see or hear through computer clicking other subjects' choices.[5] Experimental instructions are presented in the Appendix. We conducted three experimental sessions which we label Sessions 1, 2, and 3. In Sessions One and Two 24 subjects participated and in Session Three 22 subjects participated for a total of 70 subjects.

[5] We used a "mouse-over" technology for subjects to make choices so that subjects could not identify when other subjects were making choices by hearing clicking, which was important to ensure that candidate identities were anonymous. Subjects were given in depth training in 5 practice sessions (2 interactive) using the mouse-over technology before subjects participated in the paid portion of the experiment

Each session was divided into 16 periods for a total of 48 campaigns and elections and 1,120 voting decisions. A period proceeded as follows – first two subjects were randomly chosen to be candidates. Then a one-minute campaign period began in which candidates were allowed to purchase campaign advertisements, which were shown to voters, as we will describe below. After the campaign period ended, all subjects (including the candidates) voted for one of the candidates or abstained. The candidate receiving the majority of votes (ties were broken by a computerized random draw) was declared the winner and the outcome was announced to voters. Then a new period began.

In each period, one candidate was designated as the candidate of the *Circle* party and the other as the candidate of the *Triangle* party. Half of the remaining subjects were also randomly assigned to each party as non-candidate voters. Candidates were not only assigned a party but also a *Pattern*, *Striped* or *Solid.* In terms of the discussion above, a candidate is Striped if his or her party identity matches the state of the world and a candidate is Solid if his or her identity does not match the state of the world.

In the experiment candidates used tokens to purchase campaign advertisements. When a candidate used a token to purchase a campaign advertisement his or her true pattern or type would be revealed to exactly one randomly chosen voter (which could be the candidate him or herself or his or her opponent). All campaign advertising was truthful. Thus, if a non-candidate voter saw at least one ad from either candidate they became completely informed about candidate types, given that one candidate was always Striped. The restriction that advertisements be truthful is supported by empirical evidence on the informational

content of candidate advertisements as reported in Abrajano and Morton (2004) and Morton (2006). They find that incumbent members of Congress are more likely to provide verifiable information about their records when their records are closer to the policy choices that are preferred by median voters in their districts and that challengers to these incumbents engage in the opposite behavior when advertising about the incumbent's record. These results suggest that candidates feel constrained to provide truthful information about their records to voters.

In Session One both Striped and Solid candidates could advertise, but in Sessions Two and Three only Striped candidates could advertise. Furthermore, unless a candidate saw one of his or her own ads, the candidate did not know which voter saw his or her ads. Thus candidates could not engage in targeted advertising to particular party members.

Treatments

We used two campaign advertisement treatments – the *Red* Token treatment where campaign advertisements by the winner did not reduce noncandidate voters' payoffs as in the Free Information Regime and the *Blue* Token treatment where campaign advertisements by the winner did reduce noncandidate voters' payoffs as in the Costly Information Regime. The red token treatment allows us to measure the baseline effect of informative campaign advertising on voter behavior, the "turned out" effect, while the blue token treatment represents a situation where campaign advertisements are provided by special interest groups who then receive favors from the winner that are costly to voters and allows us to measure the "turned off" effect. We used a within subjects design; that is, campaign advertising treatments varied

by period according to a predetermined pattern. All subjects were told which campaign advertising treatment applied before making choices in a given period and were given in-depth training in understanding the two types of campaign advertisement treatments. Table 1 presents a summary of the three sessions and the campaign advertising treatments by period.

Table 1: Summary of Sessions and Treatments

Session	Subjects	Red Periods	Blue Periods
1	24	1, 3, 4, 5, 6, 9, 16	2, 7, 8, 10, 11, 12, 13, 14, 15
2	24	3, 6, 9, 11, 15	1, 2, 4, 5, 7, 8, 10, 12, 13, 14, 16
3	22	3, 6, 9, 11, 15	1, 2, 4, 5, 7, 8, 10, 12, 13, 14, 16

By comparing the two campaign advertising treatments we can disentangle the informational effects of campaign spending on voter participation decisions from the effects of having these advertisements paid by special interests. Our within subjects design also allows us to make these comparisons controlling for unobservable subject differences that might confound a between subjects design. We also compare our results to experiments conducted earlier by Houser and Stratmann (2006), which were identical to those reported here except that voters were not allowed to abstain.[6] This allows us to examine the benefits and costs of mandatory or compulsory voting on election outcomes and candidate and voter behavior, although in this comparsion we use a between subjects design.

[6] These experiments are reported in Houser and Stratmann (2006)

Subject Payoffs

As noted above, in our experiments we used the parameters $C = 15$ and $c = 0.1$ for candidate payoffs. The payoffs of noncandidate voters depended on their party assignment and the party and pattern of the winning candidates as well as the number of campaign advertisements of the winning candidate in the blue token treatment such that $\lambda = \frac{1}{7}$, as discussed above. The specific amounts we used are described below in Table 2.

Table 2: NonCandidate Voter Payoffs

Where m_W = Number of Winner's Ads

	Striped Wins		Solid Wins	
	Red	Blue	Red	Blue
Own Party	7.5	$7.5 - 0.5m_W$	5.0	$5.0 - 0.5m_W$
Other Party	7.0	$7.0 - 0.5m_W$	4.5	$4.5 - 0.5m_W$

Experimental Results

Election Outcomes and Overall Efficiency

We report the results working backwards, in the reverse order in which they occurred in the experiments; first we discuss election outcomes, then voter behavior, and then candidate choices. So we begin with an examination of election outcomes.

Theoretically we expect that there to be little difference in electoral outcomes between the Red Token and Blue Token treatments since we expect that candidate and voter behavior will be unaffected. This is not supported by the data. We find that in the Red Token

treatment Striped candidates win 88.24% of the time and Solid candidates win 11.76% of the time, and there are no tie elections, while in the Blue Token treatment Striped candidates win only 54.84% of the time, Solid candidates win 29.03% of the time, and 16.13% of the elections end in ties.

In order to determine if these differences are statistically significant, we compare the informational efficiency of the treatments as to whether voters are choosing the candidate whose identity matches the state of the world. Furthermore, when Blue Tokens are used, if the Striped candidate is advertising 6 or more ads than the Solid candidate, then it is more informationally efficient for the Solid candidate to win. We therefore assigned an informational efficiency rating to wins by the Striped candidate a value of 1, a tie a value of 0.5, and 0 to a win by a Solid candidate in the Red Token periods and the periods in which the Striped candidate ran 5 or less ads than the Solid candidate. When the Striped candidate ran 7 or more ads than the Solid candidate we assigned an informational efficiency rating to wins by the Solid candidate a value of 1, a tie a value of 0.5, and 0 to a win by a Striped candidate. Cases where the Striped candidate advertised exactly 6 ads more than the Solid candidate were assigned 0.5.

Table 3 below presents these efficiency results. We find a significant decrease in informational efficiency when Blue Tokens are used as compared to Red Tokens.[7] We find this decrease in efficiency occurs because of the greater number of wins by the Solid candidate and tie elections.

[7] The value of the t statistic is 2.23.

Table 3: Efficiency of Election Outcomes

Treatment	Informational	Economic
Red Tokens	0.88	7.49
Blue Tokens	0.63	4.50

We also compare the economic efficiency of the treatments. To compute economic efficiency we calculate the mean subject payoff per period including payoffs to candidates as well as voters. For tie elections we use the expected mean subject payoff rather than the actual payoff since random draws that favor the Striped candidate over the Solid may suggest an efficiency difference that does not exist. Not surprisingly, as with informational efficiency, we find that the Red Token treatment is significantly more economically efficient.[8]

These efficiency results, particularly the informational efficiency ones, suggest that candidates and/or voters choices are at variance with our theoretical predictions. We now turn to examining individual behavior to determine the sources of the efficiency results.

Voter Behavior

Candidate Vote Choices

As we noted candidates are also voters and we theoretically predict that they should trivially vote for themselves in both the Red and Blue Token Treatments. In 100 percent of the cases this is true for the Striped candidate in the Red Token treatments. However, the Solid candidates did not vote for themselves in 4 out of the 17 Red Token elections, twice abstaining and twice voting for the Striped candidate. It is possible that these candidates

[8] The t statistic is 5.05 for this comparison.

perceived that their probability of winning was extremely small and abstained or voted for the other candidate as a protest or they may have falsely believed that candidates would receive payoffs as voters did. We also found that in compulsory voting Solid candidates voted for the other candidate 8 out of 29 times in the Red Token elections, while Striped candidates always voted for themselves.

We found a similar relationship in the Blue Token treatments, Solid candidates appeared more likely to make errors, which could be explained by the low probability that these candidates would win election. Only 1 of 31 Striped candidates in the Blue Token periods did not vote for him or herself, choosing to abstain and only 4 out of 31 Solid candidates did not vote for him or herself, one choosing to abstain and the other three to vote for the other candidate.

Participation Decisions of Non-Candidate Voters

As discussed in the Introduction, both the decision-theoretic and the game theoretic approaches suggest that uninformed voters will be more likely to abstain. We find that indeed this is the case in our data. Of the 152 voters who were not exposed to a campaign advertisement purchased by a Red Token, 37 abstained (24.34%), while of the 212 non-candidate voters who were exposed to a campaign advertisement, only 2 abstained (0.94%). This difference is significant [t statistic = 6.58]. Similarly, of the 468 voters who were not exposed to a campaign advertisement purchased by a Blue Token, 139 abstained (29.70%), while of 139 voters who were exposed to a campaign advertisement, only 26 abstained (13.54%), which is also significantly different [t statistic = 4.96].

Nevertheless, we find some inconsistencies between the general theoretical predictions and the observed participation decisions of non-candidate voters. First, we find that a large majority of uninformed voters participated in the election (75.66% in the Red Token treatment and 70.30% in the Blue Token treatment), which is in sharp contrast to BMP's previous experimental analysis of the effect of information on voting and our equilibrium prediction of 100% abstention. BMP (2008) find that uninformed voters participated only 15% of the time when there are zero computer voters and both jars are equally likely, the treatment equivalent to our treatment with Red Tokens.[9]

As discussed above, our general theoretical equilibrium prediction endogenizing candidate behavior is that all uninformed voters will abstain. However, because of the payoff asymmetry in our experiment it is a best response for uniformed voters, when the Striped candidate is advertising a small number of ads, to vote their party identity. Of those uninformed voters who participated, the majority, 92.17% voted for candidates from their own party in the Red Token treatment and 91.49% did so in the Blue Token treatment. This suggests that the majority of uninformed voters assumed Striped candidates were advertising a small numnber of ads and thus best responded by voting their party identity.

Furthermore, we find significant evidence of asymmetric behavior by uninformed voters. That is, voters tended to almost always vote when uninformed or almost always abstain. Table 4 below summarizes the behavior of subjects when they were uninformed voters. Notice that 41 out of 70 subjects when uninformed in the Red Token treatments voted more

[9] BMP (2006) find even higher abstention rates of over 90%. The BMP (2008) results are more comparable since they involve voting groups of 17 and 21, whereas the BMP (2006) results are from voting groups of 7.

than 2/3 of the time and similarly 41 out of 63 did so in the Blue Token treatments. In contrast, 18 out of 70 subjects when uninformed in the Red Token treatments abstained more than 2/3 of the time and 14 out of 63 did so in the Blue Token treatments.

Table 4: Abstention Choices of Uninformed Voters

Turnout Rates by Subject	**Red Tokens**	**Blue Tokens**
Always Abstained	7%	13%
Abstained $< \frac{1}{3}$ of time	19%	10%
Abstained Between $\frac{1}{3}$ and $\frac{2}{3}$	16%	13%
Abstained $> \frac{2}{3}$ of time	16%	3%
Never Abstained	43%	62%
Total Number of Subjects	70	63

Our second inconsistency with the theoretical predictions on abstention is strong evidence that informed non-candidate voters are "turned off" by campaign advertising purchased with Blue Tokens. That is, informed non-candidate voters in the Blue Token treatment are more likely to abstain in the Blue Token treatment than in the Red Token treatment (13.54% compared to 0.94%), which is statistically signifcant [t statistic = 4.91]. This is inconsistent with the theoretical prediction since informed non-candidate voters should vote for the Striped candidate in equilibrium. However, in order to determine better the causes of this higher abstention rate, we need to explore the overall behavior of informed noncandidate voters, which we do next.

Vote Choice Behavior of Informed Voters

Tables 5 presents the voting choices of informed noncandidate voters in the voluntary Red Token treatments. We find that informed noncandidate voters are significantly influenced by the information they receive in the Red Token treatment. When the Striped candidate is a member of their own party, they vote for that candidate 87.62% of the time, but when the Striped candidate is a member of the other party, they vote for the other party 82.24% of the time. These voters' decisions are slightly less rational than informed noncandidate voters in the Red Token compulsory voting treatments who voted for the Striped candidate 92.83% of the time, which is significantly greater.

Table 5: Choices of Informed Voters in Red Treatment

Predicted Choices in Bold (Non-Candidates Only)				
	Abstain	Own Party	Other Party	Obs.
Informed Own Party Striped				
1 Own Ad	2%	**93%**	4%	85
> 1 Own Ad	3%	**98%**	0	45
1 Other Ad	0	**22%**	78%	9
> 1 Other Ad	0	**75%**	25%	4
Both Ads	0	**86%**	14%	7
Informed Other Party Striped				
1 Own Ad	0	78%	**22%**	9
> 1 Own Ad	0	60%	**40%**	5
1 Other Ad	0	8%	**92%**	50
> 1 Other Ad	0	11%	**89%**	37
Both Ads	0	17%	**83%**	6

Informed voters' errors in the Red Token voting treatment appear to be related to seeing ads from a candidate revealed as Solid and no ads from the Striped candidate. When the informed noncandidate voters' own party is Striped but the only campaign ads voters received are from the other party, informed voters vote incorrectly 61.54% vote for the other party. Similarly, when the informed voters' own party is Solid and the only campaign ads voters received are from their own party candidate, informed voters vote incorrectly from their own

party 71.43% of the time. In all other information environments, the majority of informed voters vote correctly.

Table 6 presents the voting choices of informed noncandidate voters in the Blue Token treatments. As we noted above, these voters are much more likely to abstain than similar voters in the Red Token treatment. Table 6 also shows that these voters are less likely to vote for the Striped candidate in response to ads as compared with voters in the Red Token treatment. This is not surprising given that candidates who advertise excessively offer lower noncandidate voter payoffs than in the Red Token treatment.

Table 6: Choices of Informed Voters in Blue Treatment

Predicted Choices in Bold (Non-Candidates Only)				
	Abstain	Own Party	Other Party	Obs.
Informed Own Party Striped				
1 Own Ad	14%	**67%**	19%	43
> 1 Own Ad	29%	**35%**	35%	17
1 Other Ad	11%	**47%**	42%	19
> 1 Other Ad	0	**67%**	33%	6
Both Ads	33%	**67%**	0	3
Informed Other Party Striped				
1 Own Ad	20%	45%	**35%**	20
> 1 Own Ad	0	29%	**71%**	7
1 Other Ad	11%	44%	**44%**	61
> 1 Other Ad	7%	57%	**36%**	14
Both Ads	0	0	**100%**	2

In order to consider more fully the combined effects of the different treatments on voter choices we estimate a multinomial logistic regression with non-candidate vote choice as the dependent variable. The results of this estimation is presented in Table 7 below. We find that voting choices are significantly affected by whether a voter is informed and the type of information received, in particular information that one's own party's candidate is Striped reduces abstention. We also find that when voters observe more than one campaign ad from

the Striped candidate in the Blue Token treatment they are significantly less likely to vote for the Striped candidate and when voters observe more than one campaign ad from the Striped candidate in the Red Token treatment they are significantly more likely to vote for the Striped candidate. Voters then appear to evaluate Blue Tokens differently from Red Tokens, however, these variables are not significant predictors of abstention decisions. We find little evidence of changes in voting behavior over time.

Table 7: Multinomial Logistic Estimation of Vote Choices

(Clustered by Subject, Null is Voting Solid, Candidates Excluded)

Abstention Equation				
Indep. Var.	Coeff.	Robust Std. Er.	z	Pr $> \|z\|$
Informed Own Striped	-0.60	0.42	-1.44	0.15
Informed Other Striped	**-1.48**	**0.38**	**-3.85**	**0.00**
Striped Ads $>$ 1 & Blue	0.42	0.51	0.83	0.41
Striped Ads $>$ 1 & Red	0.76	0.84	0.90	0.37
Blue Treatment	0.33	0.21	1.54	0.12
Period	0.01	0.02	0.30	0.77
Constant	-0.60	0.29	-2.06	0.04
Vote for Striped Candidate Equation				
Informed Own Striped	**1.17**	**0.28**	**4.13**	**0.00**
Informed Other Striped	0.16	0.17	0.91	0.36
Striped Ads $>$ 1 & Blue	**-0.96**	**0.49**	**-1.97**	**0.05**
Striped Ads $>$ 1 & Red	**1.93**	**0.43**	**4.48**	**0.00**
Blue Treatment	**-0.34**	**0.19**	**-1.81**	**0.07**
Period	0.01	0.01	0.77	0.44
Constant	0.24	0.19	1.24	0.21
Number of Observations		1120		
Psuedo R Squared		0.0847		

Candidate Advertising Behavior

We expect that Solid candidates should not advertise. However, given that sometimes voters respond to Solid candidate advertisements as discussed above, we might expect some Solid candidates advertise anyway. Nevertheless, Solid candidates rarely advertise. In the Red Token treatment, only one subject advertised when he or she was assigned to be the Solid candidate. This subject did so in the first period of session 1 and in the 16th period of session 1, where he or she purchased with Red Tokens 26 and 22 advertisements respectively. In the Blue Token treatment two subjects assigned as Solid candidates purchased ads, both in the first 10 periods of the experiment, one purchased 27 ads and the other purchased 3 ads. In all other cases, subjects assigned as Solid candidates chose not to purchase advertisements.

Second, we expect Striped candidates to purchase 2 ads. Interestingly, we find that Striped candidates advertised significantly more than predicted in both treatments as reported in Table 8 below. This was true regardless of the number of subjects. Striped candidates in the Red Token treatment with voluntary voting purchased on average 20.67 campaign ads in sessions 1 and 2 and in session 3 Striped candidates purchased on average 29 campaign ads. In the Blue Token treatment Striped candidates purchased on average 8.15 ads in sessions 1 and 2 and in session 3 Striped candidates purchased on average 9.36 ads.

Table 8: Striped Candidate Ads

	Red Tokens	Blue Tokens
Mean	23.12	8.58
Std. Dev.	20.51	9.73
No. of Obs.	17	31

Although candidates advertised much more than theoretically predicted, we do observe that candidates advertise significantly less in the Blue Token treatment compared to the Red Token treatment. These results suggest that candidates anticipate campaign advertising under the Blue Token treatment will have negative consequences, "turn off" voters.

Compulsory versus Voluntary Voting

Houser and Stratmann (2008) report on similar experiments in which voting is compulsory, so abstention is not an option. How do our results in terms of election outcomes and candidate advertising strategies compare? Their results in terms of efficiency and candidate advertising are summarized in Table 9 below:

Table 9: Compulsory Voting Results

	Treatment	
Efficiency	Red Tokens	Blue Tokens
Informational	0.86	0.49
Economic	7.67	3.83
Striped Ads		
Mean	11	8.78
Std. Dev.	9.77	9.54
No. of Obs.	27	36

We find only minor differences in informational efficiency between compulsory and voluntary voting in both the Red and Blue Token treatments as the only significant difference is between voluntary and compulsory voting in the Blue Token treatment at the 10% significance level.[10] Thus, we find little evidence that voluntary voting affects informational efficiency. We also find no significant difference in economic efficiency between compulsory and voluntary voting.[11]

How does Striped candidate advertising compare in voluntary voting to compulsory voting? We find that Striped candidates advertise significantly more when abstention is allowed than under compulsory voting in the Red Token treatment. Under compulsory voting, Striped candidates in Red Token treatments purchase on average 11 campaign ads which is significantly less than the purchases of Striped candidates in voluntary voting at a

[10]The t statistic for the comparison between voluntary and compulsory voting under Red Tokens is 0.25 and under Blue Tokens is 1.31.
[11]The t statistic for this comparison with Red Tokens is 0.82 and for Blue Tokens is 0.74.

5% confidence level. However, in the Blue Token treatments, we find no significant difference between the number of ads purchased under voluntary voting as compared to compulsory voting.

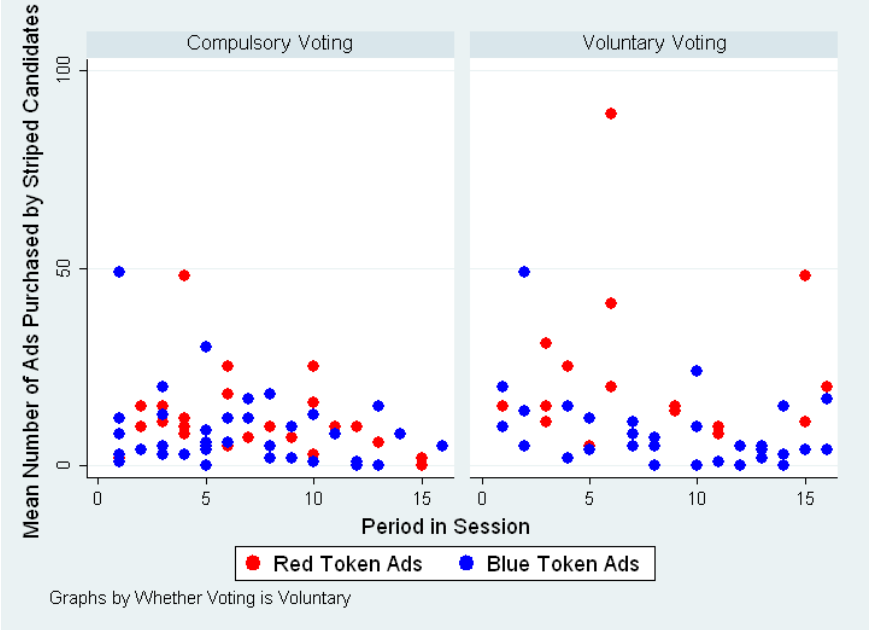
Given that we are making multiple comparisons and that in a few cases we are observing repeated choices by the same subjects, as well as some learning during the experiment, we estimated a linear regression model clustered by subject where the dependent variable was the number of campaign ads purchased by Striped party candidates and the independent variables were the different treatments and the period of the experiment. These results are reported in Table 10 below. We find that indeed campaign advertisements are significantly higher in the Red Token treatments and when voting is voluntary. We also see significant evidence of learning; as number of periods increases, the number of campaign ads purchased significantly declines. For example, we estimate that the number of ads, controlling for other effects, in the 16th period is 8.61 less than in the 1st period. Figure 3 shows how these choices in the different treatments change by period. It appears, not surprisingly, that most of the learning takes place in the Blue Token treatments.

Table 10: Linear Regression Estimation of Striped Ads

Null Case is Red Compulsory, Clustered by Subject

Indep. Var.	Coeff.	Robust Std. Er.	t	Pr $> \|t\|$
Blue	**-7.10**	**2.70**	**-2.63**	**0.01**
Voluntary	**5.59**	**2.65**	**2.11**	**0.04**
Period	**-0.57**	**2.45**	**-2.34**	**0.02**
Constant	17.61	2.77	6.36	0.00
Number of Observations		111		
R Squared		0.1406		

Figure 3: Candidate Ads by Period and Treatment



Concluding Remarks

Much debate exists over whether campaign advertising and the implicit assumption that such advertising is paid by special interest groups causes voters to participate less (turns them off) or provides voters with information that then increases their probability of participation (turns them out). In this paper we address this question using laboratory experiments where campaign advertising is endogenous and may or may not be costly to voters. We also compare our results to elections with compulsory voting. We find a number of important results that previously have not been explored in the literature:

1. Concerning Efficiency of Elections
   (a) We find that advertising that has no payoff consequences to voters is significantly more informationally and economically efficient than advertising with payoff consequences.
   (b) However, we find that there is no informational or economic advantage of voluntary over compulsory voting.
2. Concerning Information and Voting Behavior:
   (a) We find that indeed when advertising is informative and not costly to voters it increases their probability of participation, as has been found in previous studies.
   (b) However, we find that the effect is not nearly as strong as that found in other similar common value voting games. We suggest that the reason for the difference is that voters payoffs in the common value game are slightly asymmetric and thus

voters are induced with a preference over which party should win, even though all voters are paid more when the group chooses the Striped candidate regardless of party.

(c) Finally, we find that when advertising is costly to voters, voters are "turned off" by advertising, more likely to abstain, even when informed.

3. Concerning Candidate Advertising Strategies:

(a) We find that Striped candidates advertise more than theoretically predicted. This can be partly explained by the fact that increasing ads beyond the optimal level reduces payoffs very little, so overadvertising is much less costly to candidates than underadvertising.

(b) However, we also find that when advertising is free to voters and voting is voluntary, candidates actually advertise significantly *more* than when voting is compulsory, directly contrary to the theoretical predictions. Candidates appear to believe that advertising is more necessary when voting is voluntary, when theoretically it is actually less necessary.

What are the implications for naturally occurring elections and the role of campaign advertising? Our analysis provides some support for the "turned off" versus "turned out" trade-off in costly campaign advertising. Although advertising that is informative to voters increases participation, when the advertising is known to have a cost to voters in terms of payoffs, informed voters are less likely to participate. It also suggests that the effect of information on turnout may not be as strong as hypothesized when voters have party

preferences even if the voting game is a common value one. Finally, our analysis provides some explanations for what may appear to be excessive advertising by candidates in elections which has often puzzled scholars – first, that overadvertising is less costly to candidates than underadvertising and second, that candidates appear to believe that advertising is more necessary when voting is voluntary than complusory.

Appendix A: Experiment Instructions

Welcome to today's experiment! You will be taking part in a decision making study. We are interested in your decisions that you make on your own. That means, now that the experiment has started, you may not talk to anyone except the experimenter. Please turn off all phones, beepers, and any other electronic devices. If you talk or otherwise communicate with another participant during the experiment, or if an electronic device of yours disturbs the experiment, you will be asked to leave and will collect only your show-up bonus. If you have any questions at any time during the experiment, please raise your hand, and we will come to you to answer your question.

VERY IMPORTANT: If you should experience any software problems at all (a program freeze, a system error message, etc.), do not touch the computer. Do not click to close any system error screens. Instead, please raise your hand, and we will assist you.

When you are finished reading a screen, click the Next button to continue.

For your participation, you will be paid a show-up bonus. You may earn more money during the course of the experiment, as explained in detail below. The experiment will take

about two hours. Please remain quiet after the experiment has concluded. Each of you will be called to the experimenter, one-by-one, to be paid your earnings privately. After you have been paid you should exit the lab.

As you proceed through these instructions, there will be a quiz question at the bottom of certain pages. You must answer the question correctly before going to the next page. When you finish the instructions, you will play a simulated version of the experiment so that you can thoroughly familiarize yourself with the interface.

In this experiment you will be assigned randomly to the role of either candidate or voter. In each round, two participants will be candidates, and the rest will be voters. Candidates campaign, and at the end of the campaign voters vote. During the course of the experiment, you will be both a candidate and a voter. No participant can be a candidate a second time unless every participant has been a candidate once. Therefore, during these instructions, you will familiarize yourself with both the candidate and the voter interfaces and rules.

Question: How many participants will be candidates during any given campaign?

A: 1 C: 3

B: 2 D: varies from campaign to campaign

Whether you are a candidate or a voter, you will be randomly assigned to a political party. This experiment is a two-party experiment. The two parties are the Circle Party and the Triangle Party. One candidate will be a Circle candidate, and the other candidate will be an Triangle candidate. There is an even number of voters, so in each campaign half the voters will be Circle party and half will be Triangle party.

Turned Off or Turned Out? Campaign Advertising, Information, and Voting

You will be randomly reassigned to a party at the beginning of each of the four campaigns. Party assignment will not affect your ability to earn payoffs during the experiment.

Question: If you are a Circle candidate in campaign 1, how many times is it possible for you to be assigned to the Circle party in subsequent campaigns?

A: None C: 1

B: No limit D: 2

Candidates always prefer to have a person from their party elected. For example, a Circle candidate will always prefer to elect a Circle candidate, and a Triangle candidate will always prefer to elect a Triangle candidate.

If you are a voter, there might be circumstances in which you could be better off if the candidate from the other party is elected. For example, if you are assigned to the role of a Triangle voter, then there may arise a situation where you would be better off if the Circle candidate won the election.

In addition to the candidates being assigned to a party, they will also be randomly assigned to either Solid or Striped.

The amount you earn in this experiment will depend partly on which candidate wins the election. Your earnings depend on whether the winning candidate belongs to your party, and whether they are a Solid or Striped candidate. You earnings also depend on the campaign decisions of the winning candidate, as described in detail below.

The campaign proceeds as follows. For 1 minute (marked by a countdown timer in the upper corner of your screen), candidates will campaign. After this, all campaigning will stop,

and all participants will enter the voting phase.

During the campaign phase, voters observe candidates' activity on their computer screens. Candidates campaign by advertising. Each advertisement will reach exactly one voter. The voter who receives an advertisement is chosen randomly, with each voter equally likely to see any advertisement. As a candidate, you might have purchased eight advertisements, but this does not necessarily mean you have reached eight unique voters: the same voter can be reached multiple times while other voters are reached no times. A candidate will be told how many voters he/she has reached. If you have advertised eight times but have only reached three unique voters, you will be given this information. You will not be told the party affiliation of the three voters you reached.

Question: If you are a voter, what is the minimum number of advertisements you will see during the campaign?

A: 1 C: 0

B: 3 D: 2

A candidate can advertise only true information about his or her quality. For example, an advertisement from a Triangle-Striped candidate reads as follows:

"You have observed an advertisement from the Triangle candidate who is revealed to be Striped."

An advertisement from a Triangle-Solid candidate will read as follows:

"You have received an advertisement from the Triangle candidate who is revealed to be Solid."

Turned Off or Turned Out? Campaign Advertising, Information, and Voting

Candidates pay for advertising with tokens. One token pays for one advertisement. There are four colors of tokens: Yellow, Blue, Red and Purple. Tokens are given to candidates at the beginning of the experiment, and candidates may purchase advertisements using any color of token available to them. Only the individual candidate knows how the advertising was purchased. For example, you are a Triangle candidate, and you purchase one advertisement using one Purple token. Your advertisement will reach one voter, but that voter will not be told that you made the purchase with a Purple token.

Question: You are a voter. In the current campaign, candidates are given Yellow and Blue tokens to use to buy advertisements. You receive an advertisement from a candidate. What color token was used to purchase the advertisement you saw?

A: Blue C: Yellow

B: Red or Blue D: Yellow Or Blue

Advertising is always costly to candidates. Each advertisement reduces a candidate's total experimental earnings by 10 cents.

Q: If you are a candidate, and during the campaign you have used 3 Red tokens and 4 Blue tokens, by how much will your earnings be reduced?

A: \$0.70 C: \$2.70

B: \$2.00 D: \$2.30

Advertisements are costly to voters only if a candidate uses Blue tokens to pay for advertising.

If a candidate is elected, and that candidate has used Blue tokens to pay for advertising,

then each voter's earnings are reduced by 50 cents for each Blue token that has been used by the elected candidate.

You are a voter. If an elected candidate advertised 5 times, and three of those advertisements were purchased with Blue tokens, by what amount is each voter's payoff reduced?

A: \$1.00 C: \$1.50

B: \$0.50 D: \$3.00

A voter's screen will show the history of all advertisements that the voter has seen during the current campaign, including the candidate who sent it, the party the candidate belongs to, and the message. You will have information only on messages you have received. You will not know how much either candidate has advertised or which other voters have seen advertisements. You will not know what color tokens that candidates have used to purchase advertising.

At the end of the campaign phase, there will be a voting period. Whether you are a candidate or a voter, you will see three voting windows, allowing you to move your mouse over one of three buttons corresponding to the candidate you wish to vote for. There will also be an option button for you to choose not to vote. When you when you move your mouse over one of the buttons, a message box will appear asking you to confirm your choice. You will not be able to change your decision once it has been confirmed, nor can you vote a second time. The election results will be shown to all participants. You will see the results along with your personal earnings for the campaign.

On the voting screen, the middle window is titled "Abstain." Abstain means simply that

you wish to vote for neither candidate. If you mouse over the "Abstain" button and confirm, your decision will be entered as a "No vote," meaning you voted for neither candidate.

There is no monetary penalty for abstaining. Given the outcome of the election, your earnings are the same whether you voted for Circle, Triangle, or you chose Abstain.

Keep in mind, however, that choosing to vote or to abstain may have an effect on the outcome of the election.

Voters' earnings are calculated in two steps.

* The candidate in your party wins and that candidate is stripes: You earn $7.50.

* The other party's candidate wins and that candidate is stripes: You earn $7.00.

* Your party's candidate wins and that candidate is solids: You earn $4.50.

* The other party's candidate wins and that candidate is solids: You earn $4.00.

The second step in calculating voters' earnings is as follows.

If Blue tokens were used by the elected candidate, then each voter's earnings will be reduced by $0.50 per Blue token used.

(You may need to use the <Back> button to view the previous screen in answering this question)

Q: You are a Circle voter. A Triangle Striped candidate wins the election, and used six Blue tokens during the campaign. What are your earnings?

A: $7.00 C: $4.50

B: $4.00 D: $3.50

Candidates' earnings are calculated as follows. Because each candidate wants only their

party to win, the first step is not used to calculate candidates' earnings.

The first step in calculating candidate's earnings is as follows.

First, a candidate will earn a bonus of \$15 if he/she is elected.

Also, a candidate's earnings are reduced by \$0.10 for every advertisement that he/she has purchased.

Candidates do not earn any money from tokens that are not used.

Here is an example: You are a Circle-Striped candidate. You win the election in a Blue token campaign. During the campaign you use 11 Blue tokens to buy 11 advertisements. Your earnings are calculated by adding together the following: \$15 because you won the election, and -\$1.10=(\$0.10 * 11) due to the 11 advertisements. Your earnings for the campaign, therefore, are \$15 - \$1.10 = \$13.90.

Here is a second example: You are a Circle-Solid candidate. You lose the election in a Red token campaign. During the campaign you purchased 1 advertisement. Your earnings are as follows: \$0 because you did not win the election, and -\$0.10 due to the 1 advertisement. Your earnings for the campaign, therefore, are \$0 - \$0.10 = \$-0.10.

While it is possible for you to lose money during an individual campaign, your earnings for the experiment will be positive.

You have now learned how the entire campaign process works for both voters and for candidates. There will be multiple campaigns in the experiment. Before each campaign begins, an information screen will be displayed for you. This screen will tell you what tokens are available for the upcoming campaign, whether you are a voter or a candidate,

your party affiliation, and, if you are a candidate, whether you are stripes or solids. These characteristics will be randomly reassigned each campaign. At the conclusion of the final campaign, a summary screen will display your total earnings including your show-up fee.

Please sit quietly after the experiment has concluded and wait to be called to receive your earnings.

You will now go through three practice screens: first the Candidate screen, second the Voter screen, and third the Voting screen. Screens will display for 1 minute each. Practice clicking the different buttons in the window to see how the interface works.

Click the <Finished> button to begin the practice screens.

Appendix B: Solving for Uninformed Voters' Equilibrium Choices

Proof of Lemma 1

Uninformed voters condition their votes on the case when they are pivotal. An uninformed voter is pivotal when one of the candidates is losing by one vote and they can force a tie election or when there is a tie election. Let P_0 be the event when there is a tie among the other voters between A and B; and P_θ for $\theta = A, B$, which is the event in which policy θ is losing by one vote among the other voters. To demonstrate that uninformed voters find it optimal to abstain when informed voters choose the candidate whose identity matches the state of the world and candidates purchase at least one ad, we calculate the expected utility of an A type voter given that all uninformed voters are abstaining and demonstrate that abstention is also this voter's optimal choice for any amount of campaign advertising.

To calculate these expected utilities, we first calculate the pivot probabilities. Let $u_\theta(A)$ for $\theta = A, B, \emptyset$ be the expected utility of an uninformed A voter of voting for policy θ. Therefore:

$$\begin{aligned}
u_A(A) = 0.5[&u(A,A,A)\Pr(P_0|A) + (0.5u(A,A,A) + 0.5u(A,B,A))\Pr(P_A|A) \\
&+u(A,A,A)\Pr(P_B|A) + u(A,A,B)\Pr(P_0|B) \\
&+ (0.5u(A,A,B) + 0.5u(A,B,B))\Pr(P_A|B) + u(A,A,B)\Pr(P_B|B)] \\
u_B(A) = 0.5[&u(A,B,A)\Pr(P_0|A) + u(A,B,A)\Pr(P_A|A) \\
&+ (0.5u(A,A,A) + 0.5u(A,B,A))\Pr(P_B|A) \\
&+u(A,B,B)\Pr(P_0|B) + u(A,B,B)\Pr(P_A|B) \\
&+ (0.5u(A,A,B) + 0.5u(A,B,B))\Pr(P_B|B)] \\
u_\emptyset(A) = 0.5[&(0.5u(A,A,A) + 0.5u(A,B,A))\Pr(P_0|A) \\
&+u(A,B,A)\Pr(P_A|A) + u(A,A,A)\Pr(P_B|A) \\
&+ (0.5u(A,A,B) + 0.5u(A,B,B))\Pr(P_0|B) \\
&+(u(A,B,B)\Pr(P_A|B) + u(A,A,B)\Pr(P_B|B)]
\end{aligned}$$

Which simplifies to:

$$u_A(A) = 0.5[\Pr(P_0|A) + 0.5\Pr(P_A|A) + \Pr(P_B|A) + \lambda\Pr(P_0|B) + 0.5\Pr(P_A|B) + \lambda\Pr(P_B|B)]$$

$$u_B(A) = 0.5[0.5\Pr(P_B|A) + (1-\lambda)\Pr(P_0|B) + (1-\lambda)\Pr(P_A|B) + 0.5\Pr(P_B|B)]$$

$$u_\emptyset(A) = 0.5[0.5\Pr(P_0|A) + \Pr(P_B|A) + 0.5\Pr(P_0|B) + (1-\lambda)\Pr(P_A|B) + \lambda\Pr(P_B|B)]$$

The expected utility of an uninformed B voter is symmetric.

With an even number of voters and two voters as candidates who always vote for them-

selves, that informed voters vote for the candidate whose identity matches the state of the world, and all other uninformed voters abstain, we can compute the pivot probabilities for an uninformed A type voter as follows:

Consider $\Pr(P_0|A)$. This probability is nonzero only if no other noncandidate voter has seen an ad. If another noncandidate voter has seen an ad, he or she will vote A and A will win by one vote. Similarly for $\Pr(P_0|B)$. Thus these probabilities are equivalent to the probability that no noncandidate voter sees an ad as follows:

$$\Pr(P_0|A) = \Pr(P_0|B) = \binom{m}{0} \left(\frac{n-3}{n-1}\right)^0 \left(1 - \frac{n-3}{n-1}\right)^m = \left(1 - \frac{n-3}{n-1}\right)^m$$

Consider $\Pr(P_A|A)$. This probability always equals zero. Why? If there are zero ads or all ads are seen by candidate voters, then there is a tie. If any uninformed voter sees an ad, he or she will vote for A and A will win. So this probability equals zero. It also follows that $\Pr(P_B|B) = 0$.

Consider $\Pr(P_A|B)$. This probability is nonzero if exactly one noncandidate voter sees all ads. What is that probability?

$$\Pr(P_A|B) = \begin{cases} 0 & \text{if } m = 0 \\ \sum_{i=1}^{m} \left(\frac{m!}{i!(m-i)!}\right) \left(\frac{n-3}{n-1}\right)^i \left(1 - \frac{n-3}{n-1}\right)^{m-i} \left(\frac{1}{n-3}\right)^{i-1} & \text{if } m > 0 \end{cases}$$

It also follows that $\Pr(P_B|A) = \Pr(P_A|B)$.

Now we can compute the expected utilities:

$$u_A(A) = \begin{cases} 0.5(1+\lambda) & \text{if } m = 0 \\ 0.5\left[\begin{array}{c} (1+\lambda)\left(1-\frac{n-3}{n-1}\right)^m + \\ 1.5\sum_{i=1}^{m}\left(\frac{m!}{i!(m-i)!}\right)\left(\frac{n-3}{n-1}\right)^i \\ \left(1-\frac{n-3}{n-1}\right)^{m-i}\left(\frac{1}{n-3}\right)^{i-1} \end{array}\right] & \text{if } m > 0 \end{cases}$$

$$u_B(A) = \begin{cases} 0.5(1-\lambda) & \text{if } m = 0 \\ 0.5\left[\begin{array}{c} (1-\lambda)\left(1-\frac{n-3}{n-1}\right)^m + \\ (1.5-\lambda)\sum_{i=1}^{m}\left(\frac{m!}{i!(m-i)!}\right)\left(\frac{n-3}{n-1}\right)^i \\ \left(1-\frac{n-3}{n-1}\right)^{m-i}\left(\frac{1}{n-3}\right)^{i-1} \end{array}\right] & \text{if } m > 0 \end{cases}$$

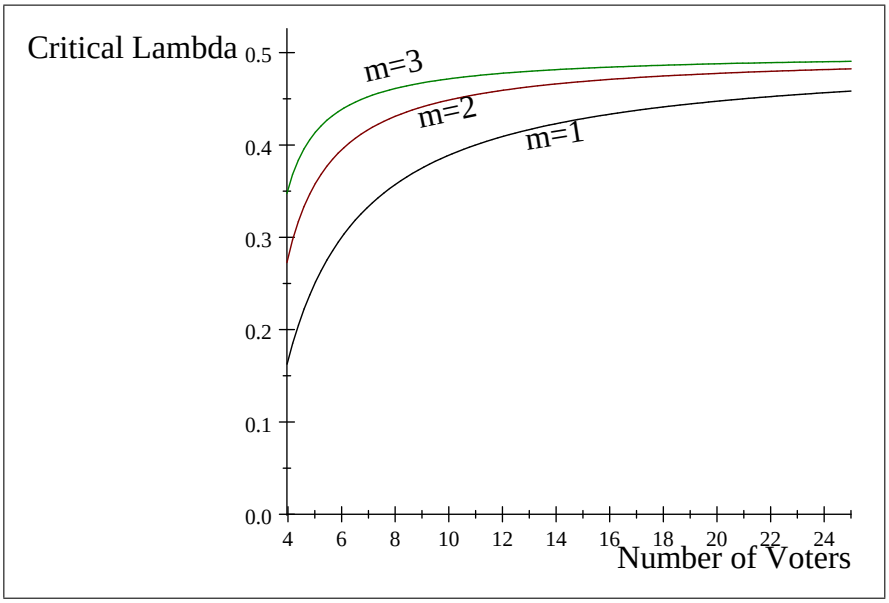
$$u_\emptyset(A) = \begin{cases} 0.5 & \text{if } m = 0 \\ 0.5\left[\begin{array}{c} \left(1-\frac{n-3}{n-1}\right)^m + \\ (2-\lambda)\sum_{i=1}^{m}\left(\frac{m!}{i!(m-i)!}\right)\left(\frac{n-3}{n-1}\right)^i \\ \left(1-\frac{n-3}{n-1}\right)^{m-i}\left(\frac{1}{n-3}\right)^{i-1} \end{array}\right] & \text{if } m > 0 \end{cases}$$

We assume that our uninformed type A voter will choose the option that gives him or her the highest expected utility. It is clear that for all values of λ, n, and m, $u_A(A) > u_B(A)$. Hence the relevant issue is which is greater, $u_A(A)$ or $u_\emptyset(A)$. The difference between these two expected utilities is given by:

$$u_A(A) - u_\emptyset(A) = \begin{cases} 0.5\lambda & \text{if } m = 0 \\ 0.5\left[\begin{array}{c} \lambda\left(1-\frac{n-3}{n-1}\right)^m - \\ (0.5-\lambda)\sum_{i=1}^{m}\left(\frac{m!}{i!(m-i)!}\right)\left(\frac{n-3}{n-1}\right)^i \\ \left(1-\frac{n-3}{n-1}\right)^{m-i}\left(\frac{1}{n-3}\right)^{i-1} \end{array}\right] & \text{if } m > 0 \end{cases}$$

$0.5\left[y\left(1-\frac{x-3}{x-1}\right)^{1}-(0.5-y)\left(\frac{x-3}{x-1}\right)^{1}\right]=0.1$, Solution is: $\frac{0.5}{x-1}(x-3)+0.2$

Obviously, when $m=0$, uninformed voters gain most by voting for the candidate who matches their type. But if $m>0$, the optimal response depends on the values of λ, n, and m. It is straightforward to show that for a given value of $m>0$, critical values of $\overline{\lambda}$ exist such that for $\lambda<\overline{\lambda}$, $u_A(A)<u_\emptyset(A)$ and abstaining is the optimal response. Figure A1 below shows the relationship between $\overline{\lambda}$ and n for given values of $m=1,2,3$, with the lowest curve for $m=1$ and the highest curve for $m=3$. Note that as m and/or n increases, $\overline{\lambda}$ increases.



Similarly, we can show that for an uninformed type B voter the same relationship holds. Note also that for the value of λ used in our experiments, $\lambda=0.14$, and the number of voters used in the experiments, $n=22$ and $n=24$, for all values of $m>0$, abstaining is an optimal response.

Proof of Lemma 2

Consider an uninformed A type voter in the A party. Assume that all informed voters are voting for the candidate whose identity matches the state of the world and all other uninformed voters are voting for the candidate whose identity matches their type. Uninformed voters condition their vote on the relative pivot probabilities as in Lemma 1.

$\Pr(P_0|i) = 0$ since n is even and there are $n-1$ other voters thus if everyone is voting, there is no possibility of a tie election..

$\Pr(P_A|A)$ is the probability that given that A is the true state and one A type is not voting – uninformed, A is losing by one vote. This can only occur if no B voter sees an A ad. So ads do not change voting behavior. If a B voter has seen an A ad, then A is winning by one or more votes. Hence:

$$\Pr(P_A|A) = \begin{pmatrix} m \\ 0 \end{pmatrix} \left(\frac{0.5(n-2)}{n-1}\right)^0 \left(1 - \frac{0.5(n-2)}{n-1}\right)^m = \left(1 - \frac{0.5(n-2)}{n-1}\right)^m$$

$\Pr(P_A|B)$ is the probability that given that B is the true state and one A type is not voting – uninformed, A is losing by just one vote. This can only occur if no A voters see an ad, all ads are seen by B voters or the candidate. If an A voter has seen an ad, then A is losing by more than one vote as this voter would vote for B. Hence:

$$\Pr(P_A|B) = \begin{pmatrix} m \\ 0 \end{pmatrix} \left(\frac{0.5(n-2)-1}{n-1}\right)^0 \left(1 - \frac{0.5(n-2)-1}{n-1}\right)^m = \left(1 - \frac{0.5(n-2)-1}{n-1}\right)^m$$

$\Pr(P_B|A)$ is the probability that given that A is the true state and one A type is not voting – uninformed, B is losing by one vote. This can only occur if only one B voter sees all the ads and there is a positive number of ads. Hence:

$$\Pr(P_B|A) = \begin{cases} 0 & \text{for } m = 0 \\ \sum_{i=1}^{m} \left(\frac{m!}{i!(m-i)!}\right) \left(\frac{0.5(n-2)}{n-1}\right)^{i} \\ \left(1 - \frac{0.5(n-2)}{n-1}\right)^{m-i} \left(\frac{1}{0.5(n-2)}\right)^{i-1} & \text{for } m > 0 \end{cases}$$

$\Pr(P_B|B) = 0$. Why? If no ads are aired or only candidates see an ad, then A is losing by one vote. If one or more ads are seen by only B voters, A is losing by one vote. If one or more ads are seen by A voters, A is losing by more than one vote.

We can now incorporate these probabilities into the expected utilities as in our proof of Lemma 1 above.

$$u_A(A) = \begin{cases} 0.5 & \text{for } m = 0 \\ 0.5 \left[\begin{array}{c} 0.5 \left(1 - \frac{0.5(n-2)}{n-1}\right)^{m} + \\ \sum_{i=1}^{m} \left(\frac{m!}{i!(m-i)!}\right) \left(\frac{0.5(n-2)}{n-1}\right)^{i} \\ \left(1 - \frac{0.5(n-2)}{n-1}\right)^{m-i} \left(\frac{1}{0.5(n-2)}\right)^{i-1} + \\ 0.5 \left(1 - \frac{0.5(n-2)-1}{n-1}\right)^{m} \end{array} \right] & \text{for } m > 0 \end{cases}$$

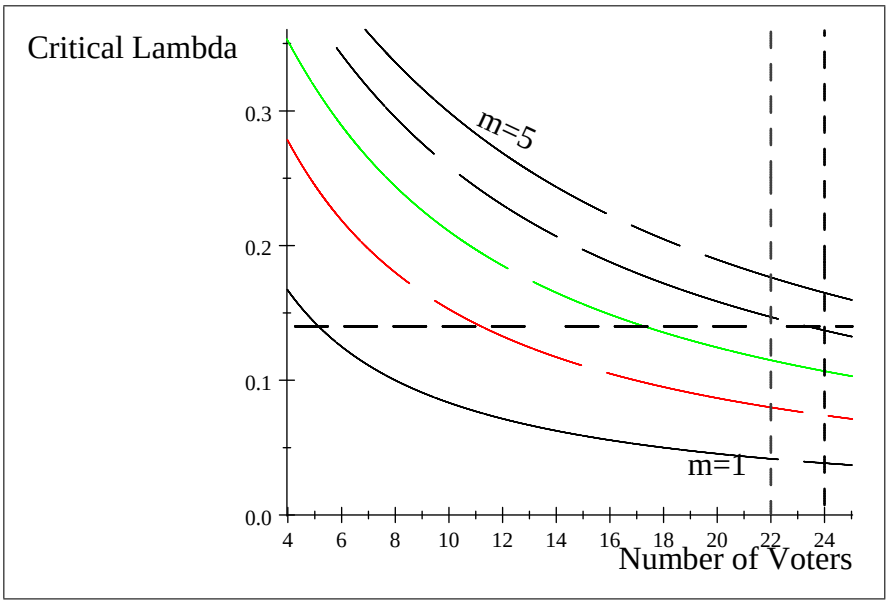
$$u_B(A) = \begin{cases} 0.5(1-\lambda) & \text{for } m = 0 \\ 0.5 \left[\begin{array}{c} 0.5 \sum_{i=1}^{m} \left(\frac{m!}{i!(m-i)!}\right) \left(\frac{0.5(n-2)}{n-1}\right)^{i} \\ \left(1 - \frac{0.5(n-2)}{n-1}\right)^{m-i} \left(\frac{1}{0.5(n-2)}\right)^{i-1} + \\ (1-\lambda) \left(1 - \frac{0.5(n-2)-1}{n-1}\right)^{m} \end{array} \right] & \text{for } m > 0 \end{cases}$$

$$u_{\emptyset}(A) = \begin{cases} 0.5(1-\lambda) & \text{for } m = 0 \\ 0.5\left[\begin{array}{c} \sum_{i=1}^{m}\left(\frac{m!}{i!(m-i)!}\right)\left(\frac{0.5(n-2)}{n-1}\right)^{i} \\ \left(1-\frac{0.5(n-2)}{n-1}\right)^{m-i}\left(\frac{1}{0.5(n-2)}\right)^{i-1} + \\ (1-\lambda)\left(1-\frac{0.5(n-2)-1}{n-1}\right)^{m} \end{array}\right] & \text{for } m > 0 \end{cases}$$

As in Lemma 1, for all values of λ, n, and m, $u_A(A) > u_B(A)$ but whether abstention or voting type is an optimal response depends on the values of λ, n, and m as follows:

$$u_A(A) - u_{\emptyset}(A) = \begin{cases} 0.5 - 0.5(1-\lambda) & \text{for } m = 0 \\ 0.5\left[\begin{array}{c} 0.5\left(1-\frac{0.5(n-2)}{n-1}\right)^{m} \\ -(0.5-\lambda)\left(1-\frac{0.5(n-2)-1}{n-1}\right)^{m} \end{array}\right] & \text{for } m > 0 \end{cases}$$

As above, we can solve for the critical value of λ, $\underline{\lambda}$, such that $u_A(A) = u_{\emptyset}(A)$. If $\lambda < \underline{\lambda}$, $u_A(A) < u_{\emptyset}(A)$ and if $\lambda > \underline{\lambda}$, $u_A(A) > u_{\emptyset}(A)$. As above, $\underline{\lambda}$ is increasing in m, however, unlike the situation in Lemma 1, $\underline{\lambda}$ is decreasing in n. Figure A2 illustrates how $\underline{\lambda}$ changes with values of $m = 1 - 5$ and n. The lowest curve represents the values when $m = 1$ and the highest curve represents the values when $m = 5$. The dotted line in the figure shows the value of λ, 0.14, which was used in our experiments. Notice that for the number of voters used in our experiments, the number of ads must be less than 3 or 4 for an uninformed voter to optimally best response by voting his or her type. That is, for $n = 22$ when $m < 3$, voting identity is optimal, but for $m \geq 3$, abstaining is an optimal choice and for $n = 24$ when $m < 4$, voting identity is optimal, but for $m \geq 4$, abstaining is an optimal choice.


Critical Lambda
0.3
0.2
0.1
0.0
m=5
m=1
4
6
8
10
12
14
16
18
20
22
24
Number of Voters

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