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**Discussion Paper**

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# Does deceptive advertising reduce political participation? Theory and evidence

Daniel Houser\* Sandra Ludwig<sup>†</sup> Thomas Stratmann<sup>‡</sup>

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## Abstract

We examine the effect of deceptive advertising on voting decisions in elections. We model two-candidate elections in which 1) voters are uncertain about candidates' attributes; and 2) candidates can inform voters of their attributes by sending advertisements. We compare political campaigns with truthful advertising to campaigns in which there is a small chance of deceptive advertising. Our theoretical model predicts that informed voters should act on the information contained in the advertisement. Thus, even in deceptive campaigns, informed voters should either vote for the candidate from whom they received an advertisement or abstain from voting; they should never vote for the opposing candidate. We test our model in laboratory elections, and, as predicted, find higher participation among informed voters in elections that allow only for truthful advertisement than in elections that permit deceptive advertising. Contrary to our theoretical predictions, we find substantial differences in voting behavior between truthful and deceptive campaigns. When faced with a small probability of deception, informed voters in deceptive campaigns vote for the candidate who did not send an advertisement, thereby making sub-optimal voting choices. Even when there is only a small chance that an advertisement is deceptive, voters are more likely to elect the candidate who generates less welfare.

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## I. Introduction

For voters, possessing accurate information about candidates' positions is a crucial element in deciding how to cast their ballot. Truthful and correct information about candidate positions<sup>1</sup> underpins much of the theoretical literature on voting. The voting literature, beginning with Downs (1957), has assumed that candidates truthfully represent their positions. More recent significant contributions allow for voter uncertainty about candidate positions, but continue to assume truthful representation of candidate positions. These include works by Matsusaka (1995) and Feddersen and Pesendorfer (1996), who show that more information about candidate positions increases voter turnout.<sup>2</sup> Yet political advertising is not always truthful, and may contain falsehoods and deception. To our knowledge, there is a dearth of scholarly theoretical work studying the effect of false information on abstention and voting decisions. Furthermore, no work has tested theoretical implications in the laboratory. Our paper takes a step toward filling these gaps by providing a theoretical framework in which to study and perform laboratory tests on false candidate advertising.<sup>3,4</sup>

In naturally occurring elections, candidates often provide false information. This phenomenon is so prevalent that it has launched multiple websites aimed at pointing out false or deceptive statements in candidate speeches and campaign advertisements. One example is

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<sup>1</sup> Candidates may differ with respect to their policy positions or with respect to valence criteria such as their qualities or attributes. In this paper we will use the positions, attributes, and qualities interchangeably.

<sup>2</sup> Empirical studies by Gentzkow (2005) and Lassen (2005) show that turnout is positively affected when voters have more sources of information, such as newspapers. Also, Coupe and Noury (2004), Palfrey and Poole (1987), and Wattenberg et al. (2000) found a positive correlation between turnout and information levels.

<sup>3</sup> Closest to our theoretical model is work by Feddersen and Pesendorfer (1999). In their model, the introduction of noisy information increased turnout of uninformed voters and decreased turnout of informed voters.

<sup>4</sup> There is a large theoretical and empirical literature on the effect of campaign advertising. Empirical works includes Levitt (1993), who analyzed the effect of campaign spending for repeat challengers, Ansolabehere and Iyengar (1996), who conducted a field experiment on this topic, and Gerber (1998), who found that campaign spending positively affected election outcomes for the U.S. Senate. Theoretical work examining strategic advertising with truthful information includes Coate (2004a, b) and Schultz (2007). Potters et al. (1997) and Prat (2002) examined the consequences of indirect informative advertising, where voters are influenced by the amount of money that has been spent on advertising. For a recent overview of this literature see Stratmann (2005).

factcheck.org, which operated during the 2008 presidential race to point out falsehoods in the campaigns of Senators Clinton, McCain and Obama.<sup>5</sup> A well-known false statement during the 2008 Democratic primary occurred when Senator Clinton, apparently trying to bolster her foreign policy credentials, incorrectly claimed that she witnessed an attack during her visit to Bosnia in 1996. While factcheck.org provides a list of false statements and deceptions to voters during the campaign, sometimes the validity of a statement (e.g., whether a candidate intends to keep a promise) can only be assessed after the election has been decided. A famous example is George Bush Sr.'s “Read my Lips: No new taxes” (eventually broken) promise made during his nomination acceptance speech at the 1988 Republican National Convention. Our theoretical model and experiments capture this latter type of false information, which is revealed as false only after the election.

Recent empirical studies examining the effect of information on voter behavior either assume truthful advertising (Houser et al., 2008) or assume that voters receive signals that either provide them with perfect information or are fully uninformative (Battaglini et al. 2008, 2008).<sup>6</sup> Corizzini et al. (2009) performed related work examining non-binding candidate promises. They found that promises are positively correlated with candidates’ actions and that voters take such promises into account in their vote choice rather than writing them off as cheap talk.

In this paper, we analyze differences in the way voters behave when they know political advertising is truthful versus the way they behave when they know there is a chance that the advertising is false (or deceptive). To our knowledge, no existing empirical study informs the effect of false advertising on voting behavior.

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<sup>5</sup> [http://www.factcheck.org/elections-2008/hillarys\\_adventures\\_abroad.html](http://www.factcheck.org/elections-2008/hillarys_adventures_abroad.html) and [http://www.factcheck.org/specialreports/our\\_disinformed\\_electorate.html](http://www.factcheck.org/specialreports/our_disinformed_electorate.html), accessed January 2009.

<sup>6</sup> These studies build on the swing voter's curse literature, e.g. Feddersen and Pesendorfer 1996.

In both our theoretical and empirical work, we compare voter behavior between truthful and deceptive advertising environments when voting is voluntary and costless. We study (informed) voters exposed to advertisements as well as (uninformed) voters without such exposure. For both groups, we examine: 1) how voter turnout and voter decisions differ under both truthful and deceptive advertising environments; 2) whether deceptive advertising influences which candidate is elected; and 3) whether the candidate who generates the highest welfare for voters wins the election. Finally, we compare welfare between deceptive and truthful advertising environments.

Our laboratory investigation compares voting decisions in an environment where advertising is always truthful to an environment in which false advertising occurs, but accounts for only a relatively small fraction of the overall level of advertising (most advertisements are true). Our theory implies several equilibria. All equilibria predict that voters should either vote for the candidate who sent them the potentially deceptive advertisement or abstain. No equilibrium predicts that a rational voter should vote for the candidate from whom she did not receive an advertisement. In our experimental tests of our theory the main finding is that informed voters in deceptive campaigns are much more likely to abstain and act suboptimally relative to campaigns that include only true information. That is, they vote for the opposition candidate from whom they did not receive an advertisement. This practice has a strong detrimental effect on electoral efficiency—introducing a small amount of false information leads to an economically and statistically significantly greater likelihood of electing a sub-optimal candidate. This large reduction in efficiency stands in sharp contrast to our theoretical prediction.

## II. Model

We consider two-candidate elections, with one candidate belonging to the Circle party (●) and the other one to the Triangle party (▲). Candidates have fixed ideologies that reflect their parties' positions. Candidates, in addition to their party affiliation, are also characterized by their types or qualities, which are either "high" (H) or "low" (L).<sup>7</sup>

The population consists of  $N$  (potential) voters. Voting is voluntary and costless. All voters are swing voters, with half leaning toward the Circle party, and the other half leaning toward the Triangle party. With respect to candidate quality, all voters' preferences are homogenous. They all prefer a high-quality candidate to a low-quality candidate, irrespective of the candidate's party affiliation. As shown in Table 1, voters' payoffs are  $x_H$  or  $x_L$  if their own-party high- or low-quality candidate is elected, respectively, and those same respective amounts, less  $\varepsilon$ , if the other party's high- or low-quality candidate is elected, where  $x_H - x_L > \varepsilon > 0$ .<sup>8</sup> A voter can cast her ballot for her own party's candidate, the other party's candidate, or abstain.

At the beginning of each campaign, voters are unaware of the true quality of a specific candidate. They do know, however, that each election will have exactly one high-quality candidate and one low-quality candidate, and that each party is equally likely to have the low-quality candidate. We consider a first-past-the-post voting system where ties are broken randomly. Voters are rational, in the sense that they are motivated by the possibility that their ballot will be pivotal. A pivotal vote occurs if, absent that ballot, either candidate leads by exactly one vote or the election is tied.

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<sup>7</sup> One interpretation of the candidates' pattern is that all voters prefer a moderate (high-quality) candidate of either party to an extreme (low-quality) one. Alternatively, we can think of any other valence criterion that all voters favor.

<sup>8</sup> This assumption ensures that voters prefer a high-quality candidate from the other party to a low-quality candidate from their own party.

## II.1 Truthful Campaigns

Consider first the case in which advertising is only truthful. Candidates engage in campaign advertising to signal that they are of high quality. Advertising is truthful (“truthful campaign”), meaning that candidates cannot lie about their quality. Hence, only high-quality candidates can send advertisements. Candidates always advertise but voters do not necessarily receive the advertisement: each voter receives an advertisement with probability  $p$ . If a voter receives an advertisement, the advertisement truthfully reveals which candidate is of high quality; therefore, it also reveals that the other candidate is of low quality (as types are perfectly negatively correlated). Figure 1 shows the timing of the game. First, candidates send advertisements. Then voters either receive or do not receive advertisements. Next, voters cast their ballots. Finally, the winner is announced and payoffs realized.

Since advertising is exogenous, the voting game that we analyze is static. We consider symmetric pure strategy Bayesian Nash equilibria of the game. Voters form beliefs about the true state conditional on any ad they receive and also condition their ballots on the same ads. The symmetry assumption rules out an equilibrium in which all voters vote for either the Circle or the Triangle candidate. This is ruled out because such voting behavior implies that some voters vote for the candidate from their own party and some vote for the candidate from the other party.

### II.1.1 Informed Voters’ Behavior

If a voter receives an advertisement, she knows perfectly which candidate is high-quality and which is low-quality. Table 1 describes our assumed structure of voter preferences. Given this structure, informed voters have a dominant strategy to vote for the high-quality candidate.

Hence, if a voter receives an ad from her own (other) candidate she always votes for her own (other) candidate.

### II.1.2 Uninformed Voters' Behavior

If a voter does not receive an advertisement, she cannot update her beliefs and thus believes it is equally likely that 1) the Triangle candidate is of high quality, while the Circle candidate is of low quality; or 2) the Triangle candidate is of low quality, while the Circle candidate is of high quality. Given that informed voters always vote for the high-quality candidate, two symmetric pure strategy equilibria exist. We derive these equilibria in Appendix II.

In the first equilibrium, all uninformed voters abstain (“Abstention equilibrium”). This equilibrium exists if  $p \geq \frac{2\varepsilon}{2\varepsilon + (x_H - x_L - \varepsilon)(N - 1)}$ ; that is, when the probability of receiving an advertisement is sufficiently high. Intuitively, the reason is that an uninformed voter who believes other uninformed voters will abstain also recognizes that their uninformed vote may cancel out an informed vote. Since all informed voters vote for the high-quality candidate, the uninformed voter finds it optimal to abstain so long as the probability of an informed vote is sufficiently large. This is similar to the swing voters curse result in Feddersen and Pesendorfer (1996).

In the second equilibrium, uninformed voters vote for their own party’s candidate (“All vote equilibrium”). This equilibrium exists if  $p \leq \frac{2\varepsilon}{x_H - x_L - \varepsilon}$ ; that is, the probability of receiving an advertisement is sufficiently low. Intuitively, when the probability of receiving an advertisement is small and when all uninformed voters vote for their own Circle (Triangle) party, then an uninformed vote is more likely to cancel out an uninformed vote for the Triangle (Circle)



party than an informed vote. In this case, an uninformed voter's utility is higher if she votes for her own party's candidate rather than abstaining.

Because the threshold for the probability of receiving an advertisement is lower for the first equilibrium than for the second, there exists a range of  $p$  in which both equilibria exist (see Figure 2.) The parameterization for our experiment ( $N = 22$ ,  $x_H = 7.5$ ,  $x_L = 4.5$ ,  $\varepsilon = 0.5$ ,  $p = 0.2$ ) is such that both equilibria exist. In our experiment, the likelihood of receiving an advertisement,  $p$ , takes the value of 0.2, while the range  $p$  where both equilibria exist goes from 0.0187 up to 0.286 (Figure 2).

### II.1.3 Efficiency of Electoral Outcome – Truthful Campaigns

We now compare the level of efficiency that is reached in equilibrium assuming truthful advertising relative to the first best, i.e., the situation where the high-quality candidate always wins. This occurs when the state of the world is common knowledge among voters. We assign an efficiency value of 1 to an election in which the high-quality candidate wins and a value of 0 when the low-quality candidate wins. When there is a tie, the winning candidate is chosen at random; thus, we assign an efficiency value of 0.5.

First, we compute the expected efficiency reached in the Abstention equilibrium. According to our model, informed voters always vote for the high-quality candidate. If at least one voter is informed and all uninformed voters abstain, then the high-quality candidate wins the election. The probability that at least one voter is informed is  $1 - (1 - p)^N$ . If no voter receives an ad, the outcome is a tie. Therefore the expected efficiency in the Abstention equilibrium is  $1 - 0.5(1 - p)^N$ . For our parameter values,  $N=22$  and  $p=0.2$ , expected efficiency equals 0.996.

Next we compute the expected efficiency of the All vote equilibrium, in which uninformed voters cast their ballot for their own party's candidate. This implies that in each state of the world at least half of all voters vote for the high-quality candidate. To see this, suppose the Circle candidate is of high quality, and thus only the Circle candidate can send ads. In this case, all voters leaning toward the Circle party will vote for the Circle candidate, irrespective of whether they receive an ad. Voters leaning toward the Triangle party will vote for the Triangle candidate unless they receive an ad from the high-quality Circle candidate. Since half of the voters lean towards the Circle and Triangle parties, at least half of them will vote for the high-quality candidate. Hence, either the high-quality candidate wins or a tie results. A tie results if exactly none of the Triangle voters receives an advertisement, which occurs with probability  $(1 - p)^{N/2}$ . The same logic applies when the Triangle candidate is of high quality. Expected efficiency is in the All vote equilibrium; thus,  $1 - 0.5(1 - p)^{N/2}$ .

Note that expected efficiency is lower when uninformed voters vote their own party's candidate than when they abstain. The reason is that the informed voter from the high-quality candidate's party has a lower probability of causing the pivotal vote. For the parameter values  $N=22$  and  $p=0.2$  implemented in our experiment, the expected efficiency in the All vote equilibrium is 0.957.

## **II.2 Deceptive Campaigns**

In deceptive campaigns, advertising need not be truthful. Both high-quality and low-quality candidates advertise, and each candidate claims to be high-quality. Hence, we define advertising as deceptive when a low-quality candidate advertises that she is of high quality. Consequently, advertisements from high-quality candidates are truthful while advertisements from low-quality

candidates are false. Like the truthful campaigns described in the previous section, we assume that candidates always advertise and that each voter receives an advertisement from the high-quality candidate with probability  $p$ . In addition she now receives an advertisement from the low-quality candidate with probability  $q$ .<sup>9</sup> We consider only cases where  $0 < q < p < 0.5$ .

Given this design, each voter can receive either zero, one, or two advertisements. Further, voters who receive two ads and voters who receive zero ads both believe that the two states of the world (whether their own candidate or the other party's candidate is of high quality) are equally likely. This implies that voters who receive two ads are effectively uninformed.

In our model, the probability of receiving an advertisement with correct information is the same in both the deceptive and the true campaigns. The deceptive campaigns differ from the true campaigns in that false information is added to the environment. In particular, the total ad frequency in true campaigns is " $p$ ," while it is " $p+q$ " in deceptive campaigns.<sup>10</sup> Both types of campaigns also differ in another important way—voters who receive exactly one advertisement in the true campaigns know the truth about candidate qualities, while voters who receive exactly one ad in the deceptive campaigns are uncertain about the true underlying state. For example, a rational Bayesian in a true campaign who receives an ad indicating that a particular candidate is high-quality knows with probability 1 that this is the case, and that the other candidate is low-quality. In a deceptive campaign the same information leads a rational Bayesian to conclude that the candidate is high-quality with probability  $[(1-q)/q]/[(1/q+1/p-2)]$ , where again we consider only the case where  $0 < q < p < 0.5$ .

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<sup>9</sup> This implies that a voter who receives an advertisement does not know for sure whether the information is correct or false before the election is decided.

<sup>10</sup> A small difference between truthful and deceptive campaigns will be that in truthful campaigns less voters will be informed since only the high-quality candidate sends ads: 20% of voters are informed and 80% uninformed in truthful campaigns, while in deceptive campaigns 23% are informed and 77% uninformed (76% receive zero ads, 1% two ads).

Following the same approach that we took for truthful campaigns, we consider symmetric pure strategy Bayesian Nash equilibria of the voting game. In Appendix II we show that in equilibrium both voters who receive zero advertisements and voters who receive two advertisements use the same strategy. Hence, when we refer to uninformed voters in the discussion below, we refer to voters who receive zero or two ads.

We have several predictions based on the equilibrium played, and others that hold regardless of the equilibrium played. The latter predictions hold independent of the parameters of the game as long as  $x_H > x_L > \varepsilon > 0$  and  $p > q > 0$ . The equilibria we discuss below, however, may not exist for parameters other than those used in the experiment.

We start with the results that hold regardless of the equilibrium played. In Appendix II, we show that in equilibrium:

- (1) It is never the case that informed voters who receive an ad from the own (other) candidate vote for the other (own) candidate;<sup>11</sup>
- (2) It is never the case that informed voters who receive an ad from the own (other) candidate abstain and that uninformed voters vote for the own (other) candidate;
- (3) It is never the case that all informed and uninformed voters abstain.

Rephrasing these results, we predict that when an informed voter receives a potentially false advertisement from her own party's candidate, she will not vote for the other candidate. Similarly, when the voter receives a potentially deceptive advertisement from the opposing candidate, she will not choose to vote for her own candidate. In both cases, the theory predicts that if the voter casts a ballot, she will vote for the candidate from whom she received the potentially deceptive advertisement. This is because the voter knows that the advertisement is

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<sup>11</sup> To rule out the case that all voters vote for their own candidate, we must assume that  $\varepsilon$  is sufficiently small compared to  $x_H - x_L$  and the informativeness of an ad, which is, however, satisfied for our parameterization.

more likely to be true than deceptive. The only case in which it is logical for some informed voters to abstain is when uninformed voters vote.

We prove the existence of three equilibria in deceptive campaigns (see Appendix II). One of those equilibria is the Abstention equilibrium that we found for truthful campaigns. In this equilibrium, uninformed voters abstain and informed voters vote according to the advertisement they received.

With regard to the other two equilibria, it is necessary to distinguish between informed voters who receive an advertisement from their own party's candidate and those who receive an advertisement from the other party's candidate. In these two equilibria, one group of informed voters votes according to the advertising received, while one group of informed voters abstains. All uninformed voters vote.<sup>12</sup> Specifically, an informed voter who receives an ad from her own (other) candidate votes for her own (other) candidate. Likewise, an informed voter who receives an ad from the other (own) candidate abstains, and an uninformed voter votes for their own (other) candidate.

The intuition for both equilibria is similar. Consider, for example, the equilibrium in which informed voters who receive an ad from the other candidate abstain. Why wouldn't it pay to vote for the other candidate? Consider the state of the world when the Circle candidate is of low quality and a voter who is leaning toward the Triangle party receives an ad from the Circle candidate. Since the Circle candidate is of low quality, Triangle ads are more likely. Thus, it is more likely that Circle-type voters will abstain and less likely that the Circle candidate will win. Consequently, voting for the Circle candidate rather than abstaining creates a relatively high chance of changing the outcome in favor of the low-quality Circle candidate. In the other state of the world, where the Circle candidate is of high quality, the logic is similar. Voters are more

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<sup>12</sup> These two equilibria exist given the parameters that we use in our experiments.

likely to receive ads from the high-quality Circle candidate; thus, Triangle-type voters are more likely to abstain and the Circle candidate is more likely to win. By voting for the Circle candidate, the chance of changing the outcome in favor of the high-quality Circle candidate is rather low. Since both states of the world are equally likely, it is better to abstain than to vote for the Circle candidate.

In Appendix II, we prove that, for the parameters we use in the experiment ( $N = 22$ ,  $x_H = 7.5$ ,  $x_L = 4.5$ ,  $\varepsilon = 0.5$ ,  $p = 0.2$ ,  $q = 0.05$ ), the “All vote equilibrium” that existed for truthful campaigns no longer exists in deceptive campaigns. The intuition is that, since some votes are based on false information (implying that both candidates receive votes and thus the election is closer than under truthful advertising), the likelihood of an uninformed vote changing the outcome to the low-quality candidate is sufficiently high to deter uninformed voting.

As mentioned in the introduction, the research closest to ours is that of Feddersen and Pesendorfer (FP 1999), who considered the effect of a noisy signal on voter behavior when the size of the electorate is uncertain. In contrast to our results, they found two types of voters: one who votes for her candidate irrespective of the signal she receives, and another who votes for candidate A as long as she does not receive information from candidate B. If the voter receives information from candidate B, FP’s voter abstains while our voter switches to candidate B.

### **II.2.2 Efficiency of Electoral Outcome – Deceptive Campaigns**

Again we consider the level of efficiency that is reached in equilibrium in the collective decision process relative to the first best. Compared to the case of truthful advertising, expected efficiency is lower in deceptive campaigns. The reason is that informed voting according to the received ad results in votes for the low-quality candidate (since some of the ads are false). This

increases the probability of electing the low-quality candidate. For the parameters  $N=22$ ,  $p=0.2$  and  $q=0.05$  used in the experiment, we simulated the probabilities for the high-quality candidate winning the election and for a tie.<sup>13</sup> In the Abstention equilibrium, the high-quality candidate wins with probability 0.91 and a tie results with probability 0.057. Thus, expected efficiency is about 0.938. In the other two equilibria, where informed voters abstain but uninformed voters vote, efficiency is lower (since not all information is used and uninformed voters vote). Here, the high-quality candidate wins with probability 0.786 and a tie results with probability 0.158. Therefore, expected efficiency is about 0.865.

### **III. Experiment Design**

The experiment was implemented entirely on computers using software created specifically for election experiments with campaign advertising. Subjects were seated in the laboratory at individual computer terminals. They could not see other subjects' decisions. Once seated, subjects completed the computerized instructions, which included an interactive quiz. A transcript of the instructions is given in Appendix I. After all subjects successfully completed the instructions, they were acquainted with the software interface and the "mouse-over" technology. First, subjects were told that mouse-clicking was not necessary during the experiment but that all decisions could be executed by moving the cursor over the appropriate area on the screen ("mouse-over"). Subjects were required to acknowledge the receipt of an advertisement. Due to this technology, subjects could not hear whether other subjects received an advertisement. Subjects practiced two interactive campaigns. In the practice rounds no money was earned. After the practice rounds, paid rounds began.

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<sup>13</sup> We ran a Monte Carlo simulation with one million draws to obtain these probabilities.

The experiment included multiple rounds. Candidates and advertising were automated in our experiment. Thus, all subjects were voters. In each round, half of the subjects were randomly assigned to each party (the experiment was always conducted using an even number of subjects). Political parties were represented by Triangle or Circle. A party's (automated) candidate was assigned a pattern, Striped or Solid, which represented a candidate's quality or ideological position.<sup>14</sup> In each round, one party's candidate was randomly assigned as Striped and the other one as Solid. Voters knew the party of each candidate (Triangle or Circle) but not the candidate's quality (Striped or Solid). We set voters' incentives such that all voters were swing voters: they preferred Striped to Solid candidates, but within a quality, they preferred a candidate of their own party. Hence, a voter's payoff depended on her own party assignment as well as the party and shading (Striped or Solid) of the winning candidate.

Table 2 shows the payoff of a voter. Payoffs are expressed in experimental dollars, which were converted at a known exchange rate (12 to 1) to US dollars at the end of the experiment. In addition, each subject received a 5 US dollars show-up fee. A round proceeded as follows: At the beginning of each round, subjects were assigned a party affiliation. Then, in a one-minute campaign period, automated candidates sent ads to the voters. Each voter received an ad with some probability as we describe below. After the campaign period, all subjects cast a vote for exactly one of the candidates or abstained from voting (each choice was an active choice). Voting was costless. The candidate receiving the majority of votes was declared the winner (ties were broken by a computerized random draw) and the outcome was announced to voters. Subjects were told the cumulative amount that they had earned over the course of the experiment. Then a new round began.

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<sup>14</sup> In the instructions we only refer to a candidate's pattern and do not use expressions like a candidate's quality.



We conducted two types of campaigns: truthful campaigns (“Treatment T”) and deceptive campaigns (“Treatment D”). During truthful campaigns, Striped candidates sent advertisements to voters providing truthful information that the candidate’s quality was Striped. During deceptive campaigns, Striped and Solid candidates sent advertisements. Advertisements sent by Striped candidates provided truthful information about the candidate’s quality. Advertisements from Solid candidates, however, falsely claimed that the candidate was Striped.

In total, each session included 39 or 40 campaigns and 22 potential voters. We used a within-subjects design, where campaign advertising treatments varied by round according to a predetermined (random) pattern.<sup>15</sup> Campaigns were split equally (or nearly equally in 39 campaign sessions) between the deceptive and truthful conditions. Subjects were not told how many campaigns were to be run in the experiment, nor the distribution of treatments. Before we began a campaign, we informed subjects about whether the campaign would be truthful or deceptive. In contrast to a between-subject design, the within-subject design allowed us to control for unobservable subject heterogeneity.

In truthful campaigns, the probability of receiving an ad from the Striped candidate was 0.2 for each voter. In deceptive campaigns, the probability of receiving an ad was 0.2 from the Striped candidate and 0.05 from the Solid candidate. Consequently, during any truthful campaign, some subjects might have seen one advertisement (from the Striped candidate) while others saw none. During any deceptive campaign, some subjects might have seen two advertisements (one ad from each candidate, occurring with probability  $pq=0.01$ ), some might have seen one advertisement (one ad from either the Striped or the Solid candidate, occurring with probability  $(1-p)(1-q)=0.76$ ), and some might have seen none (with probability  $p(1-q)+q(1-$

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<sup>15</sup> This predetermined pattern also included the random choice of candidates’ types which ensured they were high-quality in half (or, in 39 campaign sessions, nearly half) of campaigns.

p)=0.23). Comparing the two campaign advertising treatments enables us to analyze the effect of deceptive advertising on voter behavior, with particular attention to voter turnout, the identity of the elected candidate, and the efficiency of electoral outcomes.

#### **IV. Theoretical Predictions**

In this section, we summarize the equilibrium predictions of our model for voter behavior and efficiency of the electoral outcome.

##### **IV. I. Voter Behavior**

Given our parameterization in truthful campaigns, both the All vote and the Abstention equilibrium exist. We hypothesize, in line with both equilibrium predictions, that voters in truthful campaigns who receive an advertisement will vote for the candidate who sent the advertisement. We predict that those voters who do not receive an advertisement will either abstain from voting or vote for their own party's candidate. Further, we hypothesize that uninformed voters will be more likely to abstain. The reason is that the Abstention equilibrium has a higher efficiency than the All vote equilibrium.

According to our theoretical analysis and parameterization for deceptive campaigns, the Abstention equilibrium exists, but the All vote equilibrium does not. Likewise, we believe the two equilibria described in Section II are less likely due to their lower efficiency. Thus, we hypothesize that in deceptive campaigns, informed voters will generally vote for the candidate who sent them an ad, while uninformed voters will mainly abstain.<sup>16</sup> One of our central findings for deceptive campaigns was that a voter who receives a potentially false advertisement makes a

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<sup>16</sup> Since in deceptive campaigns three equilibria exist, the turnout decision of voters might be affected by observing whether other people decided to vote or not. Grosser and Schram (2006) experimentally analyze the effect of observability of other people's decisions and find that this information increases turnout.

suboptimal choice when she votes for the other candidate. Consequently, receiving a potentially deceptive advertisement should not cause a voter to vote against the candidate sending the advertisement. Otherwise, this would lead to a significant decrease in efficiency. Our experiments shed light on whether voters, when faced with the possibility that an advertisement is deceptive, follow this optimal strategy of not voting against the candidate who sent the advertisement.

#### **IV. 2. Efficiency of Electoral Outcomes**

As derived in Section II, expected efficiency in truthful campaigns is between 0.957 and 0.996. In deceptive campaigns, it is between 0.938 and 0.865 for our parameters. Thus, we hypothesize that efficiency in deceptive campaigns is lower.

#### **V. Results**

All subjects were recruited from George Mason University's student population via an automated recruitment mechanism. Subjects were in the laboratory for about one hour. They were paid privately at the end of the experiment and earned about \$25 on average. In total, 44 subjects participated in 39 or 40 two-candidate campaigns and elections. Overall, we observed 1,738 voting decisions.

In this section we investigate the effect of advertising on voting behavior and the efficiency of electoral outcomes in both truthful and deceptive campaigns. We begin by analyzing decisions of voters who received no advertisement (“uninformed voters”)<sup>17</sup>, followed

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<sup>17</sup> In the following we exclude voters who received two ads, yet the results do not change if we include them (two ads are received with empirical frequency 1.17% in the deceptive campaigns).

by the decisions of voters who received an advertisement (“informed voters”). Finally, we examine efficiency.

### **V.1. Uninformed Voters**

In true advertising campaigns 80% of all voters were uninformed. The number of uninformed voters (who received no advertisement) was 75% in deceptive campaigns. Naturally, these empirical frequencies correspond closely with the theoretical values of 80% and 76%, respectively, implied by our experiment design.

Table 3 reports that voting and abstention decisions of uninformed voters are similar between treatments (statistical differences are reported in section V.3 below). The overall fractions of abstentions are 25% and 24% in the true and deceptive ad treatments, respectively. The chance of voting for one’s own party’s candidate is 64% and 60% in these two cases. The likelihood of voting for the other party’s candidate is 11% when ads are true, and 17% when ads might include deceptive information. Thus, in contrast to our hypothesis that uninformed voters abstain, we find instead that a larger fraction of uninformed voters votes. In particular, voters tend to vote for their own party’s candidate. For both campaigns, however, voting one’s own party’s candidate is consistent with behavior in one of the less efficient equilibria.

### **V.2. Informed Voters**

Table 4 summarizes the decisions of informed voters in campaigns with true and deceptive advertisements. As predicted by theory, there are almost no abstentions for informed voters in truthful campaigns. Also, roughly the same number of voters vote for their own candidate (51%) and the other party’s candidate (48%), which makes sense in light of the fact that each candidate

is high-quality with probability 0.5. In campaigns with deceptive advertising, abstention rates are substantially higher (15%), while the likelihood of voting for the other party's candidate is only half as large as in truthful campaigns (25% vs. 48%). Higher abstention rates of informed voters in deceptive campaigns are consistent with our two equilibria in which informed voters abstain. Our theory, however, also predicts that informed voters should never vote for the candidate who did not send the ad. We address this issue in subsequent tables.

In relation to Table 3, it is worth noting that voters in truthful campaigns with truthful information are nearly five times more likely to vote for the other party's candidate than uninformed voters. In contrast, one observes smaller differences between informed and uninformed voters in deceptive campaigns: abstention rates are 15% and 24%, respectively, and the uninformed and informed voters are about equally (59.8% and 60.3%) likely to vote for their own party's candidate.

Overall, informed voters' decisions in deceptive campaigns do not follow the patterns observed for truthful campaigns. Instead, in deceptive campaigns, once-informed voters are more likely to abstain. Likewise, instead of voting for the candidate from whom they received the advertisement, they vote against that candidate by voting for the opposition candidate. Not voting for the candidate who sent the advertising is suboptimal and occurs most frequently when the advertisement came from the other party's candidate (see Table 4).

Table 5 describes the decisions of informed voters after receiving an advertisement from the other party's candidate in both treatments. We find, consistent with our theory, that an informed voter in the truthful environment votes according to the information received. 85% of voters who receive an advertisement from the other party's candidate vote for that candidate. In the deceptive treatment, however, only 42% of those voters switch when they receive the other

candidate's advertisement. The remainder choose to abstain (20%) or vote for their own party (38%). This occurs in spite of the fact that theory suggests the optimal decision is to vote for the other party's candidate or to abstain. According to our theoretical prediction, voting for one's own party after receiving a potentially deceptive advertisement from the other party's candidate is the "wrong" choice. Thus, it appears that the presence of incorrect information leads to suboptimal decisions.<sup>18</sup>

Table 6 presents the choices of informed voters when they receive an advertisement from their own party's candidate. In the truthful treatment, the overwhelming fraction (96%) of informed voters vote for their own party, as predicted by our theory. In the deception campaign this fraction drops to 80%. Again (as in Table 5), some voters make the suboptimal choice to vote for the other party's candidate.

### **V.3. Multinomial Analysis of Voting Decisions**

Next, we test our predictions within a random effects multinomial logistic regression framework. Our dependent variable is the voter's choice; that is, whether to vote for the voter's own candidate, to vote for the candidate from the other party, or to abstain. Our independent variables include a treatment dummy, which we code as zero for the truthful treatment and one for the deceptive treatment (Treatment D). We also include dummy variables for receiving an advertisement from the voter's own party's candidate or the other party's candidate (Ad from own candidate, Ad from other candidate). We omit the "receiving no advertisements" category. We account for individual heterogeneity by including individual random effects.

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<sup>18</sup>One might ask whether our results are influenced by the fact that individuals often tend to overweigh small probabilities. However, even if subjects in our experiment suffer from such a bias, they should realize that the chance of receiving truthful information is four times as high as receiving false information.

To test whether responses differ by treatment, we include an interaction between the treatment and whether the voter received an advertisement from either the own party's candidate or the other party's candidate. We implement this full set of interactions (Treatment D\*Ad from own candidate, Treatment D\*Ad from other candidate) when the observed outcome is "voting for the other party," but our data do not allow us to construct this full set of interactions when the observed outcome is "abstain." The reason is that "Ad from other candidate" and "Treatment D\*Ad from other candidate" are perfectly collinear. This perfect collinearity is explained by the fact that when advertising is truthful, we do not observe subjects abstaining when they receive an advertisement from the other candidate. Therefore, for the abstention category, we create a "Treatment D\*Seen ad" variable, where "Seen ad" equals one if either "Ad from own candidate" or "Ad from other candidate" equals one. To control for temporal effects we include the campaign number (Campaign) among our independent variables.

We present the results of the estimation in Table 7. The first column contains no interactions between the deception treatment and the candidate from whom subjects received an advertisement. The second column, however, contains these interactions. In these regressions, the coefficients are evaluated relative to the baseline outcome, which is voting for the voter's own party's candidate.

The top panel of Table 7 shows the determinants of voting for the other party's candidate. As predicted, receiving an advertisement from the voter's own party's candidate reduces the probability that the recipient will vote for the other party's candidate. Further, receiving an advertisement from the other party's candidate increases the likelihood that the voter will vote for the other party's candidate. We also find that in deceptive campaigns, uninformed voters are

more likely to vote for the other party's candidate when we include the interactions in column 2. This is consistent with one of our additional equilibria for deceptive campaigns.

The coefficient on the interactions between the deception treatment variable and the variables indicating who sent the advertisement once again indicate that the presence of false information leads voters to make suboptimal choices. In particular, our theory predicts that the point estimates on these interactions should all be zero, but they are not. For example, the coefficient of the interaction "Treatment D\*Ad from other candidate" is negative and statistically significant, indicating that subjects in the deception treatment who receive an advertisement are less likely to make the optimal choice to vote for the other party's candidate. Similarly, the estimation results indicate that, relative to the truthful treatment, the probability of voting for one's own party's candidate is lower when receiving a possibly deceptive advertisement from that candidate.

The bottom panel of Table 7 details the estimates for the decision to abstain. Here, the point estimates for having seen an advertisement from the voter's own party's candidate are negative and statistically significant, indicating that when voters receive an advertisement, they are less likely to abstain. However, the point estimate on having seen an ad from the other party's candidate is positive (in column 1), indicating that seeing an advertisement from the other party's candidate makes the voter more likely to abstain. This result, however, is due to the specification that does not allow for differences in responses between the two treatments. We see in Table 7, column 2 – which allows for differences in responses between the two treatments – that the point estimate on having seen an advertisement from the other party's candidate is negative and statistically significant. This indicates a lower chance of abstention when seeing an advertisement. Thus, information reduces abstention. This reduction is larger when voters



receive an advertisement from their own party's candidate than when they receive one from the other party's candidate.

The interaction effect between the deception treatment and having seen an advertisement is positive and statistically significant (Table 7, column 2). This is consistent with one of our predictions. The positive coefficient on the interaction shows that deception makes informed voters more likely to abstain. This result shows that even a small probability of deception lowers the probability that those voters who have information will vote in elections. If voters with truthful information decide to abstain due to the fact that they do not trust the information, this will increase the likelihood that the low payoff candidate will be elected, and result in a reduction in welfare. Finally, we find no evidence supporting temporal effects in the decision to vote for the other party's candidate, though there is some support for weakly positive effects in the decision to abstain.

#### **V.4. Efficiency of Electoral Outcomes**

To assess the effect of information on efficiency of electoral outcomes, we begin by investigating the effect of information between treatments. Table 8 shows that informed voters cast their ballot for the high-quality candidate when advertising is truthful, but fail to do so when advertising is deceptive. A reason, as discussed with Table 4, is that informed voters in the deception treatment appear to abstain rather than vote for the high-quality candidate. In particular, we find that 91% of informed voters vote for the high-quality candidate in the true advertising environment, and only 59% of informed voters vote for the high-quality candidate in the deception treatment. This is despite the greater than 4:1 odds that the information is accurate, and that the theoretically optimal decision is to vote for the candidate who sent the

advertisement. Comparing both treatments, we also find that in the deception treatment, when information is received, there is a four-fold increase in the likelihood of an informed voter casting a ballot for a low-quality candidate (Table 8).

These observations suggest deceptive advertising affects electoral outcome efficiency. As discussed above, our theoretical model predicts that efficiency under true advertising is about 0.95 to 0.99, while predicted efficiency is slightly lower, 0.87 to 0.94, when ads are deceptive. To measure efficiency empirically, we assign an efficiency value of 1 to an election where the Striped candidate wins, a value of 0.5 if there is a tie, and zero if the Solid candidate wins. So measured, mean efficiencies are 0.89 for Treatment T and 0.49 for Treatment D, and this difference is statistically significant (t-test,  $p = 0.00$ , two-tailed).<sup>19</sup> Thus, campaigns with deceptive advertising are much more likely than truthful campaigns to result in the election of a low-quality candidate. In particular, there would be an average efficiency of 0.5 (as we observe for Treatment D) if voters cast their votes randomly.

## **VI. Conclusion**

It is widely accepted that candidates do not always tell the truth during electoral campaigns. This raises the question of how deception influences voter behavior, turnout, and the overall efficiency of elections. In this paper, we address this question using laboratory experiments in which campaign advertising is exogenous and is either truthful or possibly deceptive. In line with previous studies that assume that advertising is truthful, we find that informative advertising leads to a higher turnout of informed voters. Yet voters make suboptimal choices when an advertisement has even a small chance of being deceptive. For example, we find that voters are reluctant to vote for the other party's candidate when they know they received a potentially

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<sup>19</sup> When we exclude ties, results do not change (t-test,  $p = 0.00$ , two-tailed).

deceptive advertisement from that candidate. Further, voters who do not receive an advertisement, but know that advertisements might be deceptive, are more likely to vote for the opposing party's candidate than when advertising is truthful.

These changes in behavior influence an election's outcome. The low pay-off candidate is more likely to be elected when deception is possible; consequently, the efficiency of the election outcome is lower in deceptive campaigns. Both 1) the decrease in efficiency; and 2) voters' reactions to a small probability of deception are much larger than predicted by our model that assumes rational behavior. Observed efficiency in deceptive campaigns is no higher than when voters cast their votes randomly.

An important open question is why relatively large changes in behavior occur in environments with small amounts of false information. It would be profitable to explore this with future theoretical research in economics and psychology. Our study of deception is a small step along a rich path for inquiry in theoretical, experimental and field research.

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## **Appendix I – 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, no talking, please. Please turn off all electronic devices. If you have any questions at any time during the experiment, or have any trouble with the computer, please raise your hand, and we will come to you to answer your question.

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 are finished reading a screen, click the <Next> button to continue.

### Overview

You are a voter in a series of election campaigns. At the beginning of each campaign you are randomly assigned to a party: either the Circle party or the Triangle party. At the end of each campaign you vote for either the Circle party candidate or the Triangle party candidate. The amount of money you earn in each campaign depends on whether the elected candidate is Striped or Solid. You earn more money if the elected candidate is Striped, regardless of the candidate's party affiliation.

Whether a party's candidate is Striped is random and can be different in each campaign. Candidates send advertisements saying that they are Striped.

These advertisements are true if they are made by a Striped candidate. The advertisement is false if it is made by a Solid candidate.

In each campaign you will make a voting decision.

We next describe the specifics of the experiment.

### Parties

You will be a voter assigned randomly to a political party. The two parties are the Circle Party and the Triangle Party. Each party will be represented by one candidate. There are an even number of voters, so in each campaign half the voters will be Circle party and half will be Triangle party.

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

*Question: If you are a Circle voter in campaign 1, how many times is it possible for you to be assigned to the Circle party in subsequent campaigns? A: None B: No limit C: 1 D: 2*

### Combinations of Striped and Solid Candidates

Whether a candidate is Striped or Solid is randomly determined at the beginning of each campaign. The two possible Striped and Solid candidate combinations are listed below. Both combinations are equally likely in any campaign.

(1) Circle candidate is Striped

Triangle candidate is Solid

(2) Circle candidate is Solid

Triangle candidate is Striped

### Candidate Advertisements

In some campaigns only Striped candidates advertise. In others Striped and Solid candidates advertise.

If candidates can send ads, they always advertise. You might not see a candidate's advertisement.

Striped candidates will advertise that they are striped. Solid candidate will also send advertisements, falsely claiming they are Striped.

In each campaign, your chance of seeing a Striped candidate's ad is 1 in 5. In campaigns in which Solid candidates can send ads (which claims that he or she is Striped) your chance of seeing a Solid candidate's ad is 1 in 20.

When you receive an ad, you will see a pop-up window alerting you that you have received an ad. Also, in the bottom panel of your screen, the shading of the candidate's symbol will change to Striped.

When Solid candidates advertise, a question mark will appear in the candidate's symbol as the candidate can actually be Solid or Striped.

### Voting

To make your voting decision, you will use the voting screen.

In each campaign you have the option to either vote or not to vote (that is, to abstain).

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. Ties will be broken randomly.

After everyone has voted, the election results will be shown to all participants. You will see the results along with your personal earnings for the campaign.

### Abstentions

“Abstain” means simply that you wish to cast a vote for neither candidate.

Choosing to vote or to abstain may affect the outcome of the election.

Your earnings depend on which candidate wins the election, and your earnings will be the same whether you voted for Circle, Triangle, or you chose to Abstain.

### How You Earn Money

Your earnings are determined by the election outcome. Potential earnings listed below are in experimental dollars, E\$, which will be converted to US dollars at a rate of E\$12 = \$1. The election outcome affects your earnings in one of four ways:

- \* The candidate in your party wins and that candidate is Striped: You earn E\$7.50.
- \* The other party’s candidate wins and that candidate is Striped: You earn E\$7.00.
- \* Your party’s candidate wins and that candidate is Solid: You earn E\$4.50.
- \* The other party’s candidate wins and that candidate is Solid: You earn E\$4.00.

Your earnings are always higher when the Striped candidate wins.

*Example Question: You are a Circle voter. A Striped Triangle candidate won the election. How much did you earn this round? A: E\$7.50 B: E\$7.00 C: E\$4.00 D: E\$4.50*

There will be multiple campaigns in this experiment. Your party affiliation will be randomly reassigned in each campaign.



Before each campaign begins, a screen will tell you your party affiliation for that campaign. It will also tell you whether only Striped or also Solid candidates send ads.

At the conclusion of the final campaign, a summary screen will display your total earnings including your show-up bonus.

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

Click the <Finished> button to begin the experiment.

## Appendix II - Equilibria in Voting Game

We consider a game with an even number of  $N \geq 2$  (potential) voters and two Candidates  $A$  and  $B$  (say  $A$  denotes the Circle party's candidate and  $B$  the Triangle party's candidate). There are two states of the world:  $HL$  (candidate  $A$  is the high type and  $B$  is the low type) and  $LH$  (candidate  $B$  is the high type and  $A$  the low type). Both states are equally likely. Half of the voters ( $n := N/2$ ) are labeled  $A$ -types, the other half  $B$ -types.  $A$ -types ( $B$ -types) have a slight preference for the  $A$  ( $B$ ) candidate based on a given quality of the candidate. The payoffs are as given in Table 1, where  $x_{AH}$  denotes the payoff for an  $A$ -type if  $A$  wins and is the high type (i.e. the own candidate is the high type and wins, thus  $x_{AH} = x_H$ , cf. Table 1). Other payoffs are denoted accordingly. A voter can decide whether to vote for her own party's candidate, the other party's candidate, or to abstain conditional on her information, i.e. conditional on the ads she may receive.

In the following, we derive the best response of an  $A$ -type voter for given strategies of the other  $n-1$   $A$ -types and the  $n$   $B$ -types. To do so, we first determine the expected payoffs for an uninformed  $A$ -type (who did not receive an ad and thus believes both states of the world are equally likely) if the  $A$ -type abstains (0), votes for the own candidate ( $A$ ) or votes for the other candidate ( $B$ ).  $Pr(P_0 | HL)$  denotes the probability of a tie given state  $HL$ ,  $Pr(P_A | HL)$  the probability that  $A$  lags by one vote given  $HL$ ,  $Pr(P_B | HL)$  means  $B$  lags by one vote given state  $HL$ , and similarly for state  $LH$ . Then, expected payoffs for an uninformed  $A$ -type are as follows (where we drop the payoff for the case that a voter is not pivotal, since then her vote choice does not matter and the payoff is identical regardless of her choice):

$$u_A(0) = \frac{1}{2} [Pr(P_0 | HL) \frac{1}{2} (x_{AH} + x_{BL}) + Pr(P_A | HL) x_{BL} + Pr(P_B | HL) x_{AH}]$$

$$+ \frac{1}{2} [Pr(P_0 | LH) \frac{1}{2} (x_{AL} + x_{BH}) + Pr(P_A | LH) x_{BH} + Pr(P_B | LH) x_{AL}]$$

$$u_A(A) = \frac{1}{2} [Pr(P_0 | HL) x_{AH} + Pr(P_A | HL) \frac{1}{2} (x_{AH} + x_{BL}) + Pr(P_B | HL) x_{AH}]$$

$$+ \frac{1}{2} [Pr(P_0 | LH) x_{AL} + Pr(P_A | LH) \frac{1}{2} (x_{AL} + x_{BH}) + Pr(P_B | LH) x_{AL}]$$

$$u_A(B) = \frac{1}{2} [Pr(P_0 | HL) x_{BL} + Pr(P_A | HL) x_{BL} + Pr(P_B | HL) \frac{1}{2} (x_{AH} + x_{BL})]$$

$$+ \frac{1}{2} [Pr(P_0 | LH) x_{BH} + Pr(P_A | LH) x_{BH} + Pr(P_B | LH) \frac{1}{2} (x_{BH} + x_{AL})]$$

First, we consider symmetric, pure strategy equilibria for truthful campaigns, then for deceptive campaigns.

### Truthful Campaigns

In truthful campaigns, voters receive an ad from the high-quality candidate with probability  $p$ . Thus, voters can only get an ad from one candidate (the high-quality candidate) in each state of the world. They can never get two ads.

As argued in the text, informed voters have the dominant strategy to vote for the candidate from whom they received the ad, i.e. a voter who received an ad from her own (other) candidate has the dominant strategy to vote for her own (other) candidate. Thus, it cannot be an equilibrium that voters always vote for their own candidate. The reason is that if a voter receives an ad from the other candidate, she is better off voting for that candidate. Similarly, it cannot be an equilibrium that voters always vote for the other candidate or always abstain.<sup>20</sup>

Given the behavior of informed voters, we now turn to the behavior of the uninformed. First, we determine whether uninformed voters can abstain in equilibrium. Under the assumption that uninformed voters abstain and ads are truthful, the probability of a tie when there are  $n-1$   $A$ -types and  $n$   $B$ -types is exactly the probability that no one gets an ad. Otherwise all informed voters would vote for the high-quality candidate so that a tie is impossible since uninformed voters abstain. This holds true for state  $HL$  as well as for state  $LH$ . The probability that  $A$  lags by one vote in state  $HL$  must be zero since only the high type ( $A$ ) can send ads. Thus, there will either be a tie or  $A$  will lead. Similarly, the probability that  $B$  lags in state  $LH$  must be zero. The probability that  $A$  leads by exactly one vote in state  $HL$  (and similarly the probability that  $B$  leads by one vote in state  $LH$ ) equals the probability that exactly one voter receives an ad and thus votes for the high-quality candidate.

Using these results, expected payoffs for an uninformed  $A$ -type become:

$$u_A(0) = \frac{1}{2} [P_0 \frac{1}{2} (x_{AH} + x_{BL}) + P_1 x_{AH} + P_0 \frac{1}{2} (x_{AL} + x_{BH}) + P_1 x_{BH}]$$

$$u_A(A) = \frac{1}{2} [P_0 x_{AH} + P_1 x_{AH} + P_0 x_{AL} + P_1 \frac{1}{2} (x_{AL} + x_{BH})]$$

$$u_A(B) = \frac{1}{2} [P_0 x_{BL} + P_1 \frac{1}{2} (x_{AH} + x_{BL}) + P_0 x_{BH} + P_1 x_{BH}]$$

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<sup>20</sup> Note that because we restrict to symmetric pure strategy equilibria, we do not consider equilibria of the kind that all voters vote for one candidate, e.g., the Circle candidate. Assuming that informed voters vote for the high-quality candidate even if they are indifferent (i.e. when they are never pivotal), would also rule out such equilibria.

where  $P_0 := Pr(P_0 | HL) = Pr(P_0 | LH) = (1-p)^{2n-1}$  and  $P_1 := Pr(P_B | HL) = Pr(P_A | LH) = (2n-1)p(1-p)^{2n-2}$ .

Is it a best response for an uninformed A-type voter to abstain? The payoff difference between abstaining and voting for candidate A is

$$u_A(0) - u_A(A) = \frac{1}{4} [P_0(x_{BH} - x_{AH} + x_{BL} - x_{AL}) + P_1(x_{BH} - x_{AL})].$$

Plugging in  $P_0$  and  $P_1$  as derived above the difference becomes

$$u_A(0) - u_A(A) = \frac{1}{4} (1-p)^{2n-2} [(1-p)(x_{BH} - x_{AH} + x_{BL} - x_{AL}) + (2n-1)p(x_{BH} - x_{AL})].$$

For our payoff parameters this difference becomes

$$u_A(0) - u_A(A) = \frac{1}{4} (1-p)^{2n-2} [(1-p)(-2\varepsilon) + (2n-1)p \cdot (x_H - x_L - \varepsilon)].$$

As  $x_H - x_L > \varepsilon > 0$  and  $n \geq 1$ , this difference is positive if  $p \geq \frac{2\varepsilon}{2\varepsilon + (x_H - x_L - \varepsilon)(2n-1)}$ . Thus, the uninformed voter abstains rather than votes for her own candidate if  $p$  is sufficiently large.<sup>21</sup>

She also does not want to vote for the other candidate but rather abstains:

$$u_A(0) - u_A(B) = \frac{1}{4} [(P_0 + P_1)(x_{AH} - x_{BL}) + P_0(x_{AL} - x_{BH})] > 0 \text{ (since } x_{AH} - x_{BL} > x_{BH} - x_{AL} \text{)}.$$

As argued earlier, informed voters perfectly know the state of the world; thus, their best response is always to vote for the high-quality candidate. Hence, we have established the following result.

**Result 1:** *There exists an equilibrium, in which the uninformed voters abstain and the informed ones vote for the candidate who sent the ad (i.e. the high-quality candidate) if*

$$p \geq \frac{2\varepsilon}{2\varepsilon + (x_H - x_L - \varepsilon)(2n-1)}.$$

Next, we ask whether uninformed voters can vote for their own candidate in equilibrium. Given that uninformed voters vote for their own candidate, then no one abstains (as the informed voters vote for the high-quality candidate). Hence, when all  $2n-1$  voters vote – all but our A-type voter – the probability of a tie is zero:  $2n-1$  is an uneven number and no one abstains. The

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<sup>21</sup> Note that the threshold is positive and smaller than 1 as  $x_H - x_L > \varepsilon > 0$ .

probability that  $A$  lags by one vote in state  $HL$  need no longer be zero since uninformed voters vote for their own candidate. Since candidate  $A$  receives at least  $n-1$  votes (as all  $A$ -types vote for him in state  $HL$  irrespective of whether they receive an ad or not), this probability equals the probability that either no voter receives an ad or only  $A$ -types receive ads, i.e. the probability that no  $B$ -type receives an ad. Then  $B$  gets exactly one vote more than  $A$  as there are  $n$   $B$ -types and  $n-1$   $A$ -types. As soon as one  $B$ -type would receive an ad – independent of whether the  $A$ -types are informed or not –  $A$  would get more ads than  $B$  because the minimum number of votes for  $A$  is  $n-1$ . Thus,  $Pr(P_A | HL) = (1-p)^n$ . The probability that  $B$  lags by one in state  $LH$ , however, is still zero, i.e.  $Pr(P_B | LH) = 0$ , as only  $B$  can send ads:  $B$  receives a minimum of  $n$  votes from the  $B$ -types whether these are informed or not, and if an  $A$ -type receives an ad, she also votes for  $B$ . The probability that  $B$  lags by one vote in state  $HL$  equals the probability that exactly one  $B$ -type receives an ad. There are at least  $n-1$  votes for  $A$ . If exactly one  $B$ -type becomes informed and thus votes for  $A$  instead of  $B$ ,  $B$  lags by one vote as  $A$  gets  $n$  votes and  $B$   $n-1$ . Thus,  $Pr(P_B | HL) = np(1-p)^{n-1}$ . The probability that  $A$  lags by one vote in state  $LH$  equals the probability that no  $A$ -type receives an ad. Since  $B$  now receives at least  $n$  votes from the  $B$ -types, only if no  $A$ -type switches,  $B$  leads by exactly one vote, i.e.

$$Pr(P_A | LH) = (1-p)^{n-1}.$$

The payoff difference between abstaining and voting for candidate  $A$  for the uninformed  $A$ -type is

$$u_A(0) - u_A(A) = \frac{1}{4}[(x_{BL} - x_{AH})(Pr(P_A | HL) + Pr(P_0 | HL)) + (x_{BH} - x_{AL})(Pr(P_0 | LH) + Pr(P_A | LH))].$$

Plugging in the derived Pivot probabilities and the payoff parameters, this difference becomes

$$u_A(0) - u_A(A) = \frac{1}{4}(1-p)^{n-1}[(x_{BL} - x_{AH})(1-p) + (x_{BH} - x_{AL})] = \frac{1}{4}(1-p)^{n-1}[(x_H - x_L + \varepsilon)p - 2\varepsilon].$$

Thus, an uninformed  $A$ -type votes for the own candidate if  $p \leq \frac{2\varepsilon}{x_H - x_L + \varepsilon}$  as  $x_H - x_L > \varepsilon > 0$ .<sup>22</sup>

Moreover, it is also better for her to vote for her own candidate than for the other one as

$$u_A(A) - u_A(B) = \frac{1}{2}[(x_{AH} - x_{BL})(Pr(P_0 | HL) + \frac{1}{2}(Pr(P_A | HL) + Pr(P_B | HL))) + (x_{AL} - x_{BH})(Pr(P_0 | LH) + \frac{1}{2}(Pr(P_A | LH) + Pr(P_B | LH)))]$$

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<sup>22</sup> Note that the threshold is positive and smaller than 1 as  $x_H - x_L > \varepsilon > 0$ .

$$= \frac{1}{4}(1-p)^{n-1}[(1-p+np)(x_{AH} - x_{BL}) + (x_{AL} - x_{BH})] > 0$$

since  $n \geq 1$  and  $x_{AH} - x_{BL} > x_{BH} - x_{AL}$ .

**Result 2:** *There exists an equilibrium in which uninformed voters vote for their own candidate and informed ones vote for the candidate from which they received the ad if  $p \leq \frac{2\varepsilon}{x_H - x_L + \varepsilon}$ .*

Note that the threshold for  $p$  in the equilibrium in which the uninformed abstain is smaller than the one in the equilibrium in which the uninformed vote the own candidate if  $\varepsilon(n-1) \leq (x_H - x_L)(n-1)$ , which holds true because  $n \geq 1$  and  $x_H - x_L > \varepsilon$ . This implies that for  $p$  sufficiently small only the second equilibrium exists, for  $p$  sufficiently large only the first one exists, and for  $\frac{2\varepsilon}{2\varepsilon + (x_H - x_L - \varepsilon)(2n-1)} \leq p \leq \frac{2\varepsilon}{x_H - x_L + \varepsilon}$  both equilibria exist.

Next, we show that it cannot be an equilibrium that uninformed voters vote for the other party's candidate, and informed voters vote for the high-quality candidate. The Pivot-probabilities for this case are as follows:  $Pr(P_A | HL) = 0$  as all  $B$ -types vote for  $A$ , thus  $A$  gets at least  $n$  votes for sure. In order for  $A$  to lag by one vote in state  $LH$  all  $B$ -types except for one (who then votes for  $B$ ) need to get no ad so that they vote for  $A$  since all  $A$ -types vote for  $B$ , i.e.

$Pr(P_A | LH) = n(1-p)^{n-1}p$ .  $B$  lags by one vote in state  $HL$  if all  $A$ -types vote for  $B$  (i.e. all  $A$ -types uninformed), and thus,  $Pr(P_B | HL) = (1-p)^{n-1}$  as all  $B$ -types vote for  $A$  (as  $B$  sends no ads). Similarly,  $Pr(P_B | LH) = (1-p)^n$  as all  $A$ -types vote for  $B$  (as  $A$  sends no ads), and thus only if all  $B$ -types vote for  $A$  (i.e. all  $B$ -types uninformed),  $B$  lags by one vote. Moreover, since no one abstains, ties are not possible if  $2n-1$  voters vote (before our  $A$ -type votes). Then, the payoff difference between abstaining and voting for the other candidate for our uninformed  $A$ -type becomes

$$\begin{aligned} u_A(0) - u_A(B) &= \frac{1}{4}[(x_{AH} - x_{BL})(Pr(P_B | HL) + Pr(P_0 | HL)) + (x_{AL} - x_{BH})(Pr(P_0 | LH) + Pr(P_B | LH))] \\ &= 1/4(1-p)^{n-1}[(x_{AH} - x_{BL}) + (1-p)(x_{AL} - x_{BH})] > 0 \quad (\text{since } x_{AH} - x_{BL} > x_{BH} - x_{AL}), \end{aligned}$$

i.e. it would be better for the uninformed voter to abstain than to vote for the other candidate.

Thus, the aforementioned strategy profile cannot be an equilibrium.

## Deceptive Campaigns

In deceptive campaigns the low-quality candidate also sends ads. Hence, voters can receive zero, one, or two ads now. a voter receives an ad from the high-quality candidate with probability  $p$ , and from the low-quality candidate with probability  $q$ . We assume that  $p > q$ . If a voter receives no ad at all, she only knows that each state realizes with  $1/2$ . If she receives an ad from her own candidate, she knows that the ad is true with probability

$$t = \frac{p(1-q)}{p(1-q) + q(1-p)}.$$

Note that  $t > 1/2$  as  $p > q$ .

For an  $A$ -type, this means she expects that she is in state  $HL$  with probability  $t$  and in  $LH$  with  $1-t$ . Similarly, if an  $A$ -type only receives an ad from the other candidate, she expects that she is in state  $HL$  with probability  $1-t$  and in  $LH$  with  $t$ . If a voter receives an ad from both candidates, she knows that each ad is true with probability  $1/2$  and thus that both states are equally likely. Note that this implies that voters who receive none and voters who receive two ads are both “uninformed.” Therefore, their expected payoff is identical and thus their behavior in equilibrium is identical. If we refer to “uninformed” voters in the following, we refer to those voters who receive zero or two ads, and by “informed” voters we denote those voters who receive exactly one ad. Note that expected payoffs for an uninformed  $A$ -type if the  $A$ -type abstains ( $0$ ), votes for own candidate ( $A$ ) or votes for other candidate ( $B$ ) are as before for truthful campaigns (yet, the Pivot-probabilities change). The payoff differences between the different actions the uninformed  $A$ -type can choose are as follows:

$$\begin{aligned} u_A(0) - u_A(A) &= \frac{1}{4}[(x_{BL} - x_{AH})(Pr(P_A | HL) + Pr(P_0 | HL)) + (x_{BH} - x_{AL})(Pr(P_0 | LH) + Pr(P_A | LH))], \\ u_A(0) - u_A(B) &= \frac{1}{4}[(x_{AH} - x_{BL})(Pr(P_B | HL) + Pr(P_0 | HL)) + (x_{AL} - x_{BH})(Pr(P_0 | LH) + Pr(P_B | LH))], \\ u_A(A) - u_A(B) &= \frac{1}{2}[(x_{AH} - x_{BL})(Pr(P_0 | HL) + \frac{1}{2}(Pr(P_A | HL) + Pr(P_B | HL))) \\ &\quad + (x_{AL} - x_{BH})(Pr(P_0 | LH) + \frac{1}{2}(Pr(P_A | LH) + Pr(P_B | LH)))]. \end{aligned}$$

We obtain the expected payoffs for an informed  $A$ -type who receives an ad from  $A$  or  $B$ , respectively, if she votes for  $A$ ,  $B$  or abstains, by substituting  $t$  and  $1-t$  for the probabilities of  $1/2$  for the states of the world in the expected payoff formulas for an uninformed  $A$ -type that we derived for truthful campaigns where we denote the expected payoff on an  $A$ -type who received an ad from  $A$  by  $u_A(\cdot | ad : A)$  and similarly by  $u_A(\cdot | ad : B)$  if she received an ad from  $B$ . The

payoff differences when choosing different actions given the A-type received an ad from A or B become:

$$u_A(0 | ad : A) - u_A(A | ad : A) = \frac{1}{2} [t(x_{BL} - x_{AH})(Pr(P_A | HL) + Pr(P_0 | HL)) \\ + (1-t)(x_{BH} - x_{AL})(Pr(P_0 | LH) + Pr(P_A | LH))],$$

$$u_A(B | ad : A) - u_A(A | ad : A) = [t(x_{BL} - x_{AH})(Pr(P_0 | HL) + 1/2(Pr(P_A | HL) + Pr(P_B | HL))) \\ + (1-t)(x_{BH} - x_{AL})(Pr(P_0 | LH) + 1/2(Pr(P_A | LH) + Pr(P_B | LH)))],$$

$$u_A(B | ad : A) - u_A(0 | ad : A) = \frac{1}{2} [t(x_{BL} - x_{AH})(Pr(P_0 | HL) + Pr(P_B | HL)) \\ + (1-t)(x_{BH} - x_{AL})(Pr(P_0 | LH) + Pr(P_B | LH))],$$

$$u_A(0 | ad : B) - u_A(B | ad : B) = \frac{1}{2} [(1-t)(x_{AH} - x_{BL})(Pr(P_B | HL) + Pr(P_0 | HL)) \\ + t(x_{AL} - x_{BH})(Pr(P_0 | LH) + Pr(P_B | LH))],$$

$$u_A(A | ad : B) - u_A(B | ad : B) = [(1-t)(x_{AH} - x_{BL})(Pr(P_0 | HL) + 1/2(Pr(P_A | HL) + Pr(P_B | HL))) \\ + t(x_{AL} - x_{BH})(Pr(P_0 | LH) + 1/2(Pr(P_A | LH) + Pr(P_B | LH))],$$

$$u_A(A | ad : B) - u_A(0 | ad : B) = \frac{1}{2} [(1-t)(x_{AH} - x_{BL})(Pr(P_0 | HL) + Pr(P_A | HL)) \\ + t(x_{AL} - x_{BH})(Pr(P_0 | LH) + Pr(P_A | LH))].$$

First, we show in Steps 1-3 that in equilibrium voters who received an ad from their own candidate cannot vote for the other candidate. To show this, we again consider the best response of an  $A$ -type for given strategies of the other  $n-1$   $A$ -types and the  $n$   $B$ -types.

**Step 1:** We show that it cannot be that informed voters who received an ad from the own candidate vote for the other candidate and those who received an ad from the other candidate vote for their own candidate – irrespective of the behavior of the uninformed. Suppose to the contrary these strategies were best responses, then in particular



$U_A(B|ad: A) - U_A(A|ad: A) \geq 0$  and  $U_A(A|ad: B) - U_A(B|ad: B) \geq 0$  have to be satisfied. This implies

$$\frac{t(x_{AH} - x_{BL})}{(1-t)(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + 1/2(Pr(P_A | LH) + Pr(P_B | LH))}{Pr(P_0 | HL) + 1/2(Pr(P_A | HL) + Pr(P_B | HL))} \leq \frac{(1-t)(x_{AH} - x_{BL})}{t(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $1-t < t$ .

**Step 2:** We show that it cannot be that informed voters who receive an ad from their own candidate vote for the other candidate and those who receive an ad from the other candidate abstain – irrespective of the behavior of the uninformed. Suppose to the contrary these strategies were best responses, then in particular

$U_A(B|ad: A) - U_A(0|ad: A) \geq 0$  and  $U_A(0|ad: B) - U_A(B|ad: B) \geq 0$  have to be satisfied. This implies

$$\frac{t(x_{AH} - x_{BL})}{(1-t)(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + Pr(P_B | LH)}{Pr(P_0 | HL) + Pr(P_B | HL)} \leq \frac{(1-t)(x_{AH} - x_{BL})}{t(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $1-t < t$ .

**Step 3:** We show that it cannot be that informed voters who receive an ad from their own candidate vote for the other candidate and those who receive an ad from the other candidate vote for the other candidate – irrespective of the behavior of the uninformed.

*Step 3.1:* The uninformed abstain.

Suppose to the contrary these strategies were best responses, then in particular

$U_A(B|ad: A) - U_A(0|ad: A) \geq 0$  and  $U_A(0) - U_A(B) \geq 0$  have to be satisfied. This implies

$$\frac{t(x_{AH} - x_{BL})}{(1-t)(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + Pr(P_B | LH)}{Pr(P_0 | HL) + Pr(P_B | HL)} \leq \frac{(x_{AH} - x_{BL})}{(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $t/(1-t) > 1$ .

*Step 3.2:* The uninformed vote for the own candidate.

Suppose to the contrary these strategies were best responses, then in particular

$U_A(B|ad: A) - U_A(A|ad: A) \geq 0$  and  $U_A(A) - U_A(B) \geq 0$  have to be satisfied. This implies

$$\frac{t(x_{AH} - x_{BL})}{(1-t)(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + 1/2(Pr(P_A | LH) + Pr(P_B | LH))}{Pr(P_0 | HL) + 1/2(Pr(P_A | HL) + Pr(P_B | HL))} \leq \frac{(x_{AH} - x_{BL})}{(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $t/(1-t) > 1$ .

*Step 3.3:* The uninformed vote for the other candidate.

This means that all voters vote for the other candidate. Since there are  $n$   $B$ -types this means that  $A$  wins if the  $A$ -type abstains or votes for  $A$ . If she votes for  $B$  there is a tie.

If the voter is informed about  $A$ , her payoffs are

$$u_A(0 | ad : A) = tx_{AH} + (1-t)x_{AL}$$

$$u_A(A | ad : A) = tx_{AH} + (1-t)x_{AL}$$

$$u_A(B | ad : A) = 1/2[t(x_{BL} + x_{AH}) + (1-t)(x_{BH} + x_{AL})]$$

Thus, voting for  $B$  cannot be optimal since

$$\begin{aligned} U_A(B | ad : A) - U_A(0 | ad : A) &= U_A(B | ad : A) - U_A(A | ad : A) \\ &= 1/2[t(x_{BL} - x_{AH}) + (1-t)(x_{BH} - x_{AL})] < 0 \end{aligned}$$

as  $t > 1-t$  (as  $t > 1/2$ ) and  $x_{AH} - x_{BL} > x_{BH} - x_{AL}$ .

This establishes Result 3:

**Result 3:** *Voters who receive an ad from the own candidate never vote for the other candidate in equilibrium.*

Next, we show in Steps 4-6 that in equilibrium voters who receive an ad from the other candidate never vote for their own candidate.

**Step 4:** We already know from Step 1 that it cannot be that in equilibrium voters who receive an ad from the other candidate vote for their own candidate and those who receive an ad from their own candidate vote for the other candidate.

**Step 5:** We show that it cannot be that voters who receive an ad from the other candidate vote for their own candidate and those who receive an ad from their own candidate abstain – irrespective of the behavior of the uninformed. Suppose to the contrary these strategies were best responses, then in particular

$U_A(0 | ad : A) - U_A(A | ad : A) \geq 0$  and  $U_A(0 | ad : B) - U_A(A | ad : B) \leq 0$  have to be satisfied. This implies

$$\frac{t(x_{AH} - x_{BL})}{(1-t)(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + Pr(P_A | LH)}{Pr(P_0 | HL) + Pr(P_A | HL)} \leq \frac{(x_{AH} - x_{BL})}{(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $t/(1-t) > 1$ .

**Step 6:** We show that it cannot be that voters who receive an ad from the other candidate and those who receive an ad from the own candidate vote for the own candidate – irrespective of the behavior of the uninformed.

*Step 6.1:* The uninformed abstain.

Suppose these strategies were best responses, then in particular

$U_A(0 | ad : B) - U_A(A | ad : B) \leq 0$  and  $U_A(0) - U_A(A) \geq 0$  have to be satisfied. This implies

$$\frac{t(x_{BH} - x_{AL})}{(1-t)(x_{AH} - x_{BL})} \leq \frac{Pr(P_0 | HL) + Pr(P_A | HL)}{Pr(P_0 | LH) + Pr(P_A | LH)} \leq \frac{(x_{BH} - x_{AL})}{(x_{AH} - x_{BL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $t/(1-t) > 1$ .

*Step 6.2:* The uninformed vote for the other candidate.

Suppose these strategies were best responses, then in particular

$U_A(A | ad : B) - U_A(B | ad : B) \geq 0$  and  $U_A(A) - U_A(B) \leq 0$  have to be satisfied. This implies

$$\frac{(x_{AH} - x_{BL})}{(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + 1/2(Pr(P_A | LH) + Pr(P_B | LH))}{Pr(P_0 | HL) + 1/2(Pr(P_A | HL) + Pr(P_B | HL))} \leq \frac{(1-t)(x_{AH} - x_{BL})}{t(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $(1-t)/t < 1$ .

*Step 6.3:* The uninformed vote for the own candidate (i.e. all voters vote for the own candidate).

Since there are  $n$   $B$ -types this means that  $B$  wins if the  $A$ -type abstains or votes for  $B$ . If she votes for  $A$  there is a tie. If she is informed about  $B$ , her expected payoffs are

$$u_A(0 | ad : B) = (1-t)x_{BL} + tx_{BH}$$

$$u_A(A | ad : B) = \frac{1}{2}[(1-t)(x_{BL} + x_{AH}) + t(x_{BH} + x_{AL})]$$

$$u_A(B | ad : B) = (1-t)x_{BL} + tx_{BH}$$

Thus, she votes for the own candidate if

$$\begin{aligned}
u_A(A|ad: B) - u_A(0|ad: B) &= u_A(A|ad: B) - u_A(B|ad: B) \\
&= 1/2[(1-t)(x_{AH} - x_{BL}) + t(x_{AL} - x_{BH})] \geq 0.
\end{aligned}$$

$$\text{This holds true if } \frac{1-t}{t} \geq \frac{(x_{BH} - x_{AL})}{(x_{AH} - x_{BL})} = \frac{(x_H - \varepsilon - x_L)}{(x_H - x_L + \varepsilon)} \Leftrightarrow \varepsilon \geq (2t-1)(x_H - x_L).$$

This condition is not satisfied for the parameters used in our experiment.

This establishes Result 4:

**Result 4:** *There is no equilibrium in which the voters who receive an ad from the other candidate vote for their own candidate.*

We now turn to the cases in which informed voters vote for the candidate from whom they receive the ad. We consider the voting decision of the remaining  $A$ -type when all other  $2n-1$  voters ( $n-1$   $A$ -types and  $n$   $B$ -types) follow the specified strategy.

*Case 1:* The uninformed voters abstain.

We simulated the Pivot-probabilities<sup>23</sup> the remaining  $A$ -type faces for  $n=11$ ,  $p=0.2$ ,  $q=0.05$  under the assumption that uninformed voters abstain and the informed ones vote for the candidate who sent the ad:

$$Pr(P_0|HL) = 0.061929, \quad Pr(P_B|HL) = 0.11642, \quad Pr(P_A|HL) = 0.025067,$$

$$Pr(P_0|LH) = 0.061746, \quad Pr(P_B|LH) = 0.024971, \quad Pr(P_A|LH) = 0.11643.$$

Plugging in the simulated values,  $t$ , and our payoff parameters<sup>24</sup>, the signs of the aforementioned payoff differences become:

$$u_A(0) - u_A(A) > 0 \quad \text{and} \quad u_A(0) - u_A(B) > 0,$$

$$u_A(0|ad: A) - u_A(A|ad: A) < 0 \quad \text{and} \quad u_A(B|ad: A) - u_A(A|ad: A) < 0,$$

$$u_A(0|ad: B) - u_A(B|ad: B) < 0 \quad \text{and} \quad u_A(A|ad: B) - u_A(B|ad: B) < 0.$$

Thus, all payoff differences are in line with the specified strategy, which establishes Result 5:

<sup>23</sup> We used Monte Carlo simulations with one million draws.

<sup>24</sup> One can show that all conditions are satisfied if  $x_H - x_L > 3\varepsilon$ .

**Result 5:** For our parameters, there exists an equilibrium in which the informed voters vote for the candidate from whom they receive the ad and the uninformed abstain.

Case 2: The uninformed vote for their own candidate.

Again, we simulated the Pivot-probabilities for  $n = 11$ ,  $p = 0.2$ ,  $q = 0.05$  now under the assumption that the uninformed vote for the own candidate and the informed vote for the candidate who sent the ad:

$$Pr(P_0 | HL) = 0, Pr(P_B | HL) = 0.26122, Pr(P_A | HL) = 0.15001,$$

$$Pr(P_0 | LH) = 0, Pr(P_B | LH) = 0.055691, Pr(P_A | LH) = 0.18081.$$

For the simulated values  $u_A(0 | ad : B) - u_A(B | ad : B) > 0$  as  $x_{AH} - x_{BL} > x_{BH} - x_{AL}$ . Thus, the aforementioned strategy profile cannot be an equilibrium.

**Result 6:** For our parameters, there exists no equilibrium in which the informed voters vote for the candidate from whom they receive the ad and the uninformed vote for their own candidate.

Case 3: The uninformed vote for the other candidate.

Again, we simulated the Pivot-probabilities for  $n = 11$ ,  $p = 0.2$ ,  $q = 0.05$  now under the assumption that the uninformed vote for the other candidate, while the informed vote for the candidate from whom they received the ad:

$$Pr(P_0 | HL) = 0, Pr(P_B | HL) = 0.056133, Pr(P_A | HL) = 0.18088,$$

$$Pr(P_0 | LH) = 0, Pr(P_B | LH) = 0.14916, Pr(P_A | LH) = 0.26076.$$

Plugging in the simulated values and t,  $u_A(0) - u_A(B) > 0$  as  $x_{AH} - x_{BL} > x_{BH} - x_{AL}$  and thus, there exists no equilibrium in which the informed voters vote for the candidate from whom they receive the ad and the uninformed vote for the other candidate.

In all 9 remaining symmetric pure strategy equilibrium candidates, some or all informed voters abstain, if not all abstain, the others vote for the candidate who sent the ad.

First, we show that it cannot be that those voters who receive an ad from their own (other) candidate abstain but the uninformed voters vote for their own (other) candidate – irrespective of what the respective other informed voters do.

Case 1: Voters who receive an ad from their own candidate abstain and the uninformed vote for their own candidate.

Suppose these strategies were best responses, then in particular

$U_A(0 | ad : A) - U_A(A | ad : A) \geq 0$  and  $U_A(0) - U_A(A) \leq 0$  have to be satisfied. This implies

$$\frac{t(x_{AH} - x_{BL})}{(1-t)(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + Pr(P_A | LH)}{Pr(P_0 | HL) + Pr(P_A | HL)} \leq \frac{(x_{AH} - x_{BL})}{(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $(1-t)/t < 1$ .

*Case 2:* Voters who receive an ad from the other candidate abstain and the uninformed vote for the other candidate.

Suppose these strategies were best responses, then in particular

$U_A(0 | ad : B) - U_A(B | ad : B) \geq 0$  and  $U_A(0) - U_A(B) \leq 0$  have to be satisfied. This implies

$$\frac{(x_{AH} - x_{BL})}{(x_{BH} - x_{AL})} \leq \frac{Pr(P_0 | LH) + Pr(P_B | LH)}{Pr(P_0 | HL) + Pr(P_B | HL)} \leq \frac{(1-t)(x_{AH} - x_{BL})}{t(x_{BH} - x_{AL})}.$$

This cannot hold true since  $0.5 < t < 1$  and thus  $(1-t)/t < 1$ .

**Result 7:** *It cannot be that in equilibrium those voters who receive an ad from their own (other) candidate abstain but the uninformed voters vote for their own (other) candidate – irrespective of what the respective other informed voters do.*

Next, we consider whether it can be that informed voters abstain if they receive an ad from the other candidate but vote for the own candidate if they receive his ad. For these cases, we cannot make a general equilibrium prediction but have to use our parameterization.

*Case 1:* The uninformed abstain.

We simulated the Pivot-probabilities for  $n = 11$ ,  $p = 0.2$ ,  $q = 0.05$  under the assumption that all voters but our A-type follow the specified strategy:

$$Pr(P_0 | HL) = 0.1804, Pr(P_B | HL) = 0.28193, Pr(P_A | HL) = 0.055559,$$

$$Pr(P_0 | LH) = 0.15063, Pr(P_B | LH) = 0.043367, Pr(P_A | LH) = 0.26068.$$

Plugging in the simulated values and  $t$ ,  $u_A(0 | B) - u_A(B | B) < 0$  and thus, there exists no equilibrium in which voters abstain if they receive an ad from the other candidate or are uninformed but vote for the own candidate if they receive his ad.

*Case 2:* The uninformed vote for the own candidate.

We simulated the Pivot-probabilities the remaining A-type faces for  $n = 11$ ,  $p = 0.2$ ,  $q = 0.05$  under the assumption that all voters but our A-type follow the specified strategy:

$$Pr(P_0 | HL) = 0.26068, Pr(P_B | HL) = 0.26377, Pr(P_A | HL) = 0.14978,$$

$$Pr(P_0 | LH) = 0.05587, Pr(P_B | LH) = 0.009698, Pr(P_A | LH) = 0.18142.$$

Plugging in the simulated values,  $t$ , and our payoff parameters, the signs of the aforementioned payoff differences become:

$$u_A(0) - u_A(A) < 0 \text{ and } u_A(A) - u_A(B) > 0$$

$$u_A(0 | ad : A) - u_A(A | ad : A) < 0 \text{ and } u_A(B | ad : A) - u_A(A | ad : A) < 0,$$

$$u_A(0 | ad : B) - u_A(B | ad : B) > 0 \text{ and } u_A(A | ad : B) - u_A(0 | ad : B) < 0.$$

Thus, all payoff differences are in line with the specified strategy, which establishes Result 7:

**Result 8:** *For our parameters, there exists an equilibrium in which the informed voters abstain if they receive an ad from the other candidate and vote for the own candidate if they receive his ad or are uninformed.*

Next, we consider whether it can be that informed voters abstain if they receive an ad from their own candidate but vote for the other candidate if they receive his ad. For these cases, again, we cannot make a general equilibrium prediction but have to use our parameterization.

*Case 1:* The uninformed abstain.

We simulated the Pivot-probabilities for  $n = 11$ ,  $p = 0.2$ ,  $q = 0.05$  under the assumption that all voters but our A-type follow the specified strategy:

$$Pr(P_0 | HL) = 0.14964, Pr(P_B | HL) = 0.26128, Pr(P_A | HL) = 0.043028,$$

$$Pr(P_0 | LH) = 0.18095, Pr(P_B | LH) = 0.055742, Pr(P_A | LH) = 0.28261.$$

Plugging in the simulated values and  $t$ ,  $u_A(0 | A) - u_A(A | A) < 0$  and thus, there exists no equilibrium in which voters abstain if they receive an ad from their own candidate or are uninformed but vote for the other candidate if they receive his ad.

*Case 2:* The uninformed vote for the other candidate.

We simulated the Pivot-probabilities the remaining A-type faces for  $n = 11$ ,  $p = 0.2$ ,  $q = 0.05$  under the assumption that all voters but our A-type follow the specified strategy:

$$Pr(P_0 | HL) = 0.055944, Pr(P_B | HL) = 0.18082, Pr(P_A | HL) = 0.009575,$$

$$Pr(P_0 | LH) = 0.26128, Pr(P_B | LH) = 0.15015, Pr(P_A | LH) = 0.26282.$$

Plugging in the simulated values,  $t$ , and our payoff parameters, the signs of the aforementioned payoff differences become:

$$u_A(0) - u_A(B) < 0 \text{ and } u_A(A) - u_A(B) < 0,$$

$$u_A(0 | ad : A) - u_A(A | ad : A) > 0 \text{ and } u_A(B | ad : A) - u_A(0 | ad : A) < 0$$

$$u_A(0 | ad : B) - u_A(B | ad : B) < 0 \text{ and } u_A(A | ad : B) - u_A(B | ad : B) < 0.$$

Thus, all payoff differences are in line with the specified strategy, which establishes Result 8:

**Result 9:** *For our parameters, there exists an equilibrium in which the informed voters abstain if they receive an ad from the own candidate and vote for the other candidate if they receive his ad or are uninformed.*

Finally, we consider the only remaining symmetric pure-strategy equilibrium candidate which is that all voters abstain. Suppose all voters but our remaining A-type abstain, then both candidates receive no vote, hence there is a tie. This means that the remaining A-type is pivotal for sure. Since ads are informative, she is better off if she votes for the candidate from whom she received an ad than if she abstains. For example,

$$u_A(0 | ad : A) - u_A(A | ad : A) = 1/2[t(x_{BL} - x_{AH}) + (1-t)(x_{BH} - x_{AL})] < 0$$

as  $0.5 < t < 1$  and  $x_{AH} - x_{BL} > x_{BH} - x_{AL}$ .

**Result 10:** *There is no equilibrium in which all voters abstain.*



**Table 1****Voters' Payoff Structure**

<b>Elected Candidate's Party</b>	<b>Elected Candidate's Quality</b>	
	High Quality	Low Quality
Own Party	$x_H$	$x_L$
Other Party	$x_H - \varepsilon$	$x_L - \varepsilon$

**Table 2****Voters' Payoffs in Experiment**

<b>Elected Candidate's Party</b>	<b>Elected Candidate's Quality</b>	
	High Quality	Low Quality
Own Party	7.50	4.50
Other Party	7.00	4.00

**Table 3**  
**Decisions of Uninformed Voters (in %)**

<b>Decision/Campaign</b>	<b>True</b>	<b>Deceptive</b>
Abstain	25.1	23.7
Vote Own	64.1	59.8
Vote Other	10.8	16.5

**Table 4**  
**Decisions of Informed Voters (in %)**

<b>Decision/Campaign</b>	<b>True</b>	<b>Deceptive</b>
Abstain	1.14	15.2
Vote Own	51.13	60.3
Vote Other	47.73	24.5

**Table 5**  
**Decisions of Informed Voters (in %):**  
**Advertising received from candidate of the other party**

<b>Decision/Campaign</b>	<b>True</b>	<b>Deceptive</b>
Abstain	0.0	19.6
Vote Own	15.3	38.1
Vote Other	84.7	42.3

**Table 6**  
**Decisions of Informed Voters (in %):**  
**Advertising received from candidate of the own party**

<b>Decision/Campaign</b>	<b>True</b>	<b>Deceptive</b>
Abstain	2.56	11.21
Vote Own	96.15	80.37
Vote Other	1.28	8.41

**Table 7**  
**Explaining Vote Choices**

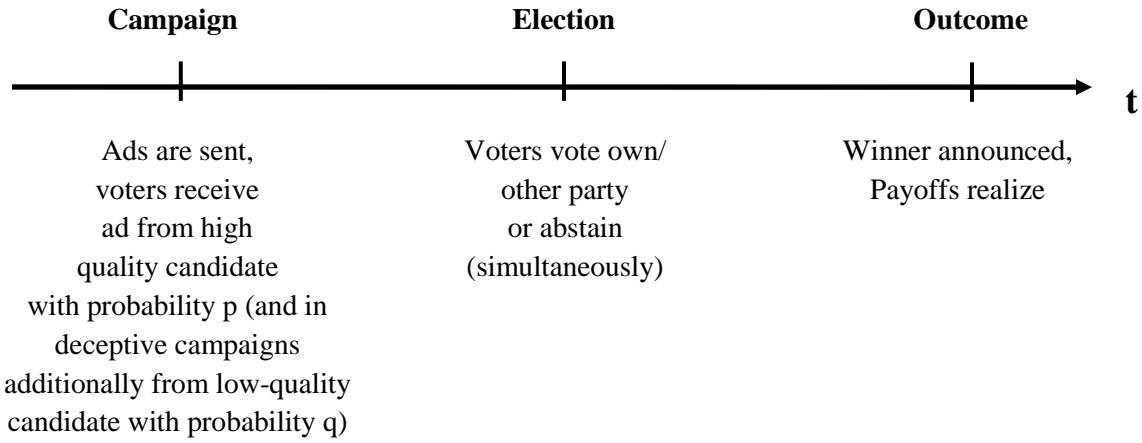
<b>Vote Choice</b>	(1)	(2)
<b>Vote Other Party</b>		
Campaign	-0.008 (0.007)	-0.004 (0.007)
Treatment D	0.086 (0.158)	0.524*** (0.183)
Ad from own candidate	-1.656*** (0.357)	-3.213*** (1.037)
Treatment D*Ad from own candidate		2.206** (1.100)
Ad from other candidate	3.146*** (0.227)	4.684*** (0.381)
Treatment D*Ad from other candidate		-2.776*** (0.465)
Constant	-1.368*** (0.215)	-1.721*** (0.221)
<b>Abstain</b>		
Campaign	0.0113* (0.0062)	0.0119* (0.0063)
Treatment D	0.185 (0.142)	0.069 (0.153)
Ad from own candidate	-1.726*** (0.315)	-3.183*** (0.626)
Ad from other candidate	0.699** (0.302)	-1.469** (0.719)
Treatment D*Seen Ad (Ad from own candidate + Ad from other candidate)		2.263*** (0.688)
Constant	-1.223*** (0.205)	-1.216*** (0.197)
Log likelihood	-1,255	-1,217
N	1,738	1,738

Notes: Multinomial logit regression with random individual effects. Base outcome in both regressions is “vote for own party’s candidate.” The table reports point estimates with standard errors in parenthesis. Statistically significant at the \*\*\* one percent, \*\* five percent, and \* ten percent level.

**Table 8**  
**Fraction of Informed Voters Voting for the High- and Low-Quality Candidate**

	<b>Treatment T</b>	<b>Treatment D</b>
vote high quality	90.8	58.96
vote low quality	9.2	41.04

**Figure 1  
Timing**



**Figure 2  
Equilibria in Truthful Campaigns**

