Attack Politics: Experimental Evidence on Going Negative

Kyle Mattes[†]

September 2007

Abstract

Political candidates use a variety of negative campaigning strategies, and these attacks have different degrees of success. To explain this, I use laboratory experiments to test how voter beliefs and voter behavior affect the frequency and content of candidates' negative campaigning. I find that, all other things equal, there is more negative campaigning when candidates are of poor quality, when voters' prior information suggests that candidates are of high quality, and when voters care strongly about the specific issue to which the negative campaigning is targeted. Furthermore, the results are better explained by a quantal response equilibrium model in which voters are risk averse and are more naïve than sophisticated in their Bayesian updating ability.

[†] Division of Humanities and Social Sciences, California Institute of Technology

Introduction

Because of divergence in the quality and ideology of political candidates, it is unreasonable to assume that every candidate has the same incentive or opportunity to utilize negative campaigning. Instead, the decision of whether to "go negative" is based upon a number of factors, and the end result is that candidates will go negative with different content, to different degrees, and with different results.

Mattes (2006) posited three reasons why candidates would be more likely to choose negative campaigning.[1] First, negative campaigning should increase as the voters' prior beliefs about political candidates in general become more positive. Second, we should see more negative campaigning on political dimensions where the candidates are weakest. Third, negative campaigning should be more likely on the dimensions of greatest importance to the voters.

The latter two predictions are rather straightforward, but the first seems contrary to the conventional wisdom that because negative campaigning has become more prominent in recent years, voters' opinions of politicians and trust in government has steadily declined. For instance, as of June 2007, Congress and the President had similar approval ratings of 25% and 26% respectively.[2] However, voters' opinions before the campaigns begin can differ substantially from their post-election viewpoints. In accordance, this model focuses not on voters' opinions of candidates already in office, but instead on the voters' prior beliefs about the character (or valence) of essentially unknown political candidates. And it is for unknown candidates that voters still maintain hope. In fact, evidence shows that evaluations of a hypothetical person exhibit a *positivity offset* – a tendency to be slightly positive rather than neutral in the absence of information (Adams-Weber 1979; Benjafield 1985); this same effect has also be demonstrated in

[1] Complete text of this paper is available at: http://www.hss.caltech.edu/~kmattes/Mattes_attack_politics
[2] This data was taken from http://www.pollingreport.com and was originally part of a Newsweek Poll administrated on June 18th-19th, 2007. These numbers are similar to those of other polls taken in the same time frame.

evaluations of unknown political candidates (Holbrook et al. 2001).[3] The positivity offset, along with the fact that voters care greatly about character issues (e.g., Cain et al. 1987), help in understanding the high frequency of negative campaigning and specifically of character-based attack. Character attacks, even if true, would give the voters no new information if they already think that every political candidate is of poor quality, or if they don't care about character traits of politicians in the first place.

That politicians can effectively use negative campaigning to transmit information to the voters has been shown by Geer (2006) and also via the formal model of Polburn and Yi (2006). The effect of negative information has also been shown in the psychology literature. Impressions formed on the basis of negative information tend to be weighted more heavily (Hamilton and Zanna 1972; Fiske 1980), and people exhibit loss aversion consistently throughout their personal lives (Kahneman and Tversky 1979, 1984). In a political setting, Cobb and Kuklinski (1997) found that opinions formed after hearing "con" arguments are longer lasting and more resistant to change than those formed after hearing advocacy arguments. Cacioppo and Gardner (1999) suggest a general bias toward negative information, though there is some evidence that when evaluating political candidates, favorable information is weighted more heavily than negative (Holbrook et al. 1999).

When considering the role of campaigns in information revelation, an important issue is the extent to which voters engage in Bayesian updating after receiving the information – whether or not they consider the implications about candidate types that can be derived from the information the candidates did *not* reveal. Failure to Bayesian update has been shown formally, in the context of the winners' curse, by many including Thaler (1988), and also demonstrated in

[3] Survey results are taken from the Cooperative Congressional Election Study (CCES), taken from October-November 2006, corroborate these findings. 70% of CCES respondents believed that candidates running for national office were generally competent (using the 4-point scale question, "If you think about most of the candidates for national elected offices (e.g. Congress, President), are they usually competent to hold that office?"), and 54% of respondents believed that candidates for national elected offices were trustworthy (using the 4-point scale question, "If you think about most of the candidates for national elected offices (e.g. Congress, President), are they usually trustworthy?"

laboratory auctions (e.g. Kagel 1995; Kagel and Levin 2002). Milgrom and Roberts (1986) explain that in games of information revelation, the effect of decision-making ability on the outcome depends upon the extent of competition and the incentives to increase social welfare. Alvarez (1998) showed how campaign information that provides the voter with certainty on a particular dimension will be most preferred by risk-averse voters with uncertain priors.

This study uses laboratory experiments to test the predictions of Mattes (2006) using a three player game in which two candidates campaign by revealing information to one voter. In this setting, I find that evidence to verify the three comparative statics hypotheses. Mattes (2006) also presents equilibria that depend upon the sophistication (i.e., Bayesian updating ability) of the voter. This experiment tests what equilibrium candidates and voters are playing, and uses that to determine the extent to which the voters are updating. The evidence here more strongly supports the hypothesis that voters are behaving naively – in other words using the information revealed to them but ignoring inferences that could be derived from the information each candidate failed to reveal.

However, subjects' behavior does not always match the expected equilibrium behavior. In order to account for these anomalies, I consider an extension to these Bayesian equilibria called Quantal Response Equilibrium (QRE: McKelvey and Palfrey 1995), which allows for the voters to make mistakes that increase in likelihood as the expected utility difference between the choices decreases, and allows candidates to choose strategies based upon this awareness of voter behavior. I also utilize a stochastic choice version of the *cursed equilibrium* concept of Eyster and Rabin (2005), which posits that voter behavior lies somewhere in between the estimates provided by the naïve and sophisticated models. I find that the model combining QRE and cursed equilibrium provides the best fit with the data, and furthermore that voters are risk averse and thus prefer the revelation of positive rather than negative information. These results provide insight regarding to the questions of which candidates tend to engage in negative campaigning, and what scenarios make them most likely to do so.

The Model

The model from Mattes (2006) is a game for political campaigns in which candidates maximize their standing with the electorate via the optimal dissemination of information. In this model there are two candidates, ℓ and -ℓ, who inherit positions on each of two separable dimensions, character and issues. The character dimension, C, is a valence dimension, given by the set $\{-x, x\}$. The issue dimension, I, is given by the set $\{-1, 0, 1\}$, where 0 indicates a moderate policy and ± 1 indicate an extreme policy. There is one voter (V), whose ideal candidate is located at (0, *x*). The voter's utility function for candidate ℓ is defined as $\mathrm{U_V}(\ell) = -\left|(\mathrm{I}_\ell)\right| + (\mathrm{C}_\ell)$. Candidates receive a fixed amount β for winning the election.

Initially, the candidates' locations $\theta_\ell = (\mathrm{I}_\ell, \mathrm{C}_\ell)$ are assigned by nature and both are known to the candidates, but not known to the voter. All players are aware that the type θ_ℓ of each candidate has been drawn independently from $\Theta = \{-1, 0, 1\} \times \{-x, x\}$ with the distribution that follows. On dimension X, a candidate is positive (*x*) with probability *p*, and is negative (-*x*) with probability $(1-p)$. On dimension Y, each candidate has probability $1-2q$ of being centrist (0), and probability *q* of favoring either extreme (±1). Since *p* and *q* are independent, at this stage the voter's expected utility is $(q-1) + x(2p-1)$. The x term, which also defines the range of dimension X, is a convenient way to capture the importance (weight) that the voter gives dimension X relative to dimension Y.

This one-period game consists of two phases: the campaign phase and the voting phase. In the first phase, a candidate's campaign is the truthful announcement of one of the four unknown locations; this can be thought of as the theme that the candidate most emphasizes during his campaign. Formally, this means that each candidate ℓ must simultaneously choose a strategy $\mathrm{s}_\ell : [\{-1, 0, 1\} \times \{x, -x\}]^2 \rightarrow \Sigma$. While Σ contains eight different types of messages, the realization of θ_ℓ and $\theta_{-\ell}$ limit the possible choices from eight to four due to the constraint requiring truthful revelation.

In the voting phase, the voter chooses the candidate who gives her the highest expected utility, though she is subject to a quantal response function where the probability of making a mistake decreases as the perceived utility difference increases. In making this decision, the voter relies on both her prior knowledge of the location distribution and the information given her by the candidates via the two campaign themes. Although there is undoubtedly a wide range of analytic ability which can be ascribed to voters, Mattes (2006) considers two archetypes of voter. The *sophisticated voter* is a Bayesian updater, and hence assumes that the revelation of a candidate may also give information about the locations that the candidate did *not* reveal. She uses the information revealed by the candidates and the candidates' entire announcement strategies s_ℓ to impute the candidates' spatial positions. The *naive voter* is not Bayesian. She utilizes the candidate announcements but does no further updating on the candidate types.

This model predicts that the incidence of negative campaigning depends upon three factors:

(1) The preconceptions of the voters: All other things equal, negative campaigning is more likely when the voters have more positive initial opinions of the attacked candidate's character.

(2) The traits of the candidates: All other things equal, there will be more negative campaigning as the candidates decrease in character quality.

(3) The preferences of the voters: All other things equal, there will be more negative campaigning on a given dimension whenever voters care more strongly about that dimension.

The following experiment is designed to test these implications of the formal model and also to determine the level of voter sophistication.

Experimental Design

The experiments were conducted during May and June 2007 at the California Institute of Technology, in the Social Science Experimental Laboratory (SSEL) using software developed at SSEL.[4] Subjects were recruited from the population of graduate and undergraduate students at Caltech and performed all tasks from a computer terminal.

Subjects were divided randomly into groups of three in which two played the role of candidate and one played the role of voter; roles and groups were reassigned after every round. Both candidates were randomly assigned traits on two independent dimensions, X and Y. There were two possibilities for each trait: "positive" or "negative", and the probability of drawing a positive trait was either 30%, 50%, or 70%. While the candidates were aware of the prior probabilities and both candidates' type draws, the voters were aware of the probabilities but not the realization of the candidates' traits.

The game consisted of two phases. In the first phase, candidates campaigned by revealing one of the four traits to the voter, but were also given a choice not to campaign. This gave candidates five campaigning options which were revealing one's own X trait, one's own Y trait, the opponent's X trait (heretofore abbreviated as oX), the opponent's Y trait (heretofore abbreviated as oY), or revealing nothing (heretofore, Ø). An example of the campaign choice screen seen by the candidates is shown in Figure 1.

[Figure 1 Goes Here]

[4] For more information about the Caltech Social Science Experimental Laboratory, see http://www.ssel.caltech.edu/info/. The computer program used was an extension to the open source Multistage game software. See http://multistage.ssel.caltech.edu for more information on this program.

Each voter simultaneously received the choices of both candidates and was then asked to vote for her preferred candidate. The vote concluded the round, after which the voters were shown both candidates' types, and all players were reassigned groups and roles for the subsequent round.

Payoffs were contingent upon the results of each round. The winning candidate received 100 points, the losing candidate received 0 points, and as shown in Table 1 below, the voter received a higher payout for choosing candidates who were positive on X (80) than for candidates positive on Y (20).

[Table 1 Goes Here]

The final subject pool consisted of 48 subjects, all of whom participated in exactly one of four sessions, with between 9 and 15 subjects participating in each. Detailed instructions were read to the subjects prior to the first round; these included a visual display of example screen shots from the software application.[5] Each session consisted of 60 rounds, and all three treatments (30%, 50%, and 70%) were used in each session. The probability and payoff information was always available on screen to all players, and the subjects were verbally reminded whenever the treatment had changed. The order of the three treatments varied by session and is summarized in Table 2.

[Table 2 Goes Here]

At the conclusion of the experiment, the points earned were converted to cash. The subjects earned an average of $25 for their participation.

[5] These instructions are available from the author upon request.

Hypotheses and Tests

I begin by testing the comparative static results derived from the Mattes (2006) theoretical model. In the analysis of this experiment, I define oX and oY as separate types of negative campaigning.[6] This results in the following three hypotheses:

(H1) **Positivity Offset Hypothesis**: For each type draw, candidates are more likely to choose negative campaigning as the probability of drawing a positive trait increases from 30% to 70%.

(H2) **Poor Candidate Hypothesis**: There should be the most negative campaigns in the 30% treatment, and the fewest negative campaigns in the 70% treatment.

(H3) **Dimension Preference Hypothesis**: As revelations on X result in higher voter payoffs, there will be more negative campaigning on dimension X than on dimension Y.

The next two hypotheses address the decision-making sophistication of the voters. To determine this, it is necessary to find which of the possible equilibria best fits the data.

(H4a) **Naive Voter Hypothesis**: The voters assume that candidates' decisions *are not* based upon their types. As a result, voters and candidates are playing the naïve equilibrium described below and shown in Table 3.

(H4b) **Sophisticated Voter Hypothesis**: The voters assume that candidates' decisions *are* based upon their types. As a result, voters and candidates are playing one of the sophisticated equilibria described below and shown in Table 4.

Assuming that the voters are naïve, Table 3 shows candidate strategies for the sixteen possible type draws. In the table, the letters X and Y refer respectively to revealing one's own X trait and one's own Y trait; oX and oY refer respectively to revealing the opponent's X or the

[6] To comport this with the Mattes (2006) model, one can think of both X and Y as valence dimensions.

opponent's Y trait. The 50% treatment is excluded from this table because in this case, any combination of the strategies for the 30% and 70% treatments results in equilibrium.

[Table 3 Goes Here]

The naïve voter strategies are derived as follows. In the 30% treatment, if a candidate ℓ reveals that he is positive on X, the naïve voter's expected earnings from voting for ℓ increase from 30 to 86. If ℓ reveals his opponent, -ℓ**,** to be negative on X, the voter's expected earnings for a -ℓ vote decrease from 30 to 6. Because the net change in voter utility from revealing X is higher, the candidates should prefer to reveal X rather than oX. Furthermore, if candidate ℓ reveals that he is positive on Y, this changes the voter's expected earnings for ℓ from 30 to 44, which makes a revelation of oX preferable to a revelation of Y. Finally the oY revelation changes earnings from a -ℓ vote from 30 to 24, the smallest change in expected earnings of the four campaign options. Thus in the naive equilibrium for the 30% treatment, we should expect candidates to choose campaigns in the order (X, oX, Y, oY). However, when the prior probability of being positive changes from 30% to 70%, the benefits from positive and negative campaigns are reversed.[7] So in this treatment, we should expect candidates to choose campaigns in the order (oX, X, oY, Y).

As with the naïve equilibria above, the sophisticated equilibria detailed in Mattes (2006) are similar to the naïve equilibrium above in that candidates' decisions are based upon an ordering of the possible disclosures. Here, candidates prefer to choose one particular revelation, a^*, and will choose a campaign on the other dimension, a^{**}, if a^* is not viable. The sophisticated voter will assume a^* is not true if a^* is not chosen, and also that a^{**} is not true

[7] In the 70% treatment, if candidate ℓ reveals oX , the voter's expected earnings from voting for -ℓ decrease from 70 to 14, while if ℓ reveals X, the voter's expected earnings for ℓ increase from 70 to 94. Furthermore, if ℓ reveals oY, then the voter's expected earnings for -ℓ decrease from 70 to 56, and if ℓ reveals Y, the voter's expected earnings for ℓ increase from 70 to 76.

whenever neither *a** nor *a*** is chosen. In this experiment, there are four possible configurations of *a** and *a*** from which candidates have no incentive to defect. In these equilibria, *a** is either X or oX, and *a*** is either Y or oY.[8] Table 4 shows the candidate strategies for each of the four sophisticated voter equilibria.

[Table 4 Goes Here]

Notice that for these equilibria, the strategies are not dependent upon the underlying probabilities (i.e. the treatments of 30%, 50%, and 70%), though it is possible that players coordinate on a different one of these four equilibria depending upon the treatment. Also, notice that revelations other than *a** and *a*** are infrequently chosen. For example, look at the column for the sophisticated-X-Y strategy (i.e., *a** = X, *a*** = Y). In this equilibrium, oX should only be chosen by a candidate who is negative on both dimensions $(-,-)$, and thus voting against the candidate that utilizes negative campaigning is a weakly dominant strategy.

It is important to understand that, unlike in the naïve voter case, a candidate's first two campaign choices (*a** and *a***) cannot be on the same dimension. For example, suppose that *a** is X, *a*** is oX, and both candidates are $(-,+)$. This would mean that both candidates are revealing oX. However, that the opponent is negative on the X dimension is already revealed by his failure to reveal X. So, if candidate ℓ reveals oX and candidate -ℓ reveals Y, then the voter knows that ℓ is $(-,+)$. But candidate -ℓ, revealing oX, could be either $(-,-)$ or $(-,+)$. Voting

[8]Any sophisticated equilibrium where *a** is a revelation on the Y dimension is not supportable because of the candidate incentive to deviate and campaign on X. For example, suppose that *a** = Y, and *a*** = X, and that both candidates are (+, +). The proposed equilibrium has both candidates choosing Y. However, suppose candidate ℓ defects and chooses X. This is not an off-path choice, so the sophisticated voter would assume that ℓ is (+, -) and that -ℓ is positive on Y but positive on X with only probability *p* (because if -ℓ were (+, +) or (-, +), he would in both cases choose Y; the likelihood of the positive case is the probability *p*). Therefore, this cannot be an equilibrium. Similarly if *a*** were oX, then whenever ℓ is (+,+) and -ℓ is (-, +), -ℓ would do better defecting to oX rather than choosing Y and settling for a tie election.

for ℓ is a dominant strategy for the voter, and thus it is better here for either candidate to defect to Y.

The predictions above assume that the voter is risk neutral, but change depending upon the risk preference of the voters. The following hypothesis addresses this.

(H5) **Risk Aversion Hypothesis**: Voters are risk averse, and thus with a naïve voter, candidates use positive campaigning more often than indicated in Table 3. Furthermore, with a sophisticated voter, candidates use the sophisticated-X-Y strategy from Table 4.

I measured voter risk aversion with a coefficient q that transforms a given payoff P into $\frac{P^{1-q}}{1-q}$. Setting q = 0 leaves P unchanged and thus is equivalent to risk neutrality, and setting q = 1 results in a log utility function. In the naïve voter model, risk aversion increases the utility that the voter derives from positive as compared to negative campaigning. For example, without risk aversion, in the 50% treatment, both positive and negative campaigning cause an equivalent net change of 40 in the voter's expected utility for one of the candidates. However, if the voter is at all risk averse, then after candidate ℓ chooses X, the voter's expected utility difference between candidates ℓ and -ℓ ($\frac{80^{1-q}}{1-q} + .5(\frac{20^{1-q}}{1-q}) - .5\frac{100^{1-q}}{1-q}$) will be greater than her expected utility difference after ℓ chooses oX ($.5\frac{100^{1-q}}{1-q} - .5(\frac{20^{1-q}}{1-q})$). For instance, while these two equations equal 40 if q = 0, if q = .01, the benefit from positive campaigning (38.91) outweighs the benefit from negative campaigning (38.42).

The following shows an example of how risk aversion affects the equilibrium strategies in the naïve voter model. In the 70% treatment, negative and positive campaigning on the X dimension are equally effective if $\frac{80^{1-q}}{1-q}+.7(\frac{20^{1-q}}{1-q})-.7\frac{100^{1-q}}{1-q}=.7\frac{100^{1-q}}{1-q}-.7(\frac{20^{1-q}}{1-q})$; this has the approximate solution of $q=0.393$. Furthermore, in the 70% treatment, at approximately $q=0.510$, positive campaigning on the Y dimension becomes as effective as negative campaigning on the X dimension – even though positive campaigning on Y only guarantees the voter a sure payoff of 20.

However, the role of risk aversion in the sophisticated model is not as clear, for two main reasons. First, in most instances, the strategies of the candidates perfectly reveal the candidate types to sophisticated voters. Second, risk aversion already has an implicit presence if the players have coordinated on the sophisticated-X-Y equilibrium instead of the other three sophisticated equilibria.

Perhaps the strongest effect that can be accorded to risk aversion in the sophisticated model is the effect on player mistakes measured by the quantal response function. This is because the risk aversion coefficient modifies the payoff structure, which changes the magnitude of the utility differences and thus the probability predictions of player mistakes.

Results

In the following analysis, I dropped the cases where candidates chose “defeatist” campaigns, defined as revelations of good information about the opponent or bad information about themselves. This means that I report that a candidate chose X, it means the candidate revealed that he is positive (and not negative) on the X dimension. The defeatist campaigns account for only 7% of campaigns. Nearly half of these (45%) were in the case (-, -) vs. (+, +), and 80% of these were chosen by (-, -) candidates. Furthermore, candidates using defeatist campaigns won only 2.2% of the time.

The first three reported results are derived from testing the three comparative statics hypotheses (H1-H3).

Result 1. *For each pair of candidate types, candidates are more likely to choose negative campaigning as the probability of a positive trait draw increases.*

There is more negative campaigning when voters have higher expected values that candidates are good; this confirms the **Positivity Offset Hypothesis (H1)**. Figure 2 shows how the percentage of negative campaigns varies by treatment.[9] In the figure, the ten relevant cases are labeled with the candidate's type followed by the opponent's type. In every case, the amount of negative campaigning in the 70% treatment is greater than in the 30% treatment.

[Figure 2 Goes Here]

Result 2. *Overall, there are more negative campaigns in the 30% treatment, and the fewest negative campaigns in the 70% treatment.*

The overall percentage of negative campaigns was 46% in the 0.3 treatment as compared to 31% in the 0.5 treatment $(t(1151) \geq 5.26, p = 0.000)$ and 14% in the 0.7 treatment $(t(1161) \geq 6.10, p = 0.000)$. All other things equal, there is more negative campaigning when candidates are more likely to have negative traits, which corroborates the **Poor Candidate Hypothesis (H2)**.

Result 3. *There is more negative campaigning on dimension X than on dimension Y.*

[9] The chart also excludes the case of a (+ ,-) candidate facing a (+, +) opponent. The (+, -) candidate chose positive campaigning (revealing X) 100% of the time, regardless of treatment.

The campaign choice oX was more than twice as common as oY (21% vs. 9%; $t(3568) \geq 9.92, p = 0.000$). This disparity was greatest in the 0.3 treatment (34% vs. 12%; $t(566) \geq 13.23, p = 0.000$) and smallest and not significant for the 0.7 treatment (8% vs. 6%; $t(178) \geq 1.12, p = 0.118$). The pooled results support the **Dimension Preference Hypothesis (H3)** that there is more negative campaigning on the dimension where information has a greater effect on voter payoffs.

Are Voters Naïve or Sophisticated?

In order to test the hypotheses about voter sophistication, it is necessary to determine which equilibrium the subjects were playing. This begins with an examination of the empirical voting strategies. Table 5 reports voter behavior, showing the probability of voting for an arbitrary candidate ℓ if the opponent -ℓ has chosen a campaign different from that of ℓ.

[Table 5 Goes Here]

Result 4. *Candidates that chose positive campaigning on X won against candidates choosing any other campaign*.

This result is shown in the first row of Table 5; candidates choosing X won at least 93% of the time against campaigns of Y, oY, or Ø. Also, candidates that chose Y won against anything other than X – with the exception of the 70% treatment, in which Y lost to oX 55% of the time, though this advantage is not distinguishable from chance ($p-value = 0.824$, two-tailed).

Result 5. *Candidates who chose not to campaign lost almost every time.*

This can be verified in Table 5, which shows that candidates not campaigning lost 95% of the elections in the 30% treatment, and every election in the other two treatments. Candidates only chose not to campaign 4% of the time, and a majority of these (61%) were (-, -) candidates facing a (+, +) opponent.

Result 6. *That the candidates changed strategies based upon the treatment strongly suggests that voters were not, and were not assumed to be, acting in accordance with the* ***Sophisticated Voting Hypothesis.***

Table 6 lists the most commonly used campaign choices for each treatment and compares them to the naïve and sophisticated-X-Y strategies.[10,11] The sophisticated-X-Y fits the data much better than the other sophisticated strategies because candidates choose X rather than oX, and also prefer revealing Y to revealing oY.

[Table 6 Goes Here]

While the **Sophisticated Voting Hypothesis (H4b)** matches the empirical data from the 30% treatment, behavior from the other treatments is inconsistent with sophisticated voting. Specifically, the voters fail to infer that a candidate who chooses oX automatically reveals that he is negative on the X dimension. This can be seen readily in the cases (-, +) vs. (-, +) and (-, +) vs. (-, -) whenever the (-, +) candidates use negative campaigning (oX). In the sophisticated-X-Y

[10] More complete information about the chosen strategies can be found in Table 10 in the Appendix.
[11] Recall that in the case of (- ,-) vs. (-, -), any of the available strategies (oX, oY, or Ø) would work as an equilibrium because the candidates' failure to choose X or Y perfectly reveals the candidate types.

equilibrium, candidates only choose oX when they are (-, -). If voters are aware of this, they should not vote for a candidate choosing oX over a candidate choosing Y. Yet, as the probability of being positive increases, we find that the number of candidates choosing oX rather than Y increases and that voters become more likely to choose the candidate revealing oX over the candidate revealing Y.[12] That voters are naïve and risk-averse is a better explanation for why most voters prefer Y over oX in the 30% and 50% treatments, but treat those revelations nearly equally in the 70% treatment.

QRE Analysis

Result 7. *Voters are risk averse and naïve.*

Result 7 was derived using the QRE model, which is a formal equilibrium model of imperfect play. Each player uses a quantal response function, which is a continuous best-response function that gives positive probability to choosing all possible actions; the function is monotonically increasing in expected payoffs. As a result, players in QRE do not always play their best responses, but do choose higher payoff responses more frequently than they choose lower payoff responses.

For this analysis, I use the logit QRE, chosen because it is a theoretical extension of the logit models commonly used to empirically estimate discrete choice in individual decision-making. All players' quantal response functions are logit functions of the expected utilities that are implied by the mixed strategies. Using logit quantal response function yields the following voter strategy equation, where $\sigma_{a_\ell a_{-\ell}}$ is the probability of voting for candidate ℓ given the

[12] The candidates' decisions to reveal oX rather than Y cannot be construed as a switch to the sophisticated oX-Y equilibrium in the 70% treatment because candidate still reveal X (rather than oX) whenever possible.

campaigns a_ℓ and $a_{-\ell}$ of candidates ℓ and -ℓ, respectively, and EU(ℓ) is the expected utility from voting for candidate ℓ.

$$\sigma_{a_\ell a_{-\ell}} = \frac{e^{\lambda EU(\ell)}}{e^{\lambda EU(\ell)} + e^{\lambda EU(-\ell)}} \tag{1}$$

$\sigma_{a_\ell a_{-\ell}}$ is a 5 x 5 matrix with one row and column for each of the five possible campaign choices. Since I assume that candidates are not allowed to choose defeatist campaigns, such choices are subsumed into the probability of not campaigning (a_5). λ is the parameter that measures the relative closeness to the Nash equilibrium. When $\lambda = 0$, voters will choose randomly between the candidates, voting for each 50% of the time regardless of the expected utilities. As $\lambda \rightarrow \infty$, strategies converge to the Nash equilibrium, which means that players choose the response with the highest expected utility 100% of the time. Note that λ measures the relative closeness of the model to the Nash equilibrium. However, because λ values are highly sensitive to the payoff structure, they only are meaningful in context, and thus we cannot determine the extent of player mistakes solely from the magnitude of any single λ value.

Labeling all sixteen possible type draws as cases 1-16 (as in Table 10 in the Appendix), the voter's expected utility for voting candidate ℓ is defined as:

$$EU(\ell) = P(case1 \mid a_\ell a_{-\ell}) * 100 + P(case2 \mid a_\ell a_{-\ell}) * 100 + ... + P(case16 \mid a_\ell a_{-\ell}) * 0 \tag{2}$$

The candidate strategy equations are dependent on the candidates' types θ_ℓ and $\theta_{-\ell}$, and are shown in the equation below, which assumes that candidate strategies are symmetric:

$$\rho_{\theta_\ell \theta_{-\ell}}^{a_i} = \frac{e^{\lambda EU(a_i)}}{\sum_{j=1}^{5} e^{\lambda EU(a_j)}} \tag{3}$$

$\rho_{\theta_\ell \theta_{-\ell}}^{a_i}$ is a 4 x 4x 5 matrix with elements constrained to equal zero for all defeatist campaigns. The candidates' expected utility for each campaign option is $EU(a_i) = 100 * \sum_{j=1}^{5} \sigma_{a_i a_j} \rho_{\theta_{-\ell}\theta_\ell}^{a_j}$, where $\rho_{\theta_{-\ell}\theta_\ell}^{a_j}$ is, due to symmetry, candidate ℓ's probability of choosing campaign *j* when the types are reversed.

Maximum likelihood estimation was used to estimate parameters λ and *q* for the empirical results. The estimation results are shown in Table 7.

[Table 7 Goes Here]

First of all, if we require risk neutrality (*q* = 0), the naïve model does not fare as well as the sophisticated. However, Table 7 also shows that the QRE for the naïve voting model, with a risk aversion coefficient of $q = .55$, provides the best fit with the data. Furthermore the predicted *q* value is very close to the theoretical point ($q = .51$) at which naïve voters, in the 70% treatment, would be evenly split between candidates choosing Y over candidates choosing oX. Recall from Table 5 that voters slightly preferred Y to oX in the 70% treatment, which is what $q = .55$ predicts. As expected, risk aversion does not have as strong of an effect with the sophisticated model as with the naïve, though the inclusion of risk aversion (*q* = .20), does provide a slightly better fit to the sophisticated-X-Y model.

Cursed Equilibrium

Result 8. *The best explanation for the experimental results involves a combination of naïve and sophisticated voting along with the inclusion of voter risk aversion.*

It is reasonable to assume that voters are not completely naïve, but instead have decision-making methods that lie somewhere on the continuum between perfectly naïve and perfectly sophisticated voting. To test this, I applied the concept of cursed equilibrium (CE: Eyster and Rabin (2005)) to this model. In a cursed equilibrium, voters are assumed to have some probability of ignoring the correlation between the candidates' actions and their underlying types. Specifically, the candidates assume that with probability χ, voters think candidates' decisions *are not* based on their types, and with probability $1- \chi$, that candidates' decisions *are* based upon their types. Accordingly $\chi = 1$ corresponds with the naïve voter equilibrium, while $\chi = 0$ corresponds with the sophisticated voter equilibrium. However, because CE makes a point prediction for each value of χ and thus presents a zero-likelihood problem, I avoid this by combining CE and QRE to obtain simultaneous parameter estimates. Table 8 shows the results from this estimation.

[Table 8 Goes Here]

The best fit is $\chi = 0.73$, which weights the naïve model more strongly than the sophisticated, this verifies that the data are best explained by using a combination of CE and QRE along with risk-averse voters.[13] Figures 3-5, which are in the appendix, show the QRE point probability estimates for campaign strategies at the predicted χ, λ and q values, and Table 9 shows the theoretical QRE probability estimates of voting for each candidate.

[13] Other studies have also found χ weighted toward naïve behavior. Eyster and Rabin (2005), in fitting the cursed model to pre-existing experimental datasets, found generally that the best-fitting χ values were above 0.5, thus conferring a stronger weight upon the naïve decision-maker model. Carillo and Palfrey (2007), in various treatments of a compromise game, found χ values ranging from 0.75 to 0.97, with a pooled average of 0.85.

Conclusions

This study analyzes political candidates' decisions to use negative campaigning by focusing on how differences between candidates and differences in voter decision-making criteria affect both the frequency and emphasis of negative campaigns. I found that candidates with negative traits were clearly more susceptible to negative campaigning, but due to voter preferences for positive information in this experiment, negative campaigning did not often lead to a successful election outcome for the candidate going negative. However, the voters' lack of sophisticated decision-making actually encouraged more negative campaigning – as the probability of candidates having positive traits increased, voters were judged by candidates as more likely to respond to negativity due to its departure from prior expectations.

Since the perception of voter naivety resulted in candidates adopting strategies to account for the level of voter decision-making ability, a useful extension would be a test of how adaptable candidates can be to unannounced changes in voter preferences, prior beliefs, and decision-making criteria. It is certainly plausible to think that in current politics, candidates sometimes choose campaign themes based upon how successful those themes were in previous elections, and if so, further experiments could determine how quickly, and under what circumstances, candidates are best able to change their styles to cater to a dynamic electorate. One possible method of testing this is replacing the voters with a decision-making algorithm (playing the role of a sophisticated voter, for example). Another is keeping candidates and voter pools separate; political candidates' votes clearly do not have as much influence over election outcomes as they did in the experiment, so this alteration could help capture that dynamic.

Overall, the experimental results presented here can help explain why we see political campaigns that can diverge so sharply in content. We should expect campaign themes to differ because candidates are playing to their strengths and their opponent's vulnerabilities, all the while accounting for the voters' prior expectations, preferences, and analytic ability. Of particular importance to the study of negative campaigning is that this model has shown the factors by which a candidate decides whether to attack the opponent. This should help supplant the idea that any candidate could improve the election outcome by simply “going negative”. Instead, future studies should seek to further understand how the target of the negative attack and the voters themselves play a role – directly or indirectly – in determining which, if any, particular attack message would have improved candidates’ electoral fate.

Appendix: Figures and Tables

Table 1: Voter Payoff Table

	Positive on Y	Negative on Y
Positive on X	**100**	**80**
Negative on X	**20**	**0**

Table 2: Experiment Session Summary

	Session 1	Session 2	Session 3	Session 4
Number of Subjects	9	15	15	9
Order of 30% Treatment	2nd	3rd	1st	3rd
Order of 50% Treatment	1st	2nd	2nd	1st
Order of 70% Treatment	3rd	1st	3rd	2nd

Table 3: Candidate Equilibrium Strategies with a Naive Voter

Self	Opponent	Naïve (30%)	Naïve (70%)
(+, +)[14]	(+, +)	X	X
(+, +)	(+, -)	X	X
(+, +)	(-, +)	X	oX
(+, +)	(-, -)	X	oX
(+, -)	(+, +)	X	X
(+, -)	(+, -)	X	X
(+, -)	(-, +)	X	oX
(+, -)	(-, -)	X	oX
(-, +)	(+, +)	Y	Y
(-, +)	(+, -)	Y	oY
(-, +)	(-, +)	oX	oX
(-, +)	(-, -)	oX	oX
(-, -)	(+, +)	Ø	Ø
(-, -)	(+, -)	oY	oY
(-, -)	(-, +)	oX	oX
(-, -)	(-, -)	oX	oX

[14] In this and future tables, traits are listed in the order (X trait, Y trait).

Table 4: Candidate Equilibrium Strategies with a Sophisticated Voter

Types		Equilibrium Strategies (a*- a**)			
Self	**Opponent**	**X - Y**	**oX - Y**	**X - oY**	**oX – oY**
(+, +)	(+, +)	X	Y	X	Y
(+, +)	(+, -)	X	Y	X	oY
(+, +)	(-, +)	X	oX	X	oX
(+, +)	(-, -)	X	oX	X	oX
(+, -)	(+, +)	X	X	X	X
(+, -)	(+, -)	X	oY	X	oY
(+, -)	(-, +)	X	oX	X	oX
(+, -)	(-, -)	X	oX	X	oX
(-, +)	(+, +)	Y	Y	Y	Y
(-, +)	(+, -)	Y	Y	oY	oY
(-, +)	(-, +)	Y	oX	Y	oX
(-, +)	(-, -)	Y	oX	oY	oX
(-, -)	(+, +)	Ø[15]	Ø	Ø	Ø
(-, -)	(+, -)	oY	oY	oY	oY
(-, -)	(-, +)	oX	oX	oX	oX
(-, -)	(-, -)	oY[16]	oX	oY	oX

[15] In this particular case, it would also be an equilibrium with the (-, -) candidate choosing any other campaign, because both candidates' types are fully revealed once the (-, -) candidate campaigns with good information about the opponent or bad information about herself.

[16] As in all cases in which the top two choices (here, X and Y) are not picked by either candidate, any revelation works in this equilibrium because both candidates' failure to reveal either a* or a** gives the voter perfect information about the two candidates' types.

Table 5: Voter Behavior

Candidate ℓ	Candidate -ℓ	Vote for Candidate ℓ (30%)	Vote for Candidate ℓ (50%)	Vote for Candidate ℓ (70%)
X	Y	1.00	0.93	0.95
X	oY	1.00	0.95	0.93
Y	oX	0.84	0.80	0.45
oX	oY	0.64	1.00	0.89
Ø	Any other[17]	0.05	0.00	0.00

[17] Both candidates chose to not campaign only once; this observation is excluded.

Table 6: Empirical Candidate Strategy Comparisons

Self	Opp.	Strategy (30%)	Strategy (50%)	Strategy (70%)	Naïve (30%)	Sophist. X, Y
(+, +)	(+, +)	X	X	X	X	X
(+, +)	(+, -)	X	X	X	X	X
(+, +)	(-, +)	X	X	X	X	X
(+, +)	(-, -)	X	X	X	X	X
(+, -)	(+, +)	X	X	X	X	X
(+, -)	(+, -)	X	X	X	X	X
(+, -)	(-, +)	X	X	X	X	X
(+, -)	(-, -)	X	X	X	X	X
(-, +)	(+, +)	Y	Y	Y	Y	Y
(-, +)	(+, -)	Y	Y, oY	Y, oY	Y	Y
(-, +)	(-, +)	Y	Y, oX	Y, oX	oX	Y
(-, +)	(-, -)	Y	Y, oX	Y	oX	Y
(-, -)	(+, +)	Ø	Ø	Ø	Ø	Ø
(-, -)	(+, -)	oY	oY	oY	oY	oY
(-, -)	(-, +)	oX	oX	oX	oX	oX
(-, -)	(-, -)	oX	oX	oX	oX	oX

Table 7: QRE Maximum Likelihood Results

Model	Log Likelihood	λ	q
Naïve	-1607	0.07	0.00
Sophisticated XY	-1445	0.06	0.00
Naïve with risk aversion	-1255	0.17	0.55
Sophisticated-XY with risk aversion	-1415	0.07	0.20

Table 8: Cursed Equilibrium Maximum Likelihood Results

Model	Log Likelihood	Λ	q	χ
Sophisticated-XY	-1415	0.07	0.20	0.00
Naïve	-1255	0.17	0.55	1.00
Cursed	-1116	0.13	0.35	0.73

Table 9: QRE/CE Probability of Voting for Candidate ℓ (row) over Candidate –ℓ (column)

		X	Y	oX	oY	Ø
30% Treatment	X	0.50	0.85	0.50	0.93	0.95
	Y	0.15	0.50	0.63	0.50	0.78
	oX	0.50	0.37	0.50	0.61	0.64
	oY	0.07	0.50	0.39	0.50	0.53
	Ø	0.05	0.22	0.36	0.47	0.50
50% Treatment	X	0.50	0.82	0.50	0.88	0.93
	Y	0.18	0.50	0.49	0.50	0.77
	oX	0.50	0.51	0.50	0.68	0.72
	oY	0.12	0.50	0.32	0.50	0.55
	Ø	0.07	0.23	0.28	0.45	0.50
70% Treatment	X	0.50	0.78	0.50	0.81	0.91
	Y	0.22	0.50	0.35	0.50	0.76
	oX	0.50	0.65	0.50	0.74	0.79
	oY	0.19	0.50	0.26	0.50	0.57
	Ø	0.09	0.24	0.21	0.43	0.50

Table 10: Candidates' Preferred Strategies

			30% Treatment		50% Treatment		70% Treatment	
Case	Self	Opp.	First Choice	Second Choice	First Choice	Second Choice	First Choice	Second Choice
1	(+, +)	(+, +)	X (90%)*	Y (10%)	X (100%)*	n/a	X (96%)*	Y (4%)
2	(+, +)	(+, -)	X (100%)*	n/a	X (93%)*	oY (6%)	X (86%)*	oY (14%)
3	(+, +)	(-, +)	X (100%)*	n/a	X (85%)*	oX (15%)	X (82%)*	oX (18%)
4	(+, +)	(-, -)	X (96%)*	oX (4%)	X (90%)*	oX (8%)	X (90%)*	oX (8%)
5	(+, -)	(+, +)	X (100%)*	n/a	X (100%)*	n/a	X (100%)*	n/a
6	(+, -)	(+, -)	X (97%)*	oY (3%)	X (91%)*	oY (9%)	X (97%)*	oY (3%)
7	(+, -)	(-, +)	X (100%)*	n/a	X (77%)*	oX (23%)	X (84%)*	oX (16%)
8	(+, -)	(-, -)	X (93%)*	oX (5%)	X (95%)*	oX (5%)	X (80%)*	oX (20%)
9	(-, +)	(+, +)	Y (92%)*	Ø (8%)	Y (88%)*	Ø (12%)	Y (92%)*	Ø (8%)
10	(-, +)	(+, -)	Y (73%)*	oY (23%)	Y (52%)	oY (48%)	oY (52%)	Y (48%)
11	(-, +)	(-, +)	Y (71%)*	oX (29%)	Y (62%)	oX (38%)	oX (57%)	Y (43%)
12	(-, +)	(-, -)	Y (84%)*	oX (16%)	Y (59%)	oX (41%)	Y (75%)	oX (13%)
13	(-, -)	(+, +)	Ø (100%)*	n/a	Ø (100%)*	n/a	Ø (100%)*	n/a
14	(-, -)	(+, -)	oY (82%)*	Ø (18%)	oY (88%)*	Ø (12%)	oY (94%)*	Ø (6%)
15	(-, -)	(-, +)	oX (100%)*	n/a	oX (100%)*	n/a	oX (100%)*	n/a
16	(-, -)	(-, -)	oX (87%)*	oY (13%)	oX (90%)*	oY (5%)	oX (75%)	oY (25%)

[*] First choice campaigns marked with * are significant with a p-value of .05 or less, with the null hypothesis that the first choice campaign is chosen only 50% of the time, and all other options combined are chosen 50% of the time.

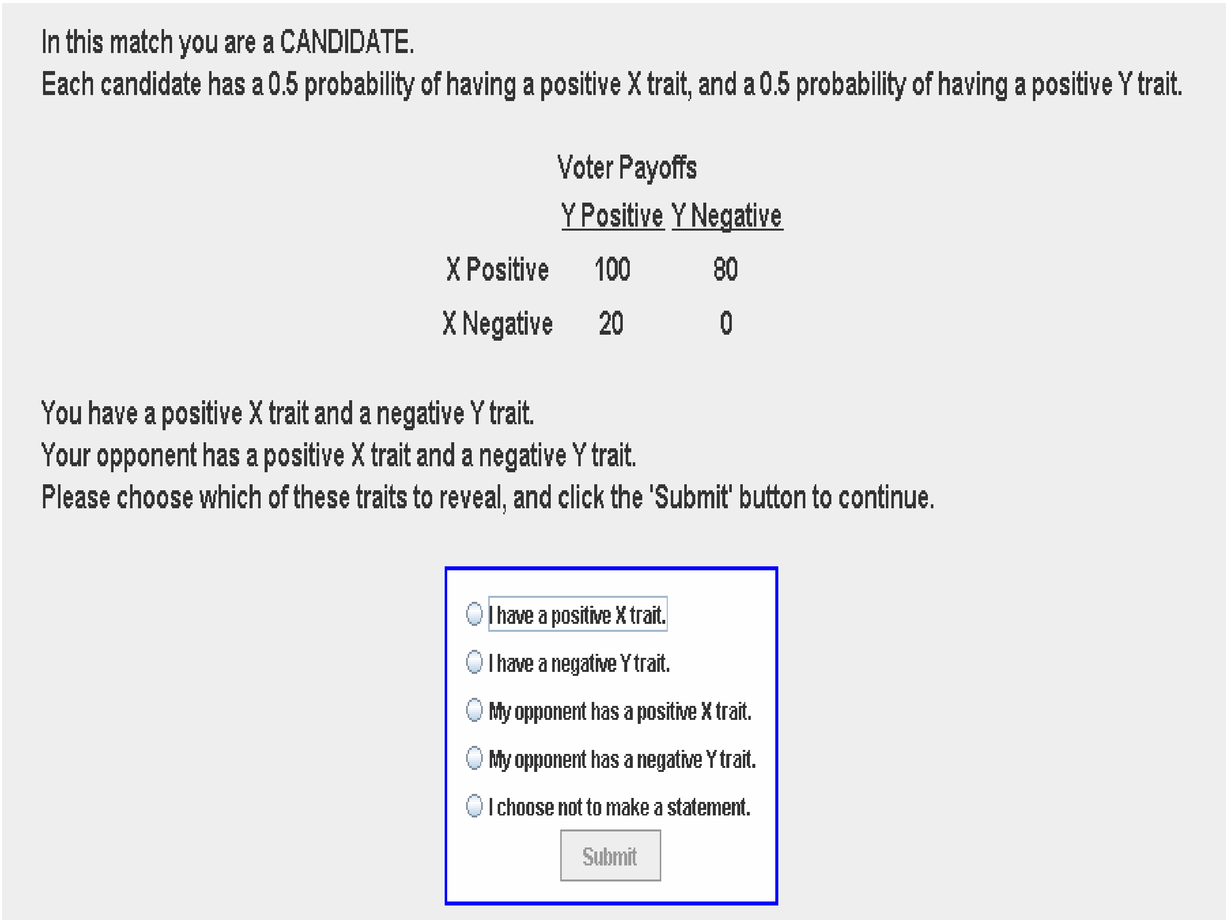

Figure 1: Screen for Players in the Candidate Role

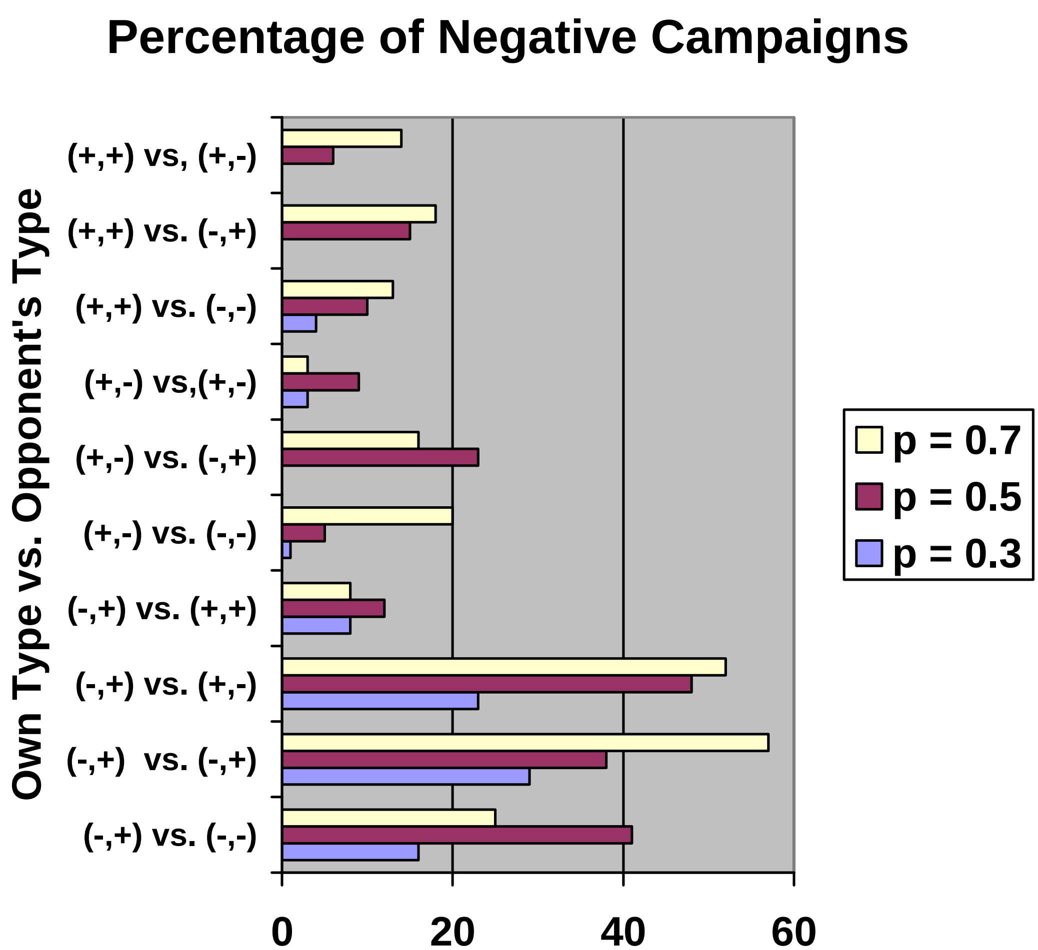

Figure 2: Incidence of Negative Campaigning by Case and Treatment

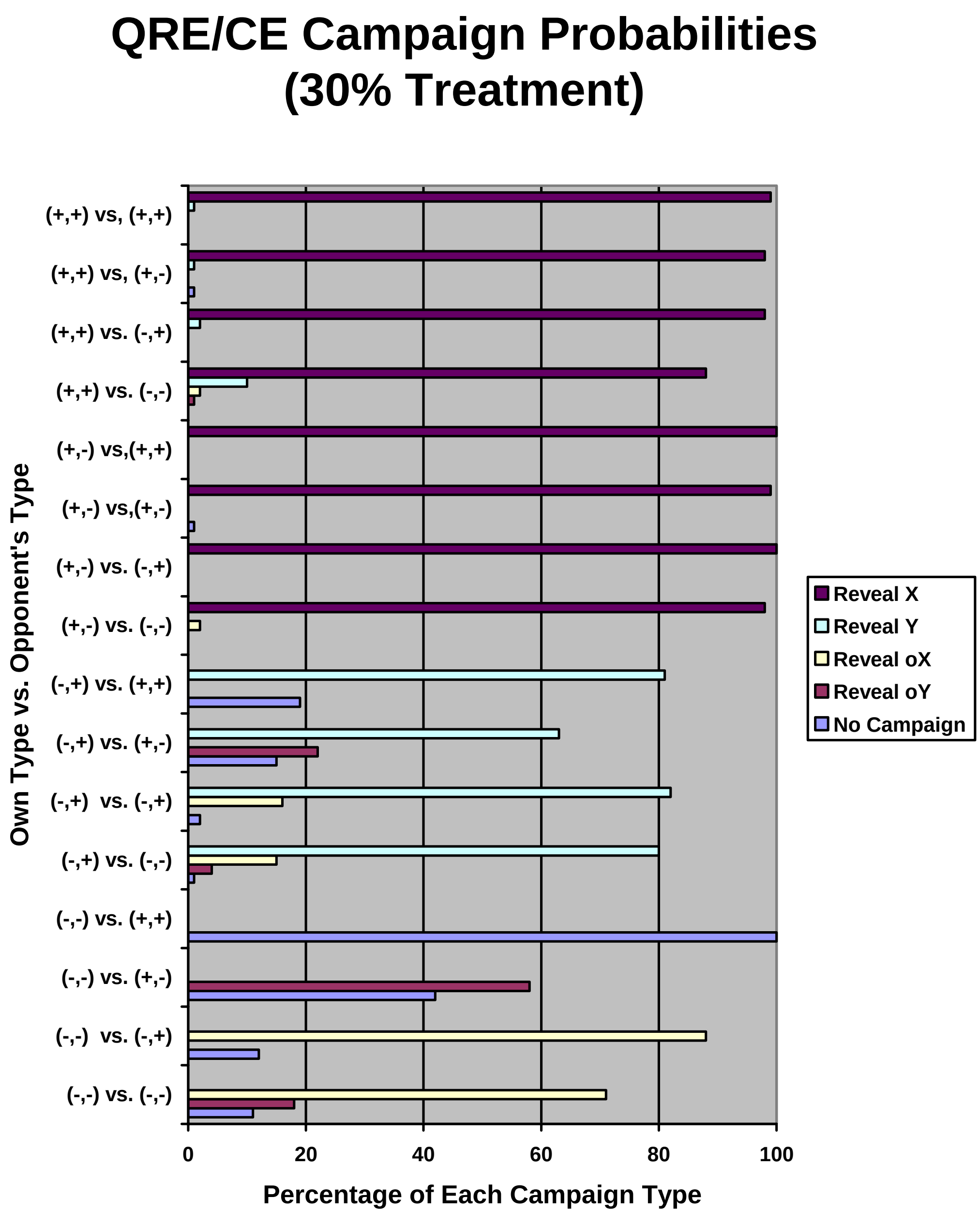

Figure 3: Table of Campaign Probabilities at the QRE/CE Estimate of λ, χ, and q (30% Treatment)

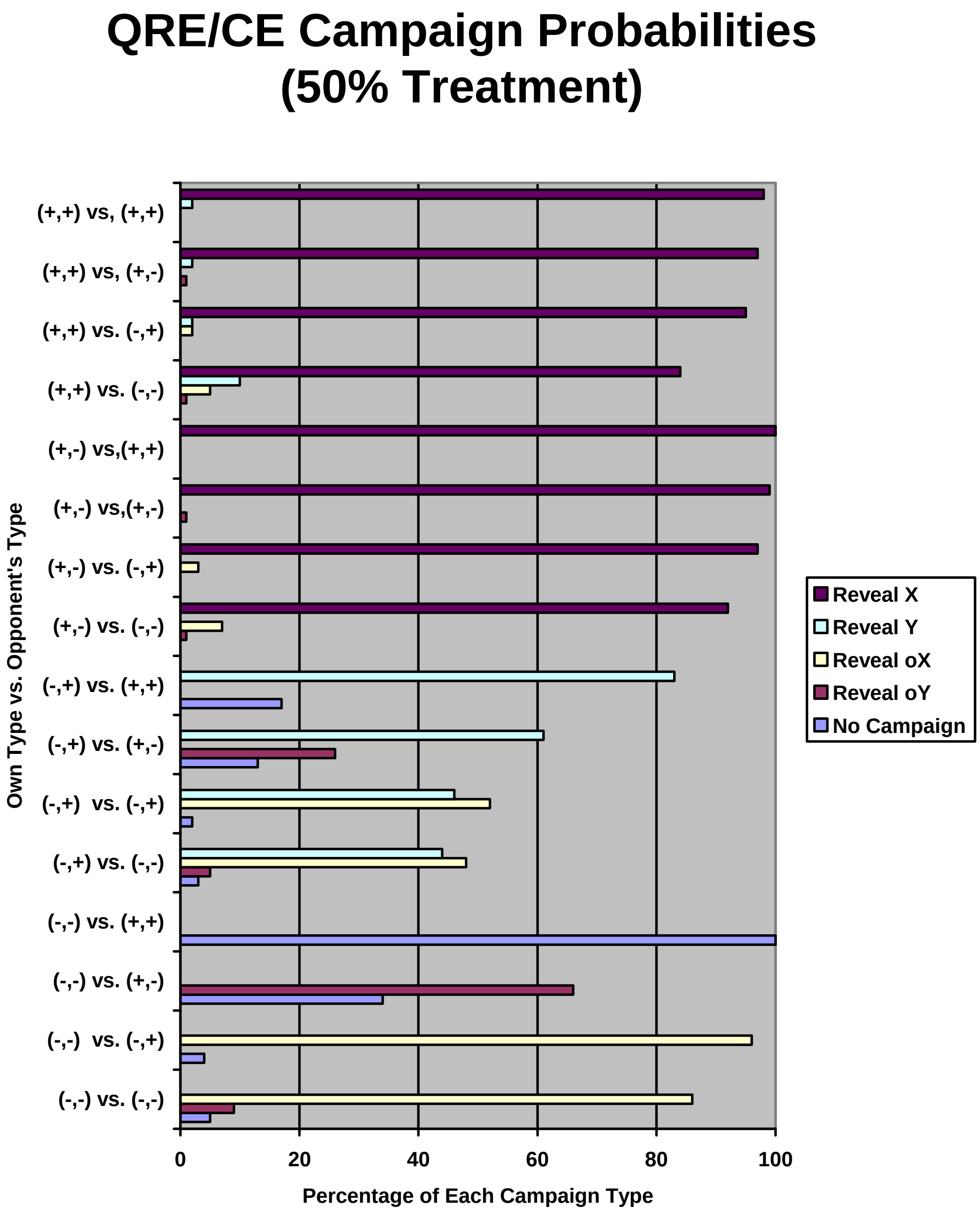

Figure 4: Table of Campaign Probabilities at the QRE/CE Estimate of λ, χ, and q (50% Treatment)

QRE/CE Campaign Probabilities (70% Treatment)

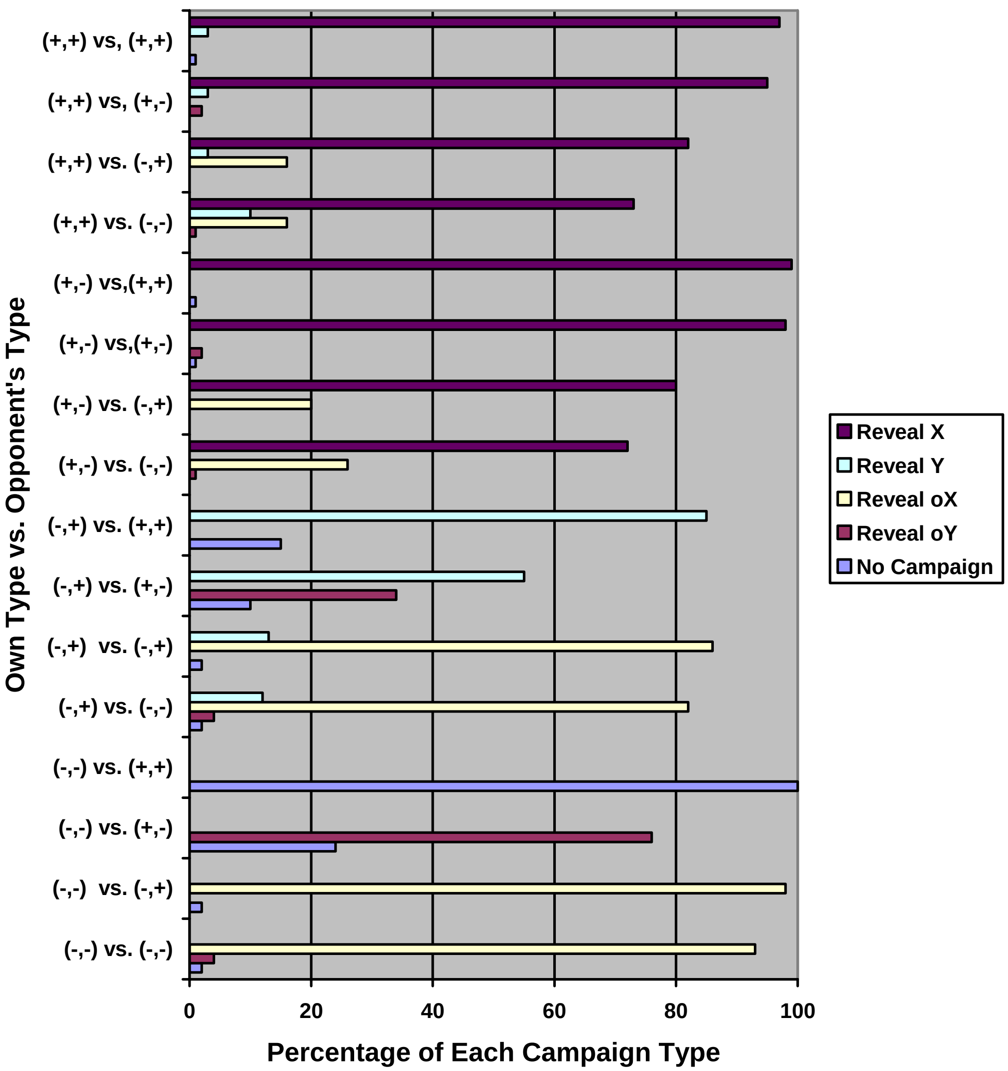

Figure 5: Table of Campaign Probabilities at the QRE/CE Estimate of λ, χ, and q (70% Treatment)

References

Adams-Webber, Jack R. 1979. *Personal Construct Theory: Concepts and Applications*. New York: Wiley.

Alvarez, R. Michael. 1998. *Information and Elections*. Ann Arbor: University of Michigan.

Benjafield, John. 1985. A Review of Recent Research on the Golden Section. *Empirical Studies of the Arts* 3, 117-134.

Cacioppo, John T. and Wendi L. Gardner. 1999. Emotion. *Annual Reviews of Psychology*, 50, 191-214.

Cain, Bruce, John Ferejohn, and Morris Fiorina. 1987. *The Personal Vote: Constituency Service and Electoral Independence.* Cambridge, MA: Harvard University Press.

Carillo, Juan D., and Thomas R. Palfrey. 2007. The Compromise Game: Two-sided Adverse Selection in the Laboratory. Manuscript.

Cobb, Michael D., and James H. Kuklinski. 1997. Changing Minds: Political Arguments and Political Persuasion. *American Journal of Political Science* 41, 1, 88-121.

Eyster, Erik, and Matthew Rabin. 2005. Cursed Equilibrium. *Econometrica* 73, 5, 1623-1672.

Fiske, Susan T. 1980. Attention and Weight in Person Perception: The Impact of Negative and Extreme Behavior. *Journal of Personality and Social Psychology* 38, 889-906.

Geer, John. 2006. *In Defense of Negativity: Attack Ads in Presidential Campaigns*. Chicago, IL, University of Chicago Press.

Goldstein, K. and P. Freedman. 2002. Campaign Advertising and Voter Turnout: New Evidence for a Stimulation Effect. *Journal of Politics*, 64, 721-740.

Hamilton, David L., and Mark P. Zanna. 1972. Differential Weighting of Favorable and Unfavorable Attributes in Impressions of Personality. *Journal of Experimental Results in Personality* 6, 204-12.

Holbrook, Allyson L., Jon A. Krosnick, Penny S. Visser, Wendi L. Gardner, and John T. Cacioppo. 2001. Attitudes Towards Presidential Candidates and Political Parties: Initial Optimism, Inertial First Impressions, and a Focus On Flaws. *American Journal of Political Science* 45, 4, 930-950.

Kagel, J. H. 1995. Auctions: A Survey of Experimental Research, in *The Handbook of Experimental Economics*, ed. by J. H. Kagel and A. E. Roth. Princeton, NJ: Princeton University Press, 501–585.

Kagel, J. H., and D. Levin. 2002. *Common Values Auctions and the Winner's Curse*. Princeton, NJ: Princeton University Press.

Kahneman, David, and Amos Tversky. 1979. Prospect Theory: An Analysis of Decision

Under Risk. *Econometrica* 47, 263-91.

Kahneman, David, and Amos Tversky. 1984. Choices, Values, and Frames. *American Psychologist* 39, 341-50.

Mattes, K. 2006. Attack Politics: Who Goes Negative and Why. Manuscript.

McKelvey, Richard D., and Thomas R. Palfrey. 1995. Quantal Response Equilibria for Normal Form Games. *Games and Economic Behavior* 10 (June), 6–38.

Milgrom, Paul, and John Roberts. 1986. Relying on the Information of Interested Parties. *Rand Journal of Economics*, 17, 1, 18-32.

Polburn, Mattias K., and David T. Yi. 2006. Informative Positive and Negative Campaigning. *Quarterly Journal of Political Science* 1, 4, 351-371

Thaler, R. H. 1988. The Winner's Curse. *Journal of Economic Perspectives* 2, 191–202.