Lotto, Blotto, or Frontrunner
U.S. Presidential Elections and The Nature of 'Mistakes'

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Abstract The Electoral College often receives attention for perceived flaws as a democratic institution. A feature of the Electoral College that has largely escaped wide discourse is the arbitrariness of winners. Close campaigns under the Electoral College resemble mixed-strategy equilibria implying that any reasonably close winner might not have been the winner if campaign choices had been slightly different. Using a novel computational method, an estimate of the probability that one candidate wins is recovered using data from the 2000 election.

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1 Introduction

For much of the modern history of political science, the connection between campaigns and electoral outcomes has been difficult to find. Campaigns may, of course, be "designed" by candidates and consultants to improve their chances of winning. The problem is that, in equilibrium, the net effects of campaigns may be hard to measure.

The difficulty is sustaining the unobserved counterfactual. What would have happened without the campaign? What would have happened if the campaign had been conducted differently? Are real political campaigns extended, self-consciously strategic contests? That is, does my best choice depend on what I expect my opponent to do? What actions lead to what changes in outcomes?

In current scholarship on U.S. presidential elections, there is a considerable gap between what we generally model as strategic electoral behavior, and its effect on the outcomes of elections. In the behavioral literature, several scholars have examined the impact of campaign messages on voters as a measure of strategy, but the focus has been on "the campaign" as if it were a dose of some drug, and the measurement of effects an exercise in epidemiology: were citizens' views different after the campaign? This search for "campaign effects" is perfectly understandable, and several papers in this tradition make important contributions (for a review, see Iyengar and Simon, 2000).

The problem is that most of these studies ignore the strategic interaction between candidates, which can either lead to biased estimators (Signorino 1999) or a misleading null result. In equilibrium, the strategic choices of candidates can be answered effectively by the opponent (Iyengar and Simon, 2000), which might lead to a null result. This does not mean that the campaign strategies were ineffective, or mistaken. Rather, this finding is consistent with an extremely effective campaign run by each candidate, with full and strategically sophisticated use of the tools of modern electioneering.

In this paper, we will argue that in U.S. presidential elections, in which candidates compete across states and money figures prominently, there are three possible classes of outcomes: Lotto, Blotto, and Frontrunner. Under a Lotto outcome, the probability that a candidate wins a state is a draw from an unknown distribution. In this context, candidates cannot make mistakes, since strategic

behavior has no impact on electoral outcomes. According to Blotto, named after the well known Colonel Blotto, outcomes are a product of the resolution of strategic uncertainty. These games have no pure strategy equilibrium, which means that the loser, by definition, made one or more "mistakes, which were unpredictable ex ante. Finally, in a Frontrunner setting, one of the candidates has an advantage that the opponent cannot overcome, assuming best play by the frontrunner. The candidate with the lead always wins, unless s/he makes a mistake; thus, mistakes are identifiable ex ante. Given that candidates can identify mistakes ex ante, we should not witness mistakes often in this class of outcomes.

We will compare this typology of presidential elections to the observed election results of 1996 and 2000. The 2000 election was one of the closest races in recent history. Following the debacle in Florida, professional and armchair pundits alike were quick to point out the flaws in Gores campaign strategy, giving the impression that such mistakes were avoidable. We argue that these so called "mistakes were not avoidable, since the candidates were playing a Blotto game. As such, while Gore could have utilized a strategy that would have won the election, such a strategy was not identifiable, ex ante. However, we argue that the 1996 election can be classified as a Frontrunner game. Bill Clinton had a sizeable advantage over Dole, such that no ex post change in Doles strategy could have changed the outcome of the 1996 election as we observed Clinton playing a pure strategy to sure victory. We are not the first to draw the Blotto-Electoral College likeness to attention, but we are the first to tackle this complexity head-on.

The paper is organized as follows. Section II reviews the literature on campaign effects and candidate strategy given the institution of the Electoral College. Section III presents the basics of each of the three models of presidential election campaigns. Section IV describes the data, and specific variables, from the 1996 and 2000 U.S. Presidential elections that will be used as illustrations. Section V presents parsimonious logit regressions predicting state-by-state outcomes. In section IV, we suggest a method to examine counter-factuals in presidential elections; specifically, we propose a method to estimate the probability that a particular candidate would have won an election across an estimated optimal mixed strategy distribution that is implied by the structure of the Blotto game and the observed outcomes of the election in each state. In this way, we are

able to simulate changes in strategy that could have led to a Gore victory. Furthermore, we can employ a similar simulation to show that no reallocation by Dole could have altered the outcome of the 1996 election. We believe that these computational results will present additional evidence for our claims that 1996 was a frontrunner election, while 2000 was a "Blotto election. Section VII presents some conclusions, and suggestions for extensions.

2 Campaign Effects and the Electoral College

Most people believe that campaigns matter. But it is surprisingly difficult to specify just how. Early work on the effects of campaigns came to the conclusion that they were minimal in changing the minds of voters. In a study of the 1940 presidential election campaign in Erie County, Ohio, the Columbia school (Lazarsfeld, Berelson, and Gaudet 1944) found that the campaign messages converted only 8 pct of the public. They did however argue that campaigns are important in activating the predispositions of voters. Other work from around this time period reinforced the findings of minimal effects. The American Voter (Campbell et al. 1960) presented evidence of partisan identification as the immovable mover and the main determinant of vote choice. Key (1966) and Fiorina (1981) followed The American Voter with arguments of the importance of retrospective evaluations of the economy on ones vote choice and partisanship. Overall, it appeared that campaigns did little to alter the outcome of elections. The finding of minimal effects was also reinforced in later work (Bartels 1992; Finkel 1993; Patterson and McClure 1976). Implicitly, Fair (1977) and Rosenstone (1983) also employ a Lotto-type model of presidential elections.

Recent work has found more supportive evidence of campaign effects. Many studies have found that campaign events do have an important impact on vote choice (Popkin 1991; Holbrook 1996; Shaw 1999a). These findings have been supported in the analysis of different types of events, such as debates, conventions, political advertisements, and media coverage (for a review, see Iyengar and Simon 2000; Kinder 1998). Even if the potential for preference change is minimal, scholars have argued that the campaign has important effects in voter learning about the candidates (e.g., Alvarez 1997; Bartels 1988; Brians and Wattenberg 1996; Popkin 1991), the decision to turnout

(e.g., Ansolabehere and Iyengar 1995; Finkel and Geer 1998; Freedman and Goldstein 1999), and the standard by which candidates are judged (e.g., Iyengar and Kinder 1987; Johnston et al 1992; Krosnick and Kinder 1990; Krosnick and Brannon 1993).

While these studies are important, almost all of them ignore the strategic setting of the campaign. If candidates are sending targeted messages optimally, then the effects may cancel each other out in equilibrium (Iyengar and Simon, 2000). The specific context of presidential general election campaigns makes this particularly relevant, because the campaign finance system often defines a nearly symmetric contest. The Democratic and Republican nominees receive grants to cover all expenses in the general election campaign. The grants are based on the 1974 figure of $20 million, adjusted for inflation. For example, in 2000, immediately after their respective conventions, the Bush and Gore campaigns each received grants of $67.56 million to cover general election campaign expenses. In addition, as mentioned above, the party committees may spend money on behalf of their nominees (in the amount of 2 cents times the voting age population of the United States; this amounted to $13.68 million in 2000). Third parties whose presidential nominees received at least five percent of the vote in the last election receive funds according to the share of the popular vote obtained.

When candidates have nearly equal resources, and campaign optimally, in the aggregate these effects may often cancel each other out, and we might expect to find minimal effects of strategic behavior. In such a context, we might be more inclined to ask such questions as the nature of mistakes in campaign strategy. In investigating the nature of mistakes, we will be able to identify just how strategy matters in presidential election campaigns. In order to investigate mistakes we formally model this institutional feature of public financing into an Electoral College game that we return to in the last section.

2.1 Electoral College and Studies of Resource Allocation

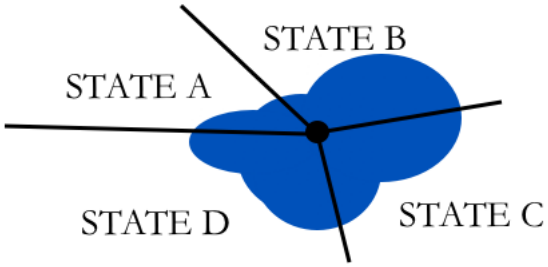
Since the 1960s and the development of the basic tools of social choice analysis, scholars have disputed the fairness and impact of using the Electoral College (EC). The controversy has centered

on the EC's violation of the one-person, one-vote, principle of democracy. However, the dispute has not resolved the exact nature of the bias introduced by the EC system. Some scholars have argued that the EC overweights large states, since its gives more power to states with more electoral votes. Others have claimed that the key feature is the overweighting of individual voters in small states, since each vote "counts" more in the less populous states.

One thing that does seem clear is this: candidates do not compete for electoral votes with equal intensity in every state. The EC creates a set of incentives and strategic advantages that benefit some states and certain groups over others in the competition for candidate attention. It may be hard to parcel out just what the net effects of these biases may be, since there are several possibilities. Some see the possibility of manipulation, or even constitutional crisis (Ball and Leuthold 1991; Berthoud 1997; Hoffman 1996). Others have simply argued that the EC distorts competition among the states (Hinich and Ordeshook 1974; Uslaner 1973, 1976). Scholars have also used game theoretic models to reach the conclusion that states with large, winner-take-all blocs of electoral votes will usually attract substantially greater party attention (Brams 1978; Mann and Shapley 1964; Owens 1975). Brams and Davis (1974) show that rational candidates playing the game should allocate their money or time to states in proportion to the size of the electoral blocs raised to the 3/2 power, in other words, the most populous states. The consequence is that the EC disenfranchises small states, even as it proportionally over-represents them. This conclusion has also received empirical support in Brams and Davis (1974) and Bartels (1985).

Subsequent research has argued that there is no EC-induced bias, but instead observed bias comes from the competitiveness of the race across states. Colantoni, Levesque and Ordeshook (1975) argue that most campaigns follow a simple rule that is not captured in the Brams-Davis game theoretic model: "Identify the states that you and your opponent are certain to carry, and focus your attention on the remaining (competitive states). That is, candidates should be concerned not only with size but also with the likelihood that resources can swing a state from one candidate to another (page 144). Using a decision-making-under-risk model, they show that candidates allocate proportionately more resources to competitive states, rather than use the 3/2nd rule. Rabinowitz and MacDonald (1986) make a similar claim, but use a constrained Shapley value to determine which states will

Figure 1: Media markets overlap states



have more power, where the constraint lies in the political predispositions of the states, which they determine empirically. In an empirical analysis of resource allocation on presidential elections from 1988-1996, Shaw (1999a, 1999b) also finds that the allocation of campaign resources is related to an interactive effect between the number of electoral votes and the competitiveness of the state. Furthermore, he finds that allocation by the opponent has an effect on candidate resource allocation. Shaw (1999b) also ties his work on resource allocation to the campaign effects literature and finds that strategic behavior does have a significant impact on electoral outcomes. We suggest that it is problematic to examine resource allocation with respect to television advertisements and presidential campaigns because of the complication of media markets and the externalities and appropriability problems that they generate (one might call this a spill-over effect). Candidates are competing over states (or rather electoral votes), but they must compete through media markets that often overlap multiple states (see Figure 1).

In this paper, we seek to extend the literature on campaign strategy and its impact on electoral outcomes. Earlier research on presidential elections often focused on the resource allocation problem, studying strategy implementation directly, but the effect of strategic behavior indirectly. We use data on the airing of political ads across media markets in the 1996 and 2000 U.S. presidential election campaigns to test whether "strategy had an impact on electoral outcomes. To investigate strategic behavior, most of the early literature compared a theoretical proposition about rational action with respect to the resource allocation problem. Often the resource to be visited was candidate campaign visits across states. Most political observers today are concerned with political television advertising. Political advertising presents an interesting problem in that while candi-

dates compete across states in the Electoral College, they purchase advertising by media market, in which markets often have overlapping states. We develop a measure of transforming the ads aired across media markets into a measure of ads aired across states. Second, we ask about the nature of mistakes in the allocation of ads and their implications for campaign strategy, which we discuss in detail in the next section. While some extant work has empirically tested whether ads have an impact on outcomes (Shaw 1999b), the analysis has not proceeded to investigate the nature of mistakes in an election.

3 Three Models of the Electoral College Game

The Electoral College creates a structured strategic environment, which we will call the Electoral College Game (ECG). The ECG is substantially different from other electoral arrangements. We model it as having the following features:

- Candidates compete in 51 simultaneous, separate contests (50 states and DC).
- The candidate who wins a state receives all of the votes (i.e. points) from that state.
- States have varying Electoral College votes (roughly proportional to population size, California has 54 electoral college votes, while Wyoming has only 3).
- Candidates do not receive any direct utility from winning an individual state; they only receive utility from winning the election as a whole, a majority of Electoral College votes (in practice, this has meant a simple majority, 270, of the total votes cast, 538). It does not matter which states or what combination of states are won to reach a majority.
- In each presidential campaign, for each state, there are particular "positional advantages, where one candidate is initially favored. For example, in California the Democrats may have a significant lead in the polls just based on the background attitudes of voters

In the ECG setting, we offer a simplified, stylized account of strategy and consider the nature of "mistakes. Understanding mistakes could be considered a dual problem to considering candidate

strategy. Studying strategy implies studying how to win, studying mistakes implies studying how not to lose. In baseball, there is an age-old controversy: has a batter ever hit a good pitch? Or must any hit, by definition, imply a "mistake by the pitcher? The same problem appears with equal or greater force in politics: did the loser make a mistake? It is the nature of "mistakes, what they are and how one would identify them, that lies at the heart of the theory of this paper. Next we consider three models for classifying types of elections under the ECG, and their observable implications for the nature of mistakes.

3.1 Lotto

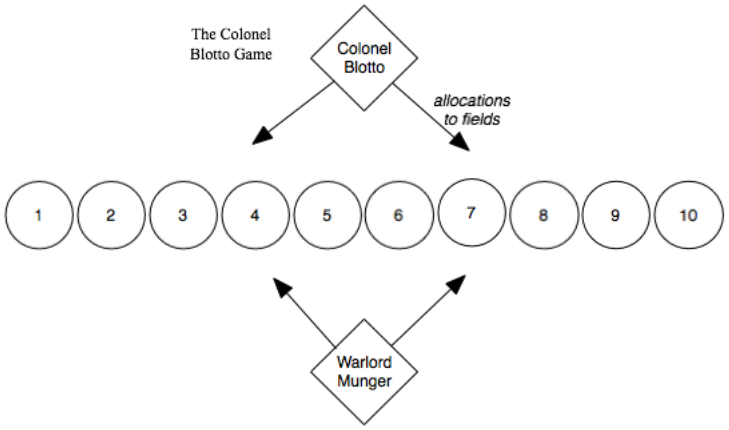
Suppose some guy wins a numbers lottery. He tells you that he used his wifes birthday, his dogs birthday, and two numbers he "just made up. What can we infer about the "science of picking lottery numbers? More specifically, should the listener go buy lottery numbers based on birthdays? Of course not, but a moments thought reveals that, ex post, the winners choice mattered. If he had not chosen those numbers, if he had not used just that strategy, he would not have won.

It may be just this sort of occurrence that determines election outcomes. Events have effects which, though understandable after the fact, seem random to participants at the time. More important, there is no predictable correspondence between actions by candidates and election results. All we may know for sure is that, after the fact, the winner won because s/he chose just that strategy, and not some other.

The point is that, in the lottery setting, it wont help you to look at someone elses strategy, because there is no predictable ex ante connection to outcomes. Ex post, strategies matter, but before the election no one can tell. One way to think of this is that random shocks, such as economic, political, or foreign events, swamp the effect of any strategies that the candidates might employ.

3.2 Blotto

Figure 2: The Colonel Blotto Game



The "Blotto game is a toy model of strategy. The game can be symmetric, or asymmetric. Here is the simple version of the Blotto game.

Tomorrow morning, you must battle the notorious Colonel Blotto. You and Blotto have 1,000 soldiers each, to be allocated across 10 battlefields. Whoever wins the most battles wins the war. A "strategy in this campaign is an ordered 10-tuple, adding up to 1,000, which might look like this: (160, 160, 0, 0, 160, 0, 40, 160, 160, 160). That is, you order 160 troops to battlefield #1, 160 to #2, 0 to #3, 0 to #4, and so on. If Blotto spreads his troops out evenly (100 each) over all the 10 battlefields, then you will win on fields 1, 2, 5, 8, 9, and 10. That means you won 6 battles, and you become the jefe maximo.

Of course, Blotto might choose (165, 165, 165, 165, 165, 165, 0, 0, 0, 10). If he picks this strategy, and you stick with your original allocations, you lose and Blotto wins. Which strategy will Blotto pick? Which strategy should you pick, knowing that the answer for you depends on what you expect the answer to be for him, and vice versa, in an infinite regress? The answer, of course, is that there is no answer, because there is no equilibrium to this game. If people actually must choose in this sort of strategic setting the outcomes will look like they come from a random number generator.

What does this say about "mistakes? For every strategy I pick, there exist many strategies that strictly beat me (this follows from the nonexistence of equilibrium). Now, suppose you are a

reporter, or political pundit, and are therefore truly skilled at predicting things that have already happened. It looks like the "loser in a Blotto situation always made a mistake. By definition, there existed at least one (and probably many) strategy available to the loser that would have beaten the winner. Yet, the loser didnt play any of those strategies, and that is why s/he lost.

In the Blotto, uncertainty is not exogenous; randomness does not come from nature. Rather, uncertainty arises from anticipating your opponents strategy, knowing that s/he is trying just as hard to anticipate yours. If you could get a quick glance at the opponents strategy for allocating troops, you could win for sure. So, unlike Lotto, where knowing what your opponent will do is irrelevant, in the Blotto game knowing your opponents strategy would allow you to win. This important feature is assumed away by the Brams-Davis model which relies on symmetric strategies in order to derive the 3/2 rule.

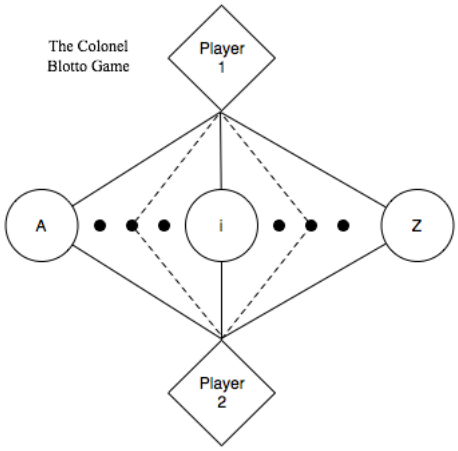
The similarities between the Colonel Blotto game and the Electoral College are straight forward. The battlefields can all be "states, and the troop allocation can be "spending. The terrain or positional advantages of one side can be the attitudes of voters, measured by early poll results. And the different battlefields can have different weights, based on the number of Electoral College votes for each state. Furthermore, if you knew the opponents strategy beforehand, you would be able to win the election. (See Appendix A in Merolla, Munger and Tofias 2003 or Gross and Wagner 1950 for a full exposition of the Colonel Blotto game).

3.3 Frontrunner

In the frontrunner game, one player has an insurmountable advantage. These advantages might be more resources, valence advantages, or a pre-dispositional advantage analogous to the "normal vote (Converse 1966) work of the 1960s.

Of course, if the positional advantages are large enough, the leading candidate may have a dominant strategy: protect the lead in enough states to ensure a majority. In these circumstances, there may exist no informational uncertainty (as in Lotto), or strategic uncertainty (as in Blotto). If you

Figure 3: The Colonel Blotto Game



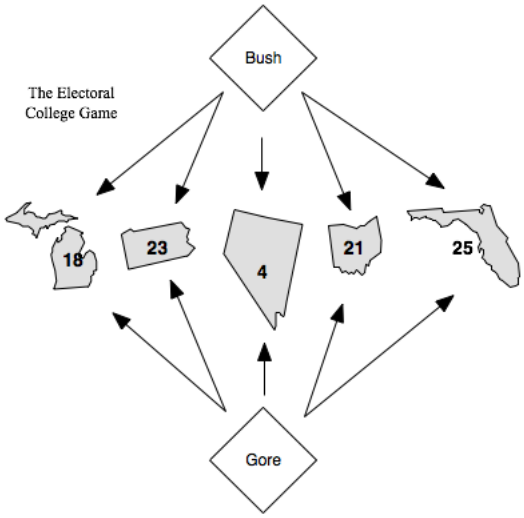
are the trailing candidate, seeing your opponents strategy in the Frontrunner game will not help, since in equilibrium the Frontrunner will be playing a pure strategy that can not be beaten. This implies that in equilibrium, the trailing candidate will always lose. Furthermore, since there is a dominant strategy, any mistakes will be identifiable ex ante, rather than ex post (Blotto game)[1]. It is also possible that a frontrunner candidate could posses multiple pure strategies that are all undominated.

Summary

To restate our theses, we do not think that the 1996 or 2000 elections were a random draw decided by nature (Lotto). Rather, the 2000 election contains all of the characteristics of a Blotto game, while the 1996 election contains all of the characteristics of a Frontrunner game. In the former, Al Gore could have chosen a different strategy and won the election, but this strategy could only be identified ex post. In 1996, the asymmetries were large enough as to be insurmountable to Bob Dole (Frontrunner). In the next sections, we test our claim with data from both elections.

[1]Of course, it may not be clear what the trailing candidate will do, but given (as is implied by the existence of a dominant strategy) his/her best play (in a trembling hand equilibrium sense), will lead to victory only off the path of equilibrium play (i.e. the front runner makes a mistake).

Figure 4: The Electoral College Game



4 Data and Variables

4.1 Data

We test the competing models of presidential election outcomes using data from the 1996 and 2000 U.S. presidential elections. As an indicator of strategic behavior, we colleted data on the number of ads run by the candidates and parties on political advertisements in each media market from the last week of August until the last week of the election. For a proxy of the positional advantage of the candidates, we collected data from state pre-election tracking polls.[2] Our sample consists of 51 "states[3] for 1996 and 49 "states. [4]

The advertisement data was made available by the Brennan Center for Justice and Professor Kenneth Goldstein, which they obtained from the Campaign Media Analysis Group.[5] The "Polaris

[2]All of the state election tracking poll data for the 2000 election was obtained from the National Journals poll track. WH 2000 General Election: State Polls. 2000. NationalJournal.com. Retrieved July 9, 2001. We would like to thank Henry Chappell for providing data on the polls for the 1996 election.

[3]Washington D.C. is included.

[4]We do not include Alaska or Wyoming for 2000 because we did not have any pre-election tracking polls for the two states.

[5]The data were obtained from a joint project of the Brennan Center for Justice at New York University School of Law and Professor Kenneth Goldstein of the University of Wisconsin-Madison, and included media tracking data from the Campaign Media Analysis Group in Washington, D.C. The Brennan Center-Wisconsin project was sponsored by a grant from the Pew Charitable Trusts. The opinions expressed in this article are those of the author and do not

Ad Detector, owned by the Campaign Media Analysis Group, is an independent satellite tracking system that monitors political advertising activity throughout the year on the national networks (ABC, CBS, NBC, and Fox) as well as 25 national cable networks (CNN, ESPN, TNT, etc). CMAG monitors all of the political advertisements run in the top 75 media markets, and uses this database of advertisements to give advice to campaigns and the media.[6]The resulting database provides information on the total number of advertisements that aired in each media market, differentiated by the sponsor, for each election.

4.2 Variables

The dependent variable for both elections is a dummy variable for whether the Democratic candidate won in the given state. The dependent variable is coded as 1 if the Democratic candidate won and zero otherwise. We label the variable Clinton victory for the 1996 election and Gore Victory for the 2000 election.

Independent variables describing positional advantages are from state pre-election tracking polls (we use the first available poll results in a state starting the last week in August). For both elections, we use the Democratic candidates percentage of the two-party vote in the tracking poll for each state (Democrat poll share). For the 2000 election, we control for thepresence of Nader in the race, which some argue cost Gore the election in some states (Burden 2003). We use the percentage of support for Nader (Nader support) in the first available state tracking poll. The Gore campaign, the DNC, and various interest groups in the 2000 election tried to convince Nader supporters to switch their vote to Gore (Merolla 2003). Since there were few incentives for strategic voting in the 1996 election (Merolla 2003), we do not include a measure of the level of support for Perot.[7]We suspect that Nader support is positively correlated with positional advantage for Gore. We expect

necessarily reflect the views of the Brennan Center, Professor Goldstein or the Pew Charitable trust.

[6]Freedman and Goldstein (1999) have used the data in testing the effect of negative advertisements on turnout. They describe the details of the system this way: The system works by recognizing the electronic seams between programming and advertising and identifies the digital fingerprints of specific ads. When the system does not recognize the fingerprint of a particular commercial spot, the storyboard (the full audio and every four seconds of the video) is captured and downloaded to the headquarters of the firm. Analysts then code the ads, assigning them to particular categories and tag them with a digital code. Thereafter, the system automatically recognizes and logs that commercial wherever and whenever it airs.

the poll measures to have a positive impact on the dependent variables.

The strategic independent variables are a bit more complicated in that the level of measurement of the ad variables is at the level of the media market, which we convert to a state level measure of the strategic interaction; the net advertisements for the Democratic candidate minus the Republican candidate. Since media markets often overlap across different states, we need to be able to assign markets to states. Furthermore, we would not expect that an ad aired in one market would have the same impact as an ad aired in another market because the population in each market varies. Thus, we also need to weight the number of ads by the state population in each media market and the overall population of the state. An ad that airs in a media market that covers multiple states will (marginally) effect the outcome of the election in each of those states. This Net Ad Score is better than directly using spending data because it is harder to measure the effect of TV spending across states/media markets since money buys different things in different places, for this reason it is better to count like things, i.e., advertisements, however (and perhaps obviously) the ad count and spending are highly correlated and we find a linear relationship between the number of TV ads a campaign runs in a media market and their total spending in that market. We only have the spending data for the 2000 election.

We first assigned the number of ads in each media market (for each candidate) to the counties contained in the market. For example, if a media market had 100 ads, we then assigned 100 ads to each county that was part of the given media market. In the next step, we multiplied the number of ads aired in each county by the population in each county, which gives an indication of the impact of the ads in each state. Next, we sum this measure across all of the counties in a state and weight by the population of the state, so that the variable would be comparable across states.[8]We have counted the proportion of a state that was exposed to an advertisement. To measure the result of the strategic interaction in a state we subtracted the Republican candidate total from the Democratic candidate total to get an indicator of the net Democratic advertisements in a state. A positive value on Democratic ad net indicates that the Democratic candidate made a stronger ad

[7]Since Perot was perceived as being in the middle of the political spectrum, there was little incentive to appeal to his supporters to vote strategically. If they all voted strategically, maybe half would have supported Clinton and half Dole; thus, canceling out any effect on the electoral outcome.

presence, while a negative value indicates that the Democratic candidate had a weaker ad presence. The measure ranges 6.5 to 14.8 in 1996 and from 13.4 to 8.95 in 2000. Our hypothesis is that the democratic candidate is more likely to win the election in a state as the Net Ad Score increases.

Table 1 presents descriptive statistics for the dependent and independent variables for the 1996 and 2000 presidential elections. We can see that Clinton had advantages over Dole in both his early poll standing and his strategic resource, TV advertisements. While Gore had a much slighter lead over Bush in the early poll standings and he also had less ads to allocate over the election.

Table 1: **Descriptive Statistics**

1996 Election (51 observations)				
	Mean	Std. Dev.	Min	Max
Democratic Poll Share	.56	.09	.37	.94
Net Ad Score	1.42	3.64	-6.50	14.80
2000 Election (49 observations*)				
	Mean	Std. Dev.	Min	Max
Democratic Poll Share	.51	.09	.34	.84
Net Ad Score	-1.51	4.62	-13.40	8.95
Nader Poll Share	3.19	2.25	0.00	9.00

The units of analysis are the states plus Washington, D.C.
* There was no polling data for Wyoming and Alaska.

Looking at unweighted descriptive statistics can be slightly misleading because of the Electoral College. One way to look at positional advantage is to look at the distribution of the electoral college votes for each candidate based on the early poll results. The 1996 election features Clinton with a fairly overwhelming 362 votes in the Electoral College compared to the 277 votes Gore was claiming in the early part of the 2000 election. There were also over 40 more electoral votes that were in the middle range during the start of the 2000 campaign.

Table 2 begins to outline the difference between a Frontrunner and a Blotto election. Clintons lead was of quite a different sort than Gores lead. Gore would go on to lose five states and 37 electoral votes that the early poll distribution suggests he had the lead (Kentucky, Louisiana, New Hampshire, Tennessee and West Virginia) and only win two states and 16 electoral votes that

[8]Population data for 2000 comes directly from the U.S. Census. The 1996 data was estimated at the county level by the U.S. Census Bureau from the 1990 Census.

Table 2: **Distribution:** 538 Electoral College Votes Based on Early Polls

Early Poll Results **f**or each state	Electoral Votes 1996	Electoral Votes 2000
Democratic Poll Share $< 47\%$	81	124
$47\ \% \leq$ Democratic Poll Share $\leq 53\%$	95	137
$53\ \% <$ Democratic Poll Share	362	277

were more or less up for grabs (New Mexico and Washington). Clinton could have lost nearly 100 electoral votes from his early base and still won the 1996 election.

A graphical way to look at the outcome of the election is with an outcome scatter plot where we can examine the effects of both positional advantage and the strategic interaction on the same plot. The action in the 2000 election is clearly in the competitive states. The allocations between the candidates is highly correlated at .84 with the candidates not allocating to a number of states, but in the 1996 campaign every media market in the top 75 received attention and the candidates allocations were correlated at .95. These differences in allocation patterns are suggestive of reactions to the qualitative difference in the 1996 and 2000 elections.

The graphical analysis leads to our multivariate analysis.

5 Analysis

5.1 Review of Hypotheses and Method

Our hypothesis is that the 2000 election is best represented by a Blotto game, while the 1996 election is best represented by a Front-runner game. If either election is best represented by a Lotto game, then we should find that none of the strategic interaction variables, i.e. the ad measures, have a significant effect on whether the Democratic candidate won a given state. Thus, if the ad variables are insignificant, then we cannot reject the null hypothesis that the 1996 and 2000 elections are

Figure 5: State Outcomes in the 2000 Election by Net Ad Score and Poll Share

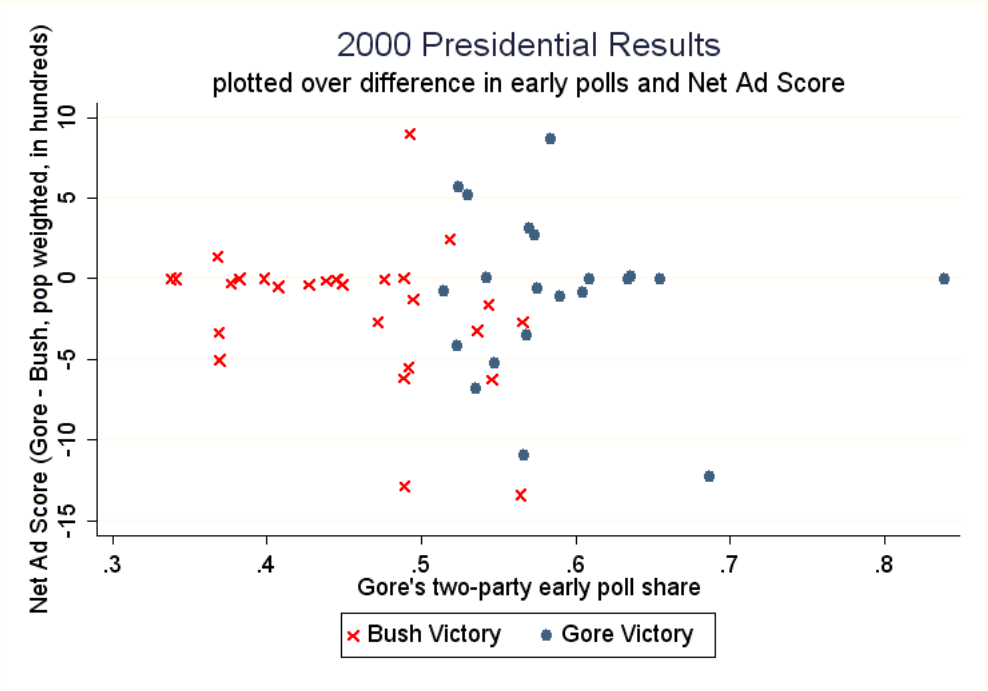
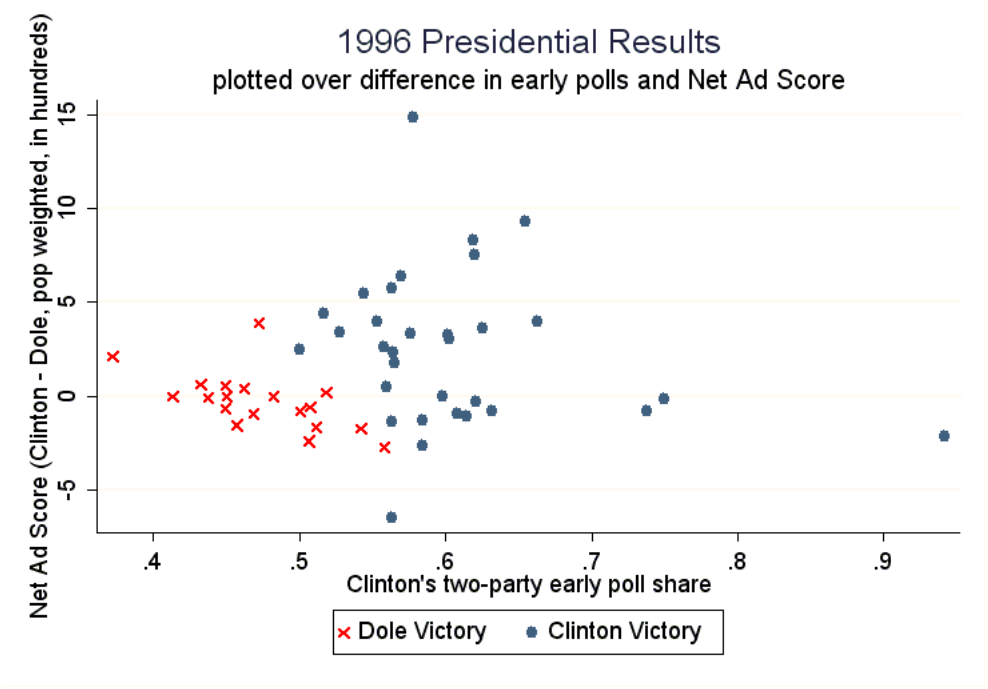


Figure 6: State Outcomes in the 1996 Election by Net Ad Score and Poll Share



best represented by Lotto. Recovering the correct sign and significance on the strategic interaction parameter can be difficult because it requires that candidates strategies are not too similar. A perfectly consistent outcome with Blotto type allocation mixed strategies would be an observed set of strategies that are nearly the same across all states. Luckily, we do not have that problem in the present analysis.

Finding that the strategic variables are significant is important in establishing that strategy matters, but it does not help us distinguish between the Blotto and Frontrunner games. We need to take extra steps to find support for our hypotheses about the 1996 and 2000 election. To show that the 1996 election is characteristic of a Front-runner game, we need to demonstrate that there is no ex post reallocation of advertisements by Dole that would change the outcome of the election. If the 2000 election is best represented by a Blotto game, we should witness mistakes in spending by Gore, which were not identifiable ex ante, but that are identifiable ex post. Uncovering reallocations, or alternate strategies, in which the loser could have won is characteristic of Blotto type competition, and not Frontrunner. We examine these claims in section VI.

5.2 Test 1

Table 3 presents the logit analysis on whether Gore won in the given state for the 200 presidential election. Before turning to the impact of the independent variables, we should note that the model performs very well. In 2000, only four states were incorrectly classified. Tennessee and Colorado were predicted as Gore wins, but Gore did not carry either state, while New Mexico and Washington were predicted as Gore loses and he carried them. However, all of the states that were not correctly classified were among the battleground states. Furthermore, the predictions for Tennessee and Colorado were very close to .5 (.54 for Tennessee and .515 for Colorado, this helps to explain the high measure of the area under the ROC curve which is 0.9745). The model also misclassifies Washington and New Mexico and classifies Florida as a win for Bush.

Turning to the independent variables, they are all significant and in the correct direction. Thus, more ad allocation by the Democratic candidate increased the likelihood that the Democratic

Table 3: **Logit Regression:** Gore Victory in the 2000 Presidential Election

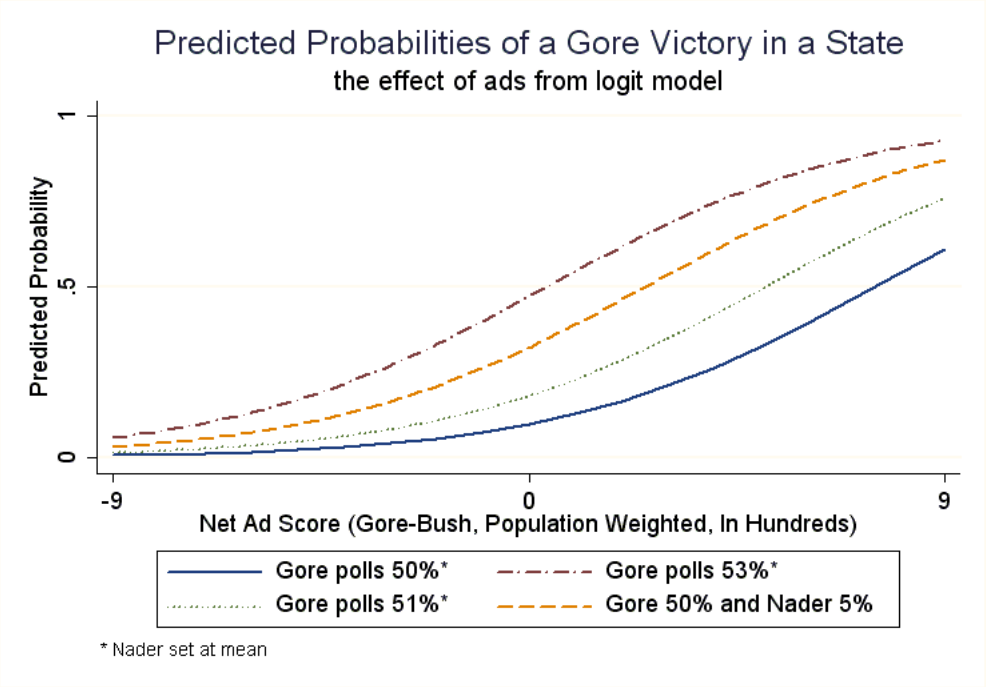
Variable	Logit Coefficient	Standard Error	P Value
Democrat Poll Share	70.018	31.623	.027
Net Ad Score	.296	.155	.056
Nader Poll Share	.813	.382	.033
Intercept	-39.819	17.409	.022
Number of observations	49		
Log likelihood	-8.849		
Pseudo R^2	0.736		
Area under the ROC Curve	0.975		

Dependent Variable coded as Yes=1 and No=0.

candidate carried the state. Furthermore, the positional advantage variables of the Democratic poll lead are positive and significant in both models, as expected. Finally, the Nader poll share variable is significant and in the expected direction. We can clearly reject the null hypothesis that the 2000 election is representative of Lotto. It is often a good idea too look for collinearity in the regression model. The strongest relationship is between Gores share of the two-party poll and the respondents identifying Nader as their vote choice. This is suggestive of how we envision Nader supporters. The intercept has a nice interpretation in these models, it represents the national campaign.

Since logit coefficients are not directly interpretable, we calculated the first differences, in order to get a sense of the size of the substantive effects of the net ad measure for the 2000 election. Figure 1 presents the predicted probability of voting for Gore at different levels of the Dem ad measure, holding Gores Poll Share held constant at different values and Naders Poll Share held at the mean. We only present cases of a close race, with Gores Poll Share at 50 pct, 51 pct with Nader at the mean and Naders Poll Share at 5 pct, and 53 pct. The figure nicely illustrates the important role of strategic behavior in the 2000 election.[9]When the net ads measure is at zero (or both candidates allocated the same number of weighted ads), Gores probability of winning is below .5, at all levels of Gores poll share (though it is very close to .5 when Gores poll share is at .53). However, as the net ad measure becomes positive, or Gore allocates more ads than Bush, the probability of a Gore win increases, and crosses the .5 threshold when Gores poll share is at 53 pct and 51 pct (with Nader at 5 pct); the scale on the x-axis represents about 3/4th of the realized interactions (in 2000

Figure 7: Predicted Probability of a Gore Victory in a State



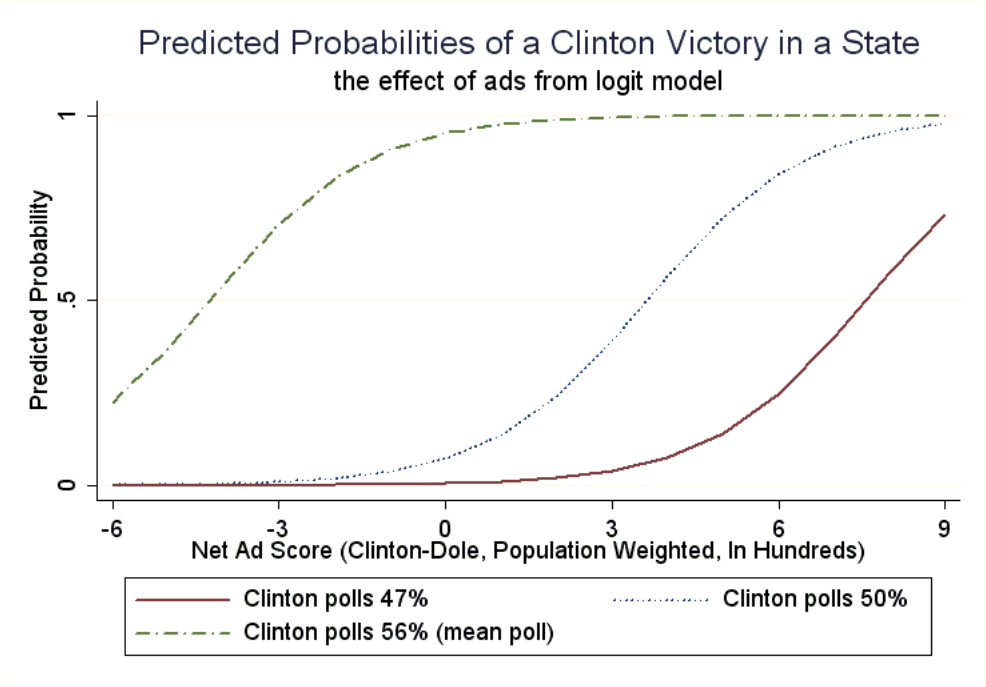
Net Ad Score is only larger than 5 in four states).

Furthermore, if the Ned Ad Score is negative, or Bush allocated more ads, then the probability of a Gore win decreases at the given levels of Gores poll share.

Table 4 presents the results for the 1996 election. Again, the model performs very well with respect to discriminations (the area under the ROC curve is 0.9901) and all of the states are correctly classifying but four (California, Colorado, Indiana, and Nevada). All of the variables are in the correct direction and statistically significant, as with the 2000 election. The Democratic Poll Share measure is significant, increasing the likelihood of a Clinton victory. The Net Ad Score is significant at the .05 level. However, it is also likely that non-election factors entered into Clintons decision making in regard to electoral strategy. If a candidate is a leader in a front-runner game, it is possible that some allocation decisions might be related to long-term strategies for their national

[9] As another indicator of strategic interaction, we examined the correlation between advertisement allocations by the two campaigns, which was .8417. This high correlation provides some initial indication of the Blotto like nature of the 2000 election. This relationship is even more pronounced if you remove the states which did not see any advertisements. Furthermore, adding the positional advantage variables to a multivariate model does not decrease the strength of this relationship much.

Figure 8: Predicted Probability of a Clinton Victory in a State



party, which may cause the effect of the net advertisements to be muted. Similarly, it may be the case that heavy republican spending in California in both elections can be explained for reasons not directly related to winning the current presidential election.

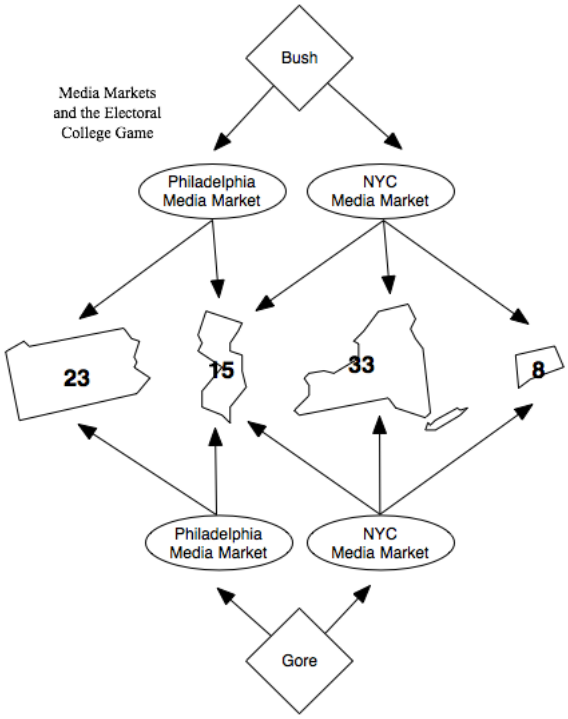
Table 4: **Logit Regression:** Clinton Victory in the 1996 Presidential Election

Variable	**Logit Coefficient**	**Standard Error**	**P Value**
Democrat Poll Share	92.771	36.297	0.011
Net Ad Score	.707	.344	0.040
Intercept	-48.951	19.161	0.011
Number of observations	51		
Log likelihood	-5.834		
Pseudo R^2	.8267		
Area under the ROC Curve	0.990		

Dependent Variable coded as Yes=1 and No=0.

While we have demonstrated strong evidence that strategy effected the electoral college in the 1996 and 2000 election, suggesting that we can reject Lotto, we still need to demonstrate that 1996 is best represented by a Frontrunner game, while 2000 is best represented by a Blotto game. The next section examines these claims using a computational model.

Figure 9: Media Markets and the Electoral College



6 Simulating Blotto Elections

In this section, we propose a method to estimate the probability of a Gore victory in the 2000 election as well as attempt to ascertain whether or not Clinton was playing a dominant strategy (i.e., did Dole posses a strategy that would have defeated the strategy employed by Clinton).

Most computational models abstract from many real world features such as geography. Here we can exploit the empirical data and statistical model we have estimated in order to investigate a specific question. Instead of investigating a generalized model (with parameters) of the Colonel Blotto game, or even the Electoral College Game, we focus on the counter-factuals of the observed elections with most of our attention on the 2000 election because of its closeness.

Finding support for our hypothesis involves two steps. First, we need to reject the null hypothesis that strategic behavior, or the allocation of ads, does not matter (Lotto) in each election. Since we found support for the strategic interaction variables in each election, we reject that the null that

the 1996 and 2000 election are best represented by a Lotto game. However, the results from the logit analysis do not allow us to distinguish between Blotto or Frontrunner, since both predict that the strategic variables matter in the same way. Thus, the second part of our analysis turns to the question of the nature of mistakes in each election. Under Blotto, we should be able to identify mistakes, ex post, which, if corrected, would change the outcome of the election. The Blotto context is more complex in that neither candidate should have a dominant strategy; thus, we need to examine reallocations by both candidates. To test whether the an election is characteristic of a Blotto game, we have developed a computational model. The model employs the statistical model that we estimate for the given election as the indicator of whether a candidate carries a state. First we search for a dominant strategy that might have been unplayed in error. When we do not find an *ex post* reallocation that would have been a dominant strategy we can then examine, in the context of the model, what is the probability of a Gore win if we re-played the 2000 election a million times where each trial features a new draw from an estimated optimal mixed strategy distribution that we recover.

We now come to the delicate task of describing the estimation procedure. To estimate this probability we are required to appreciate the problem posed by the electoral college and its Colonel Blotto game-like structure. Blotto implies that agents employ mixed strategies. To recover the probability that a candidate wins an election requires the recovery of the probability distributions employed by each candidate. This is a hard problem.

In the canonical formulation of Blotto, players have symmetric resources and battlefields are undistinguished. In the 2000 electoral college competition, neither of these things are the case. Furthermore, while the electoral college game is a competition over states, the strategy is carried through media markets. To recover the probability that Gore should have won requires us to develop a new technique that takes into account issues of resource asymmetry, positional advantage, differential costs and benefits of advertisement across media markets and perhaps most importantly an assumption about the objective function for strategies used by the candidates.

While taking the utility function from the Blotto game is straightforward (win election =1, lose election =0) with respect to outcome, we employ a semi-lexicographic objective function over

strategies in order to create a fitness rank that we use in a genetic algorithm (Holland 1975) to recover the proper probability distribution over pure strategies (this is not so different from the concept of a component game utility function discussed in de Marchi 2005). The details of this function and the algorithm are discussed below.

We do not suggest that the Bush and Gore campaigns employed a GA to construct a probability distribution and then proceeded to play a randomly selected strategy, however, we do appeal to the motivation for mixed strategies, in that it appears to be what they did because if a candidates strategy had been common knowledge or the device to select it transparent then the rival candidate would not have had any difficulty in discerning their best response. However, the technology described below would also uncover a dominant strategy had one existed for either candidate in the 2000 election.

6.1 Computational Blotto

Sequence and Definitions

Define candidate budgets such that an agent's budget is the sum of spending over all media markets since aggregate spending for each candidate-state was observed in 2000.

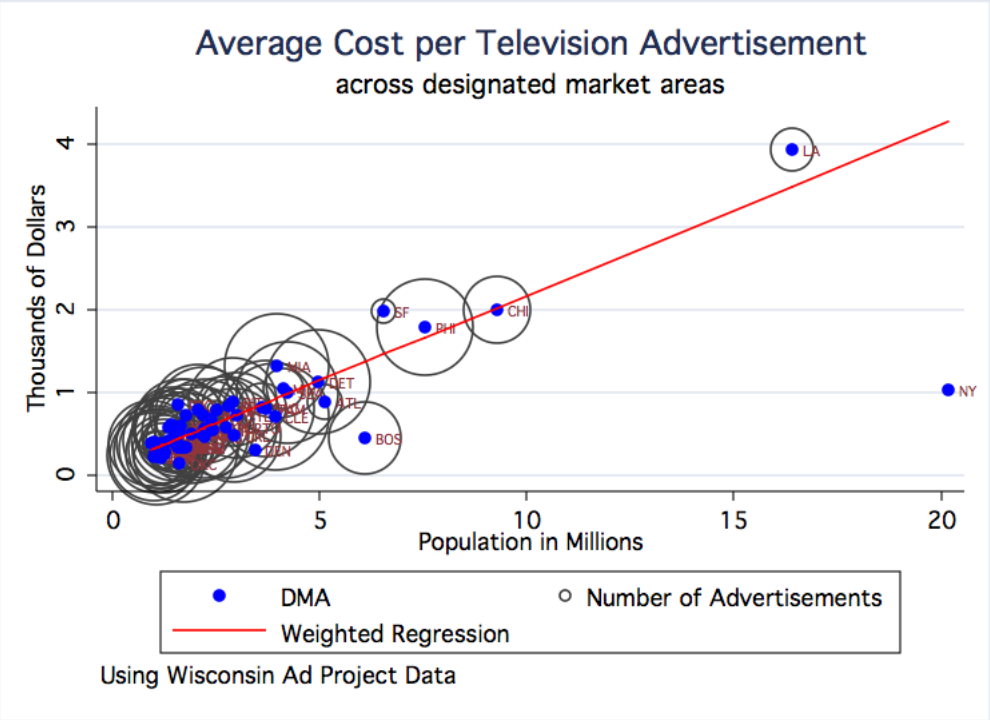
Develop strategies over media markets a. A strategy is a vector of allocations to each media market. A strategy can therefore be expressed as a vector of shares points such that for each agent the amount of spending purchased in a media market is expressed as a percentage of the budget. Therefore an element of the strategy vector can be expressed as

$$s_m = \frac{a_m}{\sum_M a_m}$$

where $a_m = [0, 1]$.

b. Let there be a set Z of 1000 strategies for each candidate, where the a_ms are each initialized

Figure 10: The Estimated Cost of an Advertisement



randomly.

2. Round-robin competition of strategies.

a. Each strategy in each agents strategy set Z is evaluated against each strategy in the rivals set. Results are recorded.

b. Evaluation is conducted using the statistical model estimated from the 2000 election results. Positional advantage in each state is taken from observed results. Each combination of agent strategies presents a vector of hypothetical allocations that can be transformed into the Net Ad Score independent variable and used to estimate the probability that an agent would win that state.

c. Strategies into Net Ad Score [recall: competition is over states but through media markets] Strategies in the computational model are expressed in dollars, but the effect on a state is in advertisements.

i. The number of advertisements in a media market comes from the estimated cost per advertise-

ment which is estimated by using the weighted regression of cost per ad onto DMA population, where the weights are determined by the number of advertisements that were purchased in a market.

ii. The Net Ad Score is calculated in the same manner from advertisements as in the empirical model. The data must be converted from media markets to states.

d. 1000^2 hypothetical elections are held.

i. Where victory in a state is $y^* > .5$

3. Development of new strategy sets with genetic algorithm.

a. For each candidate, strategies in Z are ranked by the following criteria in a semi-lexicographic fashion

i. Number of victorious elections (out of 1000)

ii. Average number of electoral college votes won in each election

iii. Average expected number of electoral college votes This objective function rewards winning, but not while privileging the maximization of the margin of victory in the election or in a state. Instead it favors strategies that were the most robust, i.e., they succeed against the greatest number of the rivals strategies.

b. Creation of new strategy sets For the GA, the share vectors are "chromosomes. Children are probabilistically more likely to receive genes from parent strategies that were successful.

4. Lather. Rinse. Repeat.

a. Repeat steps 2 & 3 100 times. Mutation intensity decreases over time.

5. Strategic Probability Distribution

a. Write-out top 100 strategies. Repeat step 4 1000 times. This creates a set, Z^*, of 100,000

strategies in which identical strategies may exist in the set, in fact the intent is for that to be the case since the optimal mix will likely overweight certain allocations even among the set that have proven to be successful.

6. Estimation of the Probability of a Gore win

a. Agents compete in 1 million elections where strategies are chosen randomly from the strategic probability distribution Z^*.

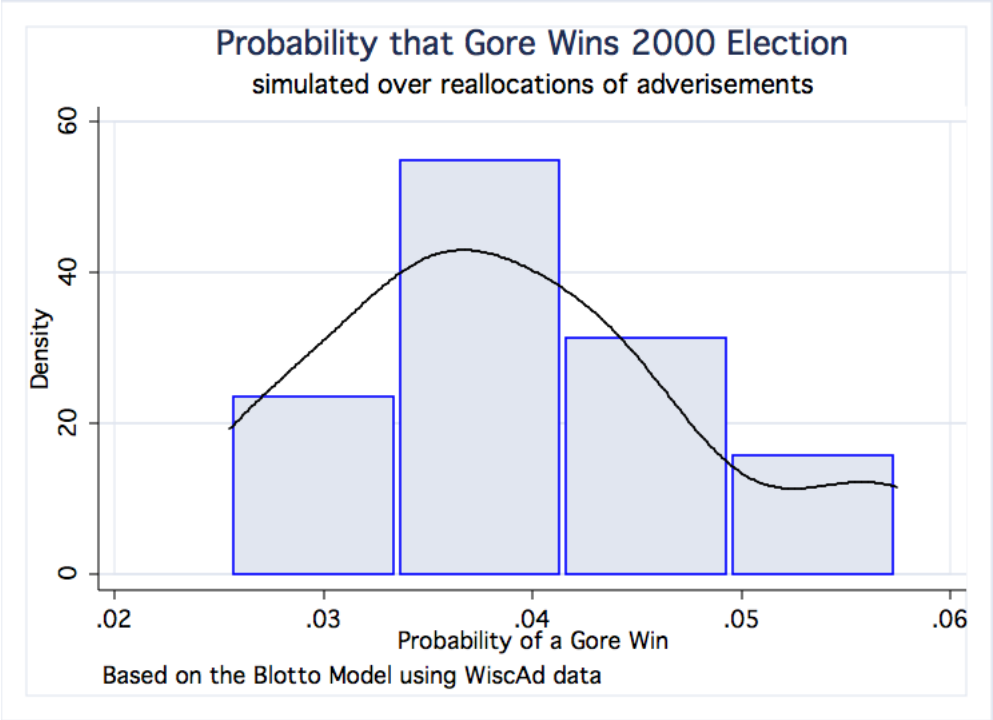
b. Detection of a dominant strategy can be accomplished by examining the set of strategies for each candidate that never lost in this contest. If the set is non-empty, competition against each rival strategy ensues.

c. Proportion of Gore victories is equal to the estimated probability that Gore would have won the election accounting for strategic uncertainty. In the canonical definition of mixed strategies, rivals derive their optimal mixes such that their opponents will be indifferent between any pure strategy. Since the game is constant sum and binary our procedure should estimate the optimal mixed strategy distributions with respect to the statistical model we estimated. While we do not have to make any assumptions about geography (as we are using the "true mapping of media markets and states), and we exploit the statistical model for determining the outcome of an election in each state the internal utility functions we propose are somewhat idiosyncratic and the mechanics of the GA are arbitrary. For robustness we should examine alternative specifications of the utility functions and the GA by perturbing them and treating them as parameter choices.

6.2 Simulation Results

The results of the Colonel Blotto simulation with the parameters empirically estimated from the 2000 data suggest that Gore would have won about 4% of the time if the election had been replayed repeatedly. Figure 11 describes the distribution of Gore's success over 16 iterations of our estimation technique. The technique may still need some refining. Four percent seems a little low at face value. In addition, Figure 12 describes how difficult it is to recover *good* strategies for Gore. This may

Figure 11: Probability that Gore wins the 2000 Election



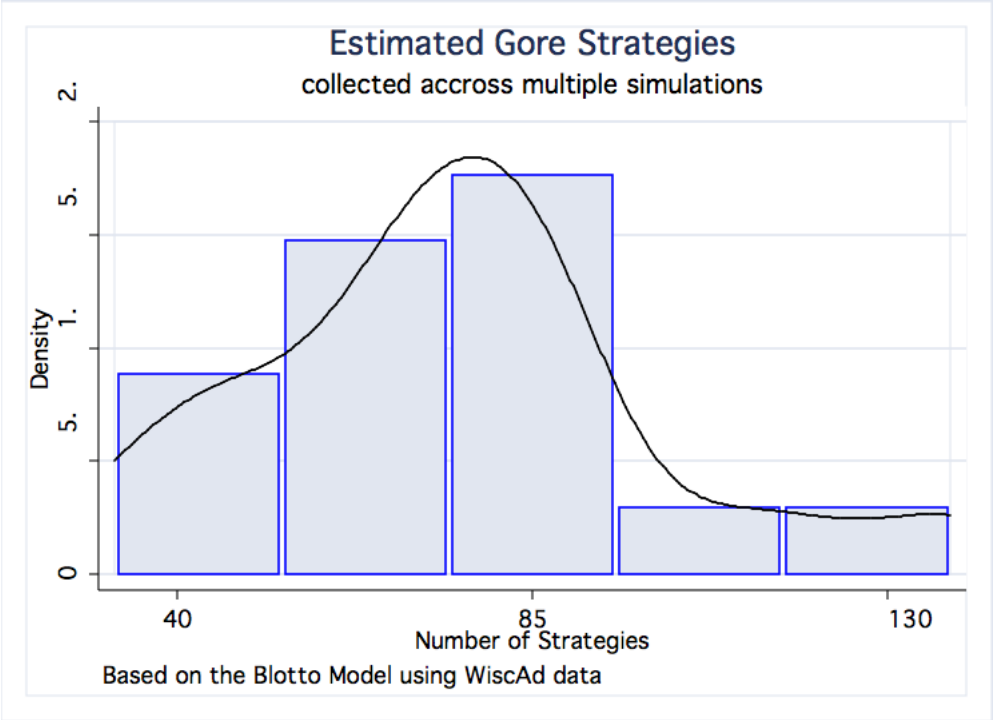
be a structural feature of his problem space, or it may reveal some difficulty with our technique. More research is needed to adjudicate these findings.

In addition, while the process of developing the computational Blotto model was quite organic to the research agenda and no wholly conceived from the beginning of the project, a step backward seems to be in order. Instead of starting with the gooey goodness of the Electoral College, we should try to understand a simpler Blotto model first, say a three "field" model. Models should be built with increasing levels of complexity, working up toward the Electoral College.

7 Discussion

In this paper we have presented three conceptual models of a U.S. Presidential election. They are Lotto, Blotto, and Frontrunner. "Lotto elections are those in which random, or exogenous (from the perspective of the candidates and the campaigns) factors dominate. The distinguishing feature

Figure 12: Number of Good Strategies recovered for Gore



of the Lotto campaigns is uncertainty, present to such an extent that there is little advantage to knowing your opponents strategy.

The second election type, "Blotto, may look very similar to the outside observer ex post, but it is fundamentally different. The key feature of Blotto campaigns is strategic uncertainty. In Blotto, there must exist at least one feasible strategy that would have defeated any strategy chosen by the opponent. Since the election is actually held, and someone wins (just as in a game of "Rock, Scissors, Paper), it looks like the loser made a mistake ("Darn! I would have played Rock, if I had known you were going to play Scissors!). But it is the nature of Blotto contests that someone always wins, and someone always loses, yet no ex ante mistake need to have occurred.

The third election type, "Frontrunner, occurs when one candidate has overwhelming advantages going into the race, and does not make any mistakes. Since this type of election requires that the frontrunner has big leads in states that together give a majority in the Electoral College, the candidate need only hold onto the lead, and s/he wins.

Our empirical analysis of the 1996 and 2000 U.S. Presidential elections lends support to our claim that the 1996 election was a Frontrunner election and the 2000 election was a Blotto election. Our support came from a parsimonious model of positional advantage and strategic interaction. We correctly classifies all but 4 of the state-by-state outcomes in each election. The direction and significance of the strategic interaction model encouraged us to reject the Lotto model as a typology for the 1996 and 2000 elections.

Of course we are still left with our initial question: what is the role of the campaign, in U.S. Presidential elections? The problem is that if campaigns are Blotto, there may be no answer. The Colonel Blotto game does match popular normative conceptions about elections and electoral mandates. The implications of Blotto elections are grossly under considered in this paper suggesting that the electoral college and US democracy may not be properly evaluated in by democratic theorists.

In future work, we will build a dynamic Blotto game played over multiple time periods, in which previous allocation are sunk but maintain an effect on the outcome of the election. This type of model and empirical analysis might increase our in-sample predictions of state outcomes, it is partially troubling that we do not predict a Florida to be a close race in the 2000 election. This is probably a distortion of the one-shot model we are enforcing on the inherently dynamic campaign. A dynamic model should enhance our understanding of the role of the campaign in U.S. Presidential elections and lead to better out-of-sample predictions in future work.

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