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## The Air War versus The Ground Game: An Analysis of Multi-Channel Marketing in U.S. Presidential Elections

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# **The Air War versus The Ground Game: An Analysis of Multi-Channel Marketing in U.S. Presidential Elections**

**Doug J. Chung  
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**Working Paper**

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The Air War versus The Ground Game:  
An Analysis of Multi-Channel Marketing in U.S. Presidential Elections

Doug J. Chung, Lingling Zhang

**Abstract**

Firms increasingly use both mass-media advertising and targeted personal selling to successfully promote products and brands in the marketplace. In this study, we jointly examine the effect of mass-media advertising and personal selling in the context of U.S. presidential elections, where the former is referred to as the “air war” and the latter the “ground game.” Specifically, we look at how different types of advertising—candidate own ads vs. outside ads—and personal selling—in the form of utilizing field offices—affect voter preferences. Further, we ask how these various campaign activities affect the outcome of elections through their diverse effects on various types of people. We find that personal selling has a stronger effect among partisan voters, while candidate’s own advertising is better received by non-partisans. We also find that personal selling accounted for the Democratic victories in the 2008 and 2012 elections, and that advertising was critical only in a close election, such as the one in 2004. Interestingly, had the Democrats received more outside advertising in 2004, the election would have ended up in a 269-269 tie. Our findings generate insights on how to allocate resources across and within channels.

keywords: multi-channel marketing, personal selling, advertising, political campaigns, discrete-choice model, instrumental variables.

# 1 Introduction

It is no secret that multi-channel marketing has increasingly been regarded as a competitive strategy critical to market success. Firms that understand the effect of and the dynamics behind their marketing channels are likely to deliver a better customer experience and, hence, win over their customers. Among these channels, mass-media advertising and personal selling are usually the biggest arsenal at the firm's disposal. Advertising has the advantage of reaching a large-scale audience, using standard and well-scripted communication messages. Its importance goes without saying: global advertising spending was reportedly around \$128 billion in 2013.<sup>1</sup> Personal selling, on the other hand, happens at a micro level and takes the form of direct customer contacts, which includes regular and ad-hoc visits, distribution of fliers, and telemarketing, to name just a few. It often relies on a sales force to carry out the actual persuasion or promotion, whether it is face-to-face or over the phone. Similar to advertising, its presence is of great importance to many businesses. In the United States alone, total spending on the sales force has been reported to be more than four times the total spending on advertising (Zoltners et al. 2006), and approximately 11% of the nation's labor force is directly involved in sales or sales-related activities.<sup>2</sup> As advertising and personal selling are foremost in the minds of marketers, it is critical to ask the relative effectiveness of each channel and the possible synergies between them.

In this study, we examine mass-media advertising and personal selling in the context of U.S. presidential elections. Recent elections have witnessed a rapid growth in campaign spending. In the 2012 election alone, the Democratic and Republican candidates combined spent close to \$2 billion, making it one of the most expensive elections in history.<sup>3</sup> Candidates have not only advertised more on the airwaves, but have also increased their spending on personal selling efforts, most notably through setting up field operations to organize voter outreach. Prompted by the tremendous increase in campaign spending, both political strategists and the general public have engaged in a heated discussion about the effect of campaign activities on actual election outcomes. Not surprisingly, as soon as election results are revealed, credit often goes to the winner's campaign and its main strategist. For example, the day after the current U.S. President, Barack H. Obama, was first elected in 2008, the *New York Times*' front-page article claimed,

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<sup>1</sup>Nielsen (2013).

<sup>2</sup>U.S. Bureau of Labor Statistics, May 2013.

<sup>3</sup>*New York Times*, "The 2012 Money Race."

“The story of Mr. Obama’s journey to the pinnacle of American politics is the story of a campaign that was, even in the view of many rivals, almost flawless.”<sup>4</sup> Also that year, fascinated by an unprecedented field campaign, the *Denver Post* stated that “Obama’s effective organization (of the field teams) could be a harbinger for how successful elections are won in battlegrounds in years to come.”<sup>5</sup> But, how much of this is true in reality? Were campaigns and their marketing activities the determining factors leading to Mr. Obama’s successes? If so, which mattered more; the macro-level mass-media advertising or the micro-level personal selling?

Identifying the effect of advertising and personal selling, as it turns out, is anything but trivial. Numerous studies in Marketing and Economics have looked at the various effects of advertising (de Kluyver and Brodie 1987; Givon and Horsky 1990; Dekimpe and Hanssens 1995; Lodish et al. 1995; Bruce 2008), and some in the domain of presidential elections (e.g., Gordon and Hartmann 2013). However, our understanding of personal selling is rather limited, despite the fact that it has long been regarded as an important ingredient of the marketing mix (Borden 1964; Weitz 1981). This gap is largely due to a paucity of high-quality empirical data and a lack of rigorous models for identifying the effect of personal selling. There are several challenges that limit a robust analysis of personal selling effectiveness.

First, personal selling is often measured without sufficient variation due to data aggregation. Narayanan et al. (2004) studied the effectiveness of personal selling in the pharmaceutical industry, and measured personal-selling efforts using the total amount of detailing across the entire U.S. market. Gatignon and Hanssens (1987) examined sales effectiveness in a defense service setting but aggregated their marketing measures to only six geographical regions. Intuitively, data on such an aggregated level can generate only limited insights into where to allocate the sales force, an important implication for marketers aiming to yield the best possible outcomes. The lack of reliable field data also helps explain why political scientists primarily used experimental settings to study the effect of personal selling on elections. For example, Gerber and Green (2000) conducted a field experiment and found that personal visits increase turnout rates. Alvarez et al. (2010), through another field experiment, found that personal selling efforts involving partisan messages can have an even larger effect than previously reported. However, the shortcoming of using experimental data is that they usually are analyzed on a limited scale and, thus, can provide

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<sup>4</sup>*The New York Times*, Nov 5, 2008.

<sup>5</sup>Sherry Allison, (2008). “Ground Game Licked G.O.P.” *The Denver Post*, Nov 5.

insights for only a particular region. As empirical data have become available in recent years, several studies have investigated personal selling effectiveness on a greater scale using field data. Masket (2009) found that a Democratic field office was associated with a disproportionate increase in its vote share in the 2008 election; Darr and Levendusky (2014) studied the allocation of field offices for the 2012 campaigns and found them to raise vote shares by roughly 1%. However, both studies only looked at a single election, confining their results to a particular candidate.

Another challenge is that formal empirical models have yet been employed to sufficiently account for customer heterogeneity and its diverse effects on various marketing-mix variables, a central focus of many marketing applications. Understanding the diversity of consumer preference and sensitivity is essential for designing targeted marketing plans and resource allocation strategies. Intuitively, consumers with different characteristics would likely respond differently to various marketing activities. Thus, when making strategic decisions about allocating sales force and advertising, managers need to take into account the effect of consumer heterogeneity on the marketing-mix variables they are trying to mobilize.

Finally, and possibly most importantly, personal selling and advertising should be assessed in an integrated manner. Including just one marketing variable may lead to biased estimates (Albers et al. 2010). Political scientists have a long history of studying the effect of advertising, but few studies have been done to understand advertising in relation to other campaign activities. In addition, results on political advertising have been inconclusive due to measurement limitations and a lack of robust empirical modeling (Goldstein and Ridout 2004). Many existing papers measure advertising using self-reported rather than actual ad exposures (as explained in Shaw 1999) and often rely on survey-based voting intention rather than on actual voting outcomes (Hillygus 2005; Huber and Arceneaux 2007). A recent paper by Gordon and Hartmann (2013) collected empirical data on county-level voting results and identified the causal effect of political advertising. However, their paper studied advertising in isolation from other campaign efforts and, as a result, could not provide guidance on how to allocate resources across campaign channels. Further, they did not distinguish between the candidate's own and outside advertising, which likely would have had different effects on different types of people—e.g., partisans vs. non-partisans.

To overcome the abovementioned challenges, we study the effect of personal selling and advertising in

the three most recent U.S. presidential elections. For several reasons, presidential elections provide a good setting for jointly studying the effect of advertising and personal selling. First, as campaign activities vary both across counties within contested states and between contested and non-contested states, our setting provides the much-needed geographical variation in the data. The level of granularity in our data measurement—for personal selling, in particular—is much improved from the extant applications involving consumer package goods. Second, because the competitive landscape changes from election to election, so do the campaigns. Thus, political elections also offer data variation over time. Third, political campaigns are concentrated primarily on a short-term goal to make sales (i.e., win votes), rather than to build brand images or maintain customer relationships. Therefore, the potential long-term effect of advertising and personal selling is less relevant in our context.

We use multiple sources to compile a rich data set that includes a total of 18,650 observations on vote outcomes and campaign activities. For each election, we collect detailed records of ground campaigning from both parties, down to the county level. Our data on television advertising record the number of ad impressions supporting each candidacy at the Designated Market Area (DMA) level, and they include not only the advertisements made by candidates and their parties, but also those made by outside political groups. The rapid growth of outside advertisements in recent presidential elections, especially in 2012, has made this too important to ignore when studying the effect of political advertising. Through this comprehensive data set, we are able to jointly assess the effect of various campaign activities and the possible synergy effects that they have on each other.

We model individuals' voting preferences via a random coefficient aggregate discrete-choice model, which allows various campaign effects to differ based on voter characteristics. Further, we apply the instrumental variables technique to account for the endogeneity concerns associated with campaign exposures. Our results show that, after controlling for heterogeneity and endogeneity, ground campaigning and advertising both have positive effects on voter preferences. The elasticity for field operations is estimated to be 0.011 for the Republicans and 0.037 for the Democrats, suggesting an asymmetrical effect across parties. The elasticity of candidates' own ads is 0.136 and 0.206 for the Republicans and the Democrats, respectively, whereas the elasticity of outside ads is 0.043 and 0.019 for the Republicans and the Democrats, respectively. We also find evidence that campaign effectiveness depends on voters' base-

line partisan preferences: field operations, which often involve volunteers making face-to-face contacts with potential voters, are more effective among more-partisan (both Democrat-leaning and Republican-leaning) voters, while candidates' own advertising, which is impersonal mass-media communication, is more effective among non-partisans. Interestingly, we find that outside ads, consisting primarily of negative ads and attacking messages, behave more like field operations than candidates' own ads, suggesting an interaction between the tone of ads and voters' partisan preferences.

To determine the importance of campaign marketing activities on election results, we conduct counterfactual analyses based on our parameter estimates. Overall, our estimates suggest that campaigns play an essential role in deciding the outcome of an election. Had campaign activities not been allowed in presidential elections, history would have been rewritten, with a different president being elected in 2008 and in 2012. In particular, field operations, which accounted for roughly 30% of the votes Obama won, can indeed be credited with his successes in 2008 and 2012. Interestingly, in the 2004 election, had the Democrats received more outside advertising, the election would have ended up in an electoral college tie with 269 electoral votes on each side.

Our paper makes two key contributions. First, we jointly examine the effectiveness of mass-media advertising and personal selling, two of the most important marketing activities that are used to reach, persuade and, thus, win over customers. While extant studies have focused primarily on planning resources across channels (Narayanan et al. 2004), little is known about the optimal marketing strategy within the channel. Our results shed light not only on the relative effectiveness of channels, but also on the customer segment for which each channel is more effective. Thus, our study can guide resource allocation both across channels and within a channel across customer segments. Second, our paper contributes to the study of political campaigns. Our compiled data set is by far the most comprehensive, in that it includes detailed data on advertising and personal selling spanning multiple election years. In addition, to the best of our knowledge, this paper is the first to jointly analyze the causal effects of multiple campaign activities at such a granular level. Our results show that campaigns play a vital role in any election. This disputes the "minimum effect" belief that voter behaviors are pre-determined and that campaigns can hardly alter election results.

The remainder of the paper is organized as follows. Section 2 describes various campaign activities and



the data used for empirical analysis. Section 3 presents the model specification, and Section 4 describes the identification and the estimation procedure. Section 5 discusses the results and counterfactual analysis. Section 6 concludes.

## 2 Data

We compile a unique data set from multiple sources that includes actual voting outcomes and campaign activities for the 2004, 2008, and 2012 U.S. presidential elections. Our data are superior to those used in extant studies in at least four aspects. First, our data cover a span of three presidential elections and, thus, do not confine our results to a particular candidate. Second, our collection of multiple campaign activities encompasses a more comprehensive record of mass-media advertising and ground campaigning than ever seen before in previous studies. Knowing where and to what extent candidates choose to campaign enables us to assess the effect of various campaign activities after controlling for one another. Third, our unit of analysis is at the county level, which is as granular as it can be to reliably measure voting results. Our campaign activities are also measured at the most granular level. Finally, we utilize registered party affiliation at the county level to examine how various campaign effects differ according to the level of voter partisanship. Using disaggregated data rather than state-level data to conduct the analysis helps control for a potential aggregation bias. This, along with the use of voter partisanship, allows us to generate optimal resource-allocation strategies in a more targeted manner.

### 2.1 Election Votes

The dependent variable for this study is the number of votes cast in each county for the presidential candidates in each election. We collect the vote results data from the CQ Press Voting and Elections Collection, a data base that tracks major U.S. political elections.

We define each county as a “market,” for which we calculate the candidates’ vote shares in each election. In the subsequent analysis, we will use “market” and “county” interchangeably. We define a county’s “market size” as the total number of resident citizens aged 18 and above, which is referred to as

Table 1: Summary Statistics for Vote Outcomes by County

	Party	N	Mean	SD	Min	Max	Total
Votes							
2004	Democrat	3,111	18,901.6	65,677.9	18	1,907,736	58,802,968
	Republican	3,111	19,866.3	47,586.2	82	1,076,225	61,804,121
2008	Democrat	3,106	22,289.4	77,146.0	8	2,295,853	69,230,895
	Republican	3,106	19,221.2	44,882.7	94	956,425	59,701,115
2012	Democrat	3,108	21,126.5	74,225.0	5	2,216,903	65,661,169
	Republican	3,108	19,537.0	44,788.5	84	885,333	60,721,119
Vote shares							
2004	Democrat	3,111	0.22	0.08	0.04	0.58	
	Republican	3,111	0.35	0.09	0.05	0.76	
2008	Democrat	3,106	0.25	0.10	0.04	0.64	
	Republican	3,106	0.33	0.09	0.04	0.78	
2012	Democrat	3,108	0.22	0.10	0.02	0.70	
	Republican	3,108	0.33	0.10	0.02	0.73	
Combined votes							
2004		3,111	38,768.0	109,873.9	155	2,983,961.0	120,607,089
2008		3,106	41,510.6	118,263.5	159	3,252,278.0	128,932,010
2012		3,108	40,663.5	114,907.8	144	3,102,236.0	126,382,288
Turnout rate							
2004		3,111	0.57	0.09	0.19	0.98	
2008		3,106	0.58	0.09	0.16	0.90	
2012		3,108	0.55	0.09	0.15	0.99	

Note: We calculate the turnout rate as the sum of votes for the Democrat and the Republican candidates divided by the number of resident citizens aged 18 and above. The vote share for each candidate is calculated as the ratio of his received votes divided by the number of resident citizens aged 18 and above.

the Voting Age Population (VAP)<sup>6</sup>. We obtain the county-level age-specific population counts from the U.S. census data base.

Table 1 presents summary statistics for the actual vote outcomes for each election<sup>7</sup>. The Republican candidate, George W. Bush, won more of the popular votes in the 2004 election, and the Democratic candidate, Barack H. Obama, won more of the popular votes in the 2008 and 2012 elections. The average vote share, calculated as the number of votes for each candidate divided by the county's VAP, is always higher for the Republican candidates. This is because the Republicans won many less-populated counties.

<sup>6</sup>A perhaps better measure of the market size for a county is the Voting Eligible Population (VEP), which equals the VAP minus ineligible felons. This metric, however, is available only at the state level. For a good introduction on how to estimate the Voting Eligible Population, see the United States Elections Project (<http://elections.gmu.edu/index.html>).

<sup>7</sup>There are a total of 3,144 counties and county equivalents in the United States. We exclude Alaska from the analysis because, there, the voting outcomes and population estimates are measured by different geographical units and are challenging to match. As a result, we end up with 3,110 counties from 49 states plus the District of Columbia, which is treated as a single county in the analysis.

Even with a higher average vote share at the county level, the Republicans still lost to the Democrats in total popular and electoral votes at the national level in 2008 and 2012.

## 2.2 Ground Campaigning

To average voters, presidential elections are perhaps most visible on the ground level through personal selling activities (henceforth, we will use ground campaigning and personal selling interchangeably). In the early stage of each election, presidential candidates establish field operations to organize voter outreach; in particular, campaign teams set up field offices from which staff and volunteers plan their door-to-door canvassing efforts and other in-person voter visits. We measure the scale of candidates' field operations by the number of field offices they deploy in each county. We collect the 2004 and 2008 field office data from the "Democracy in Action" project hosted by George Washington University<sup>8</sup> and the 2012 data from Newsweek Daily Beast,<sup>9</sup> both of which scoured the Democratic and Republican campaign websites and gathered addresses for all of the field offices. We then use the Geographic Information System (GIS) software to map the office addresses onto the corresponding county.

Table 2 presents some summary statistics for field operations. In all elections, the Democratic party had an indisputable lead in establishing field operations: the ratio of the Democratic and Republican field offices was 3.51, 3.53, and 2.69 in 2004, 2008, and 2012, respectively. Furthermore, the allocation of field offices seems even more prominent in the two Obama campaigns than in the Kerry campaign: while the latter had at least one office in 237 (8%) counties, the former set up field offices in 624 (20%) counties in 2008 and 439 (14%) in 2012.

## 2.3 Television Advertising

In the U.S., three types of players are primarily responsible for presidential election advertisements: the candidates, their party committees—namely, the Democratic National Committee (DNC) and the Republican National Committee (RNC)—and outside political groups. Because the candidates and party committees often coordinate advertising efforts, we combine the ads of these two types of players and label them as the candidates' own advertisements.

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<sup>8</sup>The URL for the project is: <http://www.gwu.edu/~action>. Accessed on 8/2/2013.

<sup>9</sup>The explanation of the data tracking method can be found at <http://newsbeastlabs.tumblr.com/post/34109019268/tracking-the-presidential-groundgame-as-the-two>. Accessed on 8/6/2013.

Table 2: Ground Campaigning by County

		<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Total</b>
Number of field offices							
2004	Democrat	3,111	0.10	0.45	0	12	313
	Republican	3,111	0.03	0.23	0	5	89
2008	Democrat	3,106	0.28	0.75	0	11	874
	Republican	3,106	0.08	0.46	0	17	247
2012	Democrat	3,108	0.24	0.93	0	21	750
	Republican	3,108	0.09	0.37	0	6	278
Presence of field offices							
2004	Democrat	3,111	0.08	0.27	0	1	237
	Republican	3,111	0.02	0.14	0	1	65
2008	Democrat	3,106	0.20	0.40	0	1	624
	Republican	3,106	0.06	0.24	0	1	192
2012	Democrat	3,108	0.14	0.35	0	1	439
	Republican	3,108	0.07	0.26	0	1	222

Note: We summarize the ground campaigning activities by county. Field operations are measured through the number of field offices in each county. We also report the number of counties that had at least one field office.

The third type of player—outside political groups, also known as the Political Action Committees (PACs)—buy television ad spots to support their preferred and to oppose their rival candidates. Although political groups have played a role in presidential elections for decades, they took on a much greater prominence in recent elections, partly because, in 2001, a campaign finance reform law set stricter restrictions on fund-raising and spending and, hence, the PACs stepped in to fill the gap. Especially in the 2012 election, a relatively new kind of organization, the Super PAC, emerged as a major influencer. Super PACs are made up of independent PACs that support a candidate with unlimited—and often anonymous—donations from unions, companies, or individuals. Due to the large number of PACs that advertise in the presidential elections, it is challenging to track all of their ads. We, however, are able to obtain the advertising data for the top spenders, which, combined, are responsible for more than 90% of the total ad spending by the PACs.

We measure the amount of advertising using gross rating points (GRPs), which quantify advertising impressions as a percentage of the targeted audience reached. For example, if an advertisement that airs in the Des Moines-Ames area reaches 25% of the total population, it receives a GRP value of 25; if the same advertisement were aired five times, the GRP value would be 125 ( $= 5 \times 25$ ). GRPs are a better

measure of ad exposures than dollar spending because the price of advertising varies significantly across markets. For example, the same amount of ad dollars would yield far fewer exposures in Los Angeles than in Kansas City. Hence, GRPs provide a measure of audience reach, independent of the advertising cost.

We obtain television advertising both for candidates and for PACs from Nielsen Media Research. Nielsen divides the U.S. media market into 210 designated market areas (DMA): residents from the same DMA receive largely the same television offerings, including advertising. Therefore, our advertising metrics are measured at the DMA level. It is noteworthy that the outcome variable of interest is at the county level, with each county belonging to one and only one DMA. To link ad impressions to county-level votes, we assume that the percent of the audience reached in a county equals the percent of the audience reached in the DMA to which the county belongs. Take the Rochester-Manson City-Austin DMA, for example: This DMA consists of seven counties from Iowa (Cerro Gordo, Floyd, Hancock, Howard, Mitchell, Winnebago, and Worth) and five counties from Minnesota (Dodge, Fillmore, Freeborn, Mower, and Olmsted). During the week of October 21, 2012, Obama campaign ads reached 1048.8% of the DMA population. By assuming that advertising impressions are homogeneous within a DMA, we assign the Democratic candidate's own GRP value to be 1048.8 for each of the twelve counties during that week.

Because voting preference is revealed on Election Day, we calculate the cumulative GRPs that each DMA has received since September 1 and use this cumulative measure in the subsequent analysis. Table 3 presents the summary statistics for candidates' own advertisements and PAC advertisements, respectively. For candidates' own advertising, the Democrats have always had more ads than the Republicans, by 20%, 50%, and 40% in the three elections, respectively. Interestingly, the PACs, which bought fewer ads than the candidates in 2004 and 2008, played a much bigger role in the 2012 election. In particular, the PACs supporting the Romney candidacy were responsible for roughly 46% of the total ads for Romney and outnumbered the PAC ads supporting the Obama candidacy by almost seven times. Even though the Obama campaign bought more ads than the Romney campaign, the PACs filled the gap; in the end,

Table 3: Television Advertising by DMA

		<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>Total</b>
Candidates' own advertising (GRPs)							
2004	Democrat	206	3,362.5	4,268.0	0	16,120	692,665
	Republican	206	2,754.0	3,204.2	0	11,579	567,316
2008	Democrat	206	5,576.5	4,760.6	255	18,418	1,148,754
	Republican	206	3,628.8	3,713.1	77	17,965	747,530
2012	Democrat	206	3,296.0	4,941.1	0	19,849	678,971
	Republican	206	2,390.0	3,611.8	0	19,597	492,346
PAC advertising (GRPs)							
2004	Democrat	206	255.9	505.0	0	2,248	52,726
	Republican	206	394.4	866.2	0	4,023	81,250
2008	Democrat	206	159.4	407.3	0	2,513	32,830
	Republican	206	217.2	435.7	0	2,188	44,736
2012	Democrat	206	254.3	694.6	0	3,840	52,378
	Republican	206	2,030.9	2,714.9	67	12,137	418,356
Total advertising (GRPs)							
2004	Democrat	206	3,618.4	4,627.9	0	16,726	745,390
	Republican	206	3,148.4	3,773.8	0	12,413	648,566
2008	Democrat	206	5,735.8	4,951.8	255	19,592	1,181,583
	Republican	206	3,846.0	3,965.4	77	19,704	792,267
2012	Democrat	206	3,550.2	5,533.5	0	22,943	731,349
	Republican	206	4,420.9	6,091.8	67	29,295	910,702

Note: We measure television advertising using Gross Rating Points (GRPs), which correspond to the percent of target reached in each Designated Market Area (DMA). For PACs, we obtain data from the top spenders, which are responsible for more than 90% of total PAC ad spending for each election. The total number of DMAs excludes those in Alaska.

Table 4: Summary Statistics of Additional Variables

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	
Median household income (\$)						
2004	3,111	46,458.1	12,258.3	20,193	121,266	
2008	3,106	46,528.0	12,333.4	19,744	122,822	
2012	3,108	44,901.4	11,550.4	19,624	122,844	
Unemployment rate						
2004	3,111	0.07	0.03	0	0.36	
2008	3,106	0.08	0.03	0	0.28	
2012	3,108	0.09	0.04	0	0.27	
Registered partisans						
2004						
	Democrat	1,318	0.35	0.17	0.06	0.98
	Republican	1,318	0.33	0.16	0.03	0.90
2008						
	Democrat	1,319	0.35	0.16	0.06	1.00
	Republican	1,319	0.33	0.15	0.03	0.93
2012						
	Democrat	1,349	0.31	0.16	0.02	0.97
	Republican	1,349	0.33	0.15	0.03	0.87

Note: Median household income and unemployment rate are obtained from the American Community Survey data base. Data on registered voters by party are compiled from various official government sources. Some states do not require voters to declare party affiliation.

25-percent more pro-Romney ads were aired than pro-Obama ads in the 2012 election.

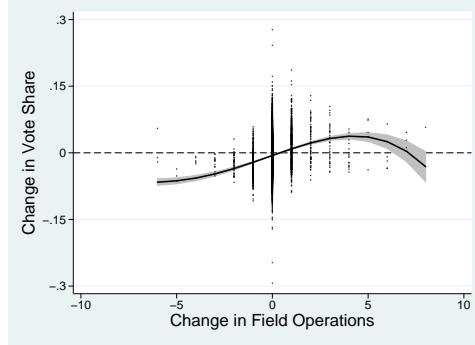
## 2.4 Additional Variables

We collect two county-level observed characteristics: the median household income and the unemployment rate, both of which reflect the county’s economic well-being and, thus, serve as contextual variables that may affect political preferences. The variables are extracted from the United States Census Bureau’s online databases. Summary statistics are presented in Table 4.

For each county, we also obtain the number of residents registered as Democrats or Republicans during an election. Based on this variable we simulate the individual-level partisan support that each party receives during an election season.<sup>10</sup>

<sup>10</sup>Because not all states require voters to declare party affiliation during registration, we have such data for only 27 states in 2004 and 2008 and 28 states in 2012. Data come from a repository tracking the U.S. elections (<http://uselectionatlas.org/>, accessed on 1/20/2014), where partisan numbers are extracted from various official websites such as the state’s Secretary of State or the Office of Elections.

Figure 1: Vote Shares versus Ground Campaigning



## 2.5 Preliminary Evidence

### 2.5.1 Model-free Evidence of Campaign Effects

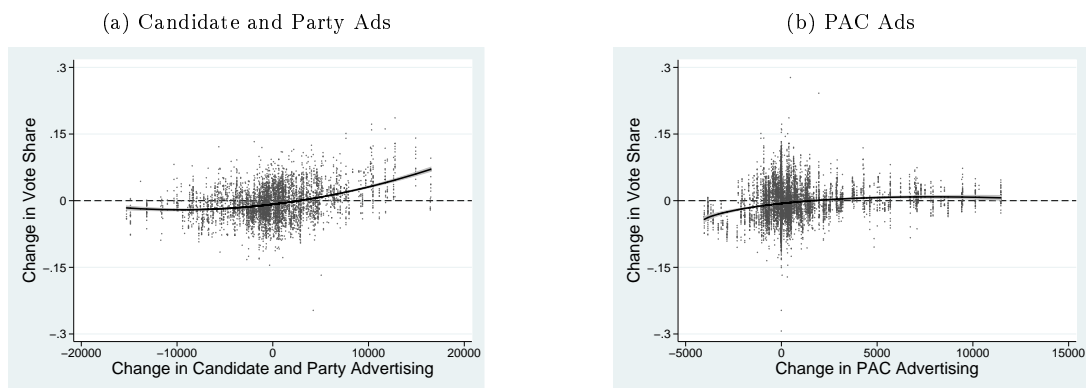
In this section, we present some model-free evidence and reduced-form regression results. First, we examine how ground campaigning and television advertising are related to vote shares. Because both political preferences and campaign activities vary significantly across regions, we calculate the changes in variables between elections to control for the cross-sectional variation across counties.

Figure 1 depicts the relation between vote shares and the scale of ground campaigning. The vertical axis of the figure corresponds to the change in vote shares from one election to the next—i.e.,  $s_{cj,t+1} - s_{cj,t}$ , where vote shares in county  $c$  for party  $j$  during election  $t$  is calculated as the vote counts for the party candidate divided by county  $c$ 's VAP. In Figure 1, the horizontal axis is the difference in the number of field offices in county  $c$  for party  $j$ —i.e.,  $G_{cj,t+1} - G_{cj,t}$ —and each dot corresponds to a county-party combination. We show the scatter plot and the best-fitting non-parametric polynomial curve with its 95% confidence interval. The figure exhibits a positive relation: a candidate's vote share in a county increased as he or she deploys more field offices. The positive trend tails off and turns downward at the far right end; the decline is, perhaps, largely driven by a few outlier counties in which the competition was intense, and the candidates added five or more field offices. For example, in Broward County, Florida, the Democrats increased field offices from four in 2008 to ten in 2012. Due to the intensity of the competition, however, the Democrats' vote share dropped slightly, from 36.6% to 35.7%.

Similarly, Figure 2 depicts the changes in vote shares against the changes in advertising. We plot



Figure 2: Vote Shares versus Television Advertising



in Figure 2a, ads made by the candidates and their national committees, and in Figure 2b, those by the PACs. The horizontal axis corresponds to the changes in advertising GRPs in each county and the vertical axis corresponds to changes in vote shares. Once again, we observe a positive trend: a candidate’s vote share goes up with an increase in advertising; this holds true for both the candidate’s own ads and PAC ads. It is highly likely that both advertising and ground operations are endogenous of which the figures above do not take into account. We use the figures merely to illustrate that there can be a relation between vote shares and campaign exposures. We correct the endogeneity concerns related to campaign activities in our main model in Section 3.

Figures 1 and 2 also indicate that both ground campaigning and television advertising vary across elections, illustrating that we have a sufficient amount of variations in our data for identification.

### 2.5.2 Campaign Channel Synergy

The next questions to naturally ask are: What is the relative effectiveness of various campaign activities, and what is the synergy between them? To provide preliminary answers to those questions, we show two reduced-form regression specifications: Column 1 in Table 5 reports the main effect for various campaign activities estimated in an Ordinary Least Squares (OLS) regression; and column 2 presents channel synergies as estimated by the interactions between campaign activities (Naik and Peters 2009). The dependent variable here is the log of county-level vote shares.

We begin by discussing the main effects. The coefficient estimate for field operations is positive and

significant, suggesting that a larger scale of field operations is associated with higher vote shares. With regard to advertising, we log-transform the advertising variables to capture potential diminishing returns. The coefficients are estimated to be positive and significant for both candidates' own ads and PAC ads.

Next, we assess the possible synergy effect of different campaign activities (see column 2 of Table 5). First, we see that ground campaigning has a positive synergy with candidates' own advertising, suggesting that ground campaigning and the candidates' advertising complement each other. This is perhaps not surprising because these two channels utilize vastly different marketing tactics: the former relies primarily on personalized messages delivered via face-to-face contacts while the latter uses less-targeted communication. Second, the interaction between ground campaigning and PAC ads is negative and significant, suggesting that PAC ads seem to work as substitutes for ground campaigning. This finding that the two types of ads exhibit different synergy effects with ground campaigning is quite interesting: while a candidate's field operations seem to strengthen the effect of his or her own advertising campaigns, they substitute for the advertising efforts by the supporting PACs. Finally, we see that the interaction between candidates' own advertising and PAC advertising is insignificant, thus providing no evidence of any synergetic effects with different types of advertisements.

### 2.5.3 Voter Heterogeneity

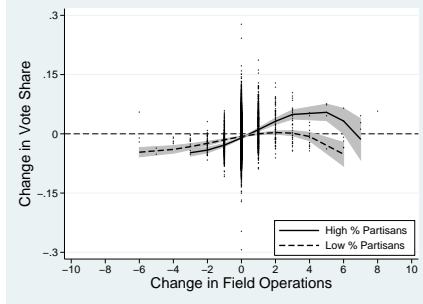
Why would the various campaign activities exhibit the above-illustrated synergies? Can it be that different campaign activities affect different types of voters? To investigate this further, we turn our attention to voter partisanship, a characteristic that is essential in identifying voters' baseline political preferences. For each county-election combination, we calculate the percent of resident citizens who are registered as either a Democrat or a Republican. We then categorize a county as a high (low)-Democrat county if the percentage of registered Democrats there is above (below) the mean, and vice versa for the high-Republican and low-Republican counties. Figure 3 depicts the relation between vote shares and field operations, separated into counties with a low or high percent of partisan support, respectively. Again, for illustration, we show a scatter plot and the best-fitting non-parametric polynomial with its 95% confidence interval. The solid and dashed lines represent counties with high and low partisanship, respectively. We see that while both lines exhibit a positive trend, the solid line has a much steeper

Table 5: OLS Regression Results on Campaign Effects

	(1)	(2)	(3)
field operations	0.066*** (0.005)	-0.038 (0.028)	0.040*** (0.006)
candidates' own ads	0.006*** (0.001)	0.007*** (0.002)	0.005** (0.002)
PAC ads	0.009*** (0.001)	0.013*** (0.003)	0.003* (0.001)
(field operations)×(candidates' own ads)		0.016*** (0.003)	
(field operations)×(PAC ads)		-0.007*** (0.001)	
(candidates' own ads)×(PAC ads)		-0.000 (0.000)	
(field operations)×(partisan support)			0.165*** (0.039)
(candidates' own ads)×(partisan support)			-0.079*** (0.008)
(PAC ads)×(partisan support)			0.017** (0.008)
partisan support			2.427*** (0.069)
other variables	(omitted)	(omitted)	(omitted)
Fixed Effects	Yes	Yes	Yes
N	18,650	18,650	7,972
R <sup>2</sup>	0.57	0.57	0.70

Note: Results are from Ordinary Least Squares regression. The county-level socio-demographic variables are controlled for but reported. The fixed effects are DMA-party level dummy variables. \*\*\* p<0.01; \*\* p<0.05; \* p<0.10

Figure 3: Effect of Ground Campaigning for Low-Partisan and High-Partisan Counties



slope, suggesting that field operations seem to have a stronger effect in counties with a higher percent of partisan voters.

In the same vein, we run a reduced-form analysis in which we regress the log of vote shares on the interaction between campaign activities and the percent of partisan support. Estimates are reported in column 3 of Table 5. We see that the level of partisan support in a county has a negative interaction with candidates' own ads and a positive interaction with PAC ads. Further, consistent with Figure 3, we see that there is a positive interaction effect between ground campaigning and the level of partisan support. These reduced-form results suggest that different campaign activities can have different effects depending on initial voter preferences, specifically partisan support.

### 3 Model of Voter Preference

We posit that individual  $i$  who lives in county  $c$  has latent voting utility that she associates with the candidate from party  $j$  during election  $t$ , denoted as  $u_{icjt}$ . An individual faces three voting options—the Democratic candidate, the Republican candidate, and the outside option, which refers to voting for an independent candidate or choosing not to vote. Individual  $i$  is assumed to choose the option that yields the highest utility, and market shares are revealed from aggregating over individual choices. The conditional indirect utility that voter  $i$  receives,  $u_{icjt}$ , is specified as

$$u_{icjt} = \Gamma_i(G_{cjt}, A_{cjt}) + \alpha_i + \eta X_{ct} + \xi_{mj} + \Delta \xi_{cjt} + \phi_t + \varepsilon_{icjt}. \quad (1)$$

The first component,  $\Gamma_i(G_{cjt}, A_{cjt})$ , captures how individual  $i$ 's goodwill towards candidate  $j$  is affected by how much she is exposed to the candidate's ground campaigning,  $G_{cjt}$ , and mass-media advertising,  $A_{cjt}$ . Because individuals may have diverse tastes for political campaigns, we allow heterogeneity in tastes and denote the effect with a subscript  $i$ . We will explain the specification for this campaign effect in Section 3.1.

The second component,  $\alpha_i$ , captures the remaining individual-specific heterogeneity in political preferences. It can be understood as the mean voting utility for individual  $i$  that is not explained by her exposures to election campaigns. This term can be further decomposed into three components: (1) the grand mean across individuals,  $\alpha_1$ ; (2) the deviation from the mean that could be attributed to individual observed characteristics,  $\alpha_2 D_{ijt}$ ; and (3) the individual departure from the mean related to all other unobserved individual characteristics,  $\sigma^\alpha \nu_i^\alpha$ , where we assume that  $\nu_i^\alpha$  comes from a standard normal distribution. We allow the three terms to enter utility such that  $\alpha_i = \alpha_1 + \alpha_2 D_{ijt} + \sigma^\alpha \nu_i^\alpha$ . Examples of the unobserved characteristics could include, for example, whether the individual gets a salary increase or loses her health insurance, which probably will shape her taste towards presidential campaigns but are usually missing from the data.

The first and second components in equation (1) capture the heterogeneity in voting utility that could be attributed to observed or unobserved individual characteristics. The next four components describe the candidate-specific and market-specific terms common to all individuals.

The term  $\eta X_{ct}$  captures how the voting utility is affected by observed county-election specific characteristics. Examples of such variables include the county's economic conditions such as the median household income and the unemployment rate, both of which could influence an individual's goodwill towards a presidential candidate.

Next,  $u_{icjt}$  is also a function of unobserved characteristics related to a specific county-party-election combination. This is further decomposed into three parts:  $\xi_{mj}$ ,  $\Delta \xi_{cjt}$ , and  $\phi_t$ , which correspond to the fourth, fifth, and sixth components of the voting utility specification.  $\xi_{mj}$  refers to the mean utility toward the candidate from party  $j$  across all the residents in the same media market  $m$ . People from the same media market likely exhibit similar political preferences due to exposures to the same media content (including news coverages) over time, as well as to similar contextual conditions such as economic well-

being. It is challenging to collect all potential factors in the data. Thus, we use the mean market-party utility,  $\xi_{mj}$ , to absorb the cross-sectional variations in political preference.

The fifth component,  $\Delta\xi_{cjt}$ , is the county-party-election specific deviation from the mean utility,  $\xi_{mj}$ , which quantifies the hard-to-measure utility shift over time. For example, residents in Arizona counties likely view the incumbent Arizona senator John McCain more favorably than Mitt Romney, even though both were Republican presidential candidates. Or, consider another example: When Hurricane Sandy hit the Northeast region of the United States days before the Election in 2012, President Obama promptly committed to the relief operations and was praised for his crisis leadership, causing a positive boost in his support. Such unobserved factors would not be reflected in  $\xi_{mj}$  but would be captured through  $\Delta\xi_{cjt}$ . It is noteworthy that this county-party-election specific deviation, which is unobserved by the econometrician, is assumed to be observed by the voters and the candidates. This potentially creates an endogeneity problem for estimating the parameters in  $\Gamma_i(G_{cjt}, A_{cjt})$ . We will discuss our solution to this problem in Section 4.

The sixth component of utility is  $\phi_t$ , which captures the election-specific shocks to voting utility that is common to all county-party combinations. And, finally,  $\varepsilon_{icjt}$  is the idiosyncratic utility shock that is assumed to be independently and identically distributed Type I extreme value across individuals, counties, candidates, and time.

### 3.1 Specification of Campaign Effects

We postulate that the campaign effect,  $\Gamma_i(G_{cjt}, A_{cjt})$ , is a function of candidates' ground campaigning and mass-media advertising. As previously discussed, ground-level campaigning takes the form of field operations,  $G_{cjt}$ , and advertising has two primary types: own ads aired by the candidates and their parties,  $A_{cjt}^o$ , and outside ads aired by the PACs,  $A_{cjt}^p$ . We allow various campaign activities to have a heterogeneous effect across individuals: the effectiveness of campaigning may vary according to individual characteristics.

To sum up, we specify the campaign effect in the following form:

$$\Gamma_i(G_{cjt}, A_{cjt}) = \beta_i G_{cjt} + \gamma_i A_{cjt}^o + \pi_i A_{cjt}^p. \quad (2)$$

The parameter,  $\beta_i$ , corresponds to the voter's taste towards field operations and consists of three components: (1) the mean taste across individuals,  $\beta_1$ ; (2) the deviation from the mean that could be attributed to observed individual characteristics,  $\beta_2 D_{ijt}$ ; and (3) the individual departure from the mean related to all unobserved individual characteristics,  $\sigma^\beta \nu_i^\beta$ . Similarly, we decompose the other taste parameters into three components such that,

$$\begin{aligned}\beta_i &= \beta_1 + \beta_2 D_{ijt} + \sigma^\beta \nu_i^\beta, \\ \gamma_i &= \gamma_1 + \gamma_2 D_{ijt} + \sigma^\gamma \nu_i^\gamma, \\ \pi_i &= \pi_1 + \pi_2 D_{ijt} + \sigma^\pi \nu_i^\pi,\end{aligned}\tag{3}$$

where each unobserved characteristic  $\nu_i$  is assumed to come from a standard normal distribution. We assume that the observed individual characteristic—level of partisan support for candidate  $j$ — $D_{ijt}$  comes from a log-normal distribution with mean of the partisan level in each county. That is, if a specific county had 30% registered Democrats, we assume that the distribution of Democratic support by individuals would come from a log-normal distribution where the mean of the corresponding normal distribution would be  $\log(0.3)$ -0.5 with unit variance.

### 3.2 Distributional Assumptions and Implied Market Shares

From equations (1), (2), and (3), the utility function can be specified as

$$\begin{aligned}u_{icjt} &= \alpha_1 + \alpha_2 D_{ijt} + \sigma^\alpha \nu_i^\alpha \\ &+ (\beta_1 + \beta_2 D_{ijt} + \sigma^\beta \nu_i^\beta) G_{cjt} \\ &+ (\gamma_1 + \gamma_2 D_{ijt} + \sigma^\gamma \nu_i^\gamma) A_{cjt}^o + (\pi_1 + \pi_2 D_{ijt} + \sigma^\pi \nu_i^\pi) A_{cjt}^p \\ &+ \eta X_{ct} + \xi_{mj} + \Delta \xi_{cjt} + \phi_t + \varepsilon_{icjt}\end{aligned}\tag{4}$$

Further, we can decompose equation (4) as

$$\begin{aligned}u_{icjt} &= \delta(G_{cjt}, A_{cjt}^o, A_{cjt}^p, X_{ct}; \theta_1) \\ &+ \mu(G_{cjt}, A_{cjt}^o, A_{cjt}^p, D_{ijt}, \nu_i; \theta_2) + \varepsilon_{icjt},\end{aligned}\tag{5}$$

where  $\theta_1 = (\alpha_1, \beta_1, \gamma_1, \pi_1, \eta, \xi_{mj}, \Delta \xi_{cjt}, \phi_t)$  and  $\theta_2 = (\alpha_2, \beta_2, \gamma_2, \pi_2, \sigma^\alpha, \sigma^\beta, \sigma^\gamma, \sigma^\pi)$ .

Hence, the utility is expressed in two parts: the mean utility across individuals,  $\delta_{cjt} = \alpha_1 + \beta_1 G_{cjt} +$

$\gamma_1 A_{cjt}^o + \pi_1 A_{cjt}^p + \eta X_{ct} + \xi_{mj} + \Delta \xi_{cjt} + \phi_t$ , and the individual departure from the mean,  $\mu_{icjt} = (\alpha_2 D_{ijt} + \sigma^\alpha \nu_i^\alpha) + (\beta_2 D_{ijt} + \sigma^\beta \nu_i^\beta) G_{cjt} + (\gamma_2 D_{ijt} + \sigma^\gamma \nu_i^\gamma) A_{cjt}^o + (\pi_2 D_{ijt} + \sigma^\pi \nu_i^\pi) A_{cjt}^p$ .

We assume that  $\varepsilon_{icjt}$  follows an i.i.d. type I extreme value distribution, and normalize the utility for the outside option to  $u_{ic0t} = 0 + \varepsilon_{ic0t}$ . Based on the distributional assumption of the idiosyncratic shocks and the utility specification stated above, the probability of voter  $i$  who resides in county  $c$  voting for the candidate from party  $j$  is given as

$$s_{icjt} = \frac{\exp(\delta(G_{cjt}, A_{cjt}^o, A_{cjt}^p, X_{ct}; \theta_1) + \mu(G_{cjt}, A_{cjt}^o, A_{cjt}^p, D_{ijt}, \nu_i; \theta_2))}{1 + \sum_{k=1}^2 \exp(\delta(G_{ckt}, A_{ckt}^o, A_{ckt}^p, X_{ct}; \theta_1) + \mu(G_{ckt}, A_{ckt}^o, A_{ckt}^p, D_{ikt}, \nu_i; \theta_2))}. \quad (6)$$

We can obtain the county-level vote share by integrating over individuals such that

$$s_{cjt} = \int \frac{\exp(\delta(G_{cjt}, A_{cjt}^o, A_{cjt}^p, X_{ct}; \theta_1) + \mu(G_{cjt}, A_{cjt}^o, A_{cjt}^p, D, \nu; \theta_2))}{1 + \sum_{k=1}^2 \exp(\delta(G_{ckt}, A_{ckt}^o, A_{ckt}^p, X_{ct}; \theta_1) + \mu(G_{ckt}, A_{ckt}^o, A_{ckt}^p, D, \nu; \theta_2))} dP(D) dP(\nu),$$

where  $P(D)$  and  $P(\nu)$  are the distributions for the demographic variables,  $\{D_{i1t}, D_{i2t}\}$ , and the idiosyncratic disturbances,  $\nu_i$ , respectively. Because we observe only the county-level aggregated statistics for  $D$  but not its true distribution, we use the empirical distribution  $\hat{P}(D)$  to approximate the true distribution.

## 4 Identification and Estimation

Based on our model specification outlined in the previous section, we estimate a model of voters' candidate choice that allows different campaign effects for voters with different levels of baseline partisan preference.

Our estimation strategy closely resembles the generalized methods of moments (GMM; see Hansen 1982) approach developed in several classic papers employing discrete-choice models that use aggregated data (e.g., Berry 1994; Berry et al. 1995; Nevo 2000). This approach has been utilized in many marketing applications (e.g., Sudhir 2001; Gordon and Hartmann 2013; Chung 2013). The estimation essentially relies on two distinct sets of moments. The first set of moments matches the model's predicted market shares to those observed in the data such that



$$\hat{s}_{cjt}(\Delta\xi(\theta), \theta) - s_{cjt} = 0, \quad j = 1, 2. \quad (7)$$

The second set of moments relates to the market-level disturbance,  $\Delta\xi_{cjt}$ —i.e., the county-party-election specific deviation from the mean utility. As previously discussed,  $\Delta\xi_{cjt}$  is assumed to be unobserved by the econometrician but is assumed to be observed by the candidates and voters, potentially causing an endogeneity problem. In other words, if these demand disturbances are correlated with the campaign activities—i.e.,  $G_{cjt}$ ,  $A_{cjt}^o$ , and  $A_{cjt}^p$ —which is highly likely, the estimates of campaign effects would be biased. A common approach would be to choose appropriate instrumental variables that are correlated with ground campaigning and advertising but uncorrelated with the disturbances,  $\Delta\xi_{cjt}$ . In the following sections, we discuss our choice of instrumental variables and present the computational algorithm we use for our estimation.

#### 4.1 The Choice of Instrumental Variables

For advertising, we use lagged ad prices as instrumental variables for both the candidates' own advertising and PAC advertising. Specifically, we use the 3rd-quarter DMA-level ad prices in the year before each election. The argument for this instrument is that price changes affect cost and, therefore, shift the demand for advertising, but the price fluctuation is assumed to be independent of  $\Delta\xi_{cjt}$ . We use prices from the previous year instead of from the election year to eliminate the possibility that price changes can be due to the changing demand of advertising in an ad-filled election year. Our ad-price data come from the Kantar Media SRDS TV and Cable Source, and we collect prices for three dayparts: prime access, prime, and late news.

We use the real estate rental price in each county the year before the election to instrument field operations. The identification argument is similar to that of using lagged ad prices to instrument advertising. Specifically, lagged rental prices affect the demand for office rental and, hence, should be correlated with the number of field offices, but not directly correlated with the unobserved common utility shocks.

## 4.2 MPEC Estimation

After choosing the set of instruments,  $Z$ , we form the moment condition  $g(\theta) = Z' \cdot \Delta\xi$  and minimize the GMM objective function such that:  $\hat{\theta} = \text{argmin } g(\theta)'Wg(\theta)$ , where  $W$  is a weight matrix.

As discussed, the first set of moments matches the predicted and the observed vote shares—i.e.,  $\hat{s}_{jct}(\Delta\xi_{cjt}(\theta), \theta) - s_{jct} = 0$ . The predicted share,  $\hat{s}_{jct}$ , is a function of not only the structural parameters,  $\theta$ , but also the market-level disturbances,  $\Delta\xi_{cjt}(\theta)$ . A popular approach in utilizing this set of moments is the nested fixed-point (NFXP) algorithm, which conducts an inner-loop contraction mapping step to explicitly solve for the vector  $\Delta\xi_{cjt}(\theta)$  such that  $\hat{s}_{jct}$  matches  $s_{jct}$ , and an outer-loop optimization over the structural parameters. Because the contraction mapping has to be done for every guess of the structural parameters, the NFXP method is computationally demanding, and the estimation also depends on the pre-specified precision level to which the predicted market shares should match the observed shares. To overcome these limitations, Dube et al. (2012) proposed a new computational approach referred to as the mathematical program with equilibrium constraints (MPEC). The idea is to treat the first set of moments as constraints and run a constrained optimization of the GMM objective function such that

$$\begin{aligned} & \min_{(\theta, \Delta\xi, g)} \quad g'Wg \\ & \text{subject to} \quad \hat{s}(\Delta\xi; \theta) = s \\ & \quad \quad \quad g = Z'\Delta\xi. \end{aligned}$$

We implement the MPEC estimation using the KNITRO solver, a state-of-the-art commercial optimization tool that can be called from Matlab. Our estimation is achieved by minimizing the GMM objective function over a large number of parameters. The main advantage of the MPEC algorithm is to avoid the time-consuming contraction mapping step in the inner-loop of the NFXP. A potential problem, however, is the number of dimensions for the optimization problem. The total number of parameters for MPEC equals the sum of three components: the number of structural parameters ( $\theta_1, \theta_2$ ); the number of market disturbances ( $\Delta\xi_{jct}$ ); and the number of GMM moments ( $g$ ), which equals the number of instruments,  $Z_{jct}$ .<sup>11</sup> When the number of parameters is large, the algorithm needs to construct a

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<sup>11</sup>Our optimization includes 19,497 parameters: 419 linear parameters, 8 non-linear parameters, 18,650 market-level disturbances, and 420 GMM moments. We simulated 1,000 individual draws in each market. The tolerance of the optimization was set to be  $10^{-6}$ . The estimation converged after 6.9 CPU hours on a workstation with 32 GB RAM.

high-dimensional Hessian matrix and Jacobian matrix for the constraints, which are memory-intensive. However, because we have a large number of independent markets with only two candidates per market, our Jacobian and Hessian matrices contain many zeros: there are 97.8% and 99.8% zero cells, respectively. Hence, our computation benefits tremendously from specifying the sparse pattern of the Jacobian and the Hessian matrices. We refer readers to Dube et al. (2012) and their online appendix for details on implementing MPEC for aggregated discrete-choice models.

## 5 Results

### 5.1 Parameter estimates

We estimate four specifications and present the results in Table 6. The first two specifications estimate the effect of ground campaigning and advertising in an OLS regression with and without DMA-party fixed effects, respectively. The third specification incorporates the instruments, and the fourth allows heterogeneous campaign effects over individual voters.

We begin with a brief discussion of the OLS estimates (see columns 1 and 2). First, adding fixed effects increases the model R-squared almost threefold; therefore, in the subsequent sections, we will always discuss the estimates with the fixed effects included. Estimates in column 2 shed light on the campaign effect, although not accounting for endogeneity. With the presence of fixed effects, field operations are still found to have a positive effect on voter preferences. We also identify positive and significant effects for candidates' own advertising and PAC advertising.

Column 3 presents the estimates based on the instruments described in Section 4.1. The IV estimate for field operations remains significant, indicating that field operations can boost voter preference towards a candidate. The magnitude of the effect almost triples compared to the OLS result, suggesting strong endogeneity with field operations: candidates are more likely to implement field staff where competition is expected to be higher. Not accounting for endogeneity—i.e., the strategic placements of field operations—would lead to underestimating the effect. We observe a similar pattern for candidates' own ads, for which the IV estimate remains significant with an even bigger magnitude than the OLS estimate. The estimate for PAC ads, although greater in magnitude, is insignificant at 0.05 level.

Table 6: Parameter Estimates

	(1)	(2)	(3)	(4)	Partisan	Sigma
	Est	Est	Est	Est	(SE)	(SE)
	(SE)	(SE)	(SE)	(SE)		
field operations	0.045*** (0.009)	0.066*** (0.008)	0.192*** (0.056)	-0.029 (0.060)	1.248*** (0.144)	0.417** (0.181)
candidates' own ads	0.005*** (0.001)	0.006*** (0.001)	0.098*** (0.026)	0.081*** (0.024)	-0.210*** (0.010)	0.006 (0.078)
PAC ads	0.047*** (0.001)	0.009*** (0.001)	0.071 (0.047)	-0.047 (0.048)	0.181*** (0.010)	0.004 (0.101)
year 2008	0.051*** (0.010)	0.018** (0.007)	-0.185*** (0.052)	-0.164*** (0.048)		
year 2012	-0.157*** (0.010)	-0.094*** (0.008)	-0.196** (0.088)	-0.016 (0.089)		
median household income	0.007*** (0.000)	0.008*** (0.000)	0.007*** (0.001)	0.008*** (0.001)		
unemployment rate	-0.015*** (0.001)	-0.011*** (0.002)	-0.011*** (0.001)	-0.010*** (0.002)		
intercept	-0.791*** (0.024)	-0.587*** (0.051)	-0.779*** (0.122)	-0.612*** (0.117)	1.050*** (0.060)	0.160 (0.205)
DMA-Party Fixed Effects	No	Yes	Yes	Yes		
Instruments	No	No	Yes	Yes		
N	18,650	18,650	18,650	18,650		
R <sup>2</sup>	0.14	0.57				

Note: We report results from four specifications. Column (1) estimates the marginal effects of ground campaigning and television advertising in OLS without fixed effects; and column (2) with fixed effects. Column (3) estimates the marginal effects with instruments. Column (4) incorporates heterogeneity of campaign effects over voters. \*\*\* p<0.01; \*\* p<0.05; \* p<0.10

Specification (4) incorporates voter heterogeneity; in particular, we examine how the effect of various campaign activities depends on voters’ baseline partisan preferences. The first column under specification (4) lists the parameter estimates of the main effects; the second column is the estimated interaction effect with voter partisan preferences; and the third column corresponds to  $\hat{\sigma}$ , the estimated unobserved heterogeneity in each campaign taste parameter.

We discover some interesting findings concerning the effectiveness of each campaign activity in different voter segments. First, we estimate the main effect of field operations to be insignificant but their interaction with voter baseline partisan preference to be significant and strong. This indicates that, overall, ground campaigning can effectively shape vote outcomes, more so for people with higher baseline partisan preferences. In contrast, campaign advertising is found to have a positive and significant main effect but a negative interaction effect with partisan preference. These estimates suggest that candidates’ own ads are more effective for voters on the margin—i.e., for those who have not yet developed a strong partisan affiliation with either party—and that the effect diminishes as partisan preference strengthens. In other words, campaign ads sponsored by the candidates and party committees seem to serve as a tool to persuade the non-decided, rather than to mobilize the likely supporters. Interestingly, PAC advertising is found to behave similarly to ground campaigning, with an insignificant main effect but a positive interaction with voter partisan preference. It is noteworthy, though, that the magnitude of this interaction is roughly a tenth of that for field operations. We interpret this to mean that PAC advertising is effective only with voters who have a strong baseline partisan preference; its effect is null otherwise, which perhaps explains the overall insignificant main effect for PAC ads when heterogeneity is not considered (see column 3 of Table 6). Finally, voters’ baseline partisan preference is found to have a strong main effect: not surprisingly, Republican partisans tend to vote for the Republican candidates and Democratic partisans for Democrats. Nevertheless, our estimates suggest that campaigns can still influence vote outcomes beyond voters’ baseline preferences.

## 5.2 Elasticity Estimates

In this section, we report the elasticities of various campaign activities. The field-operation elasticity, defined from the utility specification in equation (1), is

$$\zeta_{jk,ct}^{\beta} = \frac{\partial s_{j,ct} G_{k,ct}}{\partial G_{k,ct} s_{j,ct}} = \begin{cases} \frac{G_{j,ct}}{s_{j,ct}} \int \beta_i s_{ij,ct} (1 - s_{ij,ct}) dP(D) dP(\nu) & \text{if } j = k \\ -\frac{G_{k,ct}}{s_{j,ct}} \int \beta_i s_{ij,ct} s_{ik,ct} dP(D) dP(\nu) & \text{if } j \neq k \end{cases},$$

which depends on the individual-specific taste parameter for field operations,  $\beta_i$ , integrated over individual voters. Elasticities for the other types of campaign activities are defined similarly.

Table 7 presents the elasticity estimates based on our parameter estimates in specification (4) in Table 6. The numbers in the diagonal refer to the percent change in vote share in response to a 1% increase in the party's own campaign efforts; and those in the off-diagonal correspond to the change in a party's vote share resulting from a 1% increase in the rival's campaign.

We begin with the elasticity estimates for advertising, as they are more straightforward to interpret. The elasticity for candidates' own ads is estimated to be 0.136 and 0.206 for the Republicans and Democrats, respectively: a percent increase in the candidate's own advertising would result in a 0.14 and 0.21 percent increase in vote shares for the Republicans and Democrats, respectively. Our elasticity estimates are comparable in magnitude to those reported in Ackerberg (2001), which finds an elasticity of 0.15 for new products, a context similar to what we are studying here. The cross-ad elasticity estimates are noticeably smaller than the own-ad elasticities. If the Democrats raise their campaign ads by 1%, the Republicans' vote share will decrease by 0.06%; the decrease is estimated to be 0.08% for the Democrats if the Republicans increase their campaign ads by 1%. The fact that the own-ad and cross-ad elasticities for the Democrats are 50% higher in magnitude than those for the Republicans suggests that the Democrats experience more elastic demand for campaign advertising.

Advertisements from PACs are found to have smaller elasticities on vote shares. Across all voters, the PAC ad elasticities are found to be tiny, given the insignificant main effect ( $\hat{\pi}_1 = -0.047$ ,  $p > 0.05$ ) and the modest interaction estimate ( $\hat{\pi}_2 = 0.181$ ,  $p < 0.01$ ). Thus, to gain insights into voters for whom they do matter, we calculated the elasticity estimates for the voter segment with the top 20% partisan preferences. The own-elasticity estimates for PAC advertisement are 0.043 for Republicans and 0.019 for Democrats, and the cross-elasticity estimates are -0.007 and -0.017, respectively. These numbers indicate an asymmetrical effect across parties: with more PAC ads from their camp, the Republicans would expect to gain more vote shares than the Democrats and, with more PAC ads from the rival's, they would lose less. This is in contrast to the effect of candidates' own advertising.

Table 7: Elasticity Estimates for Ground Campaigning and Advertising

	Focal party	1% increase from	
		Republican	Democrat
field operations	Republican	0.011	-0.018
	Democrat	-0.006	0.037
candidates' own ads	Republican	0.136	-0.055
	Democrat	-0.084	0.206
PAC ads	Republican	0.043	-0.007
	Democrat	-0.017	0.019

Note: The elasticities are computed based on estimates from the random-coefficient logit model. The diagonal estimates are the own elasticities and the off-diagonal elements are cross elasticities. The elasticities are interpreted as the percent change in vote shares in response to a 1% increase in corresponding campaign activity. For PAC ads, we report the elasticity for the top 20% partisans; the overall elasticity is insignificant, as PAC ads are found to be effective only on voters with strong partisan preferences.

Interpreting the elasticities for field operations deserves extra caution because a 1% increase in the number of field offices has no realistic meaning, due to the low number of field offices in most counties. Nevertheless, the estimates shed light on the relative effectiveness of ground campaigning. We find that the elasticity for field operations is higher for the Democrats than for the Republicans: the own elasticity is estimated to be 0.037 (vs. 0.011), and the cross-elasticity is -0.006 (vs. -0.018), suggesting that the Democrats benefit relatively more from field operations.

It is rather tricky to compare our field-operation elasticity estimates to those found in previous studies, as these studies did not account for endogeneity or voter heterogeneity. For example, Darr and Levendusky (2014) identified a 1.04% boost in county-level vote shares with the presence of a Democratic field office. By our estimates, a Democratic field office would yield a 2.4%<sup>12</sup> increase in vote shares, which is larger than the Darr and Levendusky estimate but still somewhat comparable in magnitude. It is worth noting that Darr and Levendusky (2014) used an OLS regression, which did not account for the endogenous placements of field operations and, as we have shown, could underestimate the true effect.

### 5.3 Counterfactual Analysis

With the structural parameter estimates, we are now ready to answer the “what if” questions: what the election results would have been had the candidates campaigned differently. These counterfactual

<sup>12</sup>An addition of one office corresponds to a 65.7% increase, given the mean of 1.52 for the Democratic field offices.

questions are crucial to understanding the true causal effect of campaign activities because a causal effect is, by definition, the difference between factual and counterfactual inferences. For example, to pin down the extent to which campaign activities matter to an election, we would eliminate ground campaigning and mass-media advertising, predict the winner for each state, and then compare them to the true electoral results. We report the various counterfactual results in Table 8.

Overall, we find that the Democrats should credit their victories to their effective campaigns: had neither party engaged in any campaign activities, the Republicans would have still won the 2004 election but with a bigger margin, and the Democrats would have lost the next two elections. In 2008, without campaigns, the Democrats would have lost Florida, Indiana, Iowa, Michigan, Nevada, New Hampshire, New Mexico, North Carolina, Ohio, Pennsylvania, Virginia, Washington, and Wisconsin, all of which, except for Washington, were considered battleground states that year. Similarly, in 2012, with the absence of campaigns, the Republicans would have taken a lead in eight swing states—Colorado, Florida, Iowa, Nevada, New Hampshire, Ohio, Pennsylvania, and Wisconsin, thus surpassing the necessary 270 electoral votes to win the presidency.

Next, we discuss the counterfactual results when eliminating each specific campaign activity while keeping the others intact. As far as candidates' own advertising is concerned, it seems to matter only in a close contest, such as the 2004 election. That year, had the candidates aired no ads, the Democrats would have won the election by a slight margin (271 vs. 267 electoral votes). In 2008 and 2012, candidates' own advertising would not have changed the national results, although the Democrats would have had a narrower winning margin. In particular, the Democrats would have lost Indiana to the Republicans in 2008, and Florida and Ohio in 2012, all of which were among the most heavily advertized states in each election.

How about outside advertisements sponsored by various PACs? Not surprisingly, we find that PAC ads played a very limited role in 2004 and 2008, considering the modest amount of PAC advertisements in those elections. Eliminating the outside ads barely moved the needle on the election results. However, if the 2012 election had not allowed outside ads, the Democrats would have won with a bigger margin. The finding that the Democrats benefited more from banning outside ads could provide insight into the consequences of the "People's Pledge," pioneered in the 2012 Massachusetts Senate race. According to



Table 8: Counterfactuals for Zero Campaigning

Electoral Votes	2004		2008		2012	
	Democrat	Republican	Democrat	Republican	Democrat	Republican
actual	252	<b>286</b>	<b>365</b>	173	<b>332</b>	206
zero campaigning	182	<b>356</b>	216	<b>322</b>	262	<b>276</b>
zero campaign ads	<b>271</b>	267	<b>358</b>	180	<b>300</b>	238
zero PAC ads	253	<b>285</b>	<b>353</b>	185	<b>383</b>	155
zero field operations	193	<b>345</b>	181	<b>357</b>	174	<b>364</b>

Note: For the zero campaigning condition, we set all three campaign activities to zero for both the Democrats and the Republicans. For zero field operations, we set the parties to have no field offices but keep the other campaigning activities intact. Vice versa for the other counterfactual conditions. The reported numbers are the total electoral votes for each party. The winner of each election is in bold. For Alaska we used the actual results for each election.

the pledge, the Republican candidate, Scott Brown, and the Democratic candidate, Elizabeth Warren, agreed not to accept any outside ads, aiming to curb the influences of third parties. Warren defeated Brown; thus, there has been a lot of speculation regarding the role that the pledge played in the outcome. Our counterfactual analysis suggests that at least a part of Warren’s victory came from the banning of PAC ads.

Our counterfactual analysis also speaks to the importance of field operations. As it turns out, there is some truth to the popular claim that the Democrats owe their victories to their unprecedented field operations. Had neither party set up any field offices, the Republicans would have won the 2008 and 2012 elections. In particular, we find that the Democratic field operations were responsible for a large portion of their total popular votes in 2008 and 2012. For both elections, without field operations, the Democrats would not have won Florida, Iowa, Michigan, Minnesota, New Hampshire, New Mexico, Ohio, Pennsylvania, Virginia, Washington, and Wisconsin. In addition, they would have lost Indiana and North Carolina in 2008 and Colorado in 2012.

If there were a chance to relive history, what would it take for the losing parties to change their fate? In particular, could the Republicans have won the 2008 and 2012 elections had they enhanced their field operations in swing states, as the public seemed to suggest?<sup>13</sup> To answer this question, we conduct a counterfactual analysis to calculate the fewest *additional* field offices needed for the Republicans to win the national election. The computation is in two steps. First, for each swing state that the Republicans

<sup>13</sup>For example, days after President Obama was first elected in 2008, the *Washington Times* published an article claiming that “one of the keys to Mr. Obama’s success was building an unprecedented ground game.” Four years later, the *New York times* (April 17) ran an article saying that the extent to which “Mr. Romney can match the Obama’s footprint [in the ground game] in the swing states may prove critical in deciding the election.”

lost, we use the model estimates to solve for the smallest number of field offices needed for the Republicans to win more popular votes in the state than the Democrats, holding constant the number and location of the Democratic field offices and other campaign activities.<sup>14</sup> The optimal numbers of field offices are presented in Table 9. In the second step, assuming that the cost of setting up a field office is constant across states, we select the optimal combination of swing states that required the fewest total number of additional field offices to reach the 270 electoral votes. The optimal combination takes into account the number of additional field offices and the electoral votes that each state carries and, hence, represents the most cost-effective way to allocate field operations in order to win the election.

We find a large variation in the number of field offices required for the Republicans to win each state. For example, while it would have taken the Republicans only one additional field office to win Indiana in the 2008 election, it would have required 21 more to win New Jersey. To reach the 270 goal that year, the McCain campaign would have had to set up at least 19 additional offices: four in Florida, one in Indiana, three in Minnesota, two in Nevada, one in North Carolina, four in Ohio, and four in Virginia. Winning these states would have brought in a total of 101 electoral votes. Four years later, the 2012 election would have required fewer additional field offices for the Republicans, considering that the Romney campaign had already invested more in field operations: Romney could have won the election by utilizing nine more field offices: one in Florida, two in Nevada, three in Ohio, and three in Virginia.

We then examine whether, and if so how much, more advertising could have helped the losing party in each election. Our analysis shows that advertising could have played a critical role in deciding the election, but only in a close competition such as the 2004 election. That year, if the Democrats had raised their ad impressions by roughly 50% in Iowa and 80% in Ohio (corresponding to a \$1.8 million and \$10.6 million increase in ad spending, respectively), they would have won the two states and, with the valuable 27 electoral votes, would have taken the white house. As far as PAC ads are concerned, they could have helped Kerry claim victory in three states by spending an additional \$0.03 million (the equivalent of 50% more GRPs) in New Mexico, \$0.18 million (60% more GRPs) in Iowa, and \$2.06 million (five times more

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<sup>14</sup>The optimization procedure, say for Colorado in 2008, goes as follows. First, we copy the value of the Democratic field operations in Colorado. Second, we solve for the number of Republican field offices per county, which minimizes the total number of field offices given that the Republicans would win the majority of votes. For the 53 counties in which the Republicans did not have an office in 2008, we restrict the value to fall between 0 and 10, as fewer than 0.5% of the counties in our sample ever had more than ten field offices. For the 11 counties with at least one office that year, we bound the variable between the current value and 10.

Table 9: Counterfactuals for Optimal Field Offices

2008			2012		
State	Existing	Optimal	State	Existing	Optimal
Colorado	11	18	Colorado	14	19
Florida* (27)	0	4	Florida* (29)	48	49
Indiana* (11)	0	1	Michigan	23	28
Iowa	16	25	Minnesota	0	3
Michigan	14	26	Nevada* (6)	12	14
Minnesota* (10)	13	16	New Hampshire	9	11
Nevada* (5)	12	14	Ohio* (18)	38	41
New Hampshire	4	7	Oregon	0	9
New Jersey	1	22	Pennsylvania	24	30
New Mexico	10	15	Virginia* (13)	28	30
North Carolina* (15)	18	19	Wisconsin	24	29
Ohio* (20)	9	13			
Oregon	0	12			
Pennsylvania	17	28			
Virginia* (13)	18	22			
Wisconsin	9	19			

Note: We report the optimal field operations that could have helped the Republicans win each state. States with an asterisk make up the optimal strategy that requires the fewest field offices to win 270 electoral votes. We list the electoral votes in parentheses.

GRPs) in Nevada. Had that happened, the 2004 election would have resulted in a 269 to 269 tie! As directed by the 12th Amendment, members of the House of Representatives would have had to choose the president that year. To break the tie, it would have cost an additional \$4.1 million to win another state (i.e., Ohio), which is probably impractical, considering that the total PAC ad spending supporting the Democrats was merely \$6.9 million that year.

However, when the winner has a big competitive advantage, it is unlikely for a losing party to change the results solely through increasing advertising, at least not with a reasonable advertising budget. For example, in the 2008 election, the Republicans could have won Indiana with an extra \$1.9 million and North Carolina with \$1.3 million; however, they would not have been able to win another state with even \$30 million more worth of ads. Similarly, if the PACs supporting McCain had spent \$12 million more, they could have helped him win 73 more electoral votes (i.e., Florida, Indiana, North Carolina, and Ohio); but this still could not have made up for the additional 97 electoral votes he needed to win the election. In 2012, the Republicans could have increased their own ads to win Ohio (by \$16.4 million more spending, the equivalent of 1.3 times more GRPs) and Virginia (by \$22.7 million more spending,

the equivalent of 1.8 times more GRPs).<sup>15</sup> Or, the PAC ads could have helped them win Florida (with an additional \$9.8 million) and Ohio (with an additional \$32.3 million, roughly a third of the total PAC ad spending that year); but it would still be prohibitively expensive to win more states simply by increasing advertising, whether the candidates' own ads or outside ads.

## 6 Conclusion

We study the effect of personal selling and mass-media advertising in the context of U.S. presidential elections. By linking various campaign activities to county-level vote results, we offer a more comprehensive identification of the causal effect for various types of campaign activities compared to extant studies on this topic. Furthermore, our results generate insights into the effectiveness of each campaign activity for different voter segments: field operations are more effective for voters with stronger baseline partisan preferences, while candidate advertising is more effective among those with weaker partisan preferences. With our parameter estimates, we predict counterfactual election results under several hypothetical scenarios. Overall, we find that political campaigns play an essential role in the outcome of elections. This is contrary to the “minimum effect of campaigning” view held by some, who claim that most voters already have their minds made up and, hence, campaigns barely move the needle in terms of voting results. Our results debunk this view. We show that advertising can play a critical role in a close election but not when one party has a big advantage: had the parties not been allowed to advertise, the Democrats would have won the 2004 election but the results would have been largely the same for the next two elections. Had either party not implemented field operations, the Republicans would have won the 2008 and 2012 elections.

Some of the results are worth further discussion. First, the finding that PAC ads behaved similarly to ground campaigning rather than candidates' own ads is counter-intuitive. While candidates' own ads are found to be more effective for voters with weaker baseline partisan preferences, the opposite is true for PAC ads. We think that this could be due to the differences in ad content: PAC ads are predominately negative and tend to attack rivals rather than promote the preferred candidates. Such a strong negative tone perhaps works better to reinforce partisans' beliefs than to persuade undecided voters. This seems

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<sup>15</sup>In 2012, the total ad spending by the Romney campaign during the general election was roughly \$109.2 million.

consistent with Finkel and Geer (1998), who found that the weakest voter-withdrawal effect for negative ad exposures happened among individuals who were the most attentive to campaign media and who tended to have relatively stronger partisan preferences.

Second, the finding that the Democrats' field operations are more effective than the Republicans' also deserves closer examination. The field-operation own elasticity for the Democrats is estimated to be 2.4 times larger than that for the Republicans (Table 7). We believe that this is in part because the Democratic candidates tended to allocate field offices where they were expected to be more effective—i.e., among partisans. Across the three elections, the percent of registered Democrats was 34% (SD=11%) in counties with at least one Democratic field office, in contrast to 28% (SD=8%; 2-sample t test p value < 0.01) registered Republicans where the Republican field operation was present.

Other factors, such as the quantity and quality of outreach activities, could also affect the effectiveness of field operations. Quantity refers to the number of voter contacts, while quality includes the techniques used to target and persuade voters. For example, more-personal voter interactions could be more powerful than indirect contacts such as door hangers. This is perhaps best echoed by a quote from an Obama field director in 2012: "Many field campaigns have historically favored quantity over quality. We do not. These are not phone calls made from a call center. They are done at the local level by our neighborhood team leaders, members and volunteers, who are talking to people in their communities."<sup>16</sup> Despite the potential importance, detailed data on how field teams work are challenging to obtain, especially at the county level. We acknowledge this data limitation and believe that future research will benefit from improving the measurement of field operations.

Another important direction for future research is to understand the dynamic effect of campaigns. In this paper, we aggregate advertising at the election level and, as a result, do not consider the temporal effect of campaign planning within an election. Allocating a lot of campaign efforts too early in the race may risk exhausting resources that are needed for the final stretch; holding off the efforts, on the other hand, may mean missing the momentum to gain a head start for the voter base. Although not addressed in this study, we believe that examining how the effectiveness of different campaign activities varies over time could be an exciting avenue for future research.

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<sup>16</sup>CNN, (2012). "Analysis: Obama won with a better ground game." Nov 7.

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