

# The Effect of Television Advertising in United States Elections

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## Abstract

We provide a comprehensive assessment of the impact of television advertising on United States election outcomes between 2000-2016. Our data expand on previous literature by including presidential, Senate, House, gubernatorial, Attorney General, and state Treasurer elections. We use two research designs to identify the causal effect of advertising, including difference-in-differences models using all counties and a border-discontinuity design with counties at media market boundaries. We show that televised broadcast campaign advertising matters up and down the ballot. But it has much larger effects in down-ballot elections than in presidential elections. We also find that political advertising aired in the post-Labor Day period affects election outcomes, but advertising aired in the summer appears not to affect outcomes for any office. We find little evidence, however, of either diminishing returns or spillover across levels of office. Our results have implications for the study of political behavior, campaigns, and elections.

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How much does televised campaign advertising affect election outcomes in the United States? This has been a pertinent question for decades, at least since the first televised advertisement was aired by President Dwight Eisenhower's 1952 campaign. Answering this question helps illuminate the motivations behind voting behavior, the influence of mass communication on the electorate, and how much candidates' resources and messages can help them win elections. Moreover, the aggregate effect of televised advertising may determine the actual winner in at least some races, thereby affecting the composition of government and the course of public policy.

Political campaigns spend a great deal of money on television advertising. According to Fowler, Ridout, and Franz (2016), over \$2.75 billion was spent on advertising in the 2015-2016 election cycle, which represents over 4.25 million ad airings. This includes about 1 million airings in the presidential race, almost 1 million airings in Senate races, about 620,000 airings in House races, and 1.25 million airings in other races at the state and local levels. Overall, spending on television advertising constitutes about 45 percent of a typical congressional campaign's budget (Jacobson and Carson 2019).

Recently, scholars have made significant strides in addressing how much ads matter (see Jacobson 2015). But there are significant limitations to what we know about the effect of televised campaign advertising on election outcomes. Most importantly, the extant literature is almost entirely focused on presidential general elections. We know less about the potential effects of advertising on outcomes at other levels of office. Because voters typically know more and have stronger opinions about presidential candidates than less familiar down-ballot candidates, advertising effects could be larger in non-presidential races.

Beyond variation between presidential and non-presidential elections, there are a number of other unanswered questions. First, little research has examined the functional form of advertising's relationship to election outcomes. Does advertising have diminishing returns, suggesting that the large amount of money spent in many races may in fact be wasted because each additional ad does less work? Or are its effects essentially linear, which in turn

incentivizes campaigns to continue raising and spending money?

Second, although citizens are routinely exposed to advertising from different races across multiple levels of office, we do not know if ads for one race “spill over” and affect voting at another level of office. Spillover could occur by increasing the appeal of candidates from a particular party or changing the partisan composition of the electorate.

Third, there is little previous research about differences in the effects of ads aired by challengers and incumbents (e.g., Panagopoulos and Green 2008). There is evidence in prior work that spending by challengers matters more than spending by incumbents (e.g., Jacobson 2006), but none of these studies have focused on ads.

Fourth, only a few studies have systematically estimated the duration of campaign advertising effects at the individual or aggregate level. These studies find that the apparent effect of advertising decays quickly. However, we lack a comprehensive test that both examines election outcomes, not just individual preferences, and includes a wide array of races.

In this paper, we seek to address all of these questions. We study the impact of televised advertising on aggregate election outcomes not only in the 5 presidential elections from 2000–2016 but also in 276 U.S. Senate elections, 176 gubernatorial, 1,655 U.S. House, and 157 other state-level elections during this time period. In total, we examine over 2,250 different races, which increases the evidence base in the existing literature by roughly 1,000%. To address the possibility that campaigns may place ads in media markets where they expect to do well (Erikson and Tedin 2019, 250), we employ research designs that strengthen the causal interpretation of our findings, including time-series cross-sectional models with a difference-in-differences design (Angrist and Pischke 2009) and a border-discontinuity regression design (Spenkuch and Toniatti 2018).

We find that the effect of ad airings is much larger in down-ballot elections than presidential elections. For example, the apparent effect of an individual airing is four times as large in gubernatorial elections as presidential elections. It is also three times larger in Senate elections and four times larger in House elections than in presidential races. Second,

we find modest evidence of diminishing returns to advertising, despite the common perception that the effects of campaigning must “level off” at some point. There only appear to be decreasing marginal returns at very high levels of advertising that are rarely observed in actual elections. We also find little evidence of spillover across races, and no evidence that the effects of advertising vary between incumbents and challengers. Consistent with prior literature, we find that advertising generally has larger effects closer to election day. However, it appears to matter throughout the post Labor Day period.

Our paper has several key implications for the study of voting behavior and elections. It shows that despite increasing partisan polarization, there continue to be voters who respond to television advertising. This is particularly true in down-ballot elections in which voters have less information about candidates, and, perhaps, the effects of partisanship are weaker. Indeed, while television advertising is likely to swing only very close presidential elections, infusions of television advertising could swing a larger number of close congressional races and other down-ballot elections.

## 1 What We Do and Don’t Know about the Effects of Televised Advertising

Over the past 20 years, research on televised political advertising has made significant progress in estimating its impact on voting behavior (see Goldstein and Ridout 2004; Jacobson 2015).<sup>1</sup> One reason is the availability of detailed television advertising data that includes the timing and location of ad airings, which can then be married to aggregate- and individual-level data on voting behavior (e.g., Freedman and Goldstein 1999; Johnston, Hagen, and Jamieson 2004; Shaw 2004; Ridout and Franz 2011; Sides and Vavreck 2013; Fowler, Ridout, and Franz 2016; Sides, Tesler, and Vavreck 2018). The second is improved methods

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1. Research has also examined the impact of advertising on citizen’s views of the candidates (separate from vote intention), knowledge of the candidates, and views of the political process (Franz et al. 2008; Huber and Arceneaux 2007; Ridout and Franz 2011), which are all important outcomes but not our focus.

of causal inference that better leverage the geographic variation in advertising volume across states and media markets (e.g., Ashworth and Clinton 2007; Huber and Arceneaux 2007; Krasno and Green 2008; Spenkuch and Toniatti 2018; Wang, Lewis, and Schweidel 2018) or, more rarely, the random assignment of advertising to media markets (Green and Vavreck 2008; Gerber et al. 2011).<sup>2</sup>

Most, although not all, of these studies have found associations between televised advertising and either individual vote intentions, aggregate vote shares, or both.<sup>3</sup> When a candidate airs more advertisements, overall or relative to their opponent, it tends to increase the likelihood that voters will say they support that candidate in surveys and also increase the percentage of the vote that the candidate wins in the areas where the ads aired. For example, Spenkuch and Toniatti (2018) find that in the 2004-12 presidential elections a one standard deviation increase in the advertising advantage of a candidate over the opponent is associated with about a 0.5-point increase in that candidate’s vote margin, which is equivalent to a 0.25-point increase in two-party vote share. In presidential general elections, the persuasive impact of televised advertising appears to be larger than the persuasive impact of other forms of electioneering, such as canvassing or mail, whose impact is quite small, even zero (Kalla and Broockman 2018).

Despite the advances in this literature, several important questions have received much less attention. The first is how much advertising matters outside of presidential general elections. The extant literature tends to focus on one or more of the 5 presidential general elections between 2000 and 2016. Only a few studies have examined advertising effects in Senate elections (Goldstein and Freedman 2000; Ridout and Franz 2011; Fowler, Ridout,

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2. Many studies have also employed random assignment of advertising in laboratory and survey experiments (e.g., Ansolabehere and Iyengar 1997; Coppock, Hill, and Vavreck 2020). This usually involves participants reacting to a single viewing of an advertisement. Our focus is on studies that estimate the cumulative effects of advertising, since actual voting reflects the accretion of influences across the campaign (Erikson and Wlezien 2012).

3. There is less evidence that televised advertising affects turnout (Ashworth and Clinton 2007; Krasno and Green 2008; Spenkuch and Toniatti 2018; Green and Vavreck 2008), although turnout can be affected by other kinds of campaign activity (Green and Gerber 2019; Enos and Fowler 2018).

and Franz 2016; Wang, Lewis, and Schweidel 2018) or House elections (Hill et al. 2013).<sup>4</sup> Only two studies have examined gubernatorial elections and both focus on survey-based vote intentions rather than election results (Hill et al. 2013; Gerber et al. 2011). To our knowledge, there has been no published research on the effect of advertising in down-ballot state-level races, such as elections for state Attorney General. And, most importantly, no study has used a comparable, credible research design to study advertising effects across multiple levels of office.

The lack of research on down-ballot races is especially problematic because advertising should more strongly affect electoral outcomes in those races than in more prominent races, especially presidential races. On average, the persuasive effects of new information are larger when people’s prior attitudes are weaker (DellaVigna and Gentzkow 2010), and in down-ballot races voters tend to know less about the candidates and have weaker (if any) opinions about those candidates, relative to candidates in more prominent races. This may help explain why advertising in Senate elections appears to have larger effects than in presidential elections (Fowler, Ridout, and Franz 2016).<sup>5</sup>

In addition, down-ballot races frequently feature asymmetries in advertising whereby one candidate substantially out-spends the other; those asymmetries are less common in presidential elections. When asymmetries occur, the information environment better approximates a “one-message communication flow” that gives partisans less ability to employ “critical resistance” and increases the probability of partisan defections (Zaller 1992). This in turn should increase the effect of advertising on the election outcome.

The second question concerns the functional form of the relationship between advertising

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4. Scholars have investigated the tone of campaigning in Senate elections and its possible effects on voter decision-making and election outcomes (Lau and Pomper 2004) and how voter decision-making depends on the “intensity” of Senate campaigns (Kahn and Kenney 1999; Westlye 1991), which are related to but distinct from our focus. Studies of U.S. House elections focus mainly on candidate spending as a (reasonable) proxy for specific forms of campaigning such as advertising (e.g., Jacobson 1978; Green and Krasno 1988). Only occasionally have scholars tried to isolate the effects of House electioneering activities (Ansolabehere and Gerber 1994; Schuster 2020).

5. Even in presidential races, advertising may have a larger effect on views of the lesser-known candidate (Broockman and Kalla 2020).

volume and election outcomes and especially whether there are diminishing returns to advertising. There is no consensus on this question despite agreement among published work on the rapid decay of advertising effects at the individual level (Shaw 2004; Hill et al. 2013). Studies that look at the relationship between candidate spending and election outcomes often employ a functional form that implies diminishing returns (e.g., Jacobson 1985; Green and Krasno 1988; Jacobson 1990; Ansolabehere and Gerber 1994). As Jacobson (1990) puts it, “it is clear that linear models of campaign spending effects are inadequate because diminishing returns must apply to campaign spending” (337).

Studies of campaign advertising, however, vary in the functional form they employ. Some assume linearity by employing the raw number of ads aired by individual candidates (e.g., Johnston, Hagen, and Jamieson 2004; Sides, Tesler, and Vavreck 2018) or the difference in advertising volume between opposing candidates (e.g., Ridout and Franz 2011; Sides and Vavreck 2013; Spenkuch and Toniatti 2018). Others assume non-linearity, and typically diminishing returns, by employing measures such as the difference between the logged number of ads by opposing candidates (Shaw 2004) or the logged ratio of advertising between the two opposing candidates (Hill et al. 2013). Less common are studies that explicitly examine functional form. But in two studies that have, the relationship between advertising and vote intention appears linear (Gerber et al. 2011) as does the relationship between the total volume of get-out-the-vote efforts and increases in turnout (Enos and Fowler 2018).

Better understanding functional form is important for campaign professionals who need to make strategic choices with limited resources. It is also important for illuminating theoretical questions about voter information-processing, such as whether there is a point at which voters have heard or learned enough that they are no longer affected by subsequent messages from candidates.

The third question is whether there are spillover effects of political advertising across races, such as when advertising for a candidate at one level of office affects support for a candidate running for a different office. To our knowledge, spillover has not been explored

in the literature on political advertising, but it may occur for at least two reasons. Studies of commercial advertising find evidence of spillover, and in particular from the advertiser to competitors who sell similar products (e.g., Sahni 2016; Shapiro 2018). From a company’s perspective, this is a problem. From a political party’s standpoint, this could be a benefit. A party’s candidates are, in a sense, selling a similar product, and if advertising in one race helps a party’s other candidates, that is all to the good. (The exception, of course, would be if a candidate’s advertising is so noxious as to turn off voters from not only that candidate but other candidates in the same party.)

In addition, studies of campaign spending and advertising have shown that it can shape the partisan composition of the electorate (e.g., McGhee and Sides 2011; Spenkuch and Toniatti 2018), which suggests the potential for spillover. For example, if a Republican candidate’s advertising mobilizes Republican voters and increases the fraction of the electorate that is Republican, this should not only increase the vote share of that candidate but other candidates in her party. This possibility is most likely when prominent races with heavy advertising, such as the presidential race, affect down-ballot outcomes with less advertising.<sup>6</sup>

The fourth question is whether the effects of advertising vary between incumbents and non-incumbents. There are both theoretical and empirical reasons to expect that the marginal returns on advertising are greater for challengers than for incumbents (see Jacobson 2015, for a review). Most importantly, incumbents are typically better known than challengers, which suggests that challengers have more to gain from advertising that raises their visibility among voters (Jacobson 2006). Moreover, studies of campaign spending effects usually find that spending by challengers has the greater impact than spending by incumbents (Jacobson 2015).

The last question is how long any effects of televised advertising actually last. Theories

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6. A related type of spillover is when the presence of a ballot initiative encourages certain voters to turn out, thereby helping the candidates whom those voters favor. For example, some research argues that ballot initiatives about same-sex marriage increased the likelihood that white evangelical conservatives turned out to vote in 2004—an effect that would have helped Republican candidate George W. Bush (Campbell and Monson 2008).

of memory-based processing suggest that the effects of advertising will decay, and potentially decay rapidly, as the information passes out of memory and leaves little residual effect on attitudes (Hill et al. 2013). The implication is that advertising aired closer to Election Day will have a larger impact than advertising aired earlier. But other theories of information processing, especially on-line models (Lodge, Steenbergen, and Brau 1995), suggest that advertising could shift opinions in durable ways even if citizens do not remember the specific information in advertising for very long.<sup>7</sup>

Only a few studies have examined the durability of political advertising effects. Mainly these have focused on individual presidential elections in 2000 (Hill et al. 2013), 2012 (Bartels 2014; Sides and Vavreck 2013) and 2016 (Sides, Tesler, and Vavreck 2018). The exceptions are a study of individual-level preferences in gubernatorial, U.S. Senate, and U.S. House races in 2006 (Hill et al. 2013) and the 2006 Republican gubernatorial primary in Texas (Gerber et al. 2011). These studies all find that most if not all of the apparent effect of advertising decays quickly—within a week—and potentially more quickly in down-ballot elections than presidential elections (Hill et al. 2013). This pattern of decay is evident in other modes of campaigning as well (Kalla and Broockman 2018).<sup>8</sup> At the same time, this research is mostly based on studies of either single elections or individual advertising campaigns. We do not know whether this pattern of decay is equally evident across election years or levels of office. If it is not, then this may help explain why political campaigns still advertise across the entire campaign season (Fowler, Ridout, and Franz 2016).

The importance of these questions, and the relative paucity of evidence that speaks to them, illustrates the argument of Kalla and Broockman (2018), who, after canvassing

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7. If voters are less attentive to political advertising as the campaign goes on, this would also have implications for the time period in which advertising is particularly effective. But in fact very few voters change the channel when they encounter political advertising and this low rate of “tune-out” barely increases over the campaign (Canen and Martin 2019).

8. Studies that do not conduct formal tests of duration also give more weight to later ads than earlier ads. For example, Johnston, Hagen, and Jamieson (2004) examine the effect of presidential ads aired in the week before the survey interview, Ridout and Franz (2011) examine the impact of Senate ads aired in the month before the election, and Spenkuch and Toniatti (2018) examine the effects of presidential ads aired in the two months before the election.

the available experiments on persuasion in general election campaigns, argue that “more evidence” on televised advertising “would clearly be welcome.” We aim to provide that evidence.

## 2 Data and Research Design

To evaluate the effect of political advertising, we built a panel dataset of election returns and advertising data at the county level. This dataset has considerable temporal and geographic scope, which, alongside a credible research design, provides a rigorous test of the causal effect of advertising on thousands of election outcomes.

We assembled 2000-2016 national, state, and local election results from various sources. For presidential, senate, and gubernatorial elections between 2000 and 2014, we used data from CQ’s Voting and Elections Collection, supplemented with 2016 data compiled by Pettigrew (2017). For House elections during this period, we used data from the Atlas of U.S. Elections (Leip 2016). This data breaks the results of each congressional election down by county. For other state offices (i.e., attorney general and treasurer), we used crowd-sourced county-level data from OurCampaigns.com.<sup>9</sup>

The main treatment variable in our analysis is the net Democratic advantage in the number of broadcast television ad airings in a county over the last two months (64 days) of the campaign.<sup>10</sup> We calculate this by taking the difference between the number of Democratic and Republican ad airings for a particular race in each media market using advertising data from the Wesleyan Media Project and the Wisconsin Advertising Project (Fowler, Franz, and Ridout 2020). These data include the top 75 media markets in the 2000 election cycle, the top 100 markets in the 2002, 2004, and 2006, cycles, and all 210 media markets since 2008. We include all advertising supporting the Democratic and Republican candidates in

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9. Thirty-six states elect state treasurers and 43 elect attorneys general.

10. Broadcast television advertisements constituted the vast majority of campaign advertising during most of this time period. In recent years, the number of advertisements on cable television has increased. But most campaign spending continues to be on broadcast television (Fowler, Ridout, and Franz 2016).

each race, including ads aired by the candidate’s campaign, parties, and outside groups. Our initial focus on advertising in the last two months of the campaign reflects the finding that ads aired closer to Election Day are more effective than ads aired earlier in the election cycle, although we investigate this further below.

One limitation of this measure is that it does not account for the size of the television audience that could have seen each ad airing. However, counts of ad airings are highly correlated with measures, such as gross ratings points, that do attempt account for the reach of each ad on voters.<sup>11</sup>

Figure 1 displays the net Democratic ad advantage in each media market for an illustrative set of offices and years. It shows not only the comprehensiveness of our data but how much advertising volume varies across offices and geography.

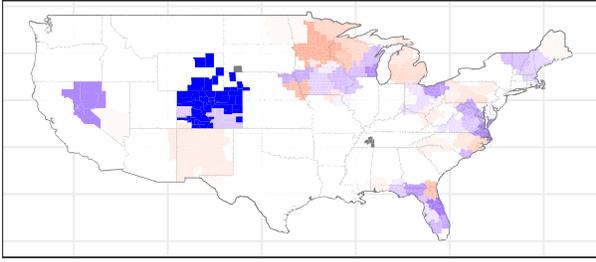
We use two parallel research designs to estimate the causal effect of television advertising on election outcomes. The first design includes all U.S. counties that lie in the media markets contained in the advertising data (e.g., all counties starting in 2008 and a subset of counties prior to that). We include either county fixed effects to account for time-invariant confounders in each county or a lagged outcome variable in lieu of county fixed effects.<sup>12</sup> These account for the overall partisan orientation of each county. We also include state-year fixed effects to control for time-varying confounders at the state and national levels (Fowler and Hall 2018; de Benedictis-Kessner and Warshaw 2020).<sup>13</sup> The state-year fixed effects

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11. In 2006, we have measures of both ad airings and gross ratings points (GRP’s) for 69 candidates in 9 media markets across 5 states (MI, MN, OH, IL, IN). These candidates were running for U.S. House of Representatives (60), Senate (4), and Governor (5). Across the 42 days leading up to election day, the correlation at the candidate-market-day level between ad airings and GRP’s ranges from .89 to 1.0 for candidates who ran ten or more ads. The average correlation across all candidate-market-days is .97. In 2012, the correlation between ads aired and GRP’s for presidential candidates Barack Obama and Mitt Romney was similarly high. In the 159 days leading up to the 2012 general election, the correlation between airings and GRP’s at the candidate-market-day level was .99 for both Obama and Romney. We estimate that each ad airing was worth 3-4 GRP’s in the 2012 presidential race.

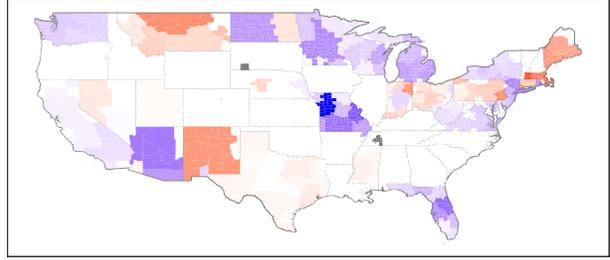
12. We do not include county fixed effects in the model with a lagged outcome variable to avoid issues of Nickell bias since we have a small number of time periods (Nickell 1981; Beck and Katz 2011).

13. We cluster our standard errors at the county level to account for serial correlation in errors. We also cluster by media market-year to account for the fact that each county in a market receives the same dosage of advertising during a particular election year (Abadie et al. 2017). In Appendix B, we show how the standard errors for our point estimates of ad effects in presidential races vary using different clustering strategies. In general, the standard errors are similar using a variety of clustering designs, but much smaller if standard



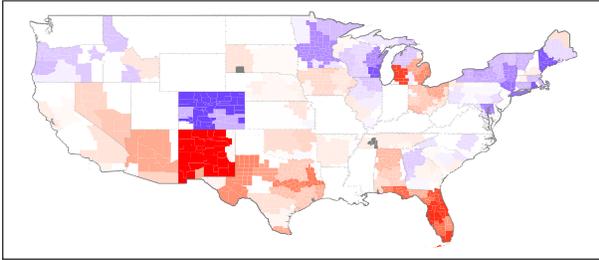
Dem. Ad. Advantage -20 0 20 40

(a) Presidential Race, 2012



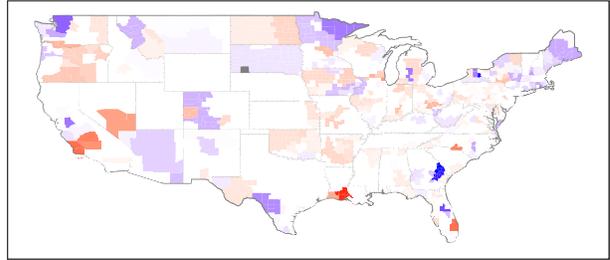
Dem. Ad. Advantage -20 0 20 40

(b) Senate Races, 2012



Dem. Ad. Advantage -40 -20 0 20

(c) Governor Races, 2014



Dem. Ad. Advantage -2000 -1000 0 1000 2000

(d) House Races, 2012

Figure 1: Democratic Advertising Advantage across Geography in an Illustrative Set of Offices and Years. Positive (bluer) values show a pro-Democratic advantage and negative (redder) values show a pro-Republican advantage.

account for trends in the political preferences of each state across election years, such as the pro-Republican trend in Ohio or the pro-Democratic trend in Arizona. They also account for race-specific dynamics in each state, such as the strength of candidates and the incumbency advantage.<sup>14</sup> Thus, this research design isolates the effects of advertising from other aspects of candidates' quality and spending.

Although this panel design addresses a host of possible confounders, it may miss the effect of unobserved time-varying confounders at the media market or county levels that could bias our estimates. In particular, campaigns could be strategically targeting their spending in areas of a state where they expect to do well by using information, such as internal polls,

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errors are not clustered at all.

14. For our analysis of congressional districts, we use district-year fixed effects to account for the strength of candidates in each race.

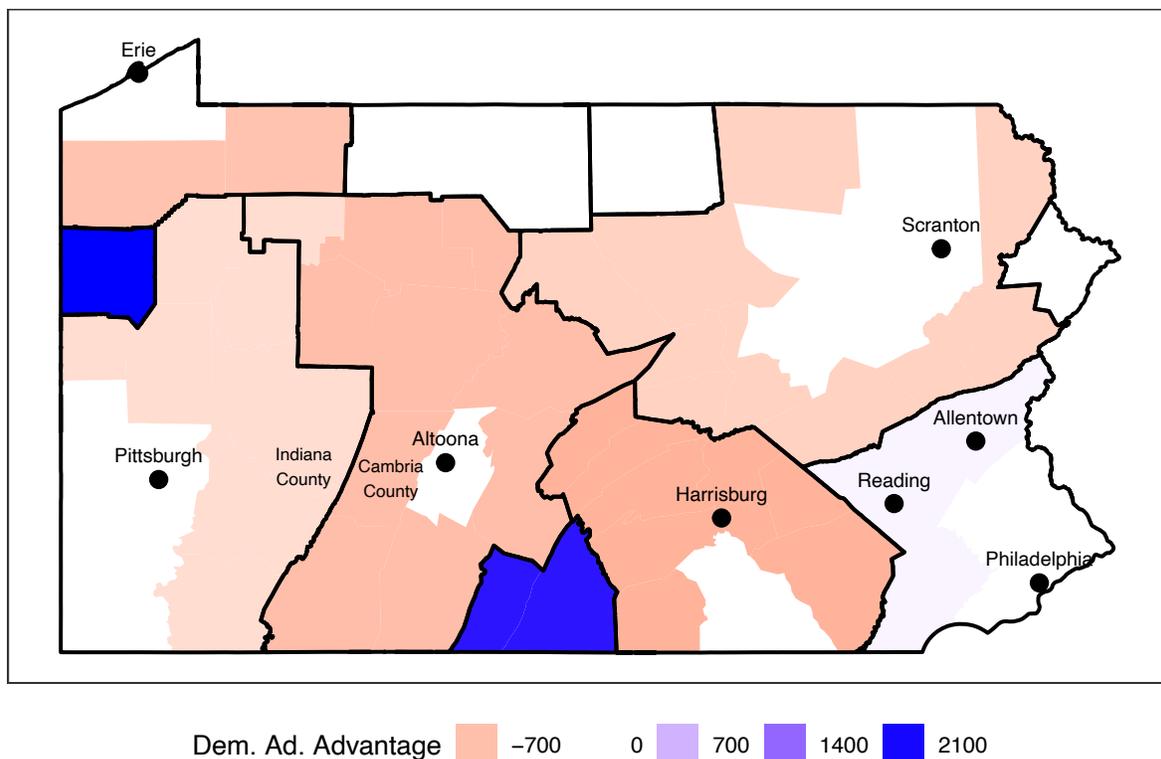
that is unavailable to researchers.

Our second research design accounts for this possibility by restricting the sample to counties in the same state that lie adjacent to one another along different sides of the border of a media market. This design has been used in the Spenkuch and Toniatti (2018) study of the effects of television advertising in recent presidential elections. Similarly, Huber and Arce-neaux (2007) use media market boundaries to study the persuasive effects of advertising in the 2000 presidential elections. Other studies have used discontinuities in treatment exposure across county or state boundaries to study the incumbency advantage (Ansolabehere, Snowberg, and Snyder 2006) or the effects of policies like Medicare expansion and right-to-work laws (e.g., Clinton and Sances 2018; Feigenbaum, Hertel-Fernandez, and Williamson 2018). The intuition behind this “border county” design is that within a state, adjacent counties on the border of a media market are likely to be similar to one another, except that the two counties straddle a media market boundary and may be exposed to different levels of television advertising. Moreover, this variation in advertising spending is plausibly exogenous to characteristics of these border counties. It seems unlikely that advertising is targeted based on the characteristics of specific border counties, especially because the counties on media market boundaries exclude the urban cores of most media markets. Only about 5% of the nation’s population lives in a county on a within-state media market boundary (Spenkuch and Toniatti 2018).

To illustrate this design, Figure 2 shows the border counties in Pennsylvania. For example, Indiana and Cambria counties are included because Indiana County is in the Pittsburgh media market and Cambria County is in the Johnstown-Altoona media market. Both counties are similar politically. For instance, they are both largely rural counties where President Trump received about two thirds of the vote in the 2016 presidential election. The map also illustrates that there is substantial variation in presidential advertising across markets.

To execute the border county design, we match each county with every other border county that lies on the other side of a media market boundary. The unit of analysis thus

Figure 2: Illustration of Border Counties Design in Pennsylvania: The dark lines indicate media market boundaries. The shaded counties, which lie along a DMA boundary next to another county in Pennsylvania, are the ones included in our sample. The shades shows the Democratic advertising advantage in the 2012 presidential election.



becomes the border county pair. This means that a particular county could be in this sample multiple times if it borders multiple counties in this fashion, and thus the overall sample size is larger in this design than the first design.<sup>15</sup> In analyzing this sample of border counties, we include county fixed effects to account for time-invariant confounders in each county. Crucially, we also include year-specific fixed effects for each pair of border counties. This accounts for the effect of any year-specific unobserved confounders in each border-pair of counties, such as trends in their partisanship or ideology. Thus, only confounders that vary between border counties within a particular election cycle could bias our results using this design. While it is impossible to definitely rule out these confounders, there appears to be

15. We cluster standard errors in the border county sample by county and media market border-year to ensure that this process does not artificially increase our statistically precision (Abadie et al. 2017).

no correlation between changes in political advertising and border counties’ time-varying observable characteristics.<sup>16</sup>

The identification strategies for both research designs rely on the assumption that there are no time-varying confounders, typically called the parallel trends assumption. To further validate this assumption, we look at whether future values of television advertising appear to have a significant effect on current outcomes. For both designs, we find that future advertising has no effect on election results (see Appendix A).<sup>17</sup> The fact that both research designs pass this “placebo test” suggests that time-varying confounders are not biasing our results.<sup>18</sup> Overall, we believe that the “border county” design is more rigorous than the “all counties” design. But it relies on a much smaller set of counties so some may worry about its external validity. As a result, we use both designs throughout the rest of the paper.

Table 1: Summary Data on Democratic Advertising Advantage (in hundreds of ads)

<b>All Counties</b>						
	Mean	Std. Dev. (across county)	Std. Dev. (within county)	Minimum	Maximum	Sample
President	4.11	11.84	6.13	-26.89	106.34	12,480
Senate	0.34	10.78	4.76	-49.53	71.32	16,878
Governor	-0.16	10.02	4.08	-44.87	38.55	12,296
House	0.43	4.20	1.61	-27.46	38.92	24,926
Attorney Gen.	0.26	3.89	1.46	-12.00	34.22	7,412
Treasurer	0.10	1.99	0.82	-10.00	12.08	5,104
<b>Border Counties</b>						
	Mean	Std. Dev. (across county)	Std. Dev. (within border-pair)	Minimum	Maximum	Sample
President	4.21	12.12	4.76	-26.89	106.34	17,552
Senate	0.20	10.39	3.82	-49.53	71.32	21,130
Governor	-0.81	11.17	3.40	-44.87	38.55	12,801
House	0.35	4.29	1.43	-30.98	41.73	33,280
Attorney Gen.	0.13	3.98	1.14	-12.00	34.22	7,795
Treasurer	0.12	2.30	0.70	-10.00	12.08	5,294

16. Spenkuch and Toniatti (2018, 1999-2000) conduct this analysis in their study of advertising effects in presidential elections using the same specification we use in our border county design. They find that there is no correlation between political advertising and border counties’ time-varying observable characteristics.

17. The only exception is the Senate races in the all counties design, where we find that future advertising seems to have small effects on contemporaneous vote shares.

18. Note, though, that both of the designs we employ are intended to identify the effects of advertising volume, not the effects of other characteristics of advertising, such as its content or tone. On the challenges of generating causal estimates of tone, see Blackwell (2013).

Table 1 shows summary statistics of advertising across offices in all counties and in border county pairs (in hundreds of ads). Our main treatment variable—the “Democratic advertising advantage” in the last two months before the election—captures the balance of ads favoring each of the opposing major-party candidates.<sup>19</sup> On average, there is considerable balance, such that the mean Democratic advantage is close to 0 in most levels of office other than presidential elections. In presidential elections, Democrats have a modest advantage on average, driven in particular by their advantages in the 2004, 2008, and 2016 elections. But there is considerable variation both across counties and, crucially given our research designs, within counties and border county pairs.<sup>20</sup> This variation is particularly large in races for president, Senate, and Governor, where there is more advertising overall.

### 3 Results

This section presents our main results. First, we show that advertising affects presidential election outcomes. Next, we show that advertising has bigger effects in down ballot elections. Then, we examine the questions of functional form, spillover, heterogeneity between incumbents and challengers, and variation in the effect of ads over the course of the campaign.

#### 3.1 Ad Effects in Presidential Elections

Table 2 shows the estimated effects of ad airings on the Democratic candidate’s major-party vote share in presidential elections between 2000 and 2016. The first four columns show the results of regression models using all counties where we have advertising data. The first column shows a naive model with just fixed effects for year. This model suggests that a

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19. It’s worth noting that using the “Democratic advertising advantage” in a regression is substantively nearly exactly equivalent to including both Democratic and Republican ads separately in the regression.

20. The standard deviations within counties or border pairs are based on the residuals in ad advantage from the fixed effect regression models in Table 3. For more on using this kind of standard deviation, see Mummolo and Peterson (2018).

100-airing advantage yields an additional 0.163 percentage points of vote share. The next column shows the results of a model with year and county fixed effects. The addition of county fixed effects, which address time-invariant confounders, dramatically decreases the estimated effect to 0.04 points – that is, four-hundredths of a percentage point. This implies that campaigns are likely targeting ads to areas where their party generally performs better. The third column shows the results of a model that includes state-year fixed effects and a lagged outcome variable. In this model, a 100-airing advantage for the Democratic candidate is associated with a .039-point increase in vote share over the candidate’s vote share in the previous election. The fourth column includes state-year fixed effects, which address time varying confounders at the state-level, as well as county fixed effects. Here, the same ad airing advantage is associated with a .023-point increase in vote share.

Table 2: Effects of Aggregate Television Advertising in Last Two Months of Presidential Elections (2000-2016). The treatment variable is Democratic Ad Advantage in terms of hundreds of ads.

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	0.163** (0.033)	0.040** (0.014)	0.039** (0.007)	0.023** (0.009)	0.029** (0.006)	0.021** (0.007)	0.020** (0.006)
Year FE	X	X					
State-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	12,480	12,480	12,478	12,480	17,551	17,552	17,552
R <sup>2</sup>	0.071	0.929	0.952	0.962	0.955	0.968	0.992

*Note:*

Standard errors clustered by county & DMA border x year.  
\*p<0.05; \*\*p<0.01

The next three columns show the estimated effects of presidential ad airings among pairs of counties along media market borders. A model that includes state-year fixed effects and a lagged outcome variable shows that a 100-airing advantage for the Democratic candidate is associated with a .029-point increase in vote share (column 5). A model that includes state-year fixed effects and county fixed effects produces a similar estimate of .021 points

(column 6). Incorporating border-pair-year fixed effects and county fixed effects yields an estimate of .020 points (column 7).<sup>21</sup>

These results show that the more stringent the modeling strategy, the smaller the effect of televised advertising on presidential election outcomes. This illustrates the importance of either employing fixed effects or isolating border counties (or both) to avoid overstating the effect. It also bolsters a causal interpretation of our results that we recover similar results with two different identification strategies. Ultimately, televised advertising in presidential elections appears to have a modest but detectable relationship to vote share, as previous literature has found.<sup>22</sup>

Our results also place a rough upper bound on the real-world effects of advertising in presidential general elections. Assuming that the effects of ads are linear, our findings imply that moving from three standard deviations below the average advertising advantage to three standard deviations above the average (a 6 SD shift) within border pairs would lead to a 0.6-point change in two-party vote share.

### 3.2 Ad Effects in Down Ballot Elections

How does the effect of televised advertising in presidential elections compare to its effects in other types of elections? The top panel of Table 3 shows the effect of advertising across

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21. The results in column (7) are also very similar to the results in Spenkuch and Toniatti (2018), who use a similar design. They find that a similar shift in advertising is associated with a shift in vote margin of about 0.5 percentage points, which is equivalent to a change in two-party vote share of 0.25 percentage points. Our results imply that a one standard deviation (across counties) change in advertising advantage leads to a change in two-party vote share of .242 percentage points (although the within-county variation in advertising is a better way to measure the plausible variation in the data). The similarity of the two sets of results is particularly notable because Spenkuch and Toniatti (2018) employ a more refined measure of advertising that uses Nielsen data on television audiences to estimate the number of times the average person in each county saw ads for each candidate. Thus, the difference between this measure and our simpler measure of advertising exposure does not seem to affect the results.

22. We find similar results in models in which we first-difference the treatment and outcome variables to calculate changes from the previous election cycle, and in models that include a linear time trend for each county. We also investigated whether advertising effects are changing over time (see Appendix E). We find no evidence of any decrease in advertising effects in more recent election cycles. Finally, for presidential elections from 2004-2016, we examined whether the presence of Democratic candidate field offices affects our results (see Appendix D). We found no evidence for this, suggesting that the estimated effects of ads are not confounded by the kinds of campaign activity associated with field offices, such as canvassing.

different offices using the all county sample. Here, we use the specification with both county and state-year fixed effects (column 4 of Table 2). The bottom panel of Table 3 shows the effect of advertising across different offices using the border county sample and the specification with county and adjacent-county-year fixed effects (column 7 of Table 2).<sup>23</sup>

Table 3: Effects of Aggregate Television Advertising in Last Two Months of Election Across Offices (2000-2016). The treatment variable is Democratic Ad Advantage in terms of hundreds of ads.

	<i>Dependent variable: Dem. Vote Share</i>					
	President (1)	Senate (2)	Governor (3)	House (4)	Attorney Gen. (5)	Treasurer (6)
<b>All Counties</b>						
Dem. Ad. Adv. (100 ads)	0.023** (0.009)	0.060** (0.012)	0.095** (0.016)	0.078* (0.030)	0.157** (0.058)	0.275** (0.072)
County FE	X	X	X	X	X	X
State-year FE	X	X	X	X	X	X
Observations	12,480	16,878	12,296	24,926	7,412	5,104
R <sup>2</sup>	0.962	0.958	0.941	0.955	0.968	0.969
<b>Border Counties</b>						
Dem. Ad. Adv. (100 ads)	0.020** (0.006)	0.054** (0.008)	0.080** (0.012)	0.081** (0.029)	0.176** (0.047)	0.286** (0.053)
County FE	X	X	X	X	X	X
Border-Pair-Year FE	X	X	X	X	X	X
Observations	17,552	21,130	12,801	33,280	7,795	5,294
R <sup>2</sup>	0.992	0.991	0.989	0.992	0.994	0.995

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

The results using both designs tell a similar story: a similar sized ad airing advantage has much larger effect in elections other than presidential elections. Column (1) recapitulates the earlier finding that a 100-airing advantage in presidential elections leads to about a 0.02-point increase in two-party vote share. But this advantage leads to a 0.05-0.06 point increase in vote share in Senate elections (column 2), a 0.08-0.09 point increase in gubernatorial elections (column 3), a 0.08 point increase in House elections (column 4), a 0.16-0.18-point increase in Attorneys General elections (column 5), and a 0.28-0.29 point increase in vote share in state Treasurer elections (column 6). Thus, the effect of a particular dosage of ad airings can be

23. In Appendix C, we show the results using all the models we reported for presidential races in Table 2.

anywhere between 2.5 and 14 times greater in down-ballot races than in presidential races.

Figure 3: Effect of Democratic Advertising Advantage on Democratic Vote Share. These graphs show the implied effects of a  $3 \pm SD$  variation in Democratic ad advantage for each office. They are based on the residuals from the border counties models in Table 4. The x-axes are standardized across plots to enhance comparability.

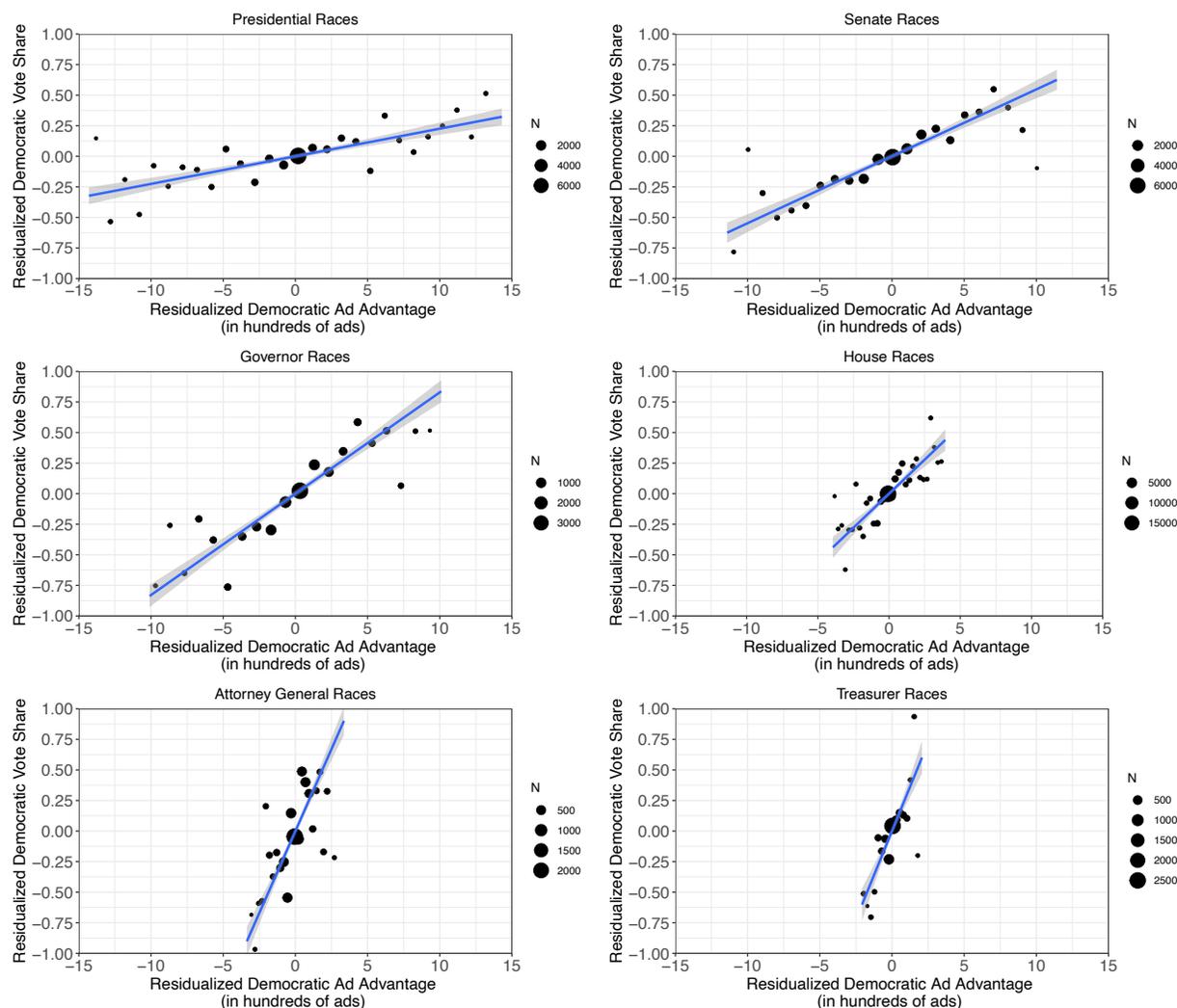


Figure 3 shows the results graphically based on the border counties design in Table 3.<sup>24</sup> It shows the effect of variation in each party’s advertising between -3 and 3 within-unit standard deviations of the mean within border pairs (Mummolo and Peterson 2018).<sup>25</sup> We

24. For this figure, we first calculate the residuals based on the fixed effects models in Table 3. This approach is similar to Figure 1 in Gerber et al. (2011). We then plot the relationship between the residualized treatment and outcome variables. We show the binned residuals to make the graphs simpler, but the linear lines on each graph are based on all of the data.

25. In other words, it shows the maximum marginal effects of advertising across the range of advertising

noted earlier that this “maximum marginal effect” of advertising was about 0.6 percentage points in presidential races. It is larger down-ballot: about 1% in Senate races, 1.5% in governor races, 1.5% in House races, 1% in Attorney General races, and 1.2% in Treasurer races.

Not only does advertising have a larger effect in down-ballot races, but it does so at a lower cost.<sup>26</sup> For presidential races, we estimate that the cost per vote is about \$285.<sup>27</sup> A \$10 million advantage in an individual state might gain a candidate 35,000 votes, or enough to tip Nevada, Maine, Michigan, Wisconsin, and New Hampshire in the 2016 election. The cost per vote is much lower in other offices: about \$142 in Senate races and \$88 in governors races. This suggests that a very plausible ad advantage of \$2 million in a Senate race would gain a candidate about 14,000 votes, which is also enough to tip several races in recent years. In addition, the cost per vote from advertising, especially in down-ballot races, is comparable to other campaign activities (Green and Gerber 2019, Table 12-1). This may explain why campaigns continue to spend so much on television advertising.

### 3.3 Marginal Returns to Advertising

The next question we examine concerns the marginal returns to advertising—specifically, does it have diminishing returns, which would imply that the large amount of money spent in many races may be wasted, or are its effects essentially linear?

Figure 3 (above) provides an initial visual evaluation of returns to scale for advertising advantage. There is little apparent evidence of diminishing returns. For many types of offices, the relationship between advertising advantage and vote share is reasonably linear. Only at extreme levels of advertising advantage, where there are very few cases, do the points deviate much from the linear regression line. Further analysis shows that a non-  

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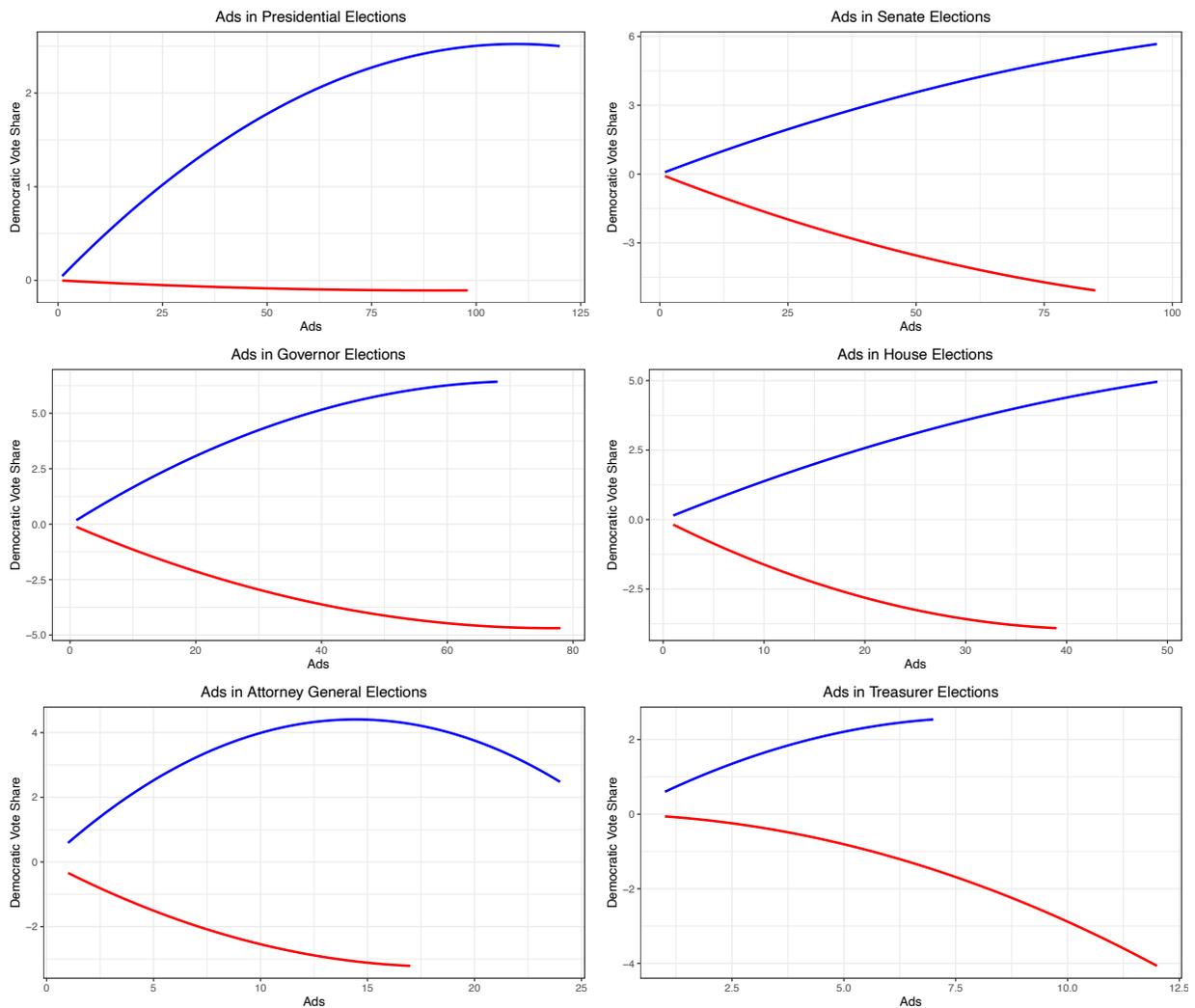
advantage we observe within border pairs.

26. These calculations are based on: the estimated average cost per ad in the Wesleyan Median Project data in 2016; the average population of DMAs where ads were aired; and the point estimates from the border counties model in Table 3.

27. This is slightly more than the \$170 per vote estimated by Spenkuch and Toniatti (2018) based on the cost of advertising in the 2008 presidential election.

parametric loess curve is generally close to the linear regression line for each level of office. Any differences appear to be essentially random across offices (see Figure A2 in Appendix F).

Figure 4: Effect of Democratic Advertising Advantage on Democratic Vote Share. These graphs show the implied effects of each party spending from 0 to the 99th percentile of their observed number of ads (in hundreds of ads) for each office (Democrats in blue and Republicans in Red). They are based on the border counties models in Table A9.



A second test of marginal returns disaggregates the advertising advantage measure and examines the effects of Democratic advertising and Republican advertising separately. We allow for non-linearity by including both linear and quadratic terms for each party's advertising. The quadratic terms should capture any decreasing (or increasing) returns to scale.

Figure 4 provides a graphical illustration of the results from these regression out to the 99th percentile of observed advertising for each office (see Appendix F for the full model results). In general, each party’s ads have their expected effect: increasing the vote share for that party.<sup>28</sup>

More importantly, that effect is approximately linear. Only at very high levels of advertising do there appear to be diminishing returns. But even at these high levels, vote share is almost always increasing at the margins, suggesting that candidates are still getting something for their dollar. Moreover, these high levels of advertising rarely translate into an advertising advantage for either candidate because the two sides typically match each other’s advertising. Given that advertising advantage also has a largely linear relationship with vote share (Figure 3), there is little reason for candidates to cease advertising, especially if their opponent continues to stay on the air.<sup>29</sup>

### 3.4 Spillover of Ad Effects

Next, we examine whether advertisements in one race affect the outcomes of other races. The expectation here is that a candidate at one level of office may benefit when candidates of his or her party running for other offices have advertising advantages. We test this expectation in two new ways. First, we test whether presidential advertising affects outcomes at other levels of office. This is plausible given the large volume of advertising in presidential general elections compared to advertising in down-ballot races. Second, we test whether election outcomes are affected by the advertising advantage summed across the non-presidential races other than the one that it is the focus of each model. For instance, in the model of presidential elections, the variable includes the advertising advantage across Senate, House, governor, Attorney General, and Treasurer elections (or whatever combination of those races

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28. The apparent null effect of Republican advertising in presidential elections (top left-hand panel) is in part due to the 2016 election, which Donald Trump’s advertising displayed little relationship to the outcome (Sides, Tesler, and Vavreck 2018). In the 2000-2012 elections, the relationship between GOP advertising and Democratic vote share is negative and statistically significant.

29. Our results are similar to those of Spenkuch and Toniatti (2018, Appendix C) for presidential races, who also provide graphical evidence that ads have approximately linear effects.

were being run in a state in a given year).<sup>30</sup>

Table 4: Spillover of Television Advertising Across Offices (2000-2016)

	<i>Dependent variable: Dem. Vote Share</i>				
	President (1)	Senate (2)	Governor (3)	Att. Gen. (4)	Treasurer (5)
<b>All Counties</b>					
Dem. Ad. Adv. in Pres. Race		-0.005 (0.012)	-0.020 (0.032)	0.018 (0.028)	0.010 (0.021)
Dem. Ad. Adv. in other Races	0.006 (0.009)	-0.007 (0.013)	0.022 (0.014)	0.034* (0.014)	0.022 (0.015)
Dem. Ad. Adv. (100 ads)	0.023* (0.009)	0.061** (0.012)	0.091** (0.015)	0.146* (0.059)	0.257** (0.074)
County FE	X	X	X	X	X
State-year FE	X	X	X	X	X
Observations	12,480	16,878	12,296	7,412	5,104
R <sup>2</sup>	0.962	0.958	0.941	0.968	0.969
<b>Border Counties</b>					
Dem. Ad. Adv. in Pres. Race		-0.007 (0.009)	-0.013 (0.022)	0.0003 (0.011)	0.012 (0.012)
Dem. Ad. Adv. in other Races	-0.002 (0.005)	-0.019** (0.007)	0.001 (0.009)	0.007 (0.008)	0.011 (0.009)
Dem. Ad. Adv. (100 ads)	0.020** (0.006)	0.056** (0.008)	0.080** (0.012)	0.177** (0.047)	0.281** (0.052)
County FE	X	X	X	X	X
Border-Pair-Year FE	X	X	X	X	X
Observations	17,552	21,130	12,801	7,795	5,294
R <sup>2</sup>	0.992	0.991	0.989	0.994	0.995

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.

\*p<0.05; \*\*p<0.01

But contrary to the expectation, we find no significant spillover effects of advertising from other races at any level of office (Table 4). This includes spillover from presidential advertising into down-ballot races as well as other types of spillover, whether up or down the ballot. This makes sense given previous findings that advertising has little effect on overall turnout, but it does not seem consistent with the finding in a recent study that presidential advertising leads to differences in the turnout of partisans (Spenkuch and Toniatti 2018). If that were the case, we would expect presidential advertising to boost the vote share of

30. This does not capture every advertisement that ran, as there are a small number of ads for other offices, ballot propositions, etc., but it does capture the vast majority of ads that could affect another races.

down-ballot candidates.

### 3.5 Heterogeneity between Incumbents and non-Incumbents Ads

Next we compare the effects of ads aired by incumbents and non-incumbents. Previous work suggests that the marginal returns on advertising should be greater for challengers than for incumbents (see Jacobson 2015, for a review). To test for differences between incumbents and challengers, we first estimate a model for both governors and Senators, combining these offices to generate additional cases and reduce any noise in the offices (Ansolabehere and Snyder 2002), and a model for U.S. House. For each set of offices, we estimate the separate effects of Democratic and Republican advertising, and then interact advertising with whether an incumbent in that party was running. If ads have a smaller effect for incumbents than other types of candidates, the interaction terms should be negative for Democrats and positive for Republicans. As before, we present results for all counties and for border county pairs.

Table 5: Heterogeneity between Effects of Incumbents and non-Incumbents Ads in Senate and Governors Races

	<i>Dependent variable: Dem. Vote Share</i>			
	<i>All Counties</i>		<i>Border Counties</i>	
	(1)	(2)	(3)	(4)
Democratic Ads	0.072*** (0.009)	0.068*** (0.008)	0.060*** (0.007)	0.056*** (0.007)
Republican Ads	-0.065*** (0.011)	-0.049*** (0.011)	-0.055*** (0.007)	-0.053*** (0.007)
Democratic Ads x Dem. Incumb.		-0.007 (0.008)		0.006 (0.006)
Republican Ads x Rep. Incumb.		0.004 (0.009)		0.009 (0.007)
County FE	X	X	X	X
State-Year-Office FE	X	X		
Border-Pair-Year FE			X	X
Observations	29,174	26,360	41,129	36,994
R <sup>2</sup>	0.946	0.948	0.986	0.987

*Note:*

\*p<0.05; \*\*p<0.01; \*\*\*p<[0.\*\*\*]

However, as Table 5 and Table 6 show, we find little difference between the effects of ads aired by incumbents and non-incumbents. While the interaction terms often have the anticipated sign, the coefficients are generally substantively small and statistically insignificant. Thus, the common finding that incumbent spending matters less than challenger spending does not appear to stem from the differential effects of advertising. At the same time, we should be cautious in interpreting the results. Our research designs do not provide any causal identification strategy for separating the effects of advertising by incumbents and non-incumbents. It is possible that our results are confounded by omitted variables that vary with the presence of incumbents.

Table 6: Heterogeneity between Effects of Incumbents and non-Incumbents Ads in House Races

	<i>Dependent variable: Dem. Vote Share</i>			
	<i>All Counties</i>		<i>Border Counties</i>	
	(1)	(2)	(3)	(4)
Democratic Ads	0.083* (0.027)	0.100** (0.028)	0.103** (0.033)	0.116** (0.037)
Republican Ads	-0.084** (0.024)	-0.071* (0.023)	-0.105** (0.026)	-0.096** (0.026)
Democratic Ads x Dem. Incumb.		-0.035* (0.011)		-0.027 (0.026)
Republican Ads x Rep. Incumb.		-0.040 (0.018)		-0.026 (0.027)
County FE	X	X	X	X
State-Year FE	X	X		
Border-Pair-Year FE			X	X
Observations	24,867	24,867	33,280	33,280
R <sup>2</sup>	0.955	0.955	0.992	0.992
Adjusted R <sup>2</sup>	0.939	0.939	0.966	0.966

\*p<0.05; \*\*p<0.01

### 3.6 Decay of Ad Effects

To estimate the potential decay of advertising effects, we estimate a model that divided the advertising advantage variable into three time periods: 1) ads aired between 0 and 36 days from election day (“October/November”), 3) ads aired between 37 and 69 days from election day (“September”), and ads aired 70 and 129 days before election day (“July-August”). In order to reduce the noise in the results, we again analyze different levels of office in combination, in this case presidential, governor, Senate. This specification allows us to more precisely estimate the effects of the ads that air closest to Election Day, which some research has found are most important, at least in presidential elections. It also allows us to determine whether there is a decline in the effect of ads as they are aired earlier and earlier, stretching back into the summer before the general election.

Table 7: Decay of Advertising Effects. This table shows the effects of advertising aired at different points during the campaign season. It stacks presidential, Senate, and governor elections

	<i>Dependent variable:</i>	
	Dem Vote Share	
	All Counties	Border Counties
	(1)	(2)
October/November	0.062** (0.015)	0.050** (0.008)
September	0.047 (0.025)	0.036** (0.012)
July/August	0.012 (0.011)	-0.0001 (0.007)
County FE	X	X
State-Year-Office FE	X	
Border-Pair-Year-Office FE		X
Observations	41,696	58,747
R <sup>2</sup>	0.945	0.986
Adjusted R <sup>2</sup>	0.939	0.966
<i>Note:</i>	*p<0.05; **p<0.01	

As Table 7 shows, we do find that ads aired in October and November have the largest effect on election outcomes. We find suggestive evidence that ads aired in September also matter. By contrast, advertising before Labor Day does not appear to affect election outcomes.

By and large, these results confirm previous studies showing that advertising effects decay, although our results do not necessarily show the rapid decay evident in several studies (e.g., Gerber et al. 2011; Hill et al. 2013; Kalla and Broockman 2018; Sides and Vavreck 2013). However, it may require more sensitive data, especially surveys conducted consistently over the days and weeks before elections, to more clearly identify the exact pattern of decay. For example, our data do not give us effective purchase on the effects of advertising within October and November. That said, we can confirm the finding that ads closer to Election Day are more strongly related to election outcomes than earlier ads.

## 4 Conclusion

Television advertising is the cornerstone of many campaigns for political office in the United States. As scholars have developed more detailed data and sophisticated estimation strategies, they have shown that television advertising is related to election outcomes: the larger a candidate's advantage in advertising compared to their opponent, the larger their share of the vote. The extant literature has demonstrated this in some presidential and U.S. Senate elections. But this finding has left many questions less explored, including the effect of advertising in other down-ballot races, whether advertising effects diminish after a certain level of spending, and whether advertising actually affects races other than the one it is intended to.

Our data on advertising and elections, which is the most comprehensive to date, provides important evidence about all of these questions. We find that television advertising affects election results across all levels of office and that the effects of advertising are larger in down-

ballot elections than presidential elections. This suggests that strategic donors may be able to get larger returns from advertising in down ballot races than in presidential elections.

We also find little evidence that advertising spills over across races or has diminishing returns or rapidly decaying effects.<sup>31</sup> Both diminishing returns and rapid decay would suggest that a certain amount of advertising is “wasted,” either because it stops working after the airwaves have been saturated with ads for a time or because its effects wear off so quickly that there is little residual effect on voters when they actually cast their ballots. However, the fact that the effects of advertising are approximately linear and those effects are visible for ads aired throughout the fall, not just right before Election Day, suggests that campaigns may get value from larger and longer advertising campaigns.

This evidence also has important implications for the study of voting behavior and political representation. Despite the increasing partisanship in the electorate, there continues to be a segment of persuadable voters that responds to television advertising, and probably to other campaign appeals as well. This is particularly true in down-ballot elections where voters have less information about candidates. Thus, although television advertising could plausibly determine the outcomes only of the closest presidential elections, large infusions of advertising could more easily determine the outcomes of close congressional and other down-ballot elections. Thus, advertising disparities between Democratic and Republican candidates could plausibly affect both the ideological composition of Congress (Lee, Moretti, and Butler 2004; McCarty, Poole, and Rosenthal 2016) and state legislatures (Shor and McCarty 2011), as well as the policies governments actually enact (Caughey, Xu, and Warshaw 2017).

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31. The lack of heterogeneity in ad effects that we observe is consistent with the conclusion of Coppock, Hill, and Vavreck (2020) that the effects of ads do not vary across context, message, sender, or receiver.

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# Supplementary Information for “The Effect of Television Advertising in United States Elections”

## A Placebo Checks

The identification strategy for our panel research design that we use in the main body of our paper relies on the assumption that there are no time-varying confounders, typically called the parallel trends assumption. In order to demonstrate that this assumption is likely to be valid, researchers commonly demonstrate that there are parallel trends in pre-treatment outcomes. In the panel framework that we use in our analyses, we can similarly demonstrate parallel trends by looking at the effects of leads of our main independent variable on contemporaneous outcomes. If future “treatment” (differing advertising advantages) affected voting in previous elections, we might worry that ad placement were affected by other factors that also affect voting and our assumptions about time-varying confounders would not be validated.

Table A1 shows placebo tests that validate the plausibility of the parallel trends assumption in our difference-in-difference models for our border counties sample. It evaluates whether advertising in the next election affects vote shares in the current election. In general, we find almost no significant effects of future advertising on elections in time  $t$ . Moreover, the point estimates of the effects are all very small.<sup>1</sup> Overall, our placebo results here strongly suggest that there are no time-varying confounders that bias our estimates of advertising effects in elections.(see also Spenkuch and Toniatti 2018).

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1. We also examined models of future advertising that included advertising in time  $t$ . And we examined models of the effect of advertising in time  $t$  on future elections. These models all indicated no effect of past or future advertising on elections.

Table A1: Placebo tests: Effect of Aggregate Television Advertising in Last Two Months of the Next Election Cycle

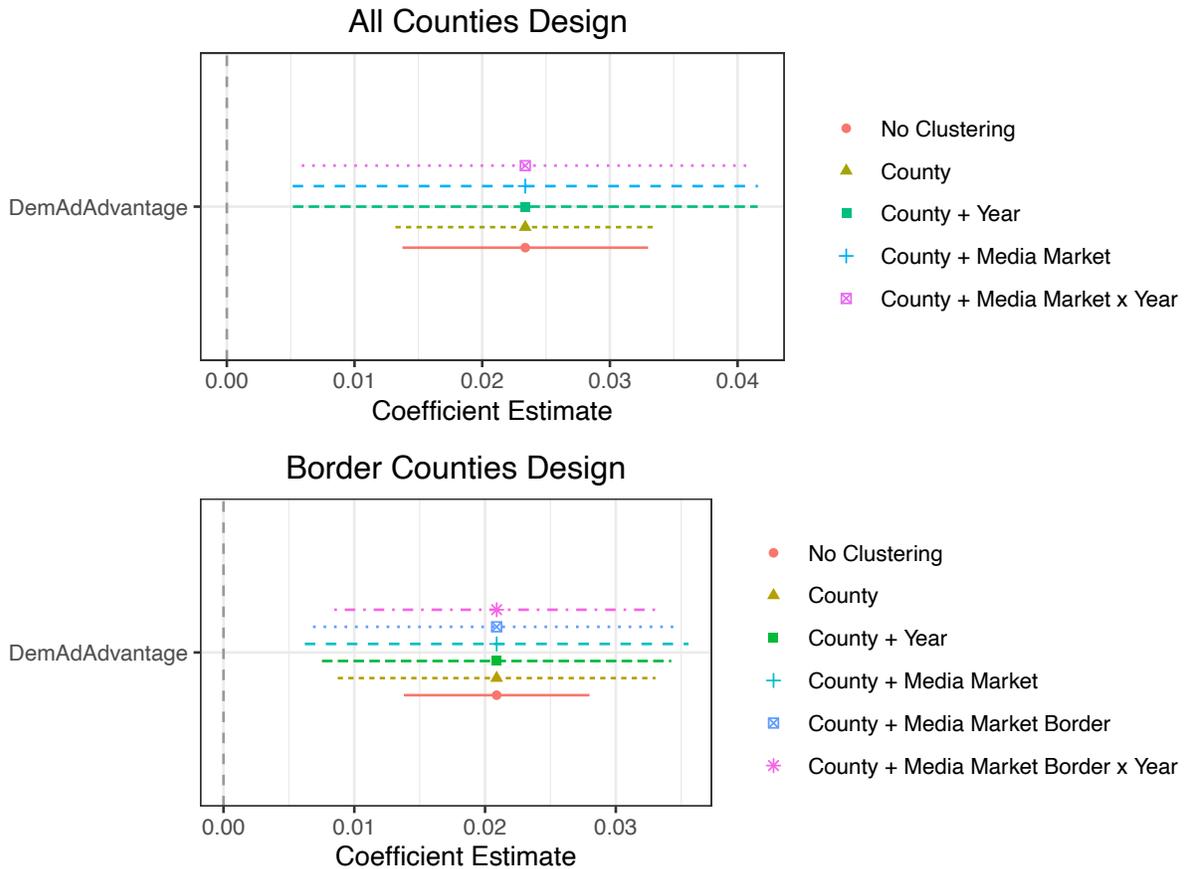
	<i>Dependent variable: Dem. Vote Share</i>					
	President	Senate	Governor	House	Attorney Gen.	Treasurer
	(1)	(2)	(3)	(4)	(5)	(6)
<b>All Counties</b>						
Dem. Ad. Adv. (100 ads) <sub>t+1</sub>	-0.002 (0.008)	-0.032* (0.016)	-0.017 (0.017)	0.077 (0.099)	-0.080 (0.065)	-0.196 (0.112)
County FE	X	X	X	X	X	X
State-year FE	X	X	X	X	X	X
Observations	12,478	16,710	12,329	27,872	7,613	4,905
R <sup>2</sup>	0.959	0.961	0.943	0.949	0.963	0.969
Adjusted R <sup>2</sup>	0.944	0.951	0.922	0.823	0.944	0.950
<b>Border Counties</b>						
Dem. Ad. Adv. (100 ads) <sub>t+1</sub>	-0.001 (0.005)	-0.006 (0.008)	0.013 (0.014)	0.036 (0.041)	-0.034 (0.052)	-0.116 (0.087)
County FE	X	X	X	X	X	X
Border-Pair-Year FE	X	X	X	X	X	X
Observations	17,551	22,504	12,735	27,872	8,094	5,271
R <sup>2</sup>	0.993	0.990	0.989	0.992	0.992	0.994
Adjusted R <sup>2</sup>	0.978	0.973	0.962	0.965	0.970	0.978

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

## B Clustering Strategies

In this appendix, we compare the main approach we use to cluster our standard errors with other plausible approaches. For simplicity, we focus on our main results for presidential elections. Overall, Figure A1 shows that the standard errors are much smaller in a naive model that doesn't cluster standard errors at all. But the standard errors are quite similar using a variety of other clustering strategies for both the all counties and border counties designs. Moreover, the results are statistically significant using all plausible clustering strategies.

Figure A1: Comparing strategies for clustering standard errors in models of effect of advertising in presidential elections. The top plot shows the all counties design and the second plot shows the border counties design.



## C Detailed Results

This appendix shows detailed results analogous to those in Table 2 for Senate, Governor, House, Attorney General, and Treasurer elections.

Table A2: Effects of Aggregate Television Advertising in Last Two Months of Presidential Elections (2000-2016)

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	0.163** (0.033)	0.040** (0.014)	0.039** (0.007)	0.023** (0.009)	0.029** (0.006)	0.021** (0.007)	0.020** (0.006)
Year FE	X	X					
State-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	12,480	12,480	12,478	12,480	17,551	17,552	17,552
R <sup>2</sup>	0.070	0.929	0.952	0.962	0.955	0.968	0.992

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

Table A3: Effects of Aggregate Television Advertising in Last Two Months of Senate Elections (2000-2016)

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	0.438** (0.052)	0.220** (0.054)	0.035* (0.015)	0.060** (0.012)	0.045** (0.012)	0.066** (0.011)	0.054** (0.008)
Year FE	X	X					
State-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	16,878	16,878	16,806	16,878	21,094	21,130	21,130
R <sup>2</sup>	0.118	0.705	0.916	0.958	0.919	0.966	0.991

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

Table A4: Effects of Aggregate Television Advertising in Last Two Months of Governor Elections (2000-2016)

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	0.284** (0.046)	0.264** (0.036)	0.090** (0.020)	0.095** (0.016)	0.086** (0.016)	0.097** (0.014)	0.080** (0.012)
Year FE	X	X					
State-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	12,296	12,296	12,256	12,296	12,735	12,801	12,801
R <sup>2</sup>	0.140	0.783	0.886	0.941	0.892	0.958	0.989

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

Table A5: Effects of Aggregate Television Advertising in Last Two Months of House Elections (2000-2016)

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	0.723** (0.067)	0.418** (0.054)	0.045 (0.024)	0.078* (0.030)	0.061* (0.025)	0.082** (0.030)	0.081** (0.029)
Year FE	X	X					
CD-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	24,926	24,926	21,028	24,926	27,883	33,280	33,280
R <sup>2</sup>	0.064	0.696	0.962	0.955	0.962	0.963	0.992

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

Table A6: Effects of Aggregate Television Advertising in Last Two Months of Attorney General Elections (2006,2010-2016)

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	0.982** (0.190)	0.631** (0.124)	0.202** (0.063)	0.157** (0.058)	0.200** (0.048)	0.161** (0.042)	0.176** (0.047)
Year FE	X	X					
State-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	7,412	7,412	6,901	7,412	7,351	7,795	7,795
R <sup>2</sup>	0.147	0.789	0.924	0.968	0.918	0.978	0.994

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

Table A7: Effects of Aggregate Television Advertising in Last Two Months of Treasurer Elections (2006, 2010-2016)

	<i>Dependent variable: Dem. Vote Share</i>						
	<i>All counties</i>				<i>Border counties</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dem. Ad. Adv. (100 ads)	1.235** (0.236)	0.774** (0.268)	0.369** (0.100)	0.275** (0.072)	0.410** (0.079)	0.398** (0.060)	0.286** (0.053)
Year FE	X	X					
State-year FE			X	X	X	X	
County FE		X		X		X	X
Lagged Outcome			X		X		
Border-Pair-Year FE							X
Observations	5,104	5,104	4,282	5,104	4,670	5,294	5,294
R <sup>2</sup>	0.171	0.682	0.921	0.969	0.934	0.982	0.995

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

## D Assessing whether field offices confound advertising effects

In this appendix, we examine the concern that field offices could confound advertising effects. We have data on Democratic presidential candidates' field offices in the 2004-2016 presidential elections (Darr and Levendusky 2014; Sides and Vavreck 2013; Sides, Tesler, and Vavreck 2018). Unfortunately, we lack consistent data on Republican presidential candidates' field offices. We also lack field office data for other races. For some of these years, we have detailed data on the number of field offices in each county, while for other years we just observe an indicator for whether the campaign had an office in a country. Thus, we convert all the data to a dichotomous indicator for whether each Democratic presidential campaign had offices in each county.

To begin, we examine whether Democratic advertising advantage is correlated with the presence of Democratic field offices in presidential elections using each of our main designs (Table A8). In both the all counties and border counties designs, we find no relationship between Democratic field offices and advertising advantage. The fact that field offices seem to be approximately orthogonal to television advertising suggests that field activities are unlikely to be confounding the effects of advertising in our main models.

Table A8: Relationship between Democratic Ad Advantage and Democratic Field Offices

	<i>Dependent variable: Dem. Field Offices</i>	
	<i>All counties</i>	<i>Border counties</i>
	(1)	(2)
Dem. Ad. Adv. (100 ads)	0.00004 (0.001)	-0.0001 (0.001)
Observations	10,968	15,651
R <sup>2</sup>	0.736	0.868
Adjusted R <sup>2</sup>	0.625	0.616

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

In Table A9, we further examine whether field offices could be confounding the main

estimates in our paper by running a series of regression models for the effect of ads in presidential elections along the lines of the ones in Table 3, except that some of the models include a control variable for Democratic field offices.

The left panel of A9 shows the all county design, while the right panel shows the border counties design. Columns 1 and 3 show the effect of television advertising using models that do not control for field offices, while columns 2 and 4 explicitly include controls for field offices.<sup>2</sup> The models that control for field offices have nearly identical point estimates for the effect of advertising as the models that don't control for field offices.<sup>3</sup> This strongly suggests that the results in our main paper are not confounded by the fact that we do not control for the presence of field offices in those models.

Table A9: Models of the Effect of TV Advertising in Presidential Elections from 2004-16 with and without Controlling for Field Offices

	<i>Dependent variable: Dem. Vote Share</i>			
	<i>All counties</i>		<i>Border counties</i>	
	(1)	(2)	(3)	(4)
Dem. Ad. Adv. (100 ads)	0.018* (0.009)	0.018* (0.009)	0.017** (0.005)	0.017** (0.005)
Dem. Field Offices		0.721** (0.228)		0.013 (0.210)
Observations	10,962	10,962	15,648	15,648
R <sup>2</sup>	0.971	0.971	0.993	0.993
Adjusted R <sup>2</sup>	0.958	0.958	0.979	0.979
<i>Note:</i>	*p<0.05; **p<0.01; ***p<[0.***]			

2. Note the results here slightly vary from those in the main paper because they only include counties and elections where we have data on field offices.

3. It should be noted that the null result for the presence of field offices in column 4 could be due to the fact that field offices can presumably conduct GOTV activities in both counties of a border pair.

## E Have Ad Effects Declined in Recent Years?

In this appendix, we examine whether ad effects have declined in recent years. In particular, we test the expectation that in a land of hardened partisans and cord-cutters, the impact of television advertising has declined over the past two decades. To do so, we replicate our analysis in Table 3 but allow the effects of advertising to vary across two time periods: 2000-2008 and 2010-2016. This is, to be sure, a simple periodization, but given that we do not have a long time-series across election years, this at least give us purchase on whether the effects of smaller in more recent elections.

Table A10: Time Trends in Effects of Aggregate Television Advertising

	<i>Dependent variable: Dem. Vote Share</i>			
	President (1)	Senate (2)	Governor (3)	House (4)
<b>All Counties</b>				
Dem. Ad. Adv. (100 ads) (2000-2008)	0.016 (0.012)	-0.021 (0.032)	0.039 (0.043)	0.107** (0.032)
Dem. Ad. Adv. (100 ads) (2009-2016)	0.028** (0.010)	0.075** (0.016)	0.113** (0.017)	0.066* (0.034)
County FE	X	X	X	X
State-Year FE	X	X	X	X
Observations	12,480	16,878	12,296	24,855
R <sup>2</sup>	0.962	0.958	0.941	0.955
<b>Border Counties</b>				
Dem. Ad. Adv. (100 ads) (2000-2008)	0.020** (0.007)	0.014 (0.022)	0.123** (0.035)	0.041 (0.036)
Dem. Ad. Adv. (100 ads) (2009-2016)	0.020** (0.008)	0.060** (0.010)	0.070** (0.014)	0.106** (0.039)
County FE	X	X	X	X
Border-Pair-Year FE	X	X	X	X
Observations	17,552	21,130	12,801	33,269
R <sup>2</sup>	0.992	0.991	0.989	0.992

Standard errors clustered by county & DMA-year in top panel, and, county & DMA border-year in bottom panel.

\*p<0.05; \*\*p<0.01

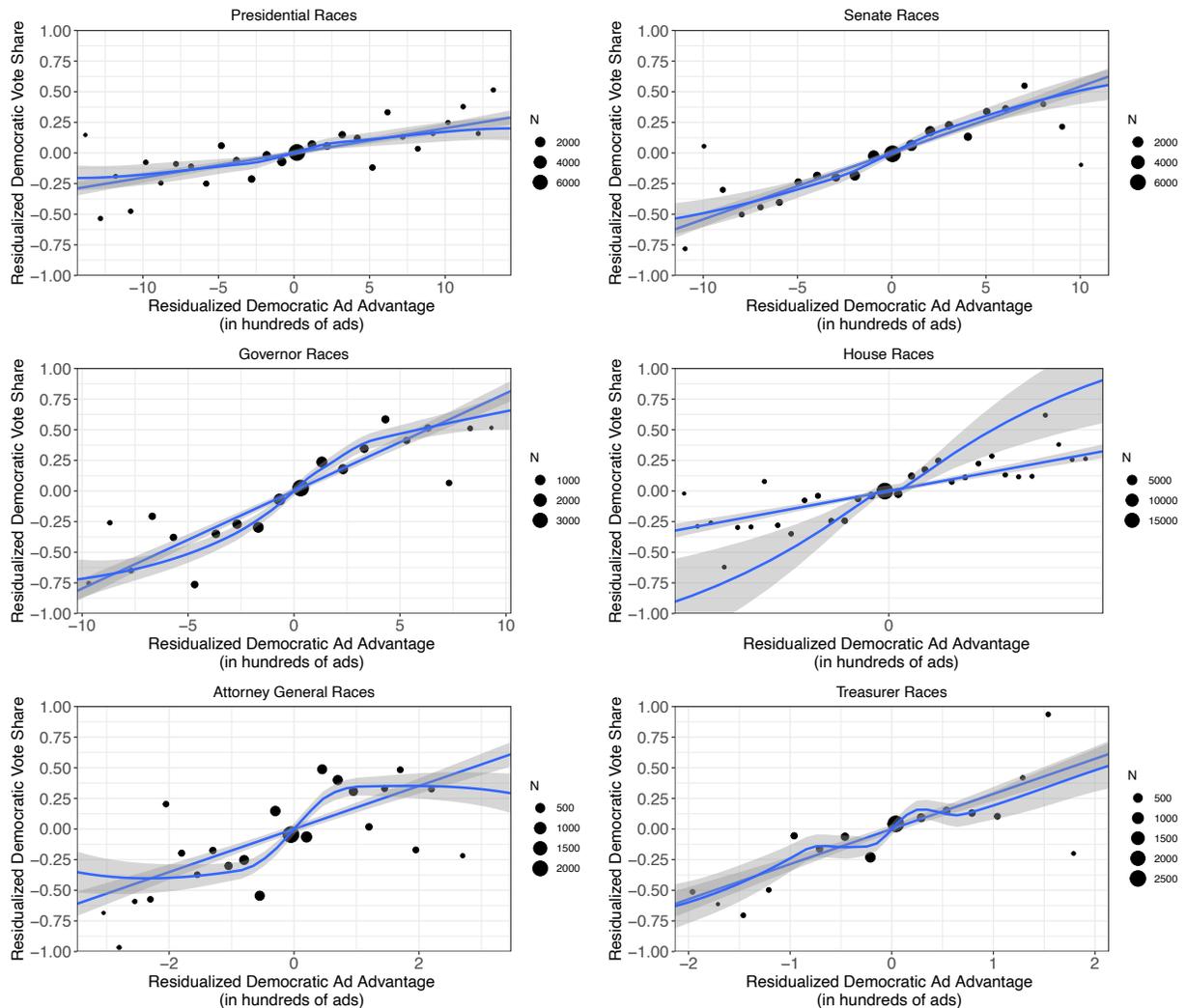
However, we find no evidence of any decrease in advertising effects (Table A10). In fact, in many cases—depending on the level of office and the modeling strategy—the effects are larger in 2010-2016 than in 2000-2008. Televised advertising appears to remain an effective

strategy for winning votes.

## F Assessing whether advertising has diminishing marginal returns

This appendix provides further evidence indicating that advertising has approximately constant returns to scale across the range of commonly observed advertising. First, we provide visual evidence based on the same models of Democratic advertising advantage that we deploy in the main body of the paper. Second, we show the results of regression models examining the effects of each party’s advertising separately.

Figure A2: Effect of Democratic Advertising Advantage on Democratic Vote Share. These graphs show the implied effects of a  $3 \pm SD$  variation in Democratic ad advantage for each office. They are based on the residuals from the border counties models in Table 4.



To provide an initial visual evaluation of returns to scale, we generate residuals from fixed effects models with our border-counties sample. We then compare a linear fit and a non-parametric loess curve. Figure A2 (above) shows that the non-parametric curve is generally very close to the linear regression line for each office. To the extent there are modest differences between the non-parametric and linear regression lines, these differences appear to be essentially random across offices. This suggests that advertising has approximately constant returns to scale across the range of plausible variation in advertising advantage for either party within counties.

Next, we run a series of regression models examining the effects of each party's advertising separately. These models include both linear and quadratic terms for each party. The quadratic terms would capture any decreasing (or increasing) returns to scale. Table A11 shows the results using all counties and Table A12 shows the results in the border counties. In both cases, we find that the quadratic terms are sometimes significant in the expected directions, but nearly always very small in size. Of course, it is difficult to determine the substantive size of the quadratic term using the regression results alone. So Figure 4 simulates the results from these regression out to the 99th percentile of advertising for each office. Once again, the figures show that advertising has approximately linear effects over the common range of observed advertising. This is especially true since the two parties typically match each other's advertising. So the higher levels of ads shown here rarely translate into an actual advertising advantage. Overall, the results here show that decreasing returns only appear at extremely high levels of advertising that are rarely observed. So both parties would likely gain votes by increasing their advertising in the vast majority of races.

Table A11: Ad advantage results looking at each party separately (all counties)

	<i>Dependent variable: Dem. Vote Share</i>					
	President	Senate	Governor	House	Attorney Gen.	Treasurer
	(1)	(2)	(3)	(4)	(5)	(6)
Democrats	0.034 (0.018)	0.083** (0.022)	0.132** (0.035)	0.168** (0.040)	0.478** (0.099)	0.384 (0.274)
Republicans	0.004 (0.026)	-0.089** (0.027)	-0.139** (0.027)	-0.190** (0.041)	-0.458** (0.089)	-0.204 (0.283)
Democrats squared	-0.0001 (0.0001)	-0.0002 (0.0001)	-0.0005 (0.0005)	-0.002* (0.001)	-0.015** (0.004)	-0.037 (0.028)
Republicans squared	-0.0001 (0.0002)	0.0003 (0.0002)	0.001* (0.0003)	0.003* (0.001)	0.011** (0.003)	-0.021 (0.019)
Observations	12,480	16,878	12,296	24,855	9,538	6,546
R <sup>2</sup>	0.962	0.958	0.941	0.955	0.959	0.961
Adjusted R <sup>2</sup>	0.948	0.948	0.919	0.940	0.942	0.944

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01

Table A12: Ad advantage results looking at each party separately (border counties)

	<i>Dependent variable: Dem. Vote Share</i>					
	President	Senate	Governor	House	Attorney Gen.	Treasurer
	(1)	(2)	(3)	(4)	(5)	(6)
Democrats	0.046** (0.011)	0.085** (0.016)	0.178** (0.028)	0.148** (0.034)	0.611** (0.096)	0.639** (0.179)
Republicans	-0.002 (0.015)	-0.087** (0.021)	-0.122** (0.021)	-0.183** (0.038)	-0.348** (0.069)	-0.034 (0.150)
Democrats squared	-0.0002** (0.0001)	-0.0003** (0.0001)	-0.001** (0.0004)	-0.001 (0.001)	-0.021** (0.004)	-0.039 (0.020)
Republicans squared	0.00001 (0.0001)	0.0003 (0.0002)	0.001** (0.0002)	0.002* (0.001)	0.009** (0.002)	-0.025* (0.012)
Observations	17,551	23,753	17,376	33,269	13,954	9,574
R <sup>2</sup>	0.950	0.990	0.985	0.992	0.990	0.991
Adjusted R <sup>2</sup>	0.849	0.972	0.956	0.966	0.970	0.972

Standard errors clustered by county & DMA-year in top panel; county & DMA border-year in bottom.  
\*p<0.05; \*\*p<0.01