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ABSTRACT

Voters are often uncertain about and biased against non-dominant political parties. By reducing the information gap with dominant parties, political advertising may thus disproportionately benefit non-dominant parties electorally. We test this argument in Mexico, where three main parties dominate many localities. To identify the effects of exposure to partisan advertising, we exploit differences across neighboring precincts in campaign ad distributions arising from cross-state media coverage spillovers induced by a 2007 reform that equalized access to ad slots across all broadcast media. Our results show that ads on AM radio increase the vote shares of the PAN and PRD, but not the previously-hegemonic PRI. Consistent with our model, campaign advertising is most effective in poorly informed and politically uncompetitive electoral precincts, and against locally dominant parties of intermediate strength.

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1 Introduction

It is widely believed that campaign advertising can effectively mobilize or persuade voters to support the party behind the ad. In the U.S. 2012 presidential campaign, for example, both parties were able to spend more than $400m on television ads.[1] Despite the perceived wisdom of campaign ads, the extent to which they are actually effective remains unclear (see e.g. DellaVigna and Gentzkow 2010). Furthermore, in many elections across the world parties do not compete on a level playing field. In contexts where a dominant party is able to capture the media (e.g. Durante and Knight 2012; Lawson and McCann 2005; McMillan and Zoido 2004) or is best known due to its perpetual incumbency, campaign ads could play a key role in informing voters about non-dominant parties. In this article, we examine the effects of campaign advertising in the presence of a dominant party.

We analyze, using a simple learning model in the spirit of Zaller (1992), the impact of changing a party's share of campaign advertising on vote choice in contexts where one party is dominant. In our model, a party is dominant in two respects. First, *informational dominance* entails that the utility a voter will receive if the dominant party wins office—generally reflecting the party's policy positions, policy emphasis or competence—is known with more certainty, relative to that of the locally non-dominant party (see also Shepsle 1972). Second, *ideological dominance* entails a bias toward the dominant party among voters, which could originate from non-performance based factors such as clientelistic ties or voter loyalty. Upon reaching voters, campaign ads are more informative about the utility level associated with the non-dominant party obtaining office. Advertising thus allows voters to learn about the relative benefits of each party, but also decreases uncertainty surrounding the utility that they expect to receive if they elect a party that is not locally established.

The model predicts that campaign advertising's effect on voting behavior is greatest among uninformed voters with weak prior beliefs about the consequences of electing the non-dominant party,

[1] *Washington Post*, "Mad Money: TV ads in the 2012 presidential campaign."

in locations (or elections) where political competition—and thus other local political activity—is low, and where the ideological bias toward the dominant party is not insurmountable. Campaign advertising is therefore most electorally beneficial for non-dominant parties where the locally dominant party is neither very strong nor facing severe competition. However, this non-linear relationship in the level of dominance should only apply to non-dominant parties, since voters are already well-informed about the dominant party. Our model thus suggests that equalizing campaign advertising has the potential to support multi-party competition by empowering non-dominant political parties among less informed voters in relatively uncompetitive localities.

Mexico represents an important application of campaign advertising's potential to shift votes away from parties that are *locally* dominant, a common way in which dominance is manifested in developing democracies. Despite losing the Presidency in 2000, after seven decades in power, the Institutional Revolutionary Party (PRI) has continued to dominate poorer and more rural parts of Mexico (Langston 2003, 2006). Mexico's other main political parties—the National Action Party (PAN) and the Party of the Democratic Revolution (PRD)—have now also developed local strongholds. These are generally located in more urban and developed areas, although the PRD—which split from the PRI—also has significant rural presence in the southern states. Since informational and ideological dominance predominantly manifest very locally, we consider precinct-level dominance. Moreover, relatively low levels of voter knowledge about political parties suggest that campaign ads have the potential to substantially shape voters' partisan preferences (e.g. Greene 2011; Lawson and McCann 2005).

To identify the effects of campaign advertising, we leverage a major campaign regulation reform reducing inequalities in access to advertising across the country. Beginning in 2009, the reform mandated that all ads broadcast on radio and television over the course of federal election campaigns be allocated by Mexico's independent Federal Electoral Institute (IFE) according to a formula reflecting the number of parties standing and their previous vote share.[2] Because this for-

[2]The IFE has since become the National Electoral Institute (INE).

mula is adjusted for media outlets located in states holding concurrent local elections, we exploit cross-state spillovers in media coverage to generate plausibly exogenous variation in the probability of exposure to ads from each political party across otherwise-similar neighboring electoral precincts. We focus primarily on AM radio because its substantial signal coverage extends beyond urban areas and more frequently crosses state borders than FM radio or television signals. This yields a large and disproportionately poor and rural sample, precisely the locations which our theory predicts that campaign advertising should be most effective.

Pooling the 2009 and 2012 federal legislative elections, we first show that greater campaign advertising on AM radio substantially increases the vote shares of the PAN and PRD. Specifically, a standard deviation increase in the campaign ad exposure share of the PAN and PRD respectively increases their vote share by 3 and 2.3 percentage points, or 11% and 14%.[3] Conversely, we find no evidence that PRI campaign ads affected the average PRI candidate's vote share. The estimated ineffectiveness of PRI advertising suggests that an important legacy of its time in power may be that voters retain relatively precise beliefs about its suitability for office that are not susceptible to campaign ads. We find no evidence to suggest that campaign ads mobilize turnout.

Consistent with our theoretical model, the electoral efficacy of PAN and PRD campaign ads varies across electoral precincts. First, in less economically developed precincts—where our survey evidence indicates that voters are less politically informed—ads are more effective at winning votes. Second, ads are less effective in more competitive precincts, as measured by the (pre-reform) effective number of political parties. Third, we find some evidence that campaign ads are less effective concurrent to the intensely-contested 2012 presidential election. Finally, the effects of campaign ads for locally non-dominant parties are non-linear in the vote share of the dominant party. Specifically, ads are least effective in both the most competitive and most locally dominated precincts.

[3]Unfortunately, in the absence of extensive ad consumption data, we cannot credibly estimate persuasion rates (see DellaVigna and Gentzkow 2010).

Taken together, our results demonstrate that equalizing access to campaign advertising can significantly increase support for locally non-dominant parties. This suggests that broad-based campaign advertising can help foster multi-party competition and informed political participation. On the other hand, our findings highlight the importance of informational advantages accruing to dominant parties, and thus challenge models of political competition where the policy positions and competence of the major parties are assumed to be equally well-known (e.g. Downs 1957).

These main findings are robust to various potential identification and interpretation concerns. First, we demonstrate that randomly reallocating spillovers in media coverage does not reproduce our results. Second, a variety of checks indicate that measurement error in signal coverage cannot explain our findings. Third, the results are robust to sensitivity analyses including control variables and sample restrictions. Fourth, we show that our findings are supported in the smaller and more urban FM radio and television samples, where our model implies similar heterogeneous effects but smaller average effects. Finally, contrary to the concern that our effects are driven by partisan news coverage rather than advertising, a second placebo test shows that the same media allocation formula does not produce the same results before the reform was implemented.

Our results contribute to the literature identifying the effects of campaign advertising in developed and developing countries. The U.S. literature has generally found limited impact on electoral outcomes (e.g. Ansolabehere, Snowberg and Snyder 2006; Huber and Arceneaux 2007; Krasno and Green 2008; Levitt 1994) and short-lived effects on voter perceptions (Gerber et al. 2011; Zaller 1992). However, a recent study by Spenkuch and Toniatti (2016) utilizing an unusually fine-grained spatial design akin to ours similarly finds that television advertising can meaningfully affect county-level vote share without altering turnout. Moreover, our results complement previous studies arguing that a key function of electoral campaigns—via political advertising in our case—is to reduce voter uncertainty about the policy positions and characteristics of different candidates (Lenz 2009; Peterson 2009). Our findings regarding the importance of party dominance also chime with evidence from Italy that media partisan control can also occur in consolidated democracies

(Durante and Knight 2012).

In contrast, the nascent developing country literature suggests that campaign ads can be highly effective outside established democracies. While Da Silveira and De Mello (2011) find that differences in television ad allocations between the first and second round of Brazilian gubernatorial elections influence candidate vote shares, we examine an entire campaign without the risk that strategic behavior between rounds confounds our estimates of advertising's effects. Surveys exploiting less compelling identification strategies also point to powerful effects of campaign advertising in Mexico (Greene 2011; Lawson and McCann 2005), but do not explain when and where different parties benefit from campaign ads. Exploiting the random assignment of ad slot times in Mexico, Durante and Gutierrez (2014) also find that vote intentions track prime time television and radio advertisements . However, in authoritarian regimes the media is often controlled or manipulated by the state (e.g. King, Pan and Roberts 2014; McMillan and Zoido 2004), while opposition groups possess few opportunities to express their political preferences and platforms (e.g. Djankov et al. 2003).

Given the extant evidence, our findings suggest that campaign ads may be most effective in consolidating democracies with dominant parties like Mexico. In such cases, voters are less well informed—particularly about non-dominant parties—and media markets are less concentrated than advanced democracies. Moreover, unlike authoritarian regimes, political competition is sufficiently robust that credible alternatives to dominant parties exist. These findings provide hope for democrats, given that many other consolidating democracies have recently introduced reforms guaranteeing political parties relatively equitable access to campaign advertising.[4]

Our findings also complement the literature examining the impact of the news media, as opposed to campaign advertising. Various studies have found that media coverage increases voter punishment of incumbent indiscretions in office (Fergusson, Vargas and Vela 2014; Ferraz and Finan 2008; Larreguy, Marshall and Snyder 2016). Using a similar design to ours, Enikolopov,

[4]For example, see the Ace Project's map detailing free broadcast allocations across the world here.

Petrova and Zhuravskaya (2011) show that the introduction of an independent television station increases the vote share of opposition parties not supported by Russian state media. Unlike campaign advertising, which our results suggest may be considerably more effective outside the relatively informed electorates of consolidated democracies, the findings in the media literature broadly reinforce prominent studies from the United States (e.g. Chiang and Knight 2011; DellaVigna and Kaplan 2007; Gentzkow, Shapiro and Sinkinson 2011; Snyder and Strömberg 2010).

Finally, this article contributes to several broader debates. First, it offers a more concrete mechanism for previous studies indicating that campaign spending is effective at winning votes (e.g. Spenkuch and Toniatti 2016). Second, our results suggest that a key function of electoral campaigns—via advertising in our case—is to reduce voter uncertainty about the policy positions and characteristics of different candidates (Lenz 2009). Third, complementing the consumer advertising literature (see DellaVigna and Gentzkow 2010), we provide further evidence that advertising in the media can persuade individuals to alter their behavior. In particular, our results reinforce the finding that advertising is most effective among consumers with little prior exposure to a product (e.g. Ackerberg 2001).

The paper proceeds as follows. Section 2 provides a brief overview of politics and media in Mexico, focusing on Mexico's campaign advertising reform. Section 3 develops a simple model to analyze the voting implications of campaign advertising in a democracy with dominant parties. Section 4 details our data and identification strategy. Section 5 presents our main results and robustness checks. Section 6 concludes.

2 Politics and media in Mexico

Mexico is divided into 31 states (and the federal district of Mexico City), and operates a presidential form of government. National legislative elections are held every three years, with members of the

Chamber of Deputies (House) and Senate elected to single three- and six-year terms respectively.[5] The president is elected to a six-year term simultaneous to every other federal legislative election. We focus on the Chamber of Deputies, which contains 300 members elected via plurality rule from single-member districts and 200 members elected according to the national party's vote share via proportional representation. Mexico's circa 67,000 electoral precincts make up the legislative districts (within states) which elect national representatives.

Between 1929 and 2000, widespread clientelistic practices and electoral manipulation ensured that the PRI maintained a stranglehold on the Presidency and almost always retained Congressional majorities. However, Mexican politics has been more competitive over the last two decades as the PRI's grip on power has subsided. In 2009 and 2012, three main political parties competed for political control: the left-wing PRD, the populist PRI, and the right-wing PAN. In this section, we provide an overview of political competition, before describing campaign advertising in Mexico and the 2007 media reforms.

2.1 Political competition

Following Mexico's revolution in 1929, the PRI retained hegemonic status up until the 1990s. The masses were co-opted into the regime, campaigning relied heavily upon distributing public resources and mobilizing voter turnout, and dissension within the party was minimized by maintaining a high political cost of exit (e.g. Cornelius 2004; Fox 1994; Greene 2007; Magaloni 2006). Nevertheless, PRI politicians frustrated by the party's hierarchy ultimately formed the left-wing offshoot National Democratic Front. This became the PRD in 1989, and has since built a strong base in Mexico City and among relatively poor southern states.

The PRI continued to govern in the 1990s, but conceded constitutional reforms in order to receive the Congressional support from the right-wing PAN required to pass pressing legislation to

[5] A constitutional reform in 2014 permitted re-election up to three times for deputies and once for senators elected from the 2018 election onward.

address economic crises. In the more competitive electoral environment, the PRI first lost control of the House in 1997 before PAN candidate Vicente Fox won the Presidency in 2000 (Greene 2007; Magaloni 2006), based on strong support in Mexico's business-friendly northern and western states. In 2006, the PAN and PRD became the largest parties in the legislature, and the PAN narrowly retained the Presidency following a contentious wafer-thin election victory.

Although the PRI's vertical hierarchy dispensing patronage was damaged by losing federal office and the party became regionally fractionalized (Langston 2003), its powerful regional presence remained. In almost one-third of states the PRI never relinquished gubernatorial control to another party, while the reforms designed to ensure fair electoral competition at the national level left local elections—that continued to fall under the jurisdiction of state electoral institutes—relatively untouched. These advantages, combined with new decentralized mechanisms better selecting candidates popular in their local area (Langston 2006) and continued vote- and turnout-buying (Larreguy 2013; Larreguy, Marshall and Querubín 2016; Nichter and Palmer-Rubin 2015), helped the PRI reclaim its majority status in 2009 in coalition with the party of the teachers' union (PNA) and the green party (PVEM), and the Presidency in 2012.

2.2 Campaign advertising and the 2007 IFE reform

Disproportionate access to political advertising in the media became a political issue as Mexico transitioned toward competitive democracy in the 1990s. Although a series of constitutional reforms were approved in 1989 and the operational establishment of the IFE in 1990—which became politically independent in 1996—contributed to substantially reducing vote fraud, the PRI enjoyed privileged access to public resources and lower commercial advertising costs, as well as significantly greater coverage and positive appraisals across media formats (Hallin 2000; Lawson 2002; Lawson and McCann 2005). However, the IFE has since progressively increased its regulation and monitoring of advertising spending by political parties, and become more willing to punish violations with fines.

As the PRI's dominance subsided around the turn of the millenium, the PAN capitalized by dominating media coverage and strategically targeting marginal voters. Lawson (2004) and Lawson and McCann (2005) argue that more equal access to television time was essential to Vicente Fox's victory in the 2000 presidential election. Similarly, Greene (2011) suggests that differential media access—in particular controlling 66% of television advertising time—was the primary reason behind Felipe Calderón's victory in 2006 by just 0.56% of the vote. The result was highly contentious, given the PAN's powerful media attacks against Andrés Manuel López Obrador and the 240 cases of electoral irregularities highlighted by the PRD. Despite upholding all such irregularities, the IFE nevertheless declared that they did not impact the electoral outcome.

Ultimately, the IFE overhauled campaign advertising regulations in 2007, following the passage of major electoral reforms after the contentious 2006 elections. The new regulations, in force in federal elections since 2009, specify that neither political parties nor independent groups can buy campaign advertising on radio and television stations. The IFE is instead responsible for allocating all advertising slots to political parties during the pre-campaign and full electoral campaign that span the five-to-six months preceding federal elections. Every media station in the country is required to provide 41 minutes of 30-second campaign advertising slots throughout each day (until the final week of the campaign). The ordering of individual ad slots is randomly allocated by the IFE (see Durante and Gutierrez 2014). Media stations are legally bound by the distribution applied in the state from which their signal is emitted.

The IFE determines the number of slots available to each political party using a clearly-defined formula that varies across states (see Appendix for details). In states not holding concurrent state-level elections, each party is allocated a minimum advertising share split equally between all parties or full coalitions (30% of total advertising time) and additional time according to their vote share at the previous national legislative election (70% of total advertising time).[6] In states holding

[6]Mexico's major parties often form coalitions for both local and national elections with smaller parties. In 2009, the PRI formed a coalition with PVEM, while in 2012 the PRD formed a coalition with the PT and MC for the national legislative elections.

concurrent state-level elections, 15 of the 41 daily minutes available for advertising are apportioned according to the number of parties or full coalitions standing (30% of state advertising time) and the vote share at the previous state legislative election (70% of state advertising time). In 2009, 11 states simultaneously held state-level elections, while 15 states held concurrent elections in 2012.[7] The distribution of campaign advertising shares thus varies across states but is fixed across all media stations broadcasting from within each state.

Our hand-coded transcription of the 683 unique federal ads broadcast on radio and television during the 2012 election campaign indicates that parties principally used relatively uniform positive messages to convey their policy positions, the salience of particular issues, and emphasize their candidate's competence.[8] Of the 68% of ads that mentioned policy issues, the vast majority focused on valence issues like public security and employment and economic development. Education, health, corruption and rural development also received significant attention. While ads emphasized particular issues, and in some cases detailed policies to address them, parties did not generally seek to distinguish their proposals from those of other parties. Explicitly negative ads were outlawed as part of the 2007 reforms, and the vast majority of ads are positive. Nevertheless, 8% of ads still solely attacked opposition parties. For example, some PRD ads alluded to the PRI's history of corruption during their 70 years in power, while some PAN ads attacked the past record of the PRI's presidential candidate Enrique Peña Nieto.

While notably less frequent than policy issues, the competence of individual candidates—predominantly the principles, previous experience and specific skills of federal candidates—was mentioned in 51% of ads. Consistent with a relatively uniform advertising strategy across the country, Table A1 in the Appendix also shows that candidate mentions were skewed toward presidential candidates: a presidential candidate was mentioned in 57% of ads, while the many legislative can-

[7]The 15 in 2012, shown in Figure 3, were: Campeche, Chiapas, Colima, Distrito Federal, Guanajuato, Guerrero, Jalisco, México, Morelos, Nueva León, Querétaro, San Luis Potosí, Sonora, Tabasco, and Yucatan. Chiapas, Guerrero, Tabasco, and Yucatán did not hold concurrent elections in 2009.

[8]These ads are publicly available at http://pautas.ife.org.mx/transparencia/camp. State-level ads were not systematically collected.

didates were mentioned in 43% of ads. The emphasis on the party and its presidential candidates likely reflects low name recognition for federal deputies. For example, the 2009 Comparative Study of Electoral Systems (CSES) survey found that only 18% of voters knew even one federal legislative candidate in their district.

These relatively nationally-uniform advertising strategies differ significantly from those used up until 2006. Before the reform, parties targeted clearly defined audiences, such as women watching afternoon telenovelas, and bought the corresponding air time to reach such audiences. After the reform, as one political strategist explained, parties were forced to fill many more slots catering to more diverse audiences, and instead adopted a more homogeneous strategy involving less advertising segmentation.

3 Campaign advertising and vote choice with dominant parties

Theories of special interest politics have typically assumed that greater campaign effort translates into votes (e.g. Baron 1994; Grossman and Helpman 1996; Snyder 1989). In these models, campaign contributions increase the probability that any voter supports the party being campaigned for in a homogeneous way. However, there now exists considerable evidence that providing factual and partisan politically-relevant information affects voters very differently (e.g. Greene 2011; Lupu 2013). Where electorates are poorly politically informed about non-dominant parties and voters are beholden to parties through local ties, the effects of campaign advertising could differ substantially across voters. Using a simple model to guide the empirical analysis, we thus ask: *when* is campaign advertising effective at winning votes in the presence of dominant parties?

3.1 Theoretical model

To examine the role of campaign advertising in the presence of dominant parties, we use a simple two-party decision-theoretic model of vote choice where one party is dominant to guide our empir-

ical analysis. Specifically, political parties N and D compete for voters in a given precinct, where party D is informationally and ideologically dominant.

Parties. Party D is dominant in two respects: information and ideology. First, D's "policy" outcome x_D—which we construe broadly to include D's policy position, emphasis on particular programs, and valence factors such as expected competence in office—is known with certainty by all voters.[9] Conversely, the outcome associated with party N is uncertain. The prior belief of all voters is normally distributed according to $\mathcal{N}(\delta, \tau^2)$, where δ is the prior distribution's mean and $\tau^2 > 0$ is its variance. This stark difference in policy uncertainty simplifies the model and clarifies D's informational dominance. However, similar but less tractable results hold if party D's position is known with *relatively* greater certainty than party N's. Illustrating this characterization of dominance, panel C of Table 1 below shows that a party's candidate is better known when that party is dominant.

Second, every voter i receives an ideological bias $v + b_i$ inclining them to vote for D. This represents favorability toward the dominant party, including factors such as loyalty biases, clientelistic benefits, and candidate-specific attributes. While the average bias v is fixed across voters, b_i allows bias to vary across voters, where b_i is distributed according to cumulative distribution function F. Below we examine how the effect of campaign advertising varies with v, which we interpret as the extent of party competition. To capture D's ideological dominance we assume $F'' > 0$, such that the mass of voters with a larger b_i is greater than the mass with a smaller b_i. By allowing the non-dominant party to overcome steadily more biased voters as it becomes more popular, this assumption ensures that the second-order effects of information complement the first-order effects.[10]

The model thus captures the idea that a dominant party has both an information and an ideo-

[9]Campaign advertising could also convey information such as attractiveness, which may be uncorrelated with political attributes, although our empirical analysis focuses primarily on radio rather than television advertising.

[10]With the exception of one case (see below), all results apply where $F'' < 0$ is sufficiently small.

logical advantage. For example, where the PRI is dominant, voters often receive material benefits from the PRI, which they expect to receive if they continue voting for the PRI. However, they are uncertain of the benefits of voting for the PAN or PRD. The asymmetric treatment of the parties is similar in spirit to models where incumbent politicians face challengers (Shepsle 1972), but contrasts with many models of political competition where uncertainty is assumed to be symmetric across parties (e.g. Downs 1957).

Voters. For simplicity, voters share the same policy preferences but differ in their ideological bias toward party D. Assuming full turnout,[11] voters must decide whether to vote for party D or party N. Each voter maximizes their expected utility, where their utility from policy outcome x is given by $u(x) = -\exp(-x)$.[12] We thus assume that i's ideological bias substitutes for policy benefits. Normalizing $x_D = 0$ voter i therefore chooses party N over party D when $\mathbb{E}[u(x_N)] \geq u(v + b_i)$. However, voters also learn about x_N from campaign advertising.

Campaign advertising. Voters update their beliefs in response to campaign advertising according to their prior beliefs and the persuasiveness of the information they receive. Each voter receives n signals, each from an ad from party N.[13] Each signal x_j is independently drawn from the normal distribution $\mathcal{N}(x_N, \sigma^2)$, where x_N is party's N true (but unknown) policy and $\sigma^2 > 0$ is the known variance of the signal distribution. We assume that $\sigma^2 > n\tau^2$, which ensures that the signal does not overwhelm the prior.

The mean signal observed by a voter is $\bar{x} = n^{-1} \sum_{j=1}^{n} x_j$, and voters form expectations using these signals to update their posterior belief about the benefits of N winning office. Although some voters may have an optimistic prior about non-dominant party N and could then update negatively about N's policy outcome, these are likely to be sufficiently few in number since the share of voters

[11] In our empirical application, no party's campaign advertising significantly affects average turnout. An interesting extension could develop a model to also explain heterogeneous effects of campaign advertising on turnout.

[12] This constant absolute risk aversion utility function is chosen because of its convenient mathematical properties when taking expectations over normally distributed lotteries. For simplicity, we set the coefficient of risk aversion to unity.

[13] Since D's position is known with certainty, we ignore any signals sent by D.

biased toward the non-dominant party is likely to be small given $F'' > 0$. Moreover, voters that are already biased toward the dominant party will not change their voting behavior. We then focus on the behavior of fairly representative voters for whom N's policy outcome is sufficiently beneficial relative to D's, and thus on those voters for whom information could cause them to switch away from the dominant party. Consequently, we let $x_N > 0$ and $\bar{x} - \delta > \frac{\sigma^2}{2n}$.[14] In words, N's true policy outcome x_N is better for voters than D's, while voters' prior beliefs are centered on an expectation below N's true policy outcome. While this is an important driver of the model's results, campaign ads would otherwise only play a limited role in changing voter behavior.

Applying Bayes' rule, each voter's posterior distribution over the policy outcome if party N wins is:

$$\mathcal{N}\left(\frac{\frac{\delta}{\tau^2}+\frac{n\bar{x}}{\sigma^2}}{\frac{1}{\tau^2}+\frac{n}{\sigma^2}}, \left(\frac{1}{\tau^2}+\frac{n}{\sigma^2}\right)^{-1}\right). \tag{1}$$

Consequently, each voter's expected utility from party N winning office is given by:

$$\begin{aligned} \mathbb{E}u(x_N) &= -\exp\left[-\left(\frac{\frac{\delta}{\tau^2}+\frac{n\bar{x}}{\sigma^2}}{\frac{1}{\tau^2}+\frac{n}{\sigma^2}} - \frac{1}{2}\left(\frac{1}{\tau^2}+\frac{n}{\sigma^2}\right)^{-1}\right)\right] \\ &= -\exp\left[-\left(\frac{\delta\sigma^2+n\bar{x}\tau^2}{\sigma^2+n\tau^2} - \frac{1}{2}\frac{\tau^2\sigma^2}{\sigma^2+n\tau^2}\right)\right], \end{aligned} \tag{2}$$

where the first term is the voter's expectation of N's policy outcome, and the negative second term reflects their disutility from risking the election of a candidate whose policy outcomes are uncertain.[15] Defining $R \equiv \frac{\delta\sigma^2+n\bar{x}\tau^2}{\sigma^2+n\tau^2} - \frac{1}{2}\frac{\tau^2\sigma^2}{\sigma^2+n\tau^2}$, voter i thus chooses to vote for party N over party D when $R > v + b_i$.

Equation (2) highlights several important implications of campaign advertising. First, voters

[14] At the cost of mathematical complexity, the model could be extended to include voters updating negatively about N's policy outcome. However, our main results hold provided that this share is relatively small.

[15] Morgenstern and Zechmeister (2001) have shown that risk-aversion was a significant factor in explaining continuing support for the PRI at the 2000 presidential elections.

are more likely to believe that party N's policy outcome will benefit them as the number of ads, n, increases. Second, as in Zaller (1992), voters with strong priors—smaller τ^2—are less responsive to an additional ad from N. Third, the effect of campaign advertising on the belief that N will be beneficial increases with the precision of the signal, or as σ^2 decreases.

Combining voter beliefs with the decision to vote for party N or party D yields our main result determining when a voter supports a non-dominant party.

Proposition 1. *The proportion of votes for party N, the non-dominant party, is $V_N \equiv F(R - v)$. The following comparative statics hold:*

(a) The vote share of N, V_N, is increasing in n (i.e. $\frac{\partial V_N}{\partial n} > 0$).

(b) The effect of n on V_N, $\frac{\partial V_N}{\partial n}$, is decreasing in v and σ^2, and increasing in τ^2 (i.e. $\frac{\partial^2 V_N}{\partial n \partial v} < 0$, $\frac{\partial^2 V_N}{\partial n \partial \sigma^2} < 0$ and $\frac{\partial^2 V_N}{\partial n \partial \tau^2} > 0$).

Proof: See Appendix. ■

Intuitively, part (a) of the proposition demonstrates that increasing party N's campaign advertising increases N's vote share by strengthening voters' posterior belief that N would implement a desirable policy if elected. However, the results in part (b) imply that this effect will vary depending on contextual campaign advertising and party characteristics. First, increasing the valence bias v toward party D reduces the effectiveness of N's ads because campaign advertising is less able to overcome strong biases in favor of D. Second, where the precision $1/\tau^2$ of voters' prior belief that party N will implement $\delta(< x_N)$ is high, voters will positively update their posterior beliefs less substantially in favor of N. Third, voters are less confident that party N will implement a desirable policy, and thus relatively less likely to vote for N, when ads are relatively imprecise (i.e. high σ^2).

3.2 Applicability to Mexico

Mexico is an appropriate context to test our argument for two main reasons. First, most parts of the country experience two-party competition where one party is *locally* dominant. Although

dominance applies at various geographic levels, dominance in Mexico is highly localized. Second, low levels of voter information about politics (e.g. Chong et al. 2015; Greene 2011; Lawson and McCann 2005; Marshall 2016) also suggest that campaign advertising's effects may be particularly large.

Despite Mexico possessing three main parties, most voters effectively experience two-party competition locally. This largely follows since Mexico's three main political parties are regionally concentrated. As noted above, the PRI remained dominant in many states despite losing its stranglehold on national offices, the PRD inherited and retained strong support in southern areas after breaking away from the PRI, and the PAN has generally controlled urban areas.[16] Furthermore, Larreguy, Marshall and Querubín (2016) show a stark rural-urban divide, where the PRI dominates rural areas and the PRD and especially PAN win both votes in urban settings. These differences ensure that, as captured by our model, most voters experience two-party competition locally. In 2009 and 2012, third parties only received more than 20% of the vote in 7% of electoral precincts and 8% of districts.

Informational and ideological dominance is often manifested at a lower level of aggregation than the district served by each incumbent. First, most of Mexico's 300 federal legislative districts—especially those outside Mexico's largest cities—contain a mix of urban and rural localities often scattered across municipalities with very different local political leaders. Second, consistent with localized differences in voter information, we show below that levels of political knowledge are significantly correlated with precinct-level covariates. Third, Larreguy, Marshall and Querubín (2016) show that turnout-buying brokers typically operate at the precinct-level, while Larreguy (2013) and Larreguy, Marshall and Trucco (2015) find that clientelism is particularly marked in small rural and urban localities. There is thus substantial variation in both the extent of dominance and which party dominates within Mexico's federal legislative districts. Consequently,

[16] After the end of our sample period, the National Regeneration Movement (MORENA) also became a important electoral player in the 2015 elections.

our analysis focuses on *precinct-level* dominance rather than district incumbency.

3.3 Hypotheses

We now derive specific empirical predictions by aggregating voters at the electoral precinct level, which our empirical analysis focuses on. The model's most obvious prediction—from Proposition 1(a)—is that greater campaign advertising (n) by a non-dominant party increases the probability that an individual votes for that party. Supporting the key assumption—informational dominance by locally dominant parties—driving this prediction, panel A of Table 1 examines the three CSES surveys conducted after Mexico's 2006, 2009 and 2012 federal elections and shows that voters are 5 percentage points more likely to know the PAN presidential candidate in precincts where the PAN is the largest party, and 2 percentage points more likely to know the PRD candidate in precincts where the PRD is the largest party.[17] Although voters are more likely to know the PRI candidate when the PRI is the largest party, the lack of a significant difference could reflect decades of PRI rule. Importantly, since no party dominates all parts of the country, campaign advertising thus has the potential to help all political parties wherever they are not locally dominant. We thus hypothesize that:

H1. *An increase in a party's campaign advertising increases its vote share.*

[Table 1 about here]

The model also identifies the types of precincts where a party's campaign advertising is most effective. Proposition 1(b) predicts that less well-informed voters—those with a weak prior, or large τ^2—are the most responsive to new information provided by political parties. Greene (2011) and Lawson and McCann (2005) argue that a legacy of Mexico's recent competitive authoritarian past is low levels of political knowledge. This is likely to be particularly true of poor and rural voters, which are easier to measure empirically. Confirming this correlation, panel B of Table 1

[17] McCann and Lawson (2006) find similar correlations before 2006.

shows that our measure of basic local development—defined below—is positively and significantly correlated with the respective probabilities that respondents know of, and have an opinion on, the PAN, PRD and PRI presidential candidates, as well as an index of political knowledge probing a respondent's knowledge of political institutions. We thus hypothesize that Mexico's impoverished voters, who are the least well informed, are most likely to internalize campaign ads, and therefore most likely to change their vote as a response.[18]

H2. *Campaign advertising is most effective at winning votes in less developed parts of the country.*

However, campaign advertising is only one tool deployed by political parties. The main political parties in Mexico also engage in significant local-level clientelism (e.g. Cornelius 2004; Larreguy 2013; Magaloni 2006) and turnout buying (e.g. Larreguy, Marshall and Querubín 2016; Nichter and Palmer-Rubin 2015). These efforts are especially concerted in swing districts (Diaz-Cayeros, Estévez and Magaloni forthcoming). In competitive localities where multiple political parties use a variety of tactics to win votes, the effect of campaign advertising—which is fixed in quantity by law—may be crowded out by other activities.[19] Supporting this argument, panel C of Table 1 shows that voters in more competitive precincts—proxied by the effective number of political parties by vote (ENPV) in 2006—are more knowledgeable about their local candidates and political institutions. In terms of the model, alternative modes of persuasion may reduce the marginal effect of a given ad by increasing the precision of voter's prior (i.e. reduce τ^2). Proposition 1(b) therefore implies that:

[18]Since impoverished voters are typically also the most susceptible to vote buying (e.g. Stokes 2005), which may reduce the effectiveness of campaign advertising (see H5 below), which effect dominates is an empirical question. Our empirical analysis also seeks to distinguish these effects empirically by using different proxies and showing that both interactive effects hold simultaneously.

[19]Theoretically, campaign advertising could complement other activities. However, it is not clear why complementarities with one party's advertising should overcome both advertising and non-advertising countervailing forces emanating from other political parties. Furthermore, strategies like vote buying are unlikely to serve as complements since they are designed to overcome political preferences. Ultimately, this is an empirical question.

H3. *Campaign advertising is most effective at winning votes in less politically competitive parts of the country.*

Similarly, while local political competition may differentially crowd out the effects of campaign advertising across electoral precincts, some elections are more salient than others. As in many other developing democracies, presidential elections in Mexico are particularly hard fought, and political parties dedicate more resources to their electoral strategies. Given that the quantity of campaign advertising is constant across national elections, even though the content may change, we also hypothesize that τ^2 is larger and σ^2 is smaller in mid-term elections, and thus predict that:

H4. *Campaign advertising is most effective at mid-term elections.*

Finally, and bringing together the key insights of our theoretical model, the relationship between campaign advertising and local dominance is not necessarily linear. When there is little bias toward the locally dominant party there are fewer votes for the locally non-dominant party to win and the election is likely to be more competitive (decreasing τ^2 and increasing σ^2). At interim levels of local dominance voters are more susceptible to campaign advertising because they possess weaker priors about the non-dominant party (larger τ^2) and advertising is not crowded out as much by political competition (smaller σ^2). However, proposition 1(b) shows that advertising ultimately becomes less effective once the ideological bias (v) toward the locally dominant party becomes sufficiently large that no amount of advertising can convince voters to abandon that party. Together, these insights imply that the effects of a non-dominant party's advertising are non-linear in the level of local dominance: where a dominant party is relatively strong, but not completely commanding, we expect advertising to be most effective. In contrast, since the model assumes that the policies of locally dominant parties are well known, we expect to find weaker effects of campaign advertising among locally dominant parties.

H5. *Campaign advertising by locally non-dominant parties is most effective at intermediate levels of local dominance, while campaign advertising by locally dominant parties is relatively*

ineffective.

4 Research design

To identify the effects of campaign advertising on party vote share, we compare neighboring electoral precincts receiving differential exposure to campaign advertising due to differences in coverage by broadcast signals from out-of-state media stations. We first describe our data and explain our focus on AM radio ads, before detailing our identification strategy.

4.1 Data

We collected data from various sources to produce a dataset combining campaign advertising shares for each political party, local economic and demographic characteristics, and federal election vote shares for each electoral precinct. Electoral precincts—which typically contain 750-1,500 voters—are the smallest area for which media coverage and electoral data could be matched. Given that campaign advertising and signal coverage data at the media outlet-level were first collected after Mexico's media reforms, we examine the 2009 and 2012 elections. We now describe our main variables; more detailed definitions and sources are provided in the Appendix.

4.1.1 Dependent variable: vote share

Our main outcome is the legislative vote share in the 2009 and 2012 elections, as a proportion of all votes cast, for each of Mexico's three main political parties—the PAN, PRD and PRI.[20] We aggregate up to the precinct level the polling station-level returns for the 2000-2012 federal legislative elections provided by the IFE.[21]

[20] 5% of votes were null or not registered, while 15% of votes were cast between six small parties. Table A3 in the Appendix shows that turnout is unaffected by campaign advertising.

[21] Although we focus on Congressional elections, which allow us to pool results across two elections, the correlation between PAN, PRI and PRD legislative and presidential vote shares always exceeds 0.91. Table A14 in the Appendix shows similar results for the 2012 presidential election.

4.1.2 Independent variable: party campaign advertising share

In their new regulatory role, the IFE collected data from every media station in the country after the 2007 media reforms.[22] This data includes the location of the signal's antennae, which allows us to identify the advertising distribution mandated in the associated state, and the coverage area for each station. The IFE defines the boundary of the coverage area using a 60 dBμ threshold for signal strength.[23] This is the threshold commonly used to determine a radio station's audience and sell advertising space commercially.[24] Inside a station's coverage area the signal is of high quality, ensuring that interior precincts have good access to the station's broadcasts. Precincts outside the coverage area experience sharply decreasing coverage quality as the distance from the boundary increases. We exclude the Federal District given the small size of its electoral precincts reduces the validity of this comparison, while our identification strategy ensures that our sample is disproportionately rural. The number of media stations has not recently changed.[25]

Our principal independent variable is the share of campaign advertising received from a given party in a given electoral precinct. Specifically, we calculate the average share of campaign advertising for party i across all media stations g covering precinct j at election t:

$$advertising\ share_{ijt} = \frac{1}{|\mathcal{G}_j|} \sum_{g \in \mathcal{G}_j} media\ share_{igt}, \tag{3}$$

where $\mathcal{G}_j \equiv \{g : g \text{ covers } j\}$ is the set of stations covering precinct j and $media\ share_{igt}$ is the share of ads allocated to party i in the state from which media station g emits. We compute

[22] This data was obtained from IFE using a freedom of information request.

[23] AM radio coverage was typically calculated using the Kirke (or equivalent distance) method, which adjusts for local terrain disrupting ground conductivity. Strömberg (2004) shows that ground conductivity is a good predictor for the number of households with radios in the U.S. in the 1930s. Coverage of FM radio and television stations was calculated similarly.

[24] In the U.S. it "is recognized as the area in which a reliable signal can be received using an ordinary radio receiver and antenna" (NTIA link).

[25] Although we were unable to obtain data for 2012, the number of radio and television stations did not change in any year between 2003 and 2010.

$advertising\ share_{ijt}$ separately for AM, FM and television ads. We focus on the share of ads, rather than the total number of ads they could access, because by regulation the number of ads is constant across all media stations and voters cannot listen to multiple radio broadcasts simultaneously. Moreover, the random allocation of slots ensures that differences in access to prime time slots quickly averages out over the campaign (Durante and Gutierrez 2014).

Our main analysis focuses on differences in campaign advertising from AM radio stations for several reasons. First, as Figure 1 indicates, AM radio's large signal range ensures that 87% of electoral precincts in the country are covered by at least one AM radio station. In contrast with the weaker signals of FM radio and television antennae based in urban areas (see Figures A1 and A2 in the Appendix), AM radio reaches more rural and less well informed voters (see Table 3 below).[26] Our theory thus suggests that AM ads possess the greatest potential to diminish locally dominant parties. Second, such greater reach of AM signals substantially increases the power of our identification strategy, relative to FM and television signals. While FM radio and television stations are more numerous, they emit weaker signals that are substantially less likely to travel across state borders, which decreases our sample. Nevertheless, our robustness checks below show qualitatively similar results for ads on FM radio and television.

[Figure 1 about here]

4.1.3 Precinct-level variables

We also collected precinct-level data to test the heterogeneous effects predicted by the model. To test H2, we measure local socioeconomic development, as a proxy for voter knowledge of politics (see Panel B in Table 1), using 5 variables: 2006 electorate density; the proportion of the precinct population that has non-dirt floors, running electricity, running water, a toilet, and drainage; the employment rate; the literate proportion of the population aged above 15; and the share of the

[26] Since the uncovered precincts differ systematically, we focus on comparing differences in party campaign advertising shares among precincts receiving AM coverage from at least one radio station. Balance across covariates declines when comparing precincts with and without AM coverage.

population aged above 15 that completed primary school.[27] Given the strong correlation between these variables, we combine them by taking the first factor from a factor analysis.[28] We refer to this standardized variable as "basic development."

To examine H3, we use ENPV at the *precinct* level as a proxy for political competition, and thus other electoral strategies that might lead to more information about party policies (see panel C in Table 1). One effective party represents complete local dominance by a single party, while larger values represent greater political competition.[29] To ensure that competition is not affected by campaign advertising during or following the 2009 or 2012 elections, we calculated ENPV using the vote share of every party that stood in each precinct in the 2006 legislative election.[30] To assess H4, we use an indicator for the 2012 presidential election.[31]

To test H5, we define the locally dominant party as the party that received the most votes in the *precinct* in the 2006 election. As noted above, we prefer a local measure of dominance to district-level incumbency because federal deputies serve large districts, while local political control, information and partisan preferences vary substantially within districts. We use linear and quadratic terms to capture the non-linearity in the locally dominant party's vote share implied by H5. Moreover, we interact these terms with an indicator for whether the party is itself the largest local party, in order to test for differential responses to campaign ads from locally dominant and non-dominant parties.

[27] The first variable was computed from electoral and spatial data from the IFE, and the final 4 variables come from the 2010 Census.

[28] In our main sample (see below), the first factor has an eigenvalue of 1.72, while the second factor's eigenvalue is only 0.56.

[29] Although most elections are two-party races, smaller parties remain sufficiently large that they should not be ignored. We thus prefer ENPV to measures based on the two largest parties.

[30] In our main sample, the correlation between 2006 ENPV and (endogenous) contemporaneous ENPV is 0.50.

[31] We obtain essentially identical results when splitting the sample.

4.2 Identification strategy

To address the concern that electoral precincts receiving different campaign advertising distributions differ in other electorally-relevant respects, our identification strategy exploits within-neighbor variation in campaign advertising shares. In particular, we compare neighboring electoral precincts that receive a different distribution of campaign advertising because they receive a different mix of radio signals from AM stations based inside and outside the state. Our design thus relies on differences in advertising shares that arise from cross-state spillovers in AM radio coverage.[32]

Specifically, we focus on "treated" precincts that differ from at least one neighboring "control" precinct in terms of the distribution of campaign advertising that they receive from AM radio stations. To ensure the comparability of media access, we use all neighboring control precincts located within 1 kilometer (km) of a coverage boundary. Since broadcast signal strength decays gradually with distance, the commercial coverage boundary is not a sharp difference between receiving or not receiving a station's signal.[33] Rather, some households beyond the boundary can nonetheless receive signals from the media outlet (perhaps not regularly, or depending on time of day), while signal quality may be erratic for some households inside the boundary.

Since we cannot accurately measure media station audiences, and the decision to listen to political ads likely correlates with other relevant variables, we rely on a measure of exposure rather than consumption (see also Huber and Arceneaux 2007).[34] Consequently, by identifying the effect

[32] See also U.S. studies exploiting differences in media market boundaries (e.g. Ansolabehere, Snowberg and Snyder 2006; Huber and Arceneaux 2007; Snyder and Strömberg 2010); see Enikolopov, Petrova and Zhuravskaya (2011) for a non-U.S. study adopting a similar approach.

[33] Our design differs from geographic regression discontinuity designs in two further respects. First, differences in the number of commercial quality local media signals between neighbors are non-binary because neighbors can differ by more than one media station. Second, the multidimensionality of these differences determining the distribution of campaign advertising do not naturally translate into a continuous forcing variable.

[34] Ideally, we could also identify the electoral effect of receiving or consuming an additional media station using instrumental variable techniques. However, in the absence of detailed individual-level variables measuring which radio or television stations voters have access to or actually consume, we cannot estimate an appropriate first stage.

of an increase in the probability of exposure to AM radio signals, we thus estimate the "intent to treat" effect of campaign advertising. It is nevertheless clear that access translates into ad consumption and recall. Exploiting within-state variation and data from the 2009 CSES post-election survey, columns (1)-(3) of Table 2 demonstrate that the likelihood that a voter recalls a televised ad by a particular party increases with their precinct's television campaign advertising share for that party. [35] Furthermore, columns (4)-(12) show that the probability that a respondent can recall a feature of the PAN, PRD or PRI's ad campaign over the course of the campaign is positively and generally significantly correlated with the precinct's average AM, FM and television share for that party. This correspondence is especially important for radio stations, given that radio ad consumption could occur as citizens commute to and from work across precincts. Moreover, although such cross-border commuting is common in metropolitan areas, our primary AM advertising sample is predominantly rural, and thus less subject to this concern.[36]

[Table 2 about here]

Pooling across the 2009 and 2012 elections, our design yields a total of 31,969 neighbor-year groups containing a single "treated" unit and up to 23 neighboring "control" units. This produced 146,140 observations in total, while Figure 3 shades in grey the 16,239 unique electoral precincts included in our sample. The range of PAN, PRD and PRI AM advertising shares are respectively 21-35%, 9-20% and 19-35%. Unsurprisingly, this sample is clustered around the borders of states holding concurrent state-level elections. Accordingly, the summary statistics in Table 3 show that the electoral precincts in our sample are more rural and less economically developed than the

[35] Unfortunately, no such data was available for radio stations. However, studies from other contexts also suggest that the volume and breadth of media access translates into the consumption of political information (Barabas and Jerit 2009; Prat and Strömberg 2005).

[36] To examine whether television produces larger effects than radio, as previous studies in Mexico comparing FM radio and television have suggested (Larreguy, Marshall and Snyder 2016), we could in principal compare the effects of campaign advertising among neighboring precincts that receive different advertising shares through both radio and television. Unfortunately, the intersection of these 3 samples is too small to allow a meaningful comparison: the AM sample drops by around 91%.

national average, as well as the analogous samples based on differences in FM radio and television ad distributions. As noted above, we expect the effect of campaign advertising in the predominantly urban areas comprising the smaller FM and television samples to be lower than in the more rural AM sample where prior exposure to the PAN and PRD is lower.

[Figure 3 and Table 3 about here]

The key identifying assumption is that neighboring precincts differ only in their AM radio campaign advertising shares. There are good reasons to believe this assumption. First, by restricting attention to within-neighbor comparisons, variation in access to radio signals is in large part determined by fixed signal impediments such as terrain and salt water that inhibit or enhance ground-level electrical conductivity (see Strömberg 2004). Second, given that out-of-state AM radio stations are unlikely to specifically target audiences at the extremities of their coverage area, both because such audiences represent a small share of their potential listenership and because they lack the technology to precisely differentiate precincts,[37] the direction and reach of cross-state spillovers are unlikely to be correlated with precinct characteristics. Third, if voters choose where to live according to media availability, they would likely choose a location much closer to the antennae, rather than near the commercial quality coverage boundary where high-quality signal coverage cannot be guaranteed. The balance tests discussed below support this identification assumption.

4.2.1 Estimation

Provided that differences in campaign advertising arising from cross-state spillovers in AM signals occur effectively randomly, we can estimate the average effect of exposure to campaign advertising

[37]The power output in watts for the AM radio stations in our sample are almost exclusively round thousands and divisible by 5,000.

from each political party using the following OLS regression:

$$vote\ share_{ijt} = \beta\ advertising\ share_{ijt} + \mu_{mt} + \varepsilon_{ijt}, \tag{4}$$

where $vote\ share_{ijt}$ is the vote share of party $i \in \{PAN, PRD, PRI\}$ in precinct j at election $t \in \{2009, 2012\}$. Since our treatment is a party's advertising share, equation (4) identifies the effect of greater exposure to a party's advertising relative to a commensurate decline among all other parties. [38] We include neighbor group-year fixed effects, μ_{mt}, to ensure that our estimates are only identified out of differences within neighboring precincts at a given election. In all specifications, we weight by the inverse of the number of precincts per neighbor group to ensure that each group is weighted equally.[39] Standard errors are clustered by state throughout.

To examine the heterogeneous effects of media conditional on X_{ijt}, we estimate:

$$vote\ share_{ijt} = \beta\ advertising\ share_{ijt} + X_{ijt}\,\gamma + (advertising\ share_{ijt} \times X_{ijt})\,\delta + \mu_{mt} + \varepsilon_{ijt}. \tag{5}$$

We test H2 by interacting a party's campaign advertising share with basic development, H3 by interacting the advertising share with the ENPV at the 2006 legislative election, H4 using an interaction for the 2012 election, and H5 by interacting the advertising share with quadratic terms for the largest local party's vote share and an indicator for whether party i is the largest local party.

4.2.2 Balance on demographic, economic and political covariates

The key concern for designs exploiting differences between neighboring locations is sorting. Although the discussion above argues that neither strategic sorting (on the part of either voters or

[38] Table A5 in the Appendix shows similar results when we also control for the share of ads allocated to other parties on the left, center and right. The controls allow us to examine vote substitutions, and suggest that the PRD benefited from centrist advertising that likely loosened the ties of voters supporting other leftists parties, while PAN advertising harmed the PRI.

[39] The results are robust to further weighting by the number of registered voters per precinct (see Table A13 in the Appendix).

radio station owners) nor incidental sorting are plausible in this case, Table A2 in the Appendix demonstrates that the PAN, PRD and PRI AM campaign advertising shares are each well balanced across 29 potentially confounding demographic, economic and political variables; 9 of 87 regressions yielded coefficients significant at the 10% level. These tests lend credibility to our design generating exogenous variation in campaign advertising shares. A variety of robustness checks below further reinforce this claim.

5 Results

We now test the implications of our theoretical model. We find that campaign advertising is effective at winning votes for the PAN and PRD. Consistent with the model, advertising's impact is greatest in less developed and less competitive precincts, and for locally non-dominant parties it increases non-linearly with the vote share of the locally dominant party. However, we find no evidence that PRI advertising is effective.

5.1 Average effects of AM radio campaign advertising on party vote share

Table 4 presents the average and heterogeneous effects of campaign advertising on AM radio. Respectively, the dependent variable in panels A, B and C are the precinct-level vote shares of the PAN, PRD and PRI. As noted above, all estimates of equations (4) and (5) include all possible neighboring precincts located within 1 km of an AM coverage boundary. To save space, lower-order interactions terms are omitted from the tables.

[Table 4 about here]

Column (1) reports the average effect of campaign advertising, showing significant variation by political party across panels. In panel A, we find that the share of PAN campaign advertising

increases the PAN's vote share. Specifically, a percentage point increase in the PAN's advertising share increases their vote share by 1.2 percentage points. At least in the context of Mexico's relatively unconcentrated advertising markets, where no party receives more than 35% of advertising slots in any precinct, this suggests that PAN advertising was able to substantially enhance the party's electoral fortunes. Alternatively put, a standard deviation increase in campaign advertising thus corresponds to a 3 percentage point increase in the PAN's vote share, or a 11% increase in their precinct vote share. For the PAN, we therefore find significant support for H1—that campaign advertising is effective on average.

In panel B, PRD campaign advertising also substantially increases the party's vote share, but is less precisely estimated. The positive coefficient indicates that a percentage point increase in advertising translates into a 0.7 percentage point increase in vote share, while a standard deviation increase in advertising also corresponds to a 2.3 percentage point and 14% increase in their vote share. The relative imprecision reflects the ineffectiveness of PRD ads in 2012: column (4) shows that the effect of PRD ads in 2009 was statistically significant and similar in magnitude to the average effect of PAN ads.

There is no evidence in panel C, however, that PRI campaign advertising affects their vote share. This finding suggests that the likelihood that voters have relatively strong priors about the PRI after seven decades in power, especially in the relatively rural sample that we examine here, and may thus be relatively unaffected by PRI advertising. Our interviews with political strategists also suggested that voter opinions of the PRI are highly polarized. During Chile's 1988 plebiscite, Boas (2015) similarly finds that opposition advertising was effective while pro-Pinochet advertising was not.

Lastly, note that Table A3 in the Appendix shows that no party's campaign advertising significantly affected average turnout.

5.2 Heterogeneous effects of AM radio campaign advertising on party vote share

We now turn to our interactive specifications in columns (2)-(6) to examine hypotheses H2-H5. We find clear evidence that the characteristics of an electoral precinct, and to a lesser extent the type of election, affect the vote-winning efficacy of campaign advertising. Column (6) includes all heterogeneous effects simultaneously to demonstrate that the individual interaction estimates are not driven by correlations among our interaction variables.

Column (2) shows that, consistent with H2, PAN and PRD campaign advertising is significantly more effective at winning votes in the less developed electoral precincts. As our survey analysis in Table 1 shows, this development index—the first factor representing electorate density and precinct-level measures of access to basic necessities, illiteracy, employment and complete primary education—is positively correlated with voter information.[40] Our estimates suggest that a standard deviation increase in the development factor variable reduces the increase in vote share due to every percentage point increase in campaign advertising by 0.25 percentage points for the PAN and 0.14 percentage points for the PRD. In the least developed precincts (with a standardized development score of -4.7), the effects of campaign advertising are substantial, increasing the PAN and PRD vote share by 2.2 and 1.3 percentage points respectively for each additional percentage point of advertising share. The PRI's campaign advertising appears to be equally ineffective across more and less developed electoral precincts.

The results in columns (3) and (4) show that campaign advertising's weakest effects are in competitive precincts and elections. In such contexts, parties are likely to engage in other political activities. First, and supporting hypothesis H3, the large and statistically significant interaction with the ENPV shows that PAN and PRD campaign advertising is most effective in precincts where

[40] These results are consistent with Greene's (2011) survey results from the pre-reform 2006 election, and Da Silveira and De Mello (2011) in Brazil.

a small number of parties garnered most of the votes in 2006. The differential is particularly large for PAN advertising, where a percentage point increase in their advertising share increases their vote share by 3.5 percentage points in the least competitive precinct in our sample and only reaches zero in the 20% of precincts with at least 3.2 effective parties. The effect of PRD advertising on the PRD's vote share, which is 0.2 percentage points lower after a standard deviation increase in political competition, declines 4 times slower with ENPV but similarly hits zero in the less than 1% of precincts with at least 4.4 effective parties. These effects are robust to the simultaneous inclusion of our other interactions with campaign advertising in column (6), where the PAN and PRD coefficients converge to relatively similar magnitudes. Again, we find no difference in the effectiveness of PRI advertising in panel C.

Second, providing some support for H4, column (4) shows that AM radio advertising was less effective during the 2012 presidential election than the 2009 legislative election. Although neither effect is quite statistically significant, consistent with our crowding out argument we find that the impact of PAN advertising was lower in 2012, although it continued to significantly increase their vote share on average. PRD ads had a large positive effect in 2009, almost on a par with PAN advertising. However, the interaction between campaign advertising and the election year indicates that PRD advertising, on average, was ineffective in 2012. This difference becomes statistically significant once we control for the other interactions in column (6). The estimates in panel C show that in neither election was the effect of PRI advertising positive. Although the 2009 and 2012 elections of course differed in other important respects, potentially including the content of the ads, turnout rates, and the presence of presidential candidates, the difference across elections provides further suggestive evidence consistent with our theory.

The estimates in column (5) show that campaign advertising is most effective for non-dominant parties and where the dominant party has intermediate strength. For both the PAN and PRD, the coefficients in the second and third rows show that the marginal effect of campaign advertising is initially increasing in the vote share of the locally dominant party, but starts to decrease once

that dominant party's vote share reaches around 50% of the vote. The final two coefficients in these specifications show that the marginal effect, for any level of the locally dominant party's vote share, is both lower and substantially flatter with respect to local dominance when either party is themselves dominant. Figure 4 illustrates these non-linear marginal effects graphically, providing clear support for H5 by demonstrating that PAN and PRD advertising are more effective in precincts dominated by other political parties until the locally dominant party becomes too strong. Again, PRI advertising is estimated to be equally ineffective across all types of precinct. Table A4 in the Appendix shows similar results when the dominant party's vote share is instead divided into quartiles.

[Figure 4 about here]

Finally, while clearly an out-of-sample extrapolation, these heterogeneous effects can be used to impute the predicted marginal effects for every precinct in the country. We can thus estimate the average nationwide marginal effect of advertising in 2009 and 2012 for each party. Consistent with the claim that the effects of ads on AM radio estimated in our rural sample are larger than those that we should expect nationwide, our results imply an average marginal effect of 0.96 for a unit increase in PAN advertising in 2009, and 0.34 for 2012. For the PRD, these estimates are 0.86 and 0.10 for 2009 and 2012 respectively. For the PRI, these estimates are -0.34 and 0.05 for 2009 and 2012 respectively.

5.3 Robustness checks

Given that our identification strategy leverages cross-state media spillovers and only exploits variation between comparable neighboring precincts, there are good reasons to be confident in the effects that we identify. However, we conduct a variety of checks to ensure that our estimates are robust to potential violations of our identification assumptions and generalize to FM and television advertising. These checks are presented in the Appendix.

We first employ a placebo test to examine the likelihood that spillovers from other hypothetical state advertising distributions could have produced our results. Since the regulation that determines political ad shares across parties induces no variation across the states that are not holding local elections, we randomly reassign (without replacement) the state-level advertising distribution to each of the AM radio stations in states holding local elections. Based on 100 random reassignments, Table A6 shows the average effects aggregating across these placebo advertising formula assignments (see Appendix for more details). The results almost invariably produce smaller and substantially less precise estimates. This indicates that our findings do not reflect idiosyncrasies in that data that any random reassignment of advertising shares at the state level could produce.

Measurement error in AM radio coverage is another potential concern. Such error occurs where changes in the probability of coverage around the boundary are smaller than the IFE maps suggest, and likely results in underestimating the effects of campaign advertising. Nevertheless, to check that our findings are not driven by such measurement error, we restrict attention to boundaries arising from lower-powered AM radio signals—for whom coverage is less variable and more accurately measured—by excluding antennae with wattages above 10,000.[41] Table A7 shows similar results. An alternative check in Table A8 shows that controlling for the interaction between campaign advertising and precinct area—in order to partial out differences in our heterogeneous effects that could simply arise from differential coverage measurement error—similarly does not affect our results. Furthermore, to ensure that our results are not driven by precincts covered by different numbers of media stations, Table A9 shows that the results are robust to the inclusion of fixed effects for the total number of AM radio stations covering an electoral precinct. These fixed effects also address the potential concern that precincts subject to cross-state spillovers could be covered by more AM radio stations, and thus provide voters with more consumption options that generate greater exposure to campaign ads.

[41] Stations with high wattage (high power) have larger total coverage areas and tend to have wider zones where signal strength is between 50 and 60 dBμ, in which coverage may be spotty or poor but often not zero.

More generally, we examined the sensitivity of our results to different specification choices. First, Table A10 shows that our average effects are very similar when we include the 29 variables used for our balance tests. Second, we control for the interaction between campaign advertising and each variable in separate regressions. The results, available in our replication code to save space, show that our main estimates are not substantially affected. Third, we examined the sensitivity of our estimates to the choice of maximum distance from the coverage boundary. Tables A11 and A12 show that restricting attention to precincts within 0.5km or 5km of the nearest coverage boundary also produced similar results.

Finally, our results also generalize to other media formats. Although the smaller FM and television samples differ markedly from our main AM sample, the *heterogeneous* effects—which are similar to the AM results and generally remain statistically significant—in Tables A17 and A18 further indicate that campaign advertising is most effective where voters are less informed, political competition is low, and a party is not locally dominant. Consistent with our theory, changes in sample composition ensure that the *average* effects of campaign advertising are lower in the better informed and more competitive precincts that constitute the FM and television samples. Moreover, we again find that neither FM nor television campaign advertising wins votes for the PRI.

5.4 Alternative interpretations

An important consideration is the possibility that our results reflect underlying differences in media content across states, rather than the effects of campaign advertising. For example, AM stations in states with larger distributions of PAN advertising, and thus higher PAN vote shares, may also more favorably or more frequently cover the PAN in the news. To address this concern, we examine the 2006 election as a placebo. Using the allocation formula specified by the 2007 reform, we compute the advertising share that each party would have received in 2006 had the reform already been passed. Using the same identification strategy, we thus compare neighboring precincts that

differ in their predicted 2006 advertising distribution.[42]

Supporting our claim that it is campaign advertising—rather than biases in media content—that affect vote choice, Table 5 shows that the predicted 2006 campaign advertising shares do not systematically impact the 2006 vote share of any party. Column (1) shows that the predicted advertising share does not affect the vote share of any party on average, while columns (2) and (3) indicate that there is little evidence that the predicted campaign advertising share produces heterogeneous effects akin to those in Table 4. In the case of local dominance, the estimates in column (4) are more similar interactions to our main results. However, closer inspection of the coefficients indicates that the overall point estimate for campaign advertising when the PAN is not locally dominant is never positive for any campaign advertising share with support in our sample. Although the slope estimates for the PRD are significant in the same direction, the magnitudes are considerably larger.

[Table 5 about here]

A further potential issue with interpreting our findings is that our estimates could also capture the response of political parties to media coverage. However, conversations with a prominent political consultant indicate that parties are either unaware of the cross-state signal spillovers that we exploit, or do not take these spillovers into account when designing their campaign advertising strategies. As highlighted in Figure 1, spillovers in AM radio signals across states are also not straightforward to detect and are likely to be second-order in determining party strategies. Nevertheless, we ultimately regard the overall effect of access to advertising—which combines the equilibrium behavior of both parties and voters—as the primary estimate of policy interest.

[42]Since there is a significant imbalance on the 2003 PAN vote share, we control for this imbalance in all specifications. However, as noted above, our main results do not suffer from this imbalance and are robust to controlling for pre-treatment vote shares.

6 Conclusion

Little is known about how campaign advertising differentially affects the electoral performance of parties in contexts where one party is dominant. Given that informational advantages are a key facet of dominance, we theorize that campaign advertising is especially effective for non-dominant parties. Our empirical design exploits within-neighboring precinct differences in campaign ad distributions arising from cross-state media coverage spillovers to test the implications of our theoretical argument in the aftermath of a major media regulation reform in Mexico. We find that campaign ads significantly benefit the PAN and PRD, but have no discernible impact on the PRI's vote share. Consistent with our model, such ads are most effective in less informed electoral precincts with lower levels of competition and intermediate levels of local party dominance.

An intriguing implication of our findings is that equalizing campaign advertising opportunities across political parties may be able to support democratic consolidation in two ways. First, greater equality in campaign advertising can enhance political representation by better matching electoral outcomes with voter preferences. Over the longer-run, this can increase support for democracy (e.g. Mattes and Bratton 2007). Second, by increasing the vote share of non-dominant parties in less competitive precincts, greater equality in campaign advertising opportunities promotes multiparty competition. Conversely, as Boas and Hidalgo (2011) show, when increased media access is concentrated among incumbent politicians, cycles of political dominance can instead be perpetuated. Our results therefore suggest that recent reforms providing equitable access to election advertising could support democratic deepening in some parts of the world. Nevertheless, further work is required to understand exactly how campaign advertising wins votes among the least knowledgeable, and how parties strategically allocate their ads as a consequence.

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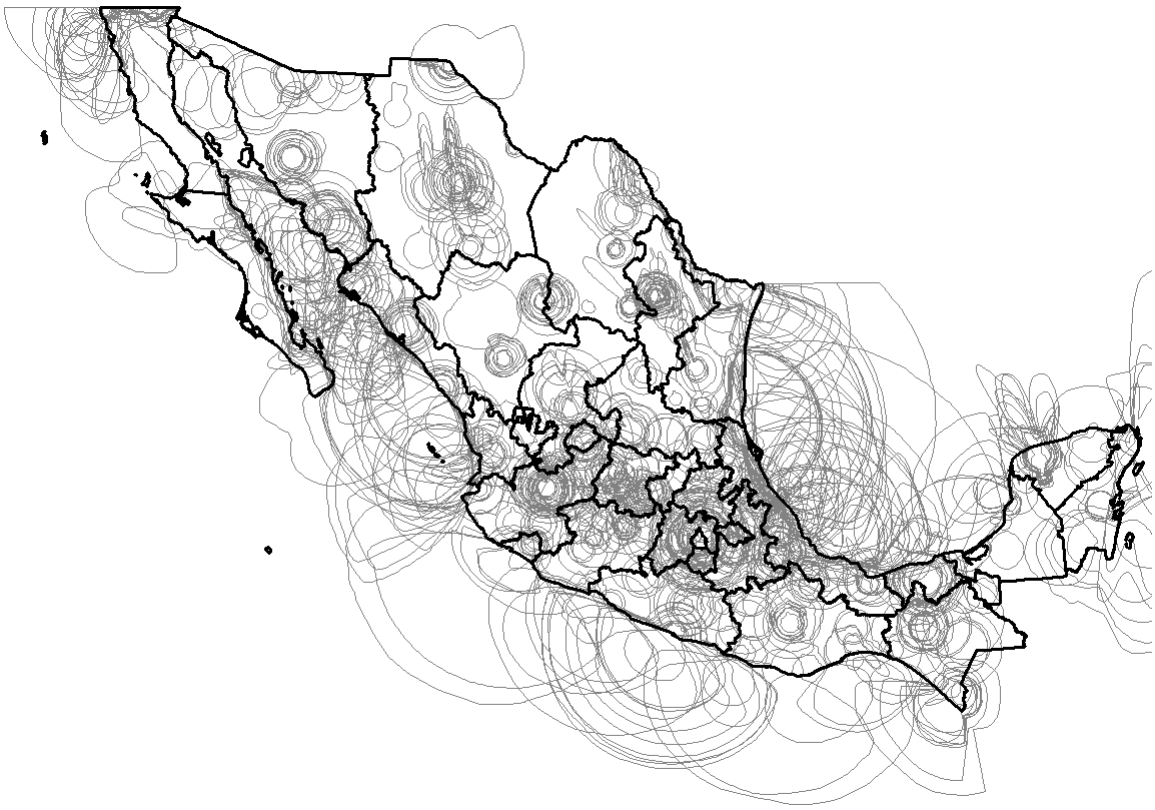


Figure 1: Commercial quality signal coverage of all AM radio stations (source: IFE)

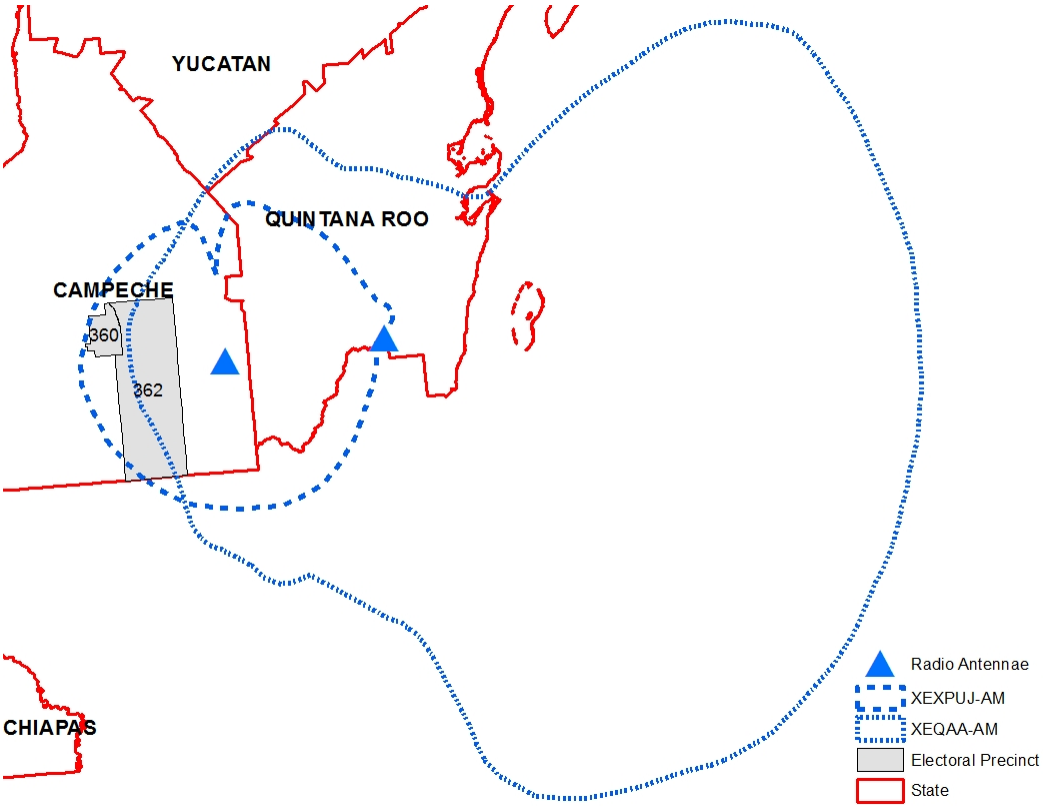


Figure 2: Neighboring electoral precincts that differ in their commercial quality radio signal coverage from out-of-state AM radio stations

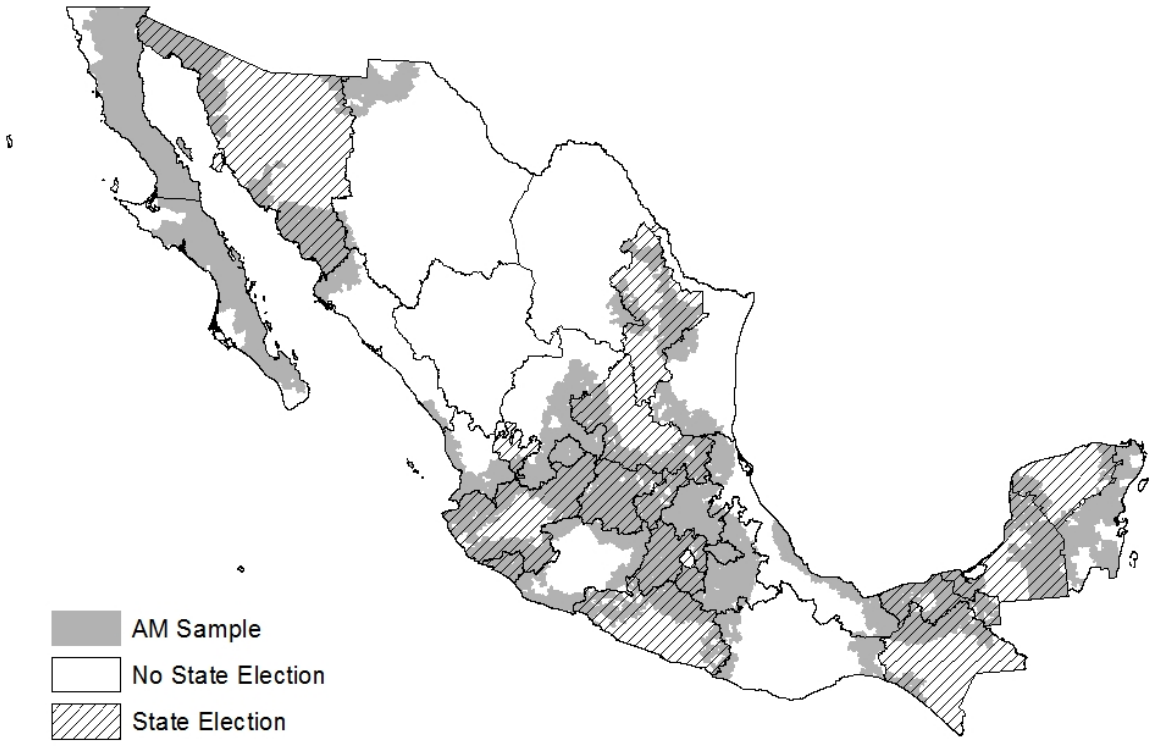
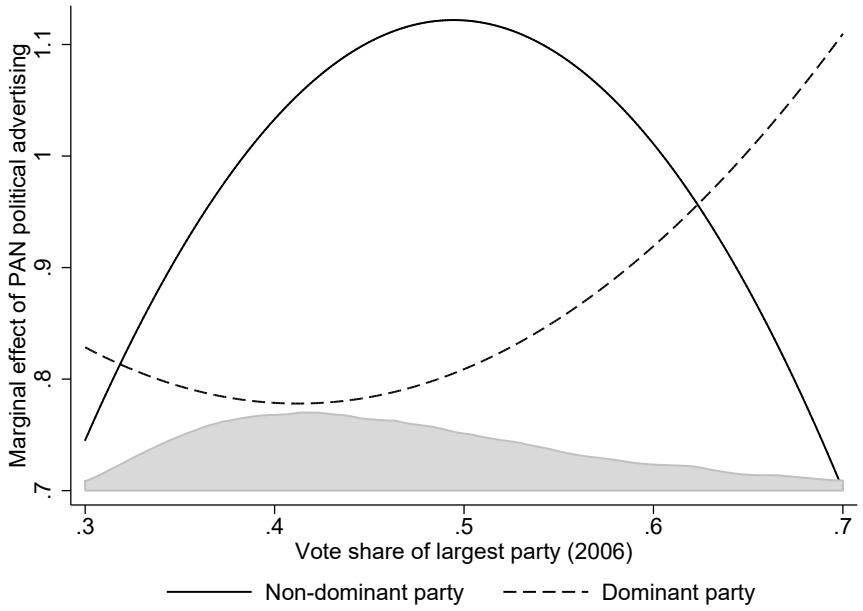


Figure 3: AM radio neighboring precinct sample used in our main analysis

(a) PAN AM campaign advertising



(b) PRD AM campaign advertising

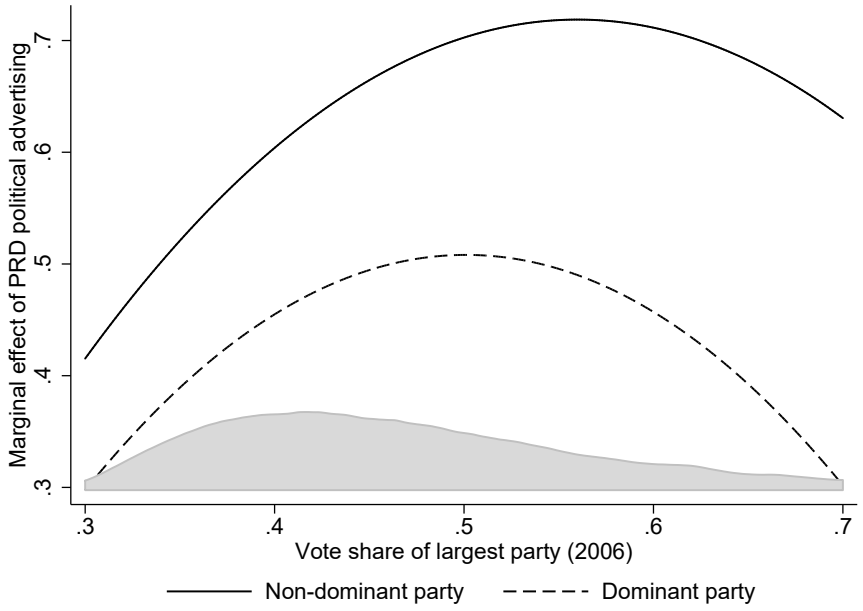


Figure 4: Effects of AM campaign advertising by vote share of largest party and local dominance

Notes: The figures plot the estimated marginal effect of AM campaign advertising, based on the estimates in Table 4. The figures show that campaign advertising is only effective for non-dominant parties, and particularly so when facing a locally dominant party of intermediate strength. The density of the data is shown in grey along the x axis; less than 1% of our sample lies outside the range depicted on the x axis. The insignificant relationships for the PRI are omitted.

Table 1: Correlation between basic development, political competition and local party dominance and political knowledge

	Knows PAN candidate	Knows PRD candidate	Knows PRI candidate	Political knowledge
Panel A: Local party dominance	(1)	(2)	(3)	
PAN largest	0.052***			
	(0.016)			
PRD largest		0.021*		
		(0.012)		
PRI largest			0.007	
			(0.016)	
Observations	12,332	12,332	12,332	
Outcome mean	0.91	0.92	0.90	
Outcome standard deviation	0.29	0.27	0.30	
Panel B: Basic development	(1)	(2)	(3)	(4)
Basic development (factor)	0.026***	0.020***	0.015**	0.077***
	(0.009)	(0.006)	(0.005)	(0.009)
Observations	10,934	10,934	10,934	10,934
Outcome mean	0.90	0.92	0.90	0.58
Outcome standard deviation	0.29	0.28	0.31	0.41
Panel C: Political competition	(1)	(2)	(3)	(4)
ENPV (2006)	0.030**	0.024***	0.032**	0.048**
	(0.011)	(0.008)	(0.013)	(0.023)
Observations	12,332	12,332	12,332	12,332
Outcome mean	0.91	0.92	0.90	0.59
Outcome standard deviation	0.29	0.27	0.30	0.41

Notes: Each regression pools the 2006, 2009 and 2012 Comparative Study of Electoral Systems (CSES) surveys. For the PAN, PRD and PRI, we code indicators for respondents that both know a given party's candidate and has an opinion about that candidate. We define political knowledge as an index combining indicators for whether a respondent can correctly identify the Congressional chambers, legislator term length, and their Governor's name. The index is the proportion of non-missing questions correctly answered by the respondent. We use the proportion to ensure comparability between the samples. All specifications are bivariate OLS regressions. Standard errors are clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table 2: Correlation between campaign advertising and voter television ad recall within last week and campaign recall

	Recall PAN television ad	Recall PRD television ad	Recall PRI television ad	Recall PAN campaign content	Recall PAN campaign content	Recall PAN campaign content	Recall PRD campaign content	Recall PRD campaign content	Recall PRD campaign content	Recall PRI campaign content	Recall PRI campaign content	Recall PRI campaign content
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PAN AM advertising share				0.454*								
				(0.254)								
PAN FM advertising share					0.630*							
					(0.348)							
PAN television advertising share	0.487**					0.454*						
	(0.202)					(0.225)						
PRD AM advertising share							0.216					
							(0.926)					
PRD FM advertising share								1.204				
								(0.816)				
PRD television advertising share		0.824*							0.592			
		(0.413)							(0.526)			
PRI AM advertising share										0.356**		
										(0.133)		
PRI FM advertising share											0.674***	
											(0.234)	
PRI television advertising share			0.457									0.445*
			(0.473)									(0.258)
Observations	738	739	738	1,189	1,189	1,189	1,189	1,189	1,189	1,188	1,188	1,188
Outcome mean	0.79	0.70	0.77	0.43	0.43	0.43	0.46	0.46	0.46	0.42	0.42	0.42
Television advertising share mean	0.26	0.15	0.19	0.28	0.27	0.26	0.16	0.15	0.15	0.20	0.19	0.18

Notes: All data are from the 2009 CSES survey. Recall television ad is an indicator coded 1 for respondents that recall having seen a campaign ad from the PAN/PRD/PRI on television in the past week. Recall campaign content is an indicator coded 1 for respondents that recall a feature of the PAN/PRD/PRI's ad campaign on either radio or television over the course of the campaign. Don't know and did not answer were coded as 0. All specifications are estimated using OLS and include state fixed effects. Standard errors are clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table 3: Comparison of AM radio neighboring precinct sample and population summary statistics

	AM radio neighboring precinct sample			FM radio neighboring precinct sample			Television neighboring precinct sample			National population (2009 and 2012)		
	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.
Dependent variables												
PAN vote share	146,140	0.272	0.158	60,142	0.257	0.149	53,892	0.261	0.148	131,346	0.264	0.144
PRD vote share	146,140	0.160	0.143	60,142	0.162	0.122	53,892	0.170	0.124	131,346	0.164	0.147
PRI vote share	146,140	0.366	0.140	60,142	0.370	0.128	53,892	0.350	0.128	131,346	0.362	0.142
Treatment variables												
PAN advertising share	146,140	0.277	0.024	60,142	0.274	0.024	53,892	0.274	0.024	131,369	0.272	0.040
PRD advertising share	146,140	0.148	0.033	60,142	0.154	0.034	53,892	0.153	0.032	131,369	0.145	0.037
PRI advertising share	146,140	0.261	0.059	60,142	0.253	0.057	53,892	0.252	0.056	131,369	0.258	0.069
Covariates												
Largest vote share (2006)	146,140	0.475	0.109	60,142	0.457	0.105	53,892	0.458	0.104	128,406	0.482	0.103
PAN largest (2006)	146,140	0.415	0.493	60,142	0.373	0.484	53,892	0.399	0.490	131,369	0.396	0.489
PRD largest (2006)	146,140	0.272	0.445	60,142	0.348	0.476	53,892	0.396	0.489	131,369	0.310	0.463
PRI largest (2006)	146,140	0.313	0.464	60,142	0.279	0.449	53,892	0.205	0.404	131,369	0.294	0.456
Electorate density (2006, log)	146,140	4.484	2.263	60,142	5.189	2.314	53,892	5.624	2.330	126,452	6.480	2.840
Share basic necessities	146,140	0.663	0.300	60,142	0.743	0.262	53,892	0.765	0.243	120,184	0.747	0.302
Share illiterate above 15	146,140	0.114	0.082	60,142	0.092	0.069	53,892	0.087	0.068	120,178	0.086	0.090
Share employed	146,140	0.946	0.059	60,142	0.947	0.044	53,892	0.944	0.046	120,176	0.954	0.045
Share primary complete	146,140	0.474	0.093	60,142	0.485	0.092	53,892	0.483	0.096	120,178	0.432	0.114
ENPV (2006)	146,140	2.726	0.529	60,142	2.881	0.539	53,892	2.887	0.523	128,406	2.729	0.493
2012 presidential election	146,140	0.530	0.499	60,142	0.503	0.500	53,892	0.502	0.500	131,369	0.506	0.500

Notes: Summary statistics are for the full AM radio neighboring precinct sample (allowing for up to three neighboring control precincts within 1 km of a coverage boundary) and full 2009 and 2012 national population of electoral precincts. Party advertising shares in the national population sample are zero for the few precincts that are not covered by a single AM radio station.

Table 4: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	1.224***	1.076**	5.006***	1.542***	-1.314	4.654***
	(0.346)	(0.400)	(0.944)	(0.496)	(0.791)	(1.451)
× Basic development (factor)		-0.249**				-0.136
		(0.116)				(0.098)
× ENPV (2006)			-1.548***			-1.145***
			(0.396)			(0.347)
× 2012 Presidential election				-0.581		-0.614
				(0.513)		(0.416)
× Largest vote share					9.852***	2.842
					(3.061)	(2.855)
× Largest vote share (squared)					-9.963***	-7.456***
					(2.872)	(2.565)
× PAN largest					2.772**	2.510**
					(1.134)	(1.140)
× Largest vote share × PAN largest					-13.153***	-11.714**
					(4.654)	(4.654)
× Largest vote share (squared) × PAN largest					13.967***	12.382***
					(4.507)	(4.458)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.702	0.603	1.592***	1.266***	-0.689	3.444***
	(0.424)	(0.462)	(0.561)	(0.362)	(0.452)	(0.848)
× Basic development (factor)		-0.139**				-0.099**
		(0.053)				(0.047)
× ENPV (2006)			-0.369**			-0.748***
			(0.144)			(0.187)
× 2012 Presidential election				-0.845		-0.757*
				(0.560)		(0.439)
× Largest vote share					5.030***	0.729
					(1.130)	(1.041)
× Largest vote share (squared)					-4.492***	-3.269***
					(0.973)	(0.824)
× PRD largest					-0.110	-0.133
					(1.026)	(1.015)
× Largest vote share × PRD largest					0.191	0.291
					(4.484)	(4.460)
× Largest vote share (squared) × PRD largest					-0.718	-0.795
					(4.698)	(4.689)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.257	-0.247	-0.292	-0.549	-0.041	-0.467
	(0.295)	(0.297)	(0.318)	(0.651)	(0.356)	(0.716)
× Basic development (factor)		-0.030				-0.064
		(0.042)				(0.039)
× ENPV (2006)			0.015			0.044
			(0.055)			(0.070)
× 2012 Presidential election				0.516		0.390
				(0.697)		(0.728)
× Largest vote share					-0.190	-0.089
					(1.059)	(1.044)
× Largest vote share (squared)					0.467	0.533
					(1.061)	(1.066)
× PRI largest					-0.215	-0.255
					(0.362)	(0.365)
× Largest vote share × PRI largest					1.049	1.210
					(1.569)	(1.576)
× Largest vote share (squared) × PRI largest					-1.751	-1.925
					(1.628)	(1.626)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table 5: Effect of the AM radio 2006 placebo on PAN, PRD and PRI vote share

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)
PAN advertising share	0.074	-0.027	-1.524	2.220	5.860*
	(0.747)	(0.728)	(1.423)	(3.094)	(2.879)
× Basic development (factor)		0.163			-0.230
		(0.320)			(0.232)
× ENPV (2003)			0.603		-0.734
			(0.515)		(0.546)
× Largest vote share				-10.055	-13.992
				(12.208)	(10.513)
× Largest vote share (squared)				11.208	12.282
				(12.199)	(11.650)
× PAN largest				0.849	1.264
				(2.295)	(2.301)
× Largest vote share × PAN largest				-5.513	-7.122
				(10.279)	(10.304)
× Largest vote share (squared) × PAN largest				3.955	5.432
				(10.154)	(10.297)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)
PRD advertising share	0.567	0.529	0.311	-1.075	-1.107
	(0.349)	(0.344)	(0.546)	(0.640)	(1.418)
× Basic development (factor)		0.086			0.188**
		(0.089)			(0.078)
× ENPV (2003)			0.137		-0.104
			(0.212)		(0.268)
× Largest vote share				6.996**	8.103***
				(2.554)	(2.880)
× Largest vote share (squared)				-6.915**	-8.214***
				(2.607)	(2.528)
× PRD largest				3.878**	3.949**
				(1.682)	(1.710)
× Largest vote share × PRD largest				-15.173**	-15.151**
				(7.209)	(7.271)
× Largest vote share (squared) × PRD largest				10.782	10.569
				(7.605)	(7.582)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)
PRI advertising share	-0.023	0.136	0.406	-2.910**	-4.625***
	(0.332)	(0.334)	(1.382)	(1.244)	(1.245)
× Basic development (factor)		-0.223			-0.034
		(0.151)			(0.093)
× ENPV (2003)			-0.155		0.230
			(0.525)		(0.189)
× Largest vote share				11.270*	14.569***
				(5.901)	(5.047)
× Largest vote share (squared)				-10.788*	-12.849**
				(5.940)	(5.191)
× PRI largest				2.299	2.046
				(1.623)	(1.698)
× Largest vote share × PRI largest				-9.770	-9.106
				(6.996)	(7.112)
× Largest vote share (squared) × PRI largest				9.658	9.510
				(6.571)	(6.496)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 66,677 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Appendix for publication online only

Proof of Proposition 1

Voter i votes for party N only when $R \geq v + b_i$, given $-\exp(-R) \geq -\exp(-(v + b_i))$. Given that b_i is randomly distributed according to F, the proportion of votes for party N is given by $V_N = F(R - v)$. We henceforth denote the cut point (for voting for N) by $\bar{b} \equiv R - v$.

We now prove the comparative static predictions by differentiating V_N. First, V_N is increasing in n:

$$\frac{\partial V_N}{\partial n} = F'(\bar{b})\frac{\partial R}{\partial n} \geq 0,$$

which is positive because F' is a probability density function, and the second term (the effect of n on the expected utility of N's policy outcome, $\frac{\partial R}{\partial n} = \frac{\sigma^2\tau^2(\bar{x}-\delta+\tau^2/2)}{(\sigma^2+n\tau^2)^2}$) is positive because $\bar{x} - \delta > 0$ (given we assume that $\bar{x} - \delta > \frac{\sigma^2}{2n}$, $\sigma^2 > 0$, and $n > 0$). $\frac{\partial V_N}{\partial n}$ is strictly positive where $F' > 0$.

Second, we identify the following cross-partial effects:

$$\begin{aligned}
\frac{\partial^2 V_N}{\partial n \partial v} &= -F''(\bar{b})\frac{\partial R}{\partial n} < 0, \\
\frac{\partial^2 V_N}{\partial n \partial \tau^2} &= F''(\bar{b})\frac{n\sigma^2(\bar{x} - \delta - \frac{\sigma^2}{2n})}{(\sigma^2 + n\tau^2)^2}\frac{\partial R}{\partial n} + F'(\bar{b})\frac{\sigma^2[(\bar{x} - \delta)(\sigma^2 - n\tau^2) + \sigma^2\tau^2]}{(\sigma^2 + n\tau^2)^3} > 0, \\
\frac{\partial^2 V_N}{\partial q \partial \sigma^2} &= -F''(\bar{b})\frac{n\tau^2(\bar{x} - \delta + \tau^2/2)}{(\sigma^2 + n\tau^2)^2}\frac{\partial R}{\partial n} - F'(\bar{b})\frac{\tau^2(\bar{x} - \delta + \tau^2/2)(\sigma^2 - n\tau^2)}{(\sigma^2 + n\tau^2)^3} < 0.
\end{aligned}$$

The first inequality holds because $F'' > 0$ and $\partial R/\partial n > 0$. The second inequality holds given the assumptions $F'' > 0$, $\sigma^2 > n\tau^2$ and $\bar{x} > \delta + \frac{\sigma^2}{2n}$ ensure that each term is positive. The third inequality holds because both fractions are positive, where the first follows from $F'' > 0$, $\bar{x} - \delta > 0$ and $\tau^2 > 0$, and the second from $\sigma^2 > n\tau^2$. ■

Media allocation formula

Here, we provide exact media allocation formulas. The IFE specifies that the 30 second advertising slots available to party i be allocated according to the following formula in states without concurrent state-wide elections:

$$national\ share_{it} = \frac{3}{10}\frac{1}{|\mathcal{C}_{it}|}\frac{1}{|\mathcal{C}_t|} + \frac{7}{10} vote\ share_{it-1},$$

where $vote\ share_{it-1}$ is i's national vote share in the previous election, $|\mathcal{C}_{it}|$ is the number of parties in i's federal coalition, and $|\mathcal{C}_t|$ is the total number of federal coalitions. This formula says that 30% of time is distributed evenly between electoral coalitions (and then between parties in a given coalition), while 70% of time is allocated to parties based on their vote share at the last election. Because the rule is based on the national-level vote share, there is no variation in campaign advertising time across states without local elections.

Crucially for our empirical strategy, media slots are shared with state-level elections when state elections are held simultaneously. Of the 41 minutes allotted to campaign advertising, 15 minutes are allocated according to the analogous state-level formula:

$$state\ share_{ist} = \frac{3}{10}\frac{1}{|\mathcal{C}_{ist}|}\frac{1}{|\mathcal{C}_{st}|} + \frac{7}{10} vote\ share_{ist-1},$$

where the subscript $st-1$ denotes that these variables are calculated using the previous state legislative election in state s. Combined, the media share of party i in state s at election t is:

$$media\ share_{ist} = \begin{cases} national\ share_{it} & \text{if } s \text{ has no concurrent election} \\ \frac{26}{41} national\ share_{it} + \frac{15}{41} state\ share_{ist} & \text{if } s \text{ has concurrent election.} \end{cases}$$

2012 ad content

Table A1 characterizes the content of all 683 unique ads broadcast on radio and television during the 2012 election campaign. These are discussed in the main paper.

Table A1: Characteristics of 2012 election campaign ads

	Share of unique ads
Media format	
Radio	0.48
Television	0.52
Party responsible for ad	
PAN	0.29
PRD	0.36
PRI (or PRD-PT-MC coalition)	0.22
Other	0.13
Race that the ad focuses on	
President	0.57
Other candidate	0.43
Emphasis of ad	
Emphasized policy position	0.49
Emphasized candidate characteristic	0.32
Emphasized policy and candidate	0.19
Tone of ad	
Only positive	0.75
Only negative	0.08
Positive and negative	0.17

Notes: All 683 unique ads were downloaded from www.pautas.ife.org.mx/camp, and independently hand-coded by two of our research assistants. Duplicated ads were dropped.

Technical details of empirical strategy

Our empirical strategy entailed conducting the following procedure. For each precinct j, we identify the set of neighboring precincts k that have different campaign advertising shares, and for whom some part of the precinct is within b kms of the media signal boundary/boundaries $m(j,k)$ (which induces the difference in campaign advertising shares). This set of control precincts is denoted $\mathcal{M}_j(b) \equiv \{k : d(m(j,k),k) \leq b\}$, where $d(a,a')$ is the minimum Euclidean distance in kilometers between a and a'. Our main estimates set $b = 1$.

Variable definitions

PAN/PRD/PRI vote share. Party legislative vote share in a given electoral precinct. One complication that arises in measuring the vote share of an individual party is the existence of cross-party federal coalitions between larger and smaller parties in certain parts of the country. Voters may cast a vote for either an individual party or a coalition. In 2009, the two coalition groups—PRI and PVEM, and PC and PT—received only 0.3% and 0.2% of the national vote share. Coalition voting was more prevalent in 2012 when the PRI-PVEM and PRD-PT-MC coalitions respectively received 3.6% and 3.3% of the national vote, with the three PRD-PT-MC sub-coalitions further receiving a 1.3% vote share. We distribute the coalition vote share among the constituent parties according to their relative vote share in the precinct. Since coalition voting is rare and the large parties have dominated these coalitions, this re-allocation method does not affect our results. Source: IFE.

PAN/PRD/PRI advertising share. Explained in main text. Source: constructed using data from IFE.

ENPV (2006). Effective number of political parties, as defined by the vote shares from the 2006

election according to the following formula:

$$ENPV\ (2006)_{ijt} = \frac{1}{\sum_{i \in \mathcal{I}_{jt-1}} (vote\ share_{ijt-1})^2},$$

where $\mathcal{I}_{jt-1}$ is the set of parties standing in precinct j at time $t-1$. We then standardized this variable in each estimation sample. Source: constructed using data from IFE.

Precinct area (log). Natural logarithm of precinct area in square kilometers. Source: own computations in ArcGIS.

Population density (log). Natural logarithm of the number of registered electors divided by precinct area. Source: IFE.

Basic amenities. Percentage of households with electricity, piped water, toilet and drainage. Source: Mexican 2010 Census.

Share employed. Percentage of the precinct population employed in 2010. Source: Mexican 2010 Census.

Share illiterate. Percentage of the precinct population aged above 15 that is illiterate in 2010. Source: Mexican 2010 Census.

Share primary complete. Percentage of the precinct population aged above 15 that completed primary education in 2010. Source: Mexican 2010 Census.

Basic development (factor). The first (standardized) factor from an iterated principal factor analysis including population density (log), basic amenities, share employed, share illiterate and share primary complete. The factor was computed separately for each sample (to ensure that a unit increase is always a standard deviation change in that sample). The first factor has an eigenvalue of 1.72, while the second factor has an eigenvalue of only 0.56. This indicates that our variables form a single coherent dimension. The Cronbach's alpha for standardized versions of these variables is 0.58.

Balancing variables. Our balancing variables are listed in Table A2. They are drawn from the

2010 Census, with the exception of 2006 party vote shares, ENPV (2006), registered voters (2006) and (log) population density (2006).

Balance tests

Table A2 reports the balance tests for AM radio ads reported in the main paper.

Robustness checks

Table A3 examines the effect of campaign advertising on turnout. Columns (1)-(3) show that the campaign advertising share of no party significantly increases precinct turnout.

Table A4 adopts a less parametric approach to estimating the non-linear effects of local dominance. Specifically, we divide the vote share of the largest party in 2006 into quartiles. Supporting the quadratic specification in the main paper, the results show that for the PAN and PRD the effect of campaign advertising is significantly greater at the second and third quartiles of the local dominance distribution when those parties are not themselves dominant. The negative triple interaction coefficients for the second and third quartiles indicate that such effects hold only when the party is not itself locally dominant.

For the average effects, Table A5 includes controls for the vote shares of other types of parties. In particular, we divide all parties receiving federal or state media allocations into left (PRD, PT, PSD, MC, ADC, POCH), centrist (PRI, PVEM, PANAL, PD, PCC, PCP and PDSY) and right (PAN) blocs. For each of the 3 main parties, we then calculate the media share for all other left, center and right parties excluding themselves (hence why there is no coefficient for other right parties for the PAN). Controlling for the left, center and right shares provides a sense of where each party's vote comes from. Other left parties is the omitted category. The results reaffirm the positive effects of PAN and PRD campaign advertising on their own vote shares. However, the results also suggest that centrist advertising that likely loosened the ties of voters supporting other

Table A2: Balance checks—partial correlation between AM radio campaign advertising and 29 covariates

	Registered electorate 2006	Population density (log) 2006	Turnout 2006	PAN vote 2006	PRD vote 2006	PRI vote 2006	ENPV 2006	Share economically active	Share employed	Share medical insurance
PAN advertising share	504.679	-6.515	-0.047	0.845*	-0.568	-0.378	-0.177	0.006	0.047	0.812*
	(1641.412)	(6.344)	(0.272)	(0.425)	(0.398)	(0.308)	(1.297)	(0.191)	(0.139)	(0.464)
PRD advertising share	977.985	0.192	0.127	-0.740**	0.567	0.280	-0.606	-0.060	-0.013	-0.365
	(1627.792)	(5.186)	(0.216)	(0.311)	(0.364)	(0.377)	(1.394)	(0.124)	(0.072)	(0.514)
PRI advertising share	-274.291	1.989	0.033	0.299	-0.093	-0.285	0.969	0.071	-0.076	-0.018
	(2077.983)	(5.593)	(0.219)	(0.255)	(0.278)	(0.378)	(1.402)	(0.138)	(0.182)	(0.329)
	Primary school attendance	Middle school attendance	Secondary school attendance	Share 6-17 in school	Share 18-24 in school	Share illiterate above 15	Share no school incomplete	Share primary complete	Share primary incomplete	Share secondary complete
PAN advertising share	-0.090	-0.414	0.118	-0.127	-0.033	0.070	0.082	-0.099	-0.159	-0.084
	(0.165)	(0.359)	(0.538)	(0.317)	(0.250)	(0.179)	(0.194)	(0.240)	(0.126)	(0.140)
PRD advertising share	0.190	0.437	-0.347	0.141	-0.179	-0.098	-0.080	0.308	0.341**	0.227
	(0.149)	(0.287)	(0.417)	(0.240)	(0.235)	(0.151)	(0.178)	(0.205)	(0.140)	(0.158)
PRI advertising share	-0.113	-0.258	0.751**	0.068	0.274	0.024	-0.068	-0.276	-0.335	-0.142
	(0.175)	(0.280)	(0.299)	(0.173)	(0.234)	(0.173)	(0.183)	(0.237)	(0.226)	(0.186)
	Share secondary incomplete	Share with house	Share non-dirt floor	Share electricity	Share piped water	Share with toilet	Share with drainage	Share basic necessities	Share with internet	
PAN advertising share	-0.083	-0.221	-0.025	-0.321	-0.228	-0.233	-0.090	-0.540	0.116	
	(0.131)	(0.340)	(0.336)	(0.474)	(0.639)	(0.446)	(0.566)	(0.683)	(0.172)	
PRD advertising share	0.219*	0.028	0.019	0.253	-0.474	-0.213	-0.134	-0.239	-0.328**	
	(0.129)	(0.234)	(0.425)	(0.463)	(0.610)	(0.385)	(0.594)	(0.616)	(0.132)	
PRI advertising share	-0.193	-0.158	0.136	0.161	0.582	0.669	0.764	0.798	0.345**	
	(0.164)	(0.260)	(0.420)	(0.519)	(0.603)	(0.521)	(0.698)	(0.592)	(0.152)	

Notes: Each coefficient is estimated separately from a regression of the outcome on a party's advertising share and neighbor group-year fixed effects. See the variable definitions section in the Appendix for further details on variable definition. All specifications include all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A3: Effect of AM radio campaign advertising on turnout

	Turnout		
	(1)	(2)	(3)
PAN advertising share	-0.294		
	(0.243)		
PRD advertising share		0.039	
		(0.235)	
PRI advertising share			0.341
			(0.364)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A4: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, by vote share quartile of largest party

	PAN	PRD	PRI
	(1)	(2)	(3)
Party advertising share	0.882***	0.496	0.037
	(0.276)	(0.387)	(0.259)
× Second quartile	0.226**	0.145**	-0.016
	(0.110)	(0.053)	(0.043)
× Second quartile × Party is largest	-0.138	-0.216*	0.057
	(0.145)	(0.115)	(0.055)
× Third quartile	0.251	0.181**	0.036
	(0.151)	(0.071)	(0.034)
× Third quartile × Party is largest	-0.075	-0.260	-0.068
	(0.224)	(0.203)	(0.052)
× Fourth quartile	-0.044	0.118	0.073
	(0.129)	(0.091)	(0.057)
× Fourth quartile × Party is largest	0.307	-0.099	-0.161
	(0.257)	(0.319)	(0.104)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. Lower order interaction terms are omitted. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A5: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, controlling for the advertising shares of other ideological groupings

	PAN	PRD	PRI
	(1)	(2)	(3)
PAN advertising share	1.223***		
	(0.344)		
PRD advertising share		1.491**	
		(0.574)	
PRI advertising share			-0.124
			(0.295)
Other center advertising share	-0.031	1.171*	-0.005
	(0.476)	(0.625)	(0.513)
Other right advertising share		0.415	-0.432*
		(0.477)	(0.251)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. Other left parties is the omitted category. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

leftists parties also benefited the PRD, while right-wing advertising hurt the PRI.

Table A6 shows the results of our placebo exercise. As explained in the body of the paper, this exercise randomly reassigns (without replacement) the state advertising distribution corresponding to all media outlets in each state to all the states holding local elections in a given year.[43] We thus replicate the exact distribution of advertising shares among those states holding local elections, but scramble which states received which distribution. We did this 100 times, and then estimate the average coefficient for our main estimates in Table A6. More specifically, each coefficient is given by $\frac{1}{100}\sum_{r=1}^{100}\beta_r$, where $beta_r$ is the estimate from replication r. Standard errors are calculated using the formula typically used for multiple imputation, which reflects both variation within and across the 100 estimates:

$$\left(\frac{1}{100}\sum_{r=1}^{100}(SE(\beta_r))^2 + \mathbb{V}[\beta_r]\left(1+\frac{1}{100}\right)\right)^{0.5},$$

[43]The regulation that determines political ad shares across parties induces no variation across the states that are not holding local elections.

Table A6: Effect of the AM radio state reassignment placebo on PAN, PRD and PRI vote share

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	0.266	0.239	1.120	0.800	-0.499	0.680
	(0.395)	(0.404)	(2.232)	(0.756)	(1.602)	(2.562)
× Basic development (factor)		-0.059				-0.069
		(0.209)				(0.178)
× ENPV (2006)			-0.337			-0.161
			(0.829)			(0.629)
× 2012 Presidential election				-0.815		-0.602
				(0.908)		(0.753)
× Largest vote share					2.793	1.792
					(6.752)	(5.108)
× Largest vote share (squared)					-2.808	-2.494
					(6.696)	(5.828)
× PAN largest					0.582	0.535
					(2.047)	(1.983)
× Largest vote share × PAN largest					-2.865	-2.630
					(8.955)	(8.616)
× Largest vote share (squared) × PAN largest					3.757	3.540
					(3.540)	(8.844)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.055	-0.054	0.394	0.558	-0.511	0.721
	(0.396)	(0.416)	(0.665)	(0.685)	(0.740)	(1.429)
× Basic development (factor)		-0.213***				-0.196***
		(0.064)				(0.065)
× ENPV (2006)			-0.136			-0.185
			(0.201)			(0.325)
× 2012 Presidential election				-0.713		-0.521
				(0.851)		(0.724)
× Largest vote share					1.752	0.649
					(2.887)	(2.116)
× Largest vote share (squared)					-1.398	-1.190
					(2.699)	(2.332)
× PRD largest					-1.336	-1.302
					(1.270)	(1.259)
× Largest vote share × PRD largest					4.797	4.689
					(5.192)	(5.148)
× Largest vote share (squared) × PRD largest					-3.364	-3.277
					(4.687)	(4.648)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.041	-0.044	-0.065	-0.346	-0.062	-0.779
	(0.474)	(0.473)	(0.519)	(0.777)	(0.443)	(0.748)
× Basic development (factor)		-0.057				-0.078**
		(0.041)				(0.039)
× ENPV (2006)			0.010			0.093
			(0.062)			(0.080)
× 2012 Presidential election				0.581		0.523
				(0.994)		(0.773)
× Largest vote share					-0.064	0.367
					(1.052)	(1.099)
× Largest vote share (squared)					0.271	0.180
					(1.055)	(1.071)
× PRI largest					-0.196	-0.222
					(0.436)	(0.439)
× Largest vote share × PRI largest					0.930	1.040
					(1.794)	(1.810)
× Largest vote share (squared) × PRI largest					-1.443	-1.581
					(1.799)	(1.806)

Notes: All coefficients are estimated across 100 state-level treatment reassignments (see text for calculation of point estimates and standard errors). The underlying specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

where $SE(\beta_r)$ is the standard error of estimate β_r and $\mathbb{V}[\beta_r]$ is the variance of the β_r estimates.

We first check the sensitivity of our estimates to factors that affect the distinctiveness of our coverage boundary. Table A7 shows the results when the sample is restricted to lower-powered AM radio stations with signal strengths of 10,000 watts or fewer. The results are similar if not stronger in this sample. Table A8 includes an interaction between the linear campaign advertising term and the (natural logarithm of one plus the) area in kilometers of a given precinct in the heterogeneous effect specifications to show that our results (especially for development where population density is central) are not simply a function of differences in the coverage boundary's reach. We obtain very similar results without using the logarithmic transformation.

Table A9 includes fixed effects for the total number of AM stations covering a precinct to allow for a separate intercept for precincts with different numbers of AM radio stations, and returns similar estimates to our main specification.

Table A10 shows that the average effects are robust to the inclusion of the 29 balancing variables as controls. The robustness of our interaction effects to the separate inclusion of each interactive control can be found in our replication code.

Tables A11 and A12 respectively show the results when using 0.5 and 5 km bandwidths to identify valid neighboring precincts. In both cases, the estimates are similar to those presented in the main paper.

We also weighted our results by the number of registered voters (in addition to weighting by the inverse of the number of neighbor comparisons). This could provide estimates that more accurately reflect population averages. The results in Table A13 indicate that the results are not substantively affected by this weighting scheme.

Finally, Table A14 shows the results when using 2012 presidential election shares. Consistent with the negative interaction with presidential elections in the main paper, the average effect falls somewhat. However, it remains statistically significant for the PAN. Moreover, the heterogeneous effects generally remain significant with broadly similar magnitudes. Given that the correlation

Table A7: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, antennae with less than 10,000 watts only

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	1.269***	1.115***	5.320***	1.561***	-1.545*	4.876***
	(0.334)	(0.391)	(0.997)	(0.432)	(0.828)	(1.343)
× Basic development (factor)		-0.250**				-0.143
		(0.122)				(0.103)
× ENPV (2006)			-1.655***			-1.245***
			(0.405)			(0.324)
× 2012 Presidential election				-0.542		-0.596
				(0.501)		(0.417)
× Largest vote share					10.636***	3.126
					(3.255)	(2.937)
× Largest vote share (squared)					-10.587***	-7.969***
					(3.136)	(2.839)
× PAN largest					3.070***	2.782**
					(1.113)	(1.129)
× Largest vote share × PAN largest					-14.304***	-12.744**
					(4.914)	(4.927)
× Largest vote share (squared) × PAN largest					15.115***	13.407**
					(5.049)	(4.993)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.848*	0.743	1.719***	1.637***	-0.401	3.855***
	(0.419)	(0.461)	(0.562)	(0.429)	(0.427)	(0.848)
× Basic development (factor)		-0.140**				-0.102*
		(0.064)				(0.056)
× ENPV (2006)			-0.364**			-0.734***
			(0.152)			(0.170)
× 2012 Presidential election				-1.182		-1.065*
				(0.750)		(0.615)
× Largest vote share					4.483***	0.271
					(1.195)	(1.211)
× Largest vote share (squared)					-4.006***	-2.812***
					(1.017)	(0.944)
× PRD largest					-0.265	-0.279
					(1.028)	(1.007)
× Largest vote share × PRD largest					0.930	1.016
					(4.556)	(4.515)
× Largest vote share (squared) × PRD largest					-1.607	-1.685
					(4.838)	(4.841)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.411	-0.425	-0.392	-0.718	-0.265	-0.514
	(0.346)	(0.346)	(0.352)	(0.648)	(0.368)	(0.709)
× Basic development (factor)		-0.037				-0.062
		(0.041)				(0.038)
× ENPV (2006)			-0.006			0.022
			(0.054)			(0.071)
× 2012 Presidential election				0.585		0.279
				(0.713)		(0.733)
× Largest vote share					0.240	0.220
					(0.946)	(0.966)
× Largest vote share (squared)					0.028	0.130
					(0.936)	(0.958)
× PRI largest					-0.245	-0.294
					(0.428)	(0.430)
× Largest vote share × PRI largest					1.031	1.222
					(1.817)	(1.818)
× Largest vote share (squared) × PRI largest					-1.631	-1.828
					(1.854)	(1.839)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 119,484 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A8: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, controlling for the interaction between campaign advertising and precinct area

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)
PAN advertising share	1.096***	4.856***	1.275**	-1.524*	4.715***
	(0.382)	(0.860)	(0.570)	(0.822)	(1.436)
× Basic development (factor)	-0.236*				-0.134
	(0.135)				(0.102)
× ENPV (2006)		-1.543***			-1.153***
		(0.392)			(0.347)
× 2012 Presidential election			-0.612		-0.613
			(0.474)		(0.416)
× Largest vote share				9.798***	2.773
				(3.068)	(2.841)
× Largest vote share (squared)				-9.926***	-7.426***
				(2.883)	(2.558)
× PAN largest				2.745**	2.505**
				(1.132)	(1.140)
× Largest vote share × PAN largest				-13.040***	-11.699**
				(4.654)	(4.653)
× Largest vote share (squared) × PAN largest				13.872***	12.383***
				(4.506)	(4.452)
× Precinct area (log)	-0.009	0.035	0.076	0.059	-0.006
	(0.039)	(0.040)	(0.049)	(0.047)	(0.026)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)
PRD advertising share	0.721	1.561**	1.189***	-0.798*	3.466***
	(0.428)	(0.585)	(0.344)	(0.459)	(0.845)
× Basic development (factor)	-0.181***				-0.119**
	(0.065)				(0.055)
× ENPV (2006)		-0.368**			-0.741***
		(0.146)			(0.190)
× 2012 Presidential election			-0.834		-0.767*
			(0.564)		(0.434)
× Largest vote share				4.990***	0.784
				(1.153)	(1.052)
× Largest vote share (squared)				-4.471***	-3.301***
				(0.992)	(0.814)
× PRD largest				-0.117	-0.127
				(1.029)	(1.013)
× Largest vote share × PRD largest				0.211	0.273
				(4.493)	(4.450)
× Largest vote share (squared) × PRD largest				-0.727	-0.785
				(4.696)	(4.676)
× Precinct area (log)	-0.041	0.007	0.019	0.033	-0.018
	(0.026)	(0.021)	(0.019)	(0.020)	(0.023)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)
PRI advertising share	-0.228	-0.327	-0.599	-0.078	-0.447
	(0.309)	(0.331)	(0.652)	(0.354)	(0.719)
× Basic development (factor)	-0.036				-0.075*
	(0.044)				(0.041)
× ENPV (2006)		0.017			0.047
		(0.055)			(0.069)
× 2012 Presidential election			0.553		0.374
			(0.700)		(0.729)
× Largest vote share				-0.214	-0.061
				(1.058)	(1.048)
× Largest vote share (squared)				0.480	0.517
				(1.062)	(1.066)
× PRI largest				-0.223	-0.250
				(0.362)	(0.363)
× Largest vote share × PRI largest				1.069	1.197
				(1.573)	(1.572)
× Largest vote share (squared) × PRI largest				-1.763	-1.921
				(1.634)	(1.620)
× Precinct area (log)	-0.004	0.009	0.008	0.013	-0.009
	(0.018)	(0.019)	(0.019)	(0.018)	(0.017)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A9: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, controlling for number of AM radio stations fixed effects

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	1.207***	1.066**	4.982***	1.530***	-1.340	4.561***
	(0.349)	(0.399)	(0.947)	(0.496)	(0.817)	(1.425)
× Basic development (factor)		-0.239**				-0.131
		(0.113)				(0.096)
× ENPV (2006)			-1.545***			-1.135***
			(0.398)			(0.346)
× 2012 Presidential election				-0.588		-0.583
				(0.497)		(0.418)
× Largest vote share					9.882***	2.950
					(3.125)	(2.851)
× Largest vote share (squared)					-9.982***	-7.510***
					(2.909)	(2.579)
× PAN largest					2.798**	2.542**
					(1.169)	(1.176)
× Largest vote share × PAN largest					-13.256***	-11.848**
					(4.738)	(4.746)
× Largest vote share (squared) × PAN largest					14.073***	12.522***
					(4.515)	(4.477)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.712	0.613	1.593***	1.279***	-0.672	3.450***
	(0.431)	(0.465)	(0.558)	(0.378)	(0.465)	(0.844)
× Basic development (factor)		-0.134**				-0.097**
		(0.052)				(0.046)
× ENPV (2006)			-0.365**			-0.744***
			(0.145)			(0.185)
× 2012 Presidential election				-0.849		-0.776*
				(0.560)		(0.433)
× Largest vote share					4.982***	0.704
					(1.131)	(1.038)
× Largest vote share (squared)					-4.455***	-3.236***
					(0.964)	(0.814)
× PRD largest					-0.113	-0.137
					(1.027)	(1.017)
× Largest vote share × PRD largest					0.191	0.296
					(4.490)	(4.470)
× Largest vote share (squared) × PRD largest					-0.700	-0.781
					(4.700)	(4.695)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.258	-0.275	-0.295	-0.571	-0.049	-0.498
	(0.299)	(0.309)	(0.327)	(0.635)	(0.350)	(0.710)
× Basic development (factor)		-0.031				-0.065
		(0.042)				(0.039)
× ENPV (2006)			0.016			0.046
			(0.055)			(0.070)
× 2012 Presidential election				0.557		0.413
				(0.690)		(0.720)
× Largest vote share					-0.175	-0.065
					(1.058)	(1.041)
× Largest vote share (squared)					0.451	0.514
					(1.059)	(1.063)
× PRI largest					-0.204	-0.243
					(0.361)	(0.364)
× Largest vote share × PRI largest					1.018	1.176
					(1.563)	(1.570)
× Largest vote share (squared) × PRI largest					-1.727	-1.900
					(1.622)	(1.619)

Notes: All specifications include neighbor group-year and number of AM radio station fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 146,410 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A10: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, controlling for the 29 balancing variables

	PAN	PRD	PRI
	(1)	(2)	(3)
PAN advertising share	0.766***		
	(0.205)		
PRD advertising share		0.428	
		(0.335)	
PRI advertising share			-0.127
			(0.257)

Notes: All specifications include neighbor group-year fixed effects and the 29 balancing variables from Table A2, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

between legislative and presidential vote shares exceeds 0.9 for each party, such similar results are not surprising.

FM radio and television signals

In the body of the paper, we focus on AM radio stations. This is because of the larger and far more rural sample that they allow. Additionally, the AM radio sample provides greater variation in types of electoral precinct, and thus allows for a better test of our heterogeneous effects. However, our findings generalize to other media formats. Here, we confirm that the FM radio and television media samples are relatively different to the AM media one and more internally homogeneous, before demonstrating that we find similar heterogeneous effects across all samples.

Examining the full sample of radio ads placed by political parties during the 2012 federal elections, we find that advertising does not substantively differ across AM and FM radio stations. Ads were fairly evenly distributed across AM and FM frequencies: of the 330 radio ads, only 15 (5%) and 11 (4%) were respectively broadcast disproportionately on AM stations and FM stations.[44]

[44]We tested for whether the proportion on AM and FM radio stations differ, retaining all those that differ at the 10% level for more detailed analysis.

Table A11: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, 0.5 km bandwidth

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	1.294***	1.161***	5.104***	1.623***	-1.356*	4.782***
	(0.367)	(0.420)	(0.925)	(0.524)	(0.780)	(1.464)
× Basic development (factor)		-0.224*				-0.116
		(0.118)				(0.102)
× ENPV (2006)			-1.565***			-1.180***
			(0.394)			(0.337)
× 2012 Presidential election				-0.599		-0.604
				(0.526)		(0.437)
× Largest vote share					10.136***	2.897
					(3.016)	(2.899)
× Largest vote share (squared)					-10.173***	-7.557***
					(2.838)	(2.542)
× PAN largest					2.902**	2.655**
					(1.139)	(1.145)
× Largest vote share × PAN largest					-13.675***	-12.286**
					(4.633)	(4.666)
× Largest vote share (squared) × PAN largest					14.481***	12.928***
					(4.374)	(4.378)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.807**	0.708	1.713***	1.328***	-0.494	3.711***
	(0.385)	(0.422)	(0.526)	(0.381)	(0.437)	(0.900)
× Basic development (factor)		-0.137**				-0.094*
		(0.056)				(0.048)
× ENPV (2006)			-0.377**			-0.779***
			(0.144)			(0.192)
× 2012 Presidential election				-0.786		-0.621
				(0.527)		(0.439)
× Largest vote share					4.722***	0.195
					(1.158)	(1.037)
× Largest vote share (squared)					-4.140***	-2.819***
					(0.970)	(0.772)
× PRD largest					-0.231	-0.261
					(1.090)	(1.078)
× Largest vote share × PRD largest					0.775	0.899
					(4.725)	(4.695)
× Largest vote share (squared) × PRD largest					-1.460	-1.560
					(4.876)	(4.857)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.301	-0.295	-0.342	-0.597	-0.012	-0.481
	(0.303)	(0.305)	(0.333)	(0.689)	(0.380)	(0.756)
× Basic development (factor)		-0.033				-0.066*
		(0.042)				(0.038)
× ENPV (2006)			0.018			0.054
			(0.055)			(0.073)
× 2012 Presidential election				0.527		0.385
				(0.757)		(0.776)
× Largest vote share					-0.496	-0.327
					(1.109)	(1.093)
× Largest vote share (squared)					0.731	0.766
					(1.124)	(1.128)
× PRI largest					-0.213	-0.250
					(0.377)	(0.382)
× Largest vote share × PRI largest					1.006	1.156
					(1.615)	(1.632)
× Largest vote share (squared) × PRI largest					-1.667	-1.833
					(1.666)	(1.671)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 0.5 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 138,789 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A12: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, 5 km bandwidth

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	1.017**	0.883**	4.796***	1.338**	-1.164	4.908***
	(0.377)	(0.423)	(1.005)	(0.527)	(0.813)	(1.525)
× Basic development (factor)		-0.231**				-0.129
		(0.113)				(0.088)
× ENPV (2006)			-1.541***			-1.166***
			(0.400)			(0.345)
× 2012 Presidential election				-0.567		-0.596
				(0.577)		(0.409)
× Largest vote share					8.755***	1.652
					(2.989)	(2.948)
× Largest vote share (squared)					-8.989***	-6.453**
					(2.736)	(2.537)
× PAN largest					2.507**	2.207*
					(1.133)	(1.152)
× Largest vote share × PAN largest					-12.142**	-10.531**
					(4.640)	(4.684)
× Largest vote share (squared) × PAN largest					13.031***	11.272**
					(4.467)	(4.471)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.564	0.466	1.465***	1.260***	-0.771	3.436***
	(0.448)	(0.495)	(0.525)	(0.348)	(0.470)	(0.786)
× Basic development (factor)		-0.141**				-0.098**
		(0.052)				(0.045)
× ENPV (2006)			-0.374**			-0.743***
			(0.138)			(0.182)
× 2012 Presidential election				-1.006*		-0.864*
				(0.555)		(0.428)
× Largest vote share					4.994***	0.714
					(1.059)	(0.962)
× Largest vote share (squared)					-4.494***	-3.267***
					(0.929)	(0.783)
× PRD largest					0.249	0.244
					(1.043)	(1.040)
× Largest vote share × PRD largest					-1.243	-1.221
					(4.543)	(4.552)
× Largest vote share (squared) × PRD largest					0.614	0.622
					(4.761)	(4.790)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.203	-0.193	-0.270	-0.361	-0.003	-0.373
	(0.282)	(0.282)	(0.312)	(0.556)	(0.329)	(0.610)
× Basic development (factor)		-0.030				-0.064
		(0.041)				(0.038)
× ENPV (2006)			0.027			0.059
			(0.054)			(0.071)
× 2012 Presidential election				0.278		0.163
				(0.579)		(0.638)
× Largest vote share					-0.427	-0.256
					(1.090)	(1.039)
× Largest vote share (squared)					0.706	0.764
					(1.096)	(1.085)
× PRI largest					-0.224	-0.269
					(0.346)	(0.346)
× Largest vote share × PRI largest					1.152	1.340
					(1.502)	(1.501)
× Largest vote share (squared) × PRI largest					-1.957	-2.161
					(1.569)	(1.564)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 5 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 157,860 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A13: Effect of AM radio campaign advertising on PAN, PRD and PRI vote share, weighting by the number of registered voters

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	1.040***	0.980***	4.971***	1.202***	-1.837*	4.590***
	(0.283)	(0.318)	(0.697)	(0.386)	(0.991)	(1.454)
× Basic development (factor)		-0.287**				-0.206
		(0.125)				(0.123)
× ENPV (2006)			-1.545***			-1.242***
			(0.293)			(0.338)
× 2012 Presidential election				-0.315		-0.360
				(0.414)		(0.306)
× Largest vote share					11.847***	4.171
					(3.817)	(3.106)
× Largest vote share (squared)					-12.268***	-9.604***
					(3.559)	(3.022)
× PAN largest					2.896*	2.455
					(1.497)	(1.484)
× Largest vote share × PAN largest					-13.303*	-11.180*
					(6.701)	(6.559)
× Largest vote share (squared) × PAN largest					13.245*	11.135
					(7.239)	(6.990)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.588	0.506	1.616***	0.964**	-0.882***	3.384***
	(0.366)	(0.388)	(0.488)	(0.374)	(0.319)	(0.639)
× Basic development (factor)		-0.181***				-0.129***
		(0.044)				(0.043)
× ENPV (2006)			-0.411***			-0.815***
			(0.125)			(0.134)
× 2012 Presidential election				-0.529		-0.587
				(0.476)		(0.451)
× Largest vote share					5.475***	1.435
					(0.941)	(1.100)
× Largest vote share (squared)					-5.210***	-4.534***
					(0.826)	(0.839)
× PRD largest					0.028	0.119
					(1.083)	(1.038)
× Largest vote share × PRD largest					-0.408	-0.776
					(4.780)	(4.641)
× Largest vote share (squared) × PRD largest					-0.020	0.342
					(4.957)	(4.858)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.333	-0.312	-0.261	-0.773	-0.223	-0.449
	(0.302)	(0.297)	(0.330)	(0.673)	(0.314)	(0.739)
× Basic development (factor)		-0.028				-0.055
		(0.046)				(0.044)
× ENPV (2006)			-0.027			-0.021
			(0.046)			(0.071)
× 2012 Presidential election				0.702		0.589
				(0.821)		(0.721)
× Largest vote share					0.328	-0.025
					(1.101)	(1.186)
× Largest vote share (squared)					0.051	0.335
					(1.158)	(1.225)
× PRI largest					-0.478	-0.532
					(0.468)	(0.466)
× Largest vote share × PRI largest					2.343	2.569
					(2.201)	(2.187)
× Largest vote share (squared) × PRI largest					-3.293	-3.529
					(2.488)	(2.457)

Notes: All specifications include neighbor group-year fixed effects, up to three neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping multiplied by the number of registered voters in the precinct. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 146,140 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A14: Effect of AM radio campaign advertising on PAN, PRD and PRI presidential vote share

Panel A: PAN presidential vote share	(1)	(2)	(3)	(4)	(5)
PAN advertising share	0.856**	0.807**	5.215***	-2.063*	6.745***
	(0.329)	(0.381)	(1.434)	(1.028)	(2.007)
× Basic development (factor)		-0.055			0.093
		(0.123)			(0.132)
× ENPV (2006)			-1.816***		-1.816***
			(0.553)		(0.445)
× Largest vote share				11.978***	1.682
				(3.659)	(3.342)
× Largest vote share (squared)				-12.139***	-8.559***
				(3.208)	(2.732)
× × PAN largest				3.682	3.409
				(2.351)	(2.396)
× Largest vote share × PAN largest				-18.109*	-16.394
				(9.718)	(9.915)
× Largest vote share (squared) × PAN largest				19.050*	16.813
				(9.671)	(9.905)
Panel B: PRD presidential vote share	(1)	(2)	(3)	(4)	(5)
PRD advertising share	0.156	0.330	2.224**	-0.989	6.898***
	(0.549)	(0.676)	(1.058)	(1.050)	(2.366)
× Basic development (factor)		0.145			0.190
		(0.182)			(0.135)
× ENPV (2006)			-0.887*		-1.680***
			(0.443)		(0.504)
× Largest vote share				5.868	-2.575
				(5.095)	(5.499)
× Largest vote share (squared)				-6.035	-3.438
				(5.479)	(5.093)
× × PRD largest				1.198	1.456
				(1.914)	(1.988)
× Largest vote share × PRD largest				-6.591	-7.562
				(8.536)	(8.947)
× Largest vote share (squared) × PRD largest				5.921	6.641
				(9.826)	(10.263)
Panel C: PRI presidential vote share	(1)	(2)	(3)	(4)	(5)
PRI advertising share	0.197	0.324	0.383	-0.298	3.352*
	(0.219)	(0.225)	(1.670)	(1.047)	(1.815)
× Basic development (factor)		0.137			-0.004
		(0.254)			(0.180)
× ENPV (2006)			-0.071		-0.704*
			(0.644)		(0.378)
× Largest vote share				1.144	-3.593
				(4.473)	(4.809)
× Largest vote share (squared)				0.761	2.790
				(4.978)	(5.348)
× × PRI largest				1.549	1.393
				(1.373)	(1.406)
× Largest vote share × PRI largest				-4.339	-3.845
				(6.006)	(6.145)
× Largest vote share (squared) × PRI largest				0.885	0.558
				(7.046)	(7.195)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 77,393 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

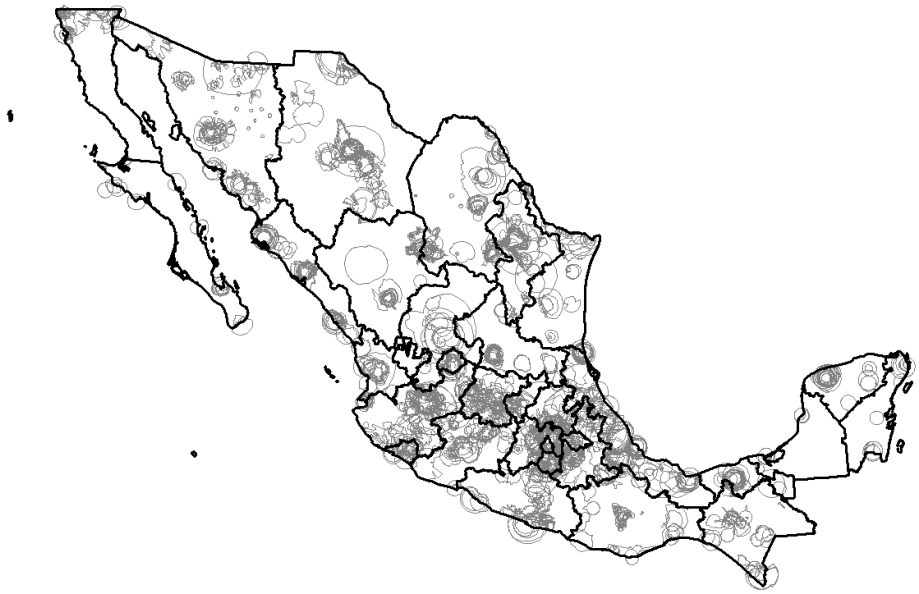


Figure A1: FM radio signal coverage (source: IFE)

Therefore, there does not appear to be any meaningful difference between the types of ads broadcast over the different wavelengths. Comparable television advert data were not available, but ads were very general and targeted the same kinds of national political issues noted in the body of the paper. Furthermore, by identifying off cross-state radio signal spillovers, the locations our effects are identified for are very unlikely to be the targets of locally-specific ads targeted at different states.

Figures A1 and A2 map the coverage areas of all FM radio and television stations, and show that the level of coverage associated with any given media outlet is far lower than for AM radio (in Figure 1 in the main paper).[45] Due to the relative limited reach of FM radio and television signals, in combination with the fact that the antennae are predominately located in and around

[45]Note that there are some television channels which emit from multiple antennae across the country. Our variable definitions adjust for any double-counting such that the same channel reaches a given precinct via multiple antennae.

Figure A2: TV signal coverage (source: IFE)

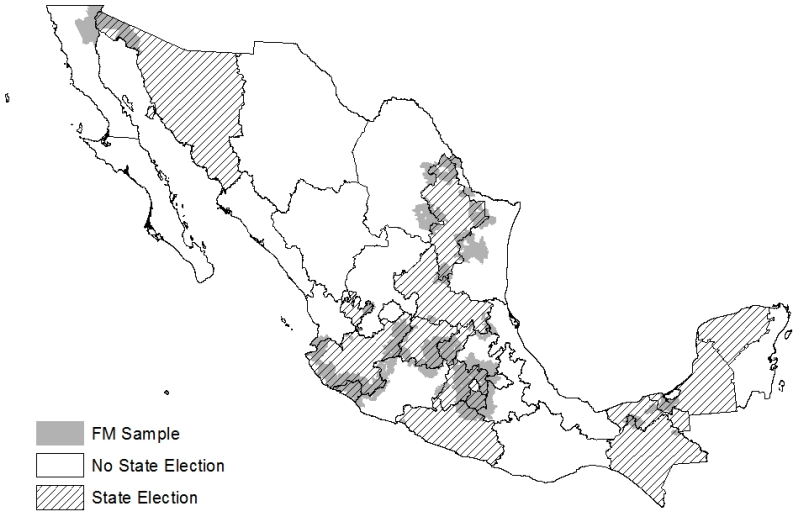


Figure A3: FM neighbor 1 km sample of electoral precincts

Figure A4: TV neighbor 1 km sample of electoral precincts

towns and cities, precincts at the boundary between receiving and not receiving a signal from a neighboring state are far more urban and closer to the state boundaries. This is confirmed in Table 3 in the main paper, which provides the summary statistics for these samples. Furthermore, Tables A15 and A16 (below) show that the FM and especially television samples are imperfectly balanced across campaign advertising distributions, and therefore provide somewhat less reliable estimates.

Column (1) of Tables A17 and A18 shows that the *average* effects of FM and television campaign advertising decline substantially. This is consistent with our theory, which explains that the more urban, developed and politically competitive precincts in these samples should experience smaller average effects. Combined with our estimates showing that campaign advertising via all media formats is less effective in more developed and politically competitive precincts, the change in sample composition is expected to reduce the average effects of ads on FM radio and television.

The *heterogeneous* effects provide clearer support for the AM radio findings. While standard errors inevitably increase as the sample size more than halves, columns (2)-(6) show that the het-

Table A15: Balance checks—partial correlation between FM radio campaign advertising and 29 balancing covariates

	Registered electorate 2006	Population density (log) 2006	Turnout 2006	PAN vote 2006	PRD vote 2006	PRI vote 2006	ENPV 2006	Share economically active	Share employed	Share medical insurance
PAN advertising share	583.610	8.814	0.118	0.393	-0.306	-0.121	-0.875	-0.114	0.127	0.333
	(1015.378)	(6.373)	(0.305)	(0.234)	(0.204)	(0.321)	(0.631)	(0.209)	(0.134)	(0.380)
PRD advertising share	-1260.282	-16.152**	-0.188	-0.471	0.563**	0.057	0.070	0.320*	-0.175	-0.442
	(1347.615)	(6.759)	(0.361)	(0.305)	(0.270)	(0.330)	(1.114)	(0.166)	(0.178)	(0.409)
PRI advertising share	633.551	17.982**	-0.166	0.327	-0.618**	0.298	-0.220	-0.188	0.088	-0.137
	(1451.553)	(7.255)	(0.319)	(0.376)	(0.234)	(0.397)	(1.340)	(0.190)	(0.196)	(0.414)
	Primary school attendance	Middle school attendance	Secondary school attendance	Share 6-17 in school	Share 18-24 in school	Share illiterate above 15	Share no school incomplete	Share primary complete	Share primary incomplete	Share secondary complete
PAN advertising share	0.040	0.268	0.787*	0.209	0.397	0.210	0.233	-0.752***	-0.668***	-0.284**
	(0.189)	(0.392)	(0.410)	(0.266)	(0.262)	(0.176)	(0.234)	(0.253)	(0.116)	(0.114)
PRD advertising share	-0.002	-0.368	-1.010	-0.305	-0.453*	-0.228	-0.208	0.570	0.670***	0.305
	(0.166)	(0.436)	(0.609)	(0.321)	(0.226)	(0.170)	(0.170)	(0.371)	(0.210)	(0.187)
PRI advertising share	-0.177	-0.028	0.544	0.042	0.107	0.190	0.111	-0.024	-0.392	-0.350**
	(0.186)	(0.419)	(0.630)	(0.336)	(0.258)	(0.137)	(0.167)	(0.437)	(0.269)	(0.168)
	Share secondary incomplete	Share with house	Share non-dirt floor	Share electricity	Share piped water	Share with toilet	Share with drainage	Share basic necessities	Share with internet	
PAN advertising share	-0.219**	0.063	-0.250	0.060	0.381	-0.019	0.661	0.438	0.436	
	(0.098)	(0.156)	(0.308)	(0.188)	(0.686)	(0.362)	(0.648)	(0.748)	(0.292)	
PRD advertising share	0.258	0.259**	0.244	-0.202	-0.394	-0.018	-0.656	-0.638	-0.319	
	(0.185)	(0.122)	(0.415)	(0.218)	(0.680)	(0.272)	(0.682)	(0.710)	(0.292)	
PRI advertising share	-0.344*	-0.418**	-0.046	0.378*	0.414	-0.002	0.856	1.063	0.085	
	(0.176)	(0.197)	(0.397)	(0.198)	(0.731)	(0.393)	(0.726)	(0.789)	(0.347)	

Notes: Each coefficient is estimated separately from a regression of the outcome on a party's advertising share and neighbor group-year fixed effects. All Census variables, in columns (8)-(29) are from 2010. All specifications include up to three neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. All specifications include 44,358 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A16: Balance checks—partial correlation between television campaign advertising and 29 balancing covariates

	Registered electorate 2006	Population density (log) 2006	Turnout 2006	PAN vote 2006	PRD vote 2006	PRI vote 2006	ENPV 2006	Share economically active	Share employed	Share medical insurance
PAN advertising share	3341.094	10.595	0.198	0.426*	-0.362*	-0.055	0.833	0.301*	0.363***	-0.541**
	(2173.777)	(12.359)	(0.203)	(0.246)	(0.209)	(0.114)	(0.688)	(0.162)	(0.091)	(0.228)
	(2079.540)	(12.902)	(0.228)	(0.165)	(0.208)	(0.117)	(0.752)	(0.127)	(0.065)	(0.167)
PRD advertising share	-8614.368***	-16.890**	0.005	-0.266	0.266	0.046	-1.055	-0.253	-0.146	0.546
	(2643.168)	(7.871)	(0.236)	(0.354)	(0.383)	(0.185)	(1.160)	(0.188)	(0.245)	(0.420)
PRI advertising share	9556.773***	12.749	-0.082	0.062	-0.109	-0.002	0.958	0.164	-0.249**	-0.199
	(2980.466)	(12.244)	(0.184)	(0.429)	(0.233)	(0.225)	(1.271)	(0.233)	(0.103)	(0.483)
	Primary school attendance	Middle school attendance	Secondary school attendance	Share 6-17 in school	Share 18-24 in school	Share illiterate above 15	Share no school incomplete	Share primary complete	Share primary incomplete	Share secondary complete
PAN advertising share	-0.063	0.136	1.034***	0.254	0.920***	-0.460**	-0.391*	-0.931***	-0.382*	-0.094
	(0.097)	(0.197)	(0.246)	(0.157)	(0.297)	(0.218)	(0.227)	(0.265)	(0.189)	(0.093)
PRD advertising share	0.201**	-0.142	-1.291***	-0.291**	-1.247***	0.431**	0.329**	1.421***	0.697***	0.233
	(0.082)	(0.163)	(0.368)	(0.141)	(0.252)	(0.169)	(0.136)	(0.287)	(0.190)	(0.142)
PRI advertising share	-0.122	0.287	0.962	0.345	0.824	-0.095	-0.000	-1.079**	-0.555**	-0.140
	(0.081)	(0.323)	(0.728)	(0.259)	(0.569)	(0.337)	(0.302)	(0.493)	(0.266)	(0.191)
	Share secondary incomplete	Share with house	Share non-dirt floor	Share electricity	Share piped water	Share with toilet	Share with drainage	Share basic necessities	Share with internet	
PAN advertising share	-0.059	-0.214	0.414***	0.084	1.084**	1.162**	1.951***	2.342***	0.689	
	(0.100)	(0.269)	(0.139)	(0.189)	(0.520)	(0.521)	(0.444)	(0.659)	(0.407)	
PRD advertising share	0.183	0.235	-0.433	0.056	-1.974***	-0.920***	-1.747***	-2.795***	-0.998***	
	(0.128)	(0.374)	(0.294)	(0.190)	(0.648)	(0.284)	(0.516)	(0.600)	(0.255)	
PRI advertising share	-0.109	0.003	0.029	-0.127	0.652	0.111	0.422	0.673	0.707	
	(0.155)	(0.302)	(0.345)	(0.190)	(0.724)	(0.892)	(1.163)	(1.319)	(0.441)	

Notes: Each coefficient is estimated separately from a regression of the outcome on a party's advertising share and neighbor group-year fixed effects. All Census variables, in columns (8)-(29) are from 2010. All specifications include up to three neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. All specifications include 42,623 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

erogeneous effects are generally similar to the AM results and remain statistically significant in many cases. Only in the case of differences between mid-term and presidential elections, which were the least robust findings for AM radio, in the FM sample do our results meaningfully differ. These results further highlight that campaign advertising is most effective in the areas least exposed to democratic political competition and most vulnerable to clientelistic practices.

Table A17: Effect of FM radio campaign advertising on PAN, PRD and PRI vote share

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	0.503*	0.285	4.089**	0.492	-2.133**	0.943
	(0.291)	(0.347)	(1.472)	(0.289)	(0.814)	(3.191)
× Basic development (factor)		-0.278				-0.256*
		(0.192)				(0.125)
× ENPV (2006)			-1.479**			-0.628
			(0.568)			(0.619)
× 2012 Presidential election				0.032		0.088
				(0.369)		(0.314)
× Largest vote share					10.518***	6.128
					(3.457)	(4.864)
× Largest vote share (squared)					-9.979**	-8.414**
					(3.626)	(3.426)
× PAN largest					2.181*	1.565
					(1.163)	(1.186)
× Largest vote share × PAN largest					-10.815**	-8.322*
					(4.844)	(4.776)
× Largest vote share (squared) × PAN largest					10.690*	8.754*
					(5.324)	(4.911)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	-0.018	-0.200	0.964**	-0.143	-1.160***	1.479
	(0.192)	(0.172)	(0.451)	(0.240)	(0.386)	(1.022)
× Basic development (factor)		-0.237***				-0.180***
		(0.049)				(0.052)
× ENPV (2006)			-0.378**			-0.583***
			(0.159)			(0.182)
× 2012 Presidential election				0.219		0.188
				(0.288)		(0.303)
× Largest vote share					4.737***	1.506
					(1.443)	(1.687)
× Largest vote share (squared)					-4.607***	-3.783***
					(1.407)	(1.320)
× PRD largest					-0.311	-0.289
					(1.501)	(1.561)
× Largest vote share × PRD largest					0.843	0.970
					(6.214)	(6.570)
× Largest vote share (squared) × PRD largest					-1.481	-1.831
					(5.606)	(6.073)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	0.087	0.153	0.369	-0.810	-0.226	0.004
	(0.471)	(0.435)	(0.476)	(1.075)	(0.559)	(0.861)
× Basic development (factor)		-0.051				-0.048
		(0.044)				(0.046)
× ENPV (2006)			-0.107**			-0.158*
			(0.046)			(0.084)
× 2012 Presidential election				1.357		0.898
				(1.188)		(0.815)
× Largest vote share					1.007	0.073
					(1.701)	(1.573)
× Largest vote share (squared)					-0.552	-0.245
					(1.628)	(1.660)
× PRI largest					0.386	0.460
					(0.707)	(0.733)
× Largest vote share × PRI largest					-1.395	-1.692
					(2.891)	(2.991)
× Largest vote share (squared) × PRI largest					0.617	0.851
					(2.856)	(2.916)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 60,142 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Table A18: Effect of television campaign advertising on PAN, PRD and PRI vote share

Panel A: PAN vote share	(1)	(2)	(3)	(4)	(5)	(6)
PAN advertising share	0.331	0.069	4.169**	0.410	-0.502	2.697
	(0.251)	(0.252)	(1.716)	(0.319)	(1.474)	(1.618)
× Basic development (factor)		-0.354**				-0.306***
		(0.135)				(0.107)
× ENPV (2006)			-1.473**			-0.672*
			(0.588)			(0.377)
× 2012 Presidential election				-0.240		-0.268
				(0.353)		(0.358)
× Largest vote share					3.247	-0.337
					(6.953)	(6.406)
× Largest vote share (squared)					-3.011	-2.189
					(7.196)	(7.155)
× PAN largest					1.013	0.905
					(2.060)	(2.124)
× Largest vote share × PAN largest					-3.838	-3.366
					(9.477)	(9.673)
× Largest vote share (squared) × PAN largest					2.346	2.184
					(10.264)	(10.351)
Panel B: PRD vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRD advertising share	0.086	-0.100	0.804	0.251	-1.403	0.237
	(0.366)	(0.365)	(0.596)	(0.412)	(0.821)	(1.671)
× Basic development (factor)		-0.247***				-0.245***
		(0.065)				(0.061)
× ENPV (2006)			-0.260*			-0.327
			(0.150)			(0.245)
× 2012 Presidential election				-0.287		-0.242
				(0.362)		(0.296)
× Largest vote share					5.530**	3.713
					(2.055)	(2.565)
× Largest vote share (squared)					-5.206***	-4.836***
					(1.679)	(1.669)
× PRD largest					0.780	0.688
					(0.937)	(0.994)
× Largest vote share × PRD largest					-3.521	-3.076
					(4.223)	(4.589)
× Largest vote share (squared) × PRD largest					3.146	2.602
					(4.706)	(5.223)
Panel C: PRI vote share	(1)	(2)	(3)	(4)	(5)	(6)
PRI advertising share	-0.647**	-0.585**	-0.633**	-1.629	-0.756**	-1.255
	(0.274)	(0.210)	(0.238)	(1.087)	(0.332)	(0.866)
× Basic development (factor)		-0.039				-0.048
		(0.046)				(0.041)
× ENPV (2006)			-0.009			-0.069
			(0.048)			(0.101)
× 2012 Presidential election				1.176		1.058
				(1.104)		(0.806)
× Largest vote share					0.381	0.002
					(1.087)	(0.984)
× Largest vote share (squared)					-0.504	-0.408
					(1.030)	(0.998)
× PRI largest					0.490	0.482
					(0.556)	(0.571)
× Largest vote share × PRI largest					-2.770	-2.713
					(2.365)	(2.414)
× Largest vote share (squared) × PRI largest					3.258	3.141
					(2.356)	(2.371)

Notes: All specifications include neighbor group-year fixed effects, all neighboring precincts within 1 km of a coverage boundary, and weight by the inverse of the number of precincts per neighbor-year grouping. The basic development factor variable (see Appendix for construction) has mean zero and a standard deviation of one, while ENPV ranges from 1 to 4.6 and largest vote share ranges from 0.13 to 0.99. Lower order interaction terms are omitted. All specifications include 53,892 observations. Standard errors clustered by state. * denotes $p < 0.1$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.